

 THE RESEARCH AGENDA

The Value of Predictive Validity Studies and the Need for “Fit-for-Purpose” Data to Inform Postsecondary Admissions Policies and Decision Making

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While college readiness continues to dominate the educational landscape in the United States, students still leave high school not ready for college. As a consequence, admissions officers need to consider all available indicators (e.g., high school performance, admissions test scores, college preparatory courses) in order to effectively evaluate prospective student applications. Predictive validity studies are one of the inherent mechanisms in the admission process and can be used to predict college performance and success. These studies ultimately are guided by the availability of data, which can be challenging to identify and procure. Although predictive validity research has played an important role in informing admissions policy in recent years, few published works appear to include a full, informative account of its role in helping to establish college readiness and the importance of identifying different sources of data for doing so. This paper aims to fill that gap, bringing together a detailed explanation of the role of predictive validity studies to investigate college readiness and success and the identification of “fit-for-purpose” data to carry out such studies and inform postsecondary admissions policy and decisions.

As an education reform initiative for enhancing student achievement, teacher efficacy, and overall high school attainment, college readiness currently dominates the

U.S. educational landscape. Its importance and implications for postsecondary success have received significant attention as college and societal aspirations rise and

government legislation promotes college readiness for all (Camara 2013; Conley 2012; U.S. Department of Education 2014, 2015). It is becoming increasingly important in light of predicted increases in college enrollment, with approximately 80 percent of Americans reported to enroll in college at some point, though with only 29 percent of first-time, full-time students to graduate with a two-year degree and just over half to graduate with a four-year degree (Kena *et al.* 2015).

A successful transition from high school to postsecondary study is dependent, in part, upon a student being college ready. Yet concerns abound among educators and policy makers as to whether prospective college students are prepared, from an academic point of view, to handle the rigors of college coursework. Despite the primacy of college readiness, students throughout the United States continue to graduate from high school not ready for college (*e.g.*, ACT 2016; Chen and Simone 2016; Radford and Horn 2012; Symonds, Schwartz and Ferguson 2011). National statistics show that in 2011–12, approximately one-third of all first- and second-year bachelor's degree students (29 percent of those at public four-year institutions and 41 percent of those at public two-year institutions) reported having taken remedial courses after high school graduation (Skomsvold 2014). Critics argue that remediation is costly and delays time to college-degree completion because students do not often earn credit that fulfills degree requirements (Camara 2013). In particular, research has shown that students who enroll in remedial courses are less successful in college than are students who do not (Attewell *et al.* 2006; Bettinger and Long 2004).

As the demand for students to be college ready continues to increase, high schools and postsecondary institutions have become outcomes-based, focusing heavily on student growth measures. Furthermore, the U.S. Department of Education has set an agenda to ensure that all students who graduate from high school are college ready. In fact, the Department of Education believes that economic progress and educational achievement are inextricably linked, and educating every American student to be prepared for college and for a career is a national imperative (U.S. Department of Education 2015).

Since 2011, more than 100 accredited U.S. colleges and universities have dropped SAT/ACT entrance requirements (Fair Test 2017). Given growing dissatisfaction with standardized tests, one strategy to improve academic performance and college readiness is to provide students with a college experience prior to postsecondary entry (Iatarola, Conger and Long 2011). Acceleration programs or college preparatory courses (*e.g.*, Advanced Placement (AP), International Baccalaureate (IB), Cambridge Advanced International Certificate of Education (AICE) Diploma) are seen as one of the main policy mechanisms for increasing college enrollment; they can have positive effects on cognitive strategies, content knowledge, and learning/behavioral techniques (Conley 2012; Conley *et al.* 2011). (The number of AP exams taken by students has more than doubled over the past fifteen years, as has the number of American students earning International Baccalaureate diplomas [College Board 2017; IBO 2016].) Students' grades in these programs, together with the strength of the high school curriculum studied, admissions test scores (*e.g.*, ACT, SAT), and high school grade point average (GPA) characterize college readiness and are influential in admissions decision making (Clinedinst, Hurley and Hawkins 2013; NACAC 2007). Predictive validity studies making use of these measures of high school performance become, therefore, one of the inherent mechanisms in the admissions process.

Although predictive validity research has played an important role in informing admissions policy (*e.g.*, Burton and Ramist 2001; Clinedinst, Koranteng and Nicola 2015; Liu *et al.* 2016; Makransky *et al.* 2017; Noble and Sawyer 2002; Rothstein 2004), no published works appear to combine a detailed account of its role in helping to establish college readiness and, in particular, the salience of different sources of data for doing so. The aim of this article is, therefore, twofold: first, to establish the role of predictive validity and “fit-for-purpose” data in the postsecondary admissions decision-making process and second, to investigate the availability and content of sources of secondary and postsecondary education data in the United States that are “fit-for-purpose” for informing postsecondary admissions policies. The

strengths, limitations, and utility in predictive research of the potential sources of data identified in the authors' recent investigations are also addressed.

Part I: Predictive Validity and the Need for "Fit-for-Purpose" Data

With increasing numbers of applications for admission to colleges and universities for the limited number of places in freshman classes, greater attention has been paid in recent years to college application, admission, and enrollment processes. (This is true of selective and highly selective institutions but less true for traditional and liberal selectivity institutions, which comprise the majority of U.S. higher education institutions.) In particular, admissions personnel at many postsecondary institutions—and especially at selective and highly selective institutions—have been charged with the difficult job of identifying applicants who are most likely to be academically successful and must decide whether students are ready for college-level coursework.

While it is difficult to generalize about the decision-making process used by college and university admissions officers, postsecondary institutions seek to admit students who are college ready and will thrive in their particular educational setting. At the most simplistic level, there appear to be two basic approaches to selection (Rigol 2003): *formulas* (by the numbers) and *judgments* (also called comprehensive, holistic, or 'whole folder' review):

- The *formulaic* approach, based on the general belief that high school curriculum and test scores will enable the selection of students likely to succeed (in terms of receiving high grades and persisting from year to year), typically includes measures such as high school GPA, grades in specific courses, and test scores.
- The *judgmental* approach usually implies a review of the applicant's entire application, essays, recommendations, and other information.

Where the number of applicants far exceeds the number of available places, more complex, often multi-step processes that employ both numbers and judg-

ments may be needed. As shown, for example in Rigol (2003) and ACT (2017), some postsecondary institutions either use open admissions or require little more than a verified high school diploma (*e.g.*, community colleges). These institutions attempt to address college readiness through placement processes that consider academic quality indicators as well as performance on placement tests. Liberal institutions usually accept any student with a high school diploma, although some popular or difficult programs within those institutions may be more selective. Traditional institutions, which comprise the majority of U.S. institutions, use standardized test scores and high school GPA as the basis for most admission decisions. Selective and highly selective institutions (the majority of freshmen accepted in these institutions are in the top 25 percent or the top 10 percent, respectively, of their high school graduating class) usually create prediction algorithms for admission decisions, with some institutions relying on these exclusively and others using them as one factor in a student portfolio review. The algorithms typically integrate performance at high school and other high school academic quality measures.

Recently, another approach to selection has advocated for colleges to look beyond grades and scores. Kalsbeek, Sandlin, and Sedlacek (2013) and Sedlacek (2017) promote the idea of considering the use of non-cognitive variables (*e.g.*, positive self-concept, leadership, persistence, creativity, and motivation) in a holistic admissions process; increasing numbers of U.S. postsecondary institutions are doing this.

Non-cognitive variables in admissions requirements can provide better assessment of student ability and potential, increase diversity, and account for different learning styles and cultural backgrounds. Institutions that use non-cognitive variables better predict students' success, regardless of their incoming GPA or admission test scores. For example, research by Farrington *et al.* (2012), Kalsbeek, Sandlin, and Sedlacek (2013), and Farruggia *et al.* (2016), to cite just a few, shows that mind-sets, perseverance, learning strategies, social skills, and behavior affect academic success. Therefore, while high school curriculum, GPA, and SAT/ACT scores continue

to be useful in measuring students' abilities, a more comprehensive assessment of applicants' potential to succeed in postsecondary education can be made by considering noncognitive variables.

Detailed examples of how colleges utilize some of these approaches in their admissions decisions can be found in many research studies of recent years. Killgore (2009) interviewed admissions officers in a sample of private, selective colleges to investigate the importance of different factors in admissions decisions. All the officers agreed that academic merit was the most important factor in admissions, with most of the colleges having developed a composite scale by which to evaluate applicants—a scale based on high school grades, test scores, and curricular rigor. However, non-academic factors such as extra-curricular activities, community service, arts, and employment were also taken into account as they could indicate skills that colleges value, such as determination, passion, and leadership.

In a similar survey of admissions officers in a wider sample of universities and colleges, Clinedinst, Hurley, and Hawkins (2013) showed that the most important factors related to academic achievements were, in order of importance, grades in college preparatory courses (*e.g.*, AP, IB, Cambridge AICE), strength of the high school curriculum studied, test scores, and high school GPA. Most institutions reported that they weighted high school GPA scores to account for different levels of difficulty of courses taken (for example, giving more weight to accelerated courses) and that students taking more rigorous courses were more likely to earn degrees. Admissions officers in this study assigned moderate importance to essays, students' interests, recommendations (by teachers and/or counselors), class rank, and extra-curricular activities. Ethnicity and high school attended were somewhat important; interviews and work experience were of least importance.

More recently, Rubin (2014) conducted a study among selective colleges and universities. The results of her research showed that their admissions processes involved narrowing the pool of applications by considering academic ability, the most important aspect of which was the rigor of courses taken, followed by high

school GPA. The author defines rigor as the most difficult courses available to students in their high school; students who take such courses show their determination to challenge themselves and an eagerness to learn. Hence, in determining whether students are college ready and should be offered the opportunity to enroll at a postsecondary institution, performance on high school assessments and/or acceleration programs and performance in postsecondary education may prove the strongest forms of evidence.

Finally, Clinedinst and Koranteng (2017), in the most recent “state of college admission” report, include information about the top decision factors for admissions gathered through the NACAC Admission Trends Survey 2016 (NACAC 2016). Their findings showed that GPA, grades in college preparatory courses, admission test scores, and strength of curriculum were given considerable importance by more than half of colleges that responded to the survey. Factors providing insights into students' personal qualities and interests (for example, essays, teacher and counselor recommendations, and extracurricular activities) were moderately important. Other factors, such as performance in acceleration programs (*e.g.*, IB, AP, Cambridge AICE), interviews, and work experience, were given moderate or considerable importance by a small percentage of institutions. Yet the authors also note that no specific combination of factors would guarantee a student admission to a specific college and that institutional characteristics (*e.g.*, enrollment size and acceptance rate) have an impact on the importance of admission factors.

Predictive Validity Studies: Scope and Importance

The overall aim of predictive validity research is to ascertain to what extent a current measure of performance (*e.g.*, high school GPA) predicts future performance. For example, Zwick (2006, 659) states that “the validity of admissions tests as a selection tool for higher education institutions is judged largely by the degree to which test scores can predict later grades.” Validity, of course, is a multifaceted concept. Staking a claim to predictive validity is contingent upon an evaluative judgement of the

different types of logical analyses and empirical evidence needed to support any such claims (Messick 1988). The different types are not alternative but rather complementary aspects of an evidential basis for admissions decisions. In fact, multiple sources of predictive evidence are necessary to equip admissions personnel with the information required to make accurate decisions (*e.g.*, Maruyama 2012; Wiley, Wyatt and Camara 2010).

Camara (2013) recommends conducting validation studies following high school students' taking of assessments as they enter postsecondary education and looking at a variety of postsecondary outcomes. Other research studies have sought to show how high school curriculum and assessment outcomes demonstrate the achievement of desirable postsecondary outcomes. For example, research by Kobrin *et al.* (2008) reveals that SAT scores are a strong predictor of how students perform in their first year at university and a stronger predictor than high school grades for students who are members of minority groups (*e.g.*, African American, Hispanic, American Indian, and Asian). However, Belfield and Crosta (2012) show that high school GPA is useful for predicting many aspects of students' college performance and that, in particular, high school GPA has a strong association with college GPA. They also conclude that other information from high school transcripts (*e.g.*, number of math, English, and honors courses taken in high school) is modestly useful.

Students who have earned AP credit have been shown to outperform those who do not in both first-year college performance and college completion (*e.g.*, Mattern, Marini and Shaw 2013; Mattern, Xiong and Shaw 2009; Morgan and Maneckshana 2000; Morgan and Ramist 1998). However, when the confounding effects of self-selection by students (with more able students joining AP programs) and inter-school differences (with better resourced secondary schools more likely to adopt the AP program taught by more experienced teachers) are taken into account, the picture is more complex. For example, after controlling for these factors, Klopfenstein and Thomas (2009) find no relationship between AP experience and either first-semester college grades or retention to the second year.

The efficacy of the IB as a college preparatory course has been investigated by Panich (2001) and Coca *et al.* (2012), among others. Comparing groups of students with no IB background, students with IB experience, and students with an IB diploma, Panich (2001) concludes that IB diploma students achieved the highest first-year university GPA whereas students with IB experience but no diploma achieved the lowest. Further, Coca *et al.* (2012) found that students who took the IB were more likely to attend a four-year college and demonstrated higher two-year persistence rates. More recently, Bergeron (2015) showed that IB diploma students enroll, persist, and graduate on time at notably higher rates than do their 'typical' university-bound American peers.

Shaw and Bailey (2011) explored the link between high school quality (in terms of the educational program followed) and postsecondary achievement. Their findings showed that students who followed an acceleration program obtained, on average, higher first-year GPAs than those who did not. The study also revealed that, after controlling for gender, race, and SAT score, students who had earned the Cambridge AICE diploma achieved higher first-year GPAs than did students who had earned an IB diploma, but there was no statistical difference between students who had earned the AICE diploma and those who had taken AP courses. (The AICE diploma recognizes students' performance on a suite of Cambridge International Advanced Subsidiary (AS)- and Advanced (A)-level examinations across a variety of subject areas. Good grades in A- and AS-level subjects can result in the award of university course credit.)

A Model for Predictive Validity

Predictive validity studies are guided ultimately by the availability of data. College attendance, persistence, and completion are key outcomes by which researchers and policy makers evaluate the effectiveness of secondary schooling and make decisions about postsecondary admissions. Therefore, tracking students into and through college is critical for predictive evaluations. However, establishing predictive validity by relating secondary school performance to later academic performance can

lead to problems associated with confounding variables that obscure the effects of other variables (Banerjee 2003). A common challenge in predictive validity studies is, therefore, controlling for factors that determine participation and outcomes in postsecondary education. Data on students' background (*e.g.*, ethnicity, gender, high school GPA, SAT/ACT scores, socioeconomic status, motivation, first-generation status) is required alongside secondary and postsecondary performance data.

There are three main steps in a predictive validity study to inform postsecondary admissions policies and decision making: the selection of a measure of success in postsecondary education; the selection of measures of high school performance; and the choice of research design and measurement model. (See Figure 1.) Each of these steps is described in detail below.

Selection of a Measure of Success in Postsecondary Education

In predictive validity studies, a number of different university performance measures (college readiness/college success) could be used. (Cognitive measures of academic performance, while highly predictive of college grades, are less so of retention and graduation [Schmitt *et al.* 2009].) These may include:

- postsecondary enrollment status;
- enrollment in remediation courses (*e.g.*, for students who enroll in postsecondary education, a lack of college readiness can be measured by the number of remedial courses they must complete);
- university enrollment status/re-enrollment in a second year at the same institution (*i.e.*, retention);
- average GPA (*e.g.*, first year; cumulative) or GPA in certain courses (*e.g.*, science/mathematics vs. humanities);
- choice of major;
- graduation status and time to graduation; and
- non-cognitive activities and/or measures of engagement (*e.g.*, greater propensity to participate in a non-curricular activity; research at university or study abroad).

The ultimate choice of performance measure would depend on the data available and should be tailored to reflect the objectives of the predictive validity study.

Selection of Measures of High School Performance

A range of measures of high school performance can be potential indicators of postsecondary readiness or success:

- High school GPA (including high school courses and grades obtained) or high school class rank: Note that high school grades reflect the standards and quality of a particular school or schooling system. Standards differ according to school area or region and even individual school (Burton and Ramist 2001).
- Standardized test scores: Although these have varying significance in admission decisions, prospective U.S. university/college students typically submit their college entrance exam scores (*e.g.*, SAT, ACT).
- Additional exams (*e.g.*, those that are part of the AP, IB, or Cambridge AICE diploma), including the number of hours of credit earned for a college course.
- Extracurricular activities and/or out-of-class accomplishments (*e.g.*, work experience, volunteer activities, community programs, clubs/societies/associations, hobbies, and sports).
- Teacher recommendations and/or testimonies: Many colleges require recommendation letters from teachers and/or high school counselors. The main reason for this requirement is that admissions officers are seeking to learn about applicants in a holistic sense (*e.g.*, how each student interacts with teachers and peers; how the student approaches the learning process).

Choice of Research Design and Measurement Model

In order to establish the predictive validity of measures of secondary school performance, it is necessary to determine the relationship between the success of students leaving school following a particular program of

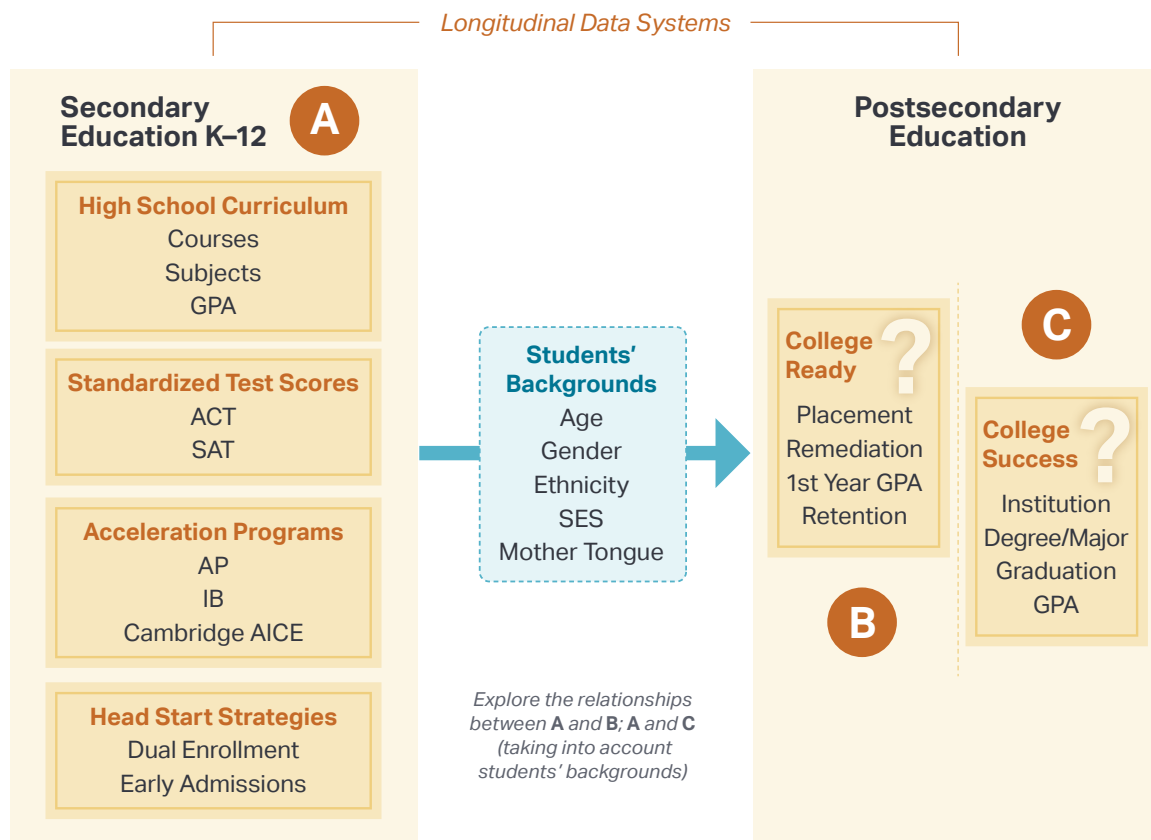


FIGURE 1 ➤ Predictive Validity Research Design

study and their success during, or at the end of, postsecondary study. (Such a model is shown in Figure 1.)

A challenge in predictive validity studies is the choice of research design and measurement model. In particular, the selection of statistical indices (*e.g.*, scatter plots, correlations, regression coefficients) has to be appropriate and technically sound. Initial analyses can entail exploratory use of descriptive statistics in order, for example, to plot a number of distributions (*e.g.*, cumulative GPA, number of hours of credits earned in each acceleration program) or correlations between secondary school and postsecondary measures of success. However, descriptive data analysis and correlations take no account of background factors that may have an impact on performance in postsecondary education and in acceleration programs (*e.g.*, age, gender, race/ethnicity, socioeconomic background). To account for these, mul-

tilevel regression models can be used. Multilevel modeling is a way of finding a line of regression through different groups, nests, or hierarchies of data. Multilevel models have been used in several predictive validity studies to take into account the hierarchical structure of educational assessment data (Bell and Dexter 2000; Shaw and Bailey 2011). Regression models would be the ideal way in which to analyze data in terms of the statistical robustness of conclusions that can be drawn. They enable comparisons between groups of students with different programs at school while allowing for background characteristics, such as prior ability (measured, for example, by SAT/ACT test scores), gender, ethnicity, and socioeconomic status.

In addition to quantitative lines of inquiry, it should be possible to investigate the predictive value of secondary school programs of study by eliciting the views,

perspectives, and attitudes of a diverse range of stakeholders (*e.g.*, students, teachers, parents, admissions personnel, departments of education). Procedures for collecting evidence in this way—used, for example, by Shaw (2011)—could include focused discussions, semi-structured interviews, lesson analyses, or surveys. Methodological triangulation, “the combination of methodologies in the study of the same issue” (Denzin 1978), has been credited for many years and might increase the validity of the analyses and findings (Cresswell and Plano Clark 2011).

Mixed method research designs, which seek to integrate qualitative and quantitative data in parallel and sequential ways, are also becoming increasingly relevant to addressing the impact of secondary school measures on college achievement. Though the analysis of each data strand is usually carried out independent of the other, evidence is drawn from both strands of inquiry, thus providing admissions officers with greater understanding. By employing a convergent parallel mixed methods research design in collecting information, admissions staff are better able to make informed decisions. The triangulation of information derived from multiple “fit-for-purpose” data sources serves to enhance staff confidence in the outcomes that inform decision making (see Greene, Caracelli, and Graham 1989) for a discussion of reasons for mixing methods). The next section of the paper investigates the availability and content of different sources of secondary and postsecondary education data in the United States that are useful in predictive studies to inform postsecondary admission decisions.

Part II: “Fit-for-Purpose” Data for Predictive Validity Studies: Types, Value, and Limitations

One of the main purposes of admissions data is to provide information to aid decision making (Goldring and Berends 2009; U.S. Department of Education 2009). However, the use of data that are not “fit-for-purpose” may lead to incorrect conclusions and poor decisions being made.

It is important, before looking for data sources, to define the data needed. Being able to specify what is

being sought or what the goals are, as described in Part I, will help ensure that the data required to make well-informed decisions are obtained.

Many sources of data are available, but careful consideration should be given to choosing the right data for the intended purpose (*e.g.*, identifying at-risk applicants, deficiencies in student preparation, placement, college-level certification, classifying enrollment as credit bearing or remedial, retention planning, etc.). There are also very different types of data sources. For example, while a survey collects data from a subset often representative of the total population, a census aims to collect information from everyone being studied. One of the most common sources is administrative data (either from individual institutions or from government agencies), which involve data collected for administrative purposes but that can be used to produce information in the research area of interest.

Data sources can be identified using web-based search engines, site-specific search engines such as state data sites, literature-reported data sources, and via communication with data owners. In our investigations, we sought only data available at the student level and, for each data source identified, we collected the following information (where available): data description, ownership, data format, record start and end years, method to obtain data, point of contact information, and data constraints/limitations. The data sources identified were spread across a wide variety of owners and locations, each with different access arrangements and data formats. Table 1 lists all the data sources considered as part of this investigation, summarizes the availability of key data elements, and provides information about access. Although some of the sources (*e.g.*, the Common Application, U.S. Census data) are not suitable for predictive validity studies to inform postsecondary admissions policies and decision making in the way described in Part I, the four data sources described below have great potential, and their use could be considered, for example, by researchers, policy makers, and other stakeholders in education to gather evidence about the predictive validity of high school programs of study and about students’ college readiness.

TABLE 1 ► Sources and Availability of Key Data

Data Source	Personal Data	High School Data		Postsecondary Data				Availability	Cost
		Acceleration Program ¹	SAT/ACT	Institution	Major	Degree Awarded	GPA		
Individual Postsecondary Institution ²	Gender, Ethnicity	Yes	Yes	Yes	Yes	Yes	Yes	Yes ³	Free
National Student Clearinghouse	Age	No	No	Yes	Yes	Yes	No	Yes	Fee ⁴
The Common Application	Gender, Ethnicity, SES ⁵ , Age	Yes ⁶	Yes	No	No	No	No	Unlikely	—
U.S. Census Data	Gender, Ethnicity, SES ⁵ , Age	No	No	No	No	No	No	Yes ⁷	Free
Survey Data									
BPS 2012	Gender, Ethnicity, SES, Age	Yes ⁶	Yes	Late 2017	Late 2017	Late 2017	Late 2017	Yes ⁸	Free
ELS 2002	Gender, Ethnicity, SES, Age	Yes ⁶	Yes	Yes	Yes	Yes	Yes	Yes ⁸	Free
HLSL 2009	Gender, Ethnicity, SES, Age	Yes ⁶	Yes	Late 2017	Late 2017	Late 2017	Late 2017	Yes ⁸	Free
State-Level Data Warehouses (Examples)									
Florida	Gender, Ethnicity, SES ⁵ , Age	Yes	Yes	Yes	Yes	Yes	Yes	Yes ⁹	Fee ¹⁰
Washington	Gender, Ethnicity, SES ⁵ , Age	Yes	Yes	Yes	Yes	Yes	Yes	Yes ⁸	Free
Virginia	Gender, Ethnicity, SES ⁵ , Age	Yes	Yes	Yes	Yes	Yes	Yes	Yes ⁹	—

SES: Socioeconomic Status; **ELS:** Education Longitudinal Study; **HLSL:** High School Longitudinal Survey; **BPS:** Beginning Postsecondary Students Longitudinal Survey; “—” indicates no information was available

¹ (e.g., AP, IB, AICE)

² Data from Florida State University have been used, for example, in Shaw, Warren, and Gill (2014)

³ Subject to institutional review board approval

⁴ (Depending on data requested)

⁵ (Proxy)

⁶ (High school transcript)

⁷ (PUMS files)

⁸ (Restricted use)

⁹ (If research is aligned with state’s research agenda)

¹⁰ (“Recovery fee”)

Individual Postsecondary Institutions

Most postsecondary institutions gather routine data via their admissions offices and students’ secondary and postsecondary transcripts, which can support predictive validity studies (see Table 1 for a list of potentially avail-

able data items). Competitive differentiation research, that is, studies highlighting the effectiveness of a specific program of study (e.g., AP, IB, Cambridge AICE, dual enrollment) to predict preparedness for and continued academic success at postsecondary institutions in terms of directly measurable, cognitive performance

outcomes (such as college first-year or cumulative GPA) can be carried out with this type of data.

Predictive validity studies using data from individual postsecondary institutions have been carried out, for example, by Shaw and Bailey (2011) and Shaw, Warren, and Gill (2014). The authors used administrative data collected from students enrolled at Florida State University to demonstrate that Cambridge International assessments (in particular, AS and A levels for sixteen- to nineteen-year-olds) prepare students as well as other acceleration programs to study at U.S. colleges and universities. (Cambridge Assessment International Education is a provider of international education programs and qualifications for five to nineteen year olds. It is part of Cambridge Assessment, a department of the University of Cambridge in the United Kingdom.)

Studies using these types of data usually take a case study approach and therefore are bounded investigations that are not readily generalizable. However, compared to other methods and in the absence of national data, a case study can examine, in depth, a particular issue within its real-life context (Yin 2006). One further disadvantage of using data from just one postsecondary institution is that there might not be enough students in a given year who participated in each of the different secondary school programs under investigation. One possible way to increase numbers would be to analyze several cohorts of students from each institution or to consider data from several universities in the same study. Alternatively, it could be possible to use meta-analysis to combine results from several small studies.

National Student Clearinghouse (NSC)

Institutions of postsecondary education submit enrollment data to the NSC several times each academic year, reporting whether a student is enrolled, at what postsecondary institution, and at what intensity (part time or full time). NSC has long recorded degree completions from a given institution, often with the types of degrees earned. However, only as of 2012 has it started to systematically record the fields in which the degrees are earned (*i.e.* students' majors).

NSC data are relatively new to academic researchers and policy makers. However, increasingly, research uses it to explore the effects of various programs or policies on postsecondary attendance, persistence, and attainment (*e.g.*, Bergeron 2015; Conley *et al.* 2014; Deming *et al.* 2014; Dynarski, Hyman and Schanzanbach 2013; Helmet, Roth and Eaton 2013; Hyman 2013; Mattern, Marini and Shaw 2013; Roderick, Nagaoka and Allensworth 2006; Vidal Rodeiro, Crawford and Shaw 2017).

When data are obtained from the NSC, researchers or policy makers use a service called Student Tracker. This service uses a proprietary algorithm to match a list of students supplied by the researcher to NSC's enrollment and degree information. NSC data do not include individual course information or GPA, so college success can only be measured by enrollment and/or graduation. Furthermore, students who are enrolled in college may not appear in NSC data. In such cases, it is not possible to distinguish whether there is some reporting/measurement error or whether the student did not enroll at all. Dynarski, Hemelt, and Hyman (2013) explored some of the pitfalls of using NSC data to measure postsecondary outcomes and reported some sources of non-coverage. The most significant way in which measurement error appears when using NSC data is that participation is voluntary, and not all colleges report enrollment information through this service. However, participation has increased markedly; as of 2018, the NSC reports that more than 3,600 colleges and universities enrolling 98 percent of all students at public and private U.S. institutions participate in the clearinghouse (NSC 2018). A second way in which measurement error might occur is due to the matching process used by NSC, which uses students' names and dates of birth as primary information (and, in some cases, the only information). A final way in which NSC data may not fully capture information on the postsecondary experiences of a sample of students pertains to the Family Educational Rights and Privacy Act (FERPA): Under FERPA, students and postsecondary institutions may prevent the sharing of enrollment and degree information. NSC cannot release student-level information if the record is "FERPA blocked."

NSC data can, therefore, be used for predictive validity studies of the progression and outcomes (*e.g.*, type of degree, field of study, completion) of full cohorts of U.S. high school graduates with specific sets of qualifications. In particular, the use of NSC data would enable the tracking of full cohorts of students in and through postsecondary education and the study of issues such as participation/performance in a specific high or secondary school program and its relationship to postsecondary participation/performance; the proportion of a program's students progressing from first to second year or successfully completing their degrees on time; performance (measured by graduation) in selected fields (*e.g.*, STEM); and relationship between high school grades and postsecondary performance (as measured by graduation) by institution and by academic program.

Data from National Surveys

Prior to the establishment of NSC, it was challenging to follow students through secondary and into postsecondary education. Researchers relied primarily on nationally representative surveys that solicited information about educational attainment. Three longitudinal surveys were identified and explored: the Education Longitudinal Study (ELS), the High School Longitudinal Survey (HSLs), and the Beginning Postsecondary Students Longitudinal Study (BPS).

Data from these surveys include background characteristics, high school performance, and postsecondary education for large samples of students (for example, the HSLs followed a sample of 24,000 ninth grade students in 2009). In particular, these surveys include information about some courses completed in high school (*e.g.*, AP and IB), but there is no explicit reference to others (*e.g.*, Cambridge AICE) in the available documentation.

These types of data allow competitive differentiation studies, such as those described earlier. However, attrition limits the capacity of surveys to follow groups of students over time. This restricts researchers' ability to meaningfully evaluate programs or policies of interest (especially as they affect a particular group or cohort of students) and to track long-term outcomes. (See Ingels

et al. 2014, 2015 and Hill *et al.* 2016, for more information about these surveys.)

Data from State-Level Warehouses

For years, many states' departments of education have been trying to link individual student records from secondary/high school to postsecondary education systems to ensure that their high school graduates are ready for postsecondary education and to identify practices and programs that best prepare students to succeed in college. This has led to the creation of state-level data warehouses. These data systems are intended to enhance states' ability to efficiently and accurately manage, analyze, and utilize education data, including individual student records; they should also facilitate research to increase student achievement and close achievement gaps, to answer critical policy questions, to inform continuous improvement, and, ultimately, to support students on their paths to success.

The data in state-level warehouses include the programs in which students participate as well as a variety of demographics. They should facilitate studies to establish the predictive validity of high school qualifications and programs relative to preparing students for college.

There are, however, data-sharing restrictions. In some cases, a review to ensure that the data request meets FERPA criteria and a data-sharing agreement are required. In some states, an important condition for the release of data is that they be used for research that supports the needs of their departments of education.

State-level warehouses in Florida, Washington, and Virginia were examined in detail in this research. These systems were selected on the basis of state progress and key priorities to promote the effective use of longitudinal data for research and policy decision making, as reported by the Data Quality Campaign. (The Data Quality Campaign is a non-profit, national organization committed to realizing an education system in which all stakeholders, from parents to policy makers, are empowered with high-quality data. The Data Quality Campaign runs an annual survey, *Data for Action*, that highlights state progress and key priorities to promote the effective use of longitudinal data. For more infor-

mation, see dataqualitycampaign.org.) (The availability of key data elements and information about access are reported in Table I, on page 31.)

Data from the state-level warehouses make it possible to conduct predictive validity studies and to make conclusions based on evidence from participation or performance in preparatory courses and from subsequent college enrollment and performance. Because these data usually include GPA, it is also possible to draw on the evidence of detailed performance in college (*e.g.*, first-year GPA, cumulative GPA) rather than only from graduation, as NSC data allow.

The potential of carrying out analyses such as those described above makes state-level data warehouses the most comprehensive source of data for studies helping to establish college readiness and for informing postsecondary admissions policies and decision making. Nevertheless, issues with data acquisition (especially relating to the purpose of the studies, timelines, and data protection) and financial costs need to be taken into account when planning to formally request state-level data.

The four sources described here can be used for predictive validity studies and, therefore, to make inferences and formulate conclusions about college readiness on the basis of the different types of data they include. However, if the data needed for a predictive validity study are not available, then researchers and other stakeholders (*e.g.*, admissions personnel and policy makers) may have to collect their own data. This can be costly and time consuming depending on the size and scope of the project. Means by which to collect data could include developing a survey and sample design, tracking a cohort of students from high school through their first year of postsecondary study or to employment, and interviewing students, teachers, admissions personnel, and/or professors.

Ultimately, predictive validity studies will be guided by the specific questions to be analyzed. The benefits of any research need to be weighed against its costs. Understanding, in advance, the availability of data needed for a specific purpose will prevent counterproductive activities such as trying to source data that are not available nor “fit for purpose.”

Conclusions and Discussion

Predictive validity can be used to quantify how well a test or a particular measure of high school performance forecasts educational outcomes; it entails the comparison of some scores with some other measure for the same candidates taken some time after the test or completion of a program of study (Alderson, Clapham and Wall 1995; Anastasi 1988). It is vital to demonstrate the predictive validity of measures of performance used for university selection.

Part I of this article shows that the results of predictive validity studies can be used by postsecondary education institutions for different purposes—mainly, to review, validate, or refine criteria used in the admission process and to demonstrate that a program of study and/or assessment helps students achieve desirable college and career outcomes.

Crucial to the efficacy of evaluating admissions data is the construction of a validity argument from which accurate interpretations of the evidence can be drawn and meaningful decisions made. According to the North American Standards for Educational Psychological Testing, the “degree of accuracy and the score range within which accuracy is needed depends on the purpose for which the test is used” (AERA 2014, 17). Predictive validity studies usually are undertaken within local contexts and at the institutional level (either in house or in partnership with an external organization) because the impact of various sources of evidence may vary from institution to institution. Predictive studies may suit the purpose of the local context, but they nevertheless may lack credibility, precision, and validity (in terms of the criterion for a given testing scenario) in a different context. Key to educational settings “is the degree to which validity evidence based on test-criterion relations can be generalized to a new situation” (AERA 2014, 18). Thus, the degree to which evidence can be generalized to a new context in order to support a claim of predictive validity will be contingent upon the availability of appropriate data and accumulated research.

Weir (2005) sounds a note of caution, arguing that predictive studies by themselves are insufficient evidence of validity. Establishing predictive validity by

correlating performance with later academic performance is often not possible given practical difficulties in mounting tracer studies and problems associated with confounding variables. Other known limitations of predictive studies relate to selected sampling (Sackett and Lievens 2008), failure to take into account variables known to correlate closely with academic performance (for example, demographic and socioeconomic factors), and models that employ composite rather than individual scores (Bettinger and Baker 2011).

Notwithstanding the challenges, predictive validity is regarded as a vital aspect of the admissions process; identifying the “right” data to carry out predictive studies is crucial and has the potential to prompt admissions personnel to engage critically with the process.

Admissions decisions usually are based on evaluative judgments often involving large and complex amounts of data (Williams, Keng and O’Malley 2012). As described above, admissions information embraces both statistical data (*e.g.*, analysis of grades, performance data) and subjective data (*e.g.*, extracurricular activities, out-of-class accomplishments, collegial aspirations). Given that a typical college application can comprise six or more pieces of information (Hernandez 2009) and receives, on average, 25 minutes of reading time (Dunbar 2007), successful decision making needs to be grounded in a clear understanding of all admissions criteria, especially in relation to the purposes to which the data are put. How universities evaluate applicants and use and weight available data in admissions decisions will depend on the adequacy of all available data for the

TABLE 2 ► Alignment of Stated Admissions Purposes and Information Yield

Institutional Admissions Purpose	Data yield information as to whether the student ...
Exemption from Remedial Courses	► needs to take developmental or remedial courses (whose content coverage is deemed to be at a lower level than college level) and is lacking readiness for college.
Placement in College Credit Courses	► is correctly placed in an appropriate course, which, in turn, benefits the institution and the student.
Identification of at-Risk Students	► with marginal credentials on entering college will need support throughout his college program.
Time to Graduation	► will complete an associate or bachelor’s degree or certificate program in two, three, four, five, or six or more years.
Graduation from a Degree	► will complete a degree successfully.
Persistence (to 2nd Year) and Completion of Degree	► will struggle academically (thereby having an impact on retention).
College “Fit” (College Needs)	► will contribute to the university community; ► will be capable of performing academically at the college; and ► would have been placed in the previous year’s cohort.
Student “Fit” (Student’s Qualities)	► will benefit from being at the college; and ► would take full advantage of the opportunities offered.

specific purpose to which they are being put. Table 2 depicts the alignment of a range of admissions purposes with the kinds of information that data should provide.

Sources of data described in Part II of this paper provide information for the admission purposes listed in Table 2. For example, NSC data could be used to look at the progression and outcomes (*e.g.*, type of degree, field of study, time to graduation, graduation) of a full cohort of U.S. high school graduates. Longitudinal data from state-level warehouses will allow the investigation of retention and persistence rates and detailed college performance using first-year or cumulative GPA. Data on remedial courses taken by students are also available in some state-level warehouses (*e.g.*, Washington); together with candidates’ background characteristics and high school performance, that information can be used to predict which students are more likely to need help to become college ready.

While the availability of data provides an opportunity to answer many research questions, the data

sources must be chosen carefully to ensure timely availability and their appropriateness to address such questions (*i.e.*, availability of key variables and coverage of the right students). It is therefore important to understand the data landscape in the United States (*e.g.*, which data are available and how to access them) and the nature of the data required for the types of analyses described in this paper. In particular, it is crucial to identify what data elements are needed, from where they derive, where they are available, and whether they are suitable for the intended purpose. This will prevent counterproductive activities such as trying to source a data set that is protected.

The extent to which academic and non-academic admissions indicators can be regarded as helpful in decision making is ultimately conditional upon the purpose(s) of an individual institution's policies and practices. However, not all indicators can be used solely for predicting success in college. For example, they can assume a high school formative function. All available evidence can

be employed at the K–12 level for improving the student's college preparation. Students' progression between education stages is invaluable for the management and continued improvement of education systems. More specifically, the ability to view students' transitions can help the education sector better plan, as well as isolate factors that contribute to specific educational outcomes for certain groups of students. The No Child Left Behind Act has mandated the establishment of data systems capable of describing students' progress, with the transition between K–12 and postsecondary education becoming increasingly important. At the K–12 level, the collection of student-level data has been framed as a need for information that will enable school improvement and the enhancement of educational outcomes (Data Quality Campaign 2005). The data sources identified in this article should be useful to researchers, government officials, teachers, policy makers, and other education stakeholders in their exploration of issues related to students' progress from K–12 to postsecondary education.

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