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Workshop to Examine Current and Potential Uses of
NCES Longitudinal Surveys
by the Education Research Community

New Tools for Measuring Context

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INTRODUCTION

For over half a century, education researchers have recognized the importance of school context for many aspects of education, from teaching and learning to the hidden curriculum that reproduces social inequality. Harnessing the prosocial power of school contextual effects on students' development, either directly or indirectly through the enhanced work of school professionals, is valuable because elements of the school context may be responsive to carefully crafted education policy. However, assessing and determining successful policy depends on the proper measurement of context and adequate data to estimate effects. In contrast to the physical or financial resources of a school or district, the school context is inherently social and depends on social relationships, both potential and realized, as well as the characteristics of each person interacting within the school context. In other words, any particular context may affect different people differently, and individuals inhabit multiple contexts simultaneously. Consequently, schools have many contexts under one roof, with the social nature of the school context presenting challenges to measurement over time and space. This paper describes issues in measuring school contexts with an eye toward understanding students' experiences and outcomes, the initiatives currently under way at the National Center for Education Statistics (NCES) that relate to measuring school contexts, possible gaps in those initiatives that if filled could provide valuable new data for researchers, and new approaches and opportunities for measuring school context. After a discussion of special considerations for measurement related to diverse populations and youth development, I conclude with recommendations for future priorities.

MEASURING SCHOOL CONTEXT

School contexts can be measured by focusing on individuals' behaviors or ties to place or relationships of individuals within the system, or by examining individuals relative to the structural features of the school. Schools have many structural settings—classrooms, sets of courses that students take together, grade levels, extracurricular activities—that bound social interactions each day and over the course of the school year, or even longer. With its well-defined boundaries, the school also provides a hub of activity for professional communities of teachers and other school personnel, as well as communities of students' families.

Over the course of childhood and adolescence, students spend many hours in classrooms and other school settings, as well as extra hours in extracurricular activities, summer programs, jobs, parent outreach events, and other opportunities for interaction of peers, friends, and their families. These settings are adapted to the students' developmental stage as they grow and gain capacity to handle more independent and complex academic challenges and social relationships. Through these ongoing and at times intense interactions, the school can emerge as a venue to define a community, where it may take on a larger role in the residential neighborhood or other collective bound by the commonality of experiences that emerge from sharing so many hours of the day over the years of childhood and adolescence. Whatever the grade level, the intensity of social interaction and judgment that students experience through the school's context may heighten the effect of the hours spent in school on social-emotional development

beyond learning and the acquisition of skills to include personality, interests, values, identity, and motivation.

Taken together, the school provides opportunities for the emergence of important and valuable social relationships, norms, and reciprocated obligations that build trust, shared information, goals, values, interests, and motivation among members of the communities. These social processes within schools are of interest to a wide range of scholars, including developmental psychologists, economists, sociologists, anthropologists, and education scientists. The social processes allow us to understand how status hierarchies and opportunities to learn are structured and reinforced, how they contribute to the development of personality and motivation, and how they shape the cultures that emerge in schools (Coleman, 1988). In all, the social relationships, culture, and personality that emerge may affect students' learning, educational processes, educational attainment, adult earnings, and long-term well-being. From the standpoint of scholars of education and education policy makers, schools represent a major investment for every developing and developed society. The potential of school contexts to either amplify or undermine the investments made in curriculum, administration, teachers, and other personnel means that understanding the contexts of schools is a priority.

Beyond these investments in the education of young people, of key interest to education researchers, policy makers, and public health professionals is that the social context of the school can be a setting in which antisocial development can occur. Recent events of school violence and bullying have heightened public awareness of the potential for rare but disastrous events to take place in schools. Additionally, school fighting, substance abuse, negative weight-related pressures, and other health risk behaviors can both cause negative school climates and be a consequence of poorly functioning schools. These school safety issues stemming from the school's context are important yet challenging to measure for a number of reasons. First, the negative outcomes that emerge from the context are relatively rare events. And second, we know very little about how such negative events come about or emerge from a school's climate, or how to identify problem pockets within a school context. These challenges are complex; for example, efforts to disrupt a negative school environment, such as the use of metal detectors or visible mechanisms of social control or surveillance, may have their own negative consequences and exacerbate an already troubling situation.

CURRENT APPROACHES TO MEASURING CONTEXT WITH NCES DATA

NCES has several programs that involve measuring school context: (1) a major new initiative, the School Climate Studies, and two notable and established programs, (2) a secondary longitudinal studies program and (3) various data on schools and districts.

The School Climate Studies

The School Survey on Crime and Safety (SSOCS) has collected information about crime at school and discipline from a sample of school principals since 1999–2000, and every other year from 2004 to 2010. Replacing the SSOCS is the new NCES initiative on measuring school climate, which is in the design phase. The website safesupportivelearning.ed.gov describes the background and topics related to the initiative to measure

"engagement, safety, and environment." The overarching purpose of the program is to prevent school violence and substance abuse through the design instruments that can be used by middle and high schools and their districts to measure and monitor the school climate as it relates to a large number of dimensions measured by a broad set of established school climate indicators. As part of the initiative, NCES will design survey instruments for students, staff (teachers, leadership, other staff), and school administrators. If funding is available, survey instruments may also be designed for parents and guardians. With these instruments, NCES will collect data from a national sample of schools to provide benchmark indicators. A positive advance from this study is to provide schools and districts with tools that they can use to conduct their own assessments of the school's climate.

From a research perspective, the initiative has the potential to make new and important contributions, but it also has some serious potential limitations. On the positive side, bringing together so many indicators of school climate in a single survey instrument will provide the opportunity to understand school climate in a more nuanced way through the study of covariation among indicators of reports from multiple perspectives (e.g., teachers, students, and administrators). However, without adequate measurement of within-school variation, achieved only with large enough probability samples of students in schools, the potential for understanding crucial sources of variation within a school will be lost. The value of measuring within-school variation is discussed below. Measuring within-school variation should be a high priority for developing an understanding of engagement and safety. In addition, the current plans do not include any capacity to link to administrative records, retain student identifiers for longitudinal data collection, or link student responses or climate measures to individual student outcomes. These shortcomings limit the potential value of the database. Measurement of school context is of limited use from both a research and policy perspective if the climate indicators do not have properties defining their relationship to student outcomes that are well established in the literature.

The Secondary Longitudinal Studies Program

For the research community's studies of school context, a centerpiece of the NCES portfolio is its rich secondary longitudinal studies program, which now includes five studies: the National Longitudinal Study of the High School Class of 1972 (NLS:72), the High School and Beyond (HS&B) longitudinal study of 1980, the National Education Longitudinal Study of 1988 (NELS:88), the Education Longitudinal Study of 2002 (ELS:2002), and the High School Longitudinal Study of 2009 (HSLS:09). Each database has had a major impact on the research infrastructure and on policy; for example HS&B alone has provided data for at least 800 peer-reviewed articles, books, doctoral dissertations, and major reports.

The emphasis of the program is on the educational development of students through high school and in the transition to adulthood. Each study includes measures of school context from administrator reports on a range of topics (e.g., school attributes and resources, school climate, and academic course offerings) and through the capacity to link school records to other school and district databases, described below. Recent efforts to link student respondents to state educational data systems have had limited

success, in large part because of challenges in negotiating federal and state data-sharing agreements. Generally, the databases do not have the capacity to measure heterogeneity within schools because they do not contain records about all students in the school or large enough probability samples of the student body within each school. However, an improved design that utilizes available administrative and extant data sources and requires only modest resources, discussed below, could correct this limitation.

The original HS&B sample of almost 60,000 sophomores and seniors—in which a probability sample of 36 sophomores and seniors along with selected subgroup oversamples completed questionnaires and achievement tests—came closest among the secondary longitudinal studies to providing researchers with contextual data from students' reports. Although HS&B advanced the field through the capacity to measure context and even within school contexts based on tracking, 72 students from two grade levels per school is not an adequate sample size to gauge within-school heterogeneity in many large schools today. The original HS&B sample was later subsampled to obtain the panel of respondents, who were followed into adulthood. In the early 1990s the National Educational Assessment of Progress High School Transcript Study, a cross-sectional study, also attempted to obtain representative samples of students in schools and sampled up to 150 students in a single school, with the school size determining the sample needed to obtain representativeness.

School and District-Level Data

NCES collects several data sources about schools and districts that provide rich information about school context for use by the research community. Databases that cover all public schools or districts are especially useful because they can be linked to the longitudinal studies of students (such as those in the Secondary Longitudinal Studies Program). Generally speaking, probability samples of schools without the capacity to link to individual student data are limited in their potential to inform for research and policy about student development and outcomes.

NCES and/or the Office for Civil Rights (OCR) sponsor four programs that collect valuable data from every school and/or district in the United States. The Common Core of Data (CCD) program has collected and makes available data from every public school and local education agency (LEA), or school district, and state annually since 1986. The range of topics is extensive, covering information "about students and staff, including demographics; and fiscal data, including revenues and current expenditures" (http://nces.ed.gov/ccd/). Complementing these data are indicators from the School District Demographic System (SDDS), which compiles demographic and geographical information from the U.S. Census products about persons residing within the attendance boundaries of LEAs. A similar product is available at the school level for many public school attendance boundaries (http://www.sabinsdata.org/). Information on the universe of private schools is collected every two years under the Private Schools Study (PSS) program. Together, the CCD and PSS cover the vast majority of schools in the United States.

Finally, the OCR Civil Rights Data Collection (CRDC) produces data from every public school and LEA in the United States. Data from every school and LEA, rather than a sample, are only collected in selected years, with increasing frequency over

the past decade. The purpose of the data collection is to provide information to help administer and enforce the civil rights statutes. The program documentation states that "CRDC collects information about school characteristics and about programs, services and outcomes for students. Most student data is disaggregated by race/ethnicity, sex, limited English proficiency and disability" (U.S. Department of Education, 2014).

GAPS AND AREAS FOR IMPROVEMENT IN MEASUREMENT

Many of the NCES school contextual databases described above include the same or similar repeated indicators over a period of time, allowing measurement of trends. The databases that include every school can be linked to databases of samples of individual students in schools, such as those in the secondary longitudinal studies program. Such linkages provide much more analytic power for measuring school contextual effects.

Yet, substantial evidence suggests that there is considerable heterogeneity within schools that is typically not captured by school-wide indicators. Students may occupy different contexts within a single school, perhaps as a function of the courses that they take or their extracurricular involvement. These structural features that are internal to the school may have implications for who the student comes into contact with during the day and for opportunities to form friendships. Furthermore, the student may experience his or her context differently depending on personal characteristics, personality, or identity.

We know that students' lives are complex and involve multiple contexts outside of school, as well. Students may come from different neighborhoods and they have different families; each setting has different resources and different adults, who may or may not be involved in the student's schooling. Although these experiences are not necessarily shared with other students in the school, much evidence suggests that these factors, ranging from the levels of education of all parents in the school to the frequency of religious attendance of students in the school, are attributes of students that in the aggregate can affect the context for all students in the school. Most surveys now rely on administrators' limited knowledge to report about students.

Researchers across many disciplines have recognized the importance of structural variations within schools for shaping student experiences and outcomes. Research on the practice of tracking, to separate students into ability groups within a school, was one of the first approaches to identify the powerful differences in opportunities to learn that could come about within schools (Gamoran, 1992; Gamoran & Mare, 1989). These unequal opportunities to learn were cause for concern (Oakes, 1985) and were followed by a call to detrack (Brewer et al., 1995), such that few school administrators currently report that their schools track students. Yet, many academic courses are still organized into sequences in which prerequisites lead to more advanced coursework. This is most common in mathematics, with the result of segregating students into different courses in a high school, sometimes over the entire four years of high school (cf. Riegle-Crumb, 2006; Stevenson et al., 1994). Similarly, sets of academic courses may be offered together, some in sequences and others as a result of scheduling constraints, resulting in effectively maintained inequalities in opportunities to learn within a single school (Lucas & Berends, 2002).

It is important to remember that schools may differ both in average level and in variability of opportunities to learn. For instance, some schools may offer students only advanced college preparatory courses, while other schools may have a range of courses that serve to advance some students toward high school graduation or career and technical educational outcomes only, while other students enroll in advanced coursework to prepare for four-year and selective colleges after high school graduation. Regardless of the exact definition of the differences in opportunities to learn, substantial evidence supports the claim that "second-generation segregation" exists in many schools in the United States and results in inequalities in opportunities to learn (Mickelson, 2001).

Social and developmental psychologists and social network researchers have also recognized within-school differences that come about from the tendency of people to form friendships according to homophily, or similarity of attributes, such as race (Moody, 2001). These friendship groups may exert powerful normative influences on students' behavior and identity. Differences in adolescent students' identity have long been recognized by researchers and may even be characterized by their perceived connections to or position in the school (e.g., Barber et al., 2001; Coleman, 1961; Willis, 1977). Students may fine-tune their reference group to suit their self-perceptions and identity (Mueller et al., 2010), with consequences that must be understood in terms of the fit between the student and his or her context within the school. It is worth noting that this fit may have positive, prosocial consequences (Riegle-Crumb et al., 2006) or negative effects for adolescents who do not fit in (Wilkinson & Pearson, 2009), or place some students in contexts that promote negative behaviors (e.g., drinking [Crosnoe et al., 2004] or suicide ideation [Abrutyn & Mueller, 2014]). Each of these approaches underscores the value of recognizing heterogeneity within schools and how students' attributes interact with the context to shape their experiences and outcomes.

The heterogeneity of school contexts presents measurement challenges because (1) students are members of different contexts, in and out of schools; (2) each school has a unique internal structure; (3) within a single school, different students may experience a similar structural position differently, and (4) schools include multiple actors—students, teachers, staff, and administrators, as well as parents and possibly community leaders—each of whom will have a unique and potentially valuable perspective. Ideally, any procedure to estimate the context would be empirically derived using data from the school and people within the school (students as well as other actors) so that the measures tap the uniqueness of the school and can be linked to students and other actors in the school and compared across schools. The recent events of school violence stemming from students' alienation underscores the value of recognizing that students may occupy different social positions in the school and may experience the school and its contexts very differently. Instances of bullying or other forms of school violence may come about when a student becomes alienated and feels like an outsider, in part because of the (perceived) insiders in the school. A single school may have both insiders and outsiders within the same contextual spaces. It is only by analyzing the relationship between the internal structure of schools and the individual students within those spaces that we will be able to identify and understand how some schools might at once promote learning for some students and become unsafe spaces for other students.

Students may be members of multiple contexts within a school. During a single academic year, for example, students may go from math class to English class and then on to band, orchestra, or choir, and then to foreign language or an elective, and they may also engage in extracurricular activities. These different venues mean they may regularly come in contact with different sets of students and teachers. Similarly, when students transition from one academic school year to the next and take different courses, their social contexts are likely to change. If each of these contexts is not measured then measurement bias can occur (possibly overestimating the effect of the context that is measured). Although it would never be possible to measure all environments a student will be exposed to, it is nonetheless important to measure the major structural features in a school, and in particular structural features that are malleable to policy intervention.

To date, the NCES approach to measuring school context is strong for identifying nationally representative samples of schools and students, and for evaluating trends over time. The extant school contextual databases measure some aspects of the structural elements within schools but lack important detail. For example, the OCR CRDC collects some limited information about within-school differences, such as percentages of the student body (by race/ethnicity and gender) in advanced placement courses; the CCD collects information on school funding, class size, and other resources indicators. The new School Climate Studies are geared toward measuring attitudes and behaviors from the perspectives of students, teachers, and staff and administrators. Yet, none of these surveys adequately measures the contextual heterogeneity *within* schools nor can the different contexts in the school be linked to particular students in the school. Doing so is a crucial first step toward developing policies that serve the diverse needs of our nation's students. Enhancing our understanding of how school policies can affect structures of opportunities within schools for different students is an important priority. Data collection to understand how the development of policies shapes positive school contexts requires the capacity to measure within-school contexts over time and would ideally allow for the estimation of causal interventions about effects of policy interventions.

NEW APPROACHES AND OPPORTUNITIES FOR MEASURING SCHOOL CONTEXTS

New approaches for measuring school contexts can capitalize on advances in technology and data availability to better capture the heterogeneity within schools and link context(s) to individual students. With the ability to link context to individual student data, such as that gathered through interviews or for administrative purposes, we can understand how the student experiences his or her context(s). These new data opportunities have the capacity to provide rich empirical evidence to improve schools. The bigger and more complex data will also likely require and indeed encourage substantial methodological advances at multiple levels and from multiple perspectives. This section begins by discussing network approaches for characterizing the structure of relations among students; then elaborates on measuring heterogeneity among students; describes the potential for considering multiple perspectives and garnering information from teachers, administrators, and parents; and concludes with a brief discussion of the implications of the advances for more strategic sampling.

Network Approaches to Placing Students Within Structural Contexts

Network methods offer promising tools for identifying clusters of students who share courses. A two-mode approach (Field et al., 2006) was developed using data from the National Longitudinal Study of Adolescent Health (Add Health). The longitudinal component of Add Health includes approximately 200 students per school and data from the Adolescent Health and Academic Achievement study (AHAA), which collected and coded their high school transcripts. The two-mode approach detects emergent clusters, called "local positions," of students who take sets of courses together. Each school has a unique structure that represents a mesolevel context, or set of local positions, in the school. These tap a source of within-school heterogeneity that is more fine grained or nuanced than a track or sequence of courses. Local positions are defined by a set of courses that typically contains fewer students than a track, and they are derived empirically and are unique to each school (Frank et al., 2013).

The local positions are potentially valuable for measuring within–high school (and possibly middle school) heterogeneity for several reasons. First, local positions identify the contextual structure within schools that predicts elements of opportunities to learn in the school: whether students take demanding courses in the later years of high school (Frank et al., 2008) and the social capital students have available within schools (Frank et al., 2013). Second, they can be estimated from available administrative data and linked directly to students who are surveyed in the school. Because most schools now keep electronic records of students' course taking, this approach has become much less expensive as there is no longer a need to collect and code high school transcripts.

Other network approaches using similar or enhanced data from administrative records or from teachers may offer important advances as well. Add Health did not contain information from teachers about themselves, their perspectives on their students, or what they taught. Indeed, it did not even identify which teachers taught the courses that were associated with the positions. Such data, which are possible to obtain, would almost certainly provide an empirical foundation for further advances in estimating school structures, students' positions in them, and the learning opportunities and social experiences of students in schools.

Enhancing the Characterization of Students and Their Experiences Within Contexts

A comprehensive mapping of the within-school structure as defined by the everyday lives of the students, such as that achieved with the local positions, can be used to place a focal student in a specific context within a school. With information derived from adequate numbers of students in each school, obtained either through survey methods or alternative methodologies, the attitudes and behaviors of a focal student's peers in the local position can be used to estimate peer effects. For example, it would be possible to develop nuanced models for the role of peers in adolescent girls' progress in science, technology, engineering, and mathematics fields. Incorporating information from teachers or even parents of the students could allow the researcher to measure or triangulate climate-related reports from multiple perspectives within the context or local position. Similarly, characteristics of the other students in a position could be based on indicators from administrative records (e.g., test scores and grades) and used

to estimate contextual effects for different students (e.g., girls and boys, and academically high- or low-performing students).

Administrative records of students' addresses could provide information about the neighborhoods of students who attend the school. Beyond measuring aspects of social class (e.g., housing values, whether housing units are owned or rented, and unemployment rates), neighborhoods vary in their crime and arrest rates, type of crime, adult (and parent) incarceration, the treatment of minors as adults in the criminal justice system, racial segregation, and other features of social organization that may have consequences for the everyday lives of students and for the functioning of the school. In addition to providing enhanced information about students' peers, such information would be valuable for comparing schools (e.g., comparing charter schools to comprehensive public high schools).

Beyond information about students' neighborhoods and school, district, and state academic records, other sources of data could provide very rich portraits of students' lives. Medical records could provide information on child health, which is very poorly measured in most studies that do not explicitly focus on the topic. Information on parents' employment, which is often available from state or federal data systems, would also greatly enhance our understanding of students and their peers.

New and rapidly changing technologies have powerful implications for gathering rich information about how students (and teachers and parents) live their lives. For instance, methods such as the Experiential Sampling Methodology (ESM) have been adapted to the new technology as they have become available. Students are effectively queried about what they are doing and how they are feeling throughout the day. Moments in time are sampled and can be analyzed to estimate, for example, the detailed reactions of students to contextual conditions (see Hektner et al. [2007] and Moneta [2012] for descriptions of the method). Newer technologies have made possible the collection of biomarkers to gauge reactions to contexts. And, students (or other actors) can be tracked using Global Positioning System (GPS) technology to place them in geographic proximity to one another, or to otherwise provide a more accurate and less intrusive strategy for placing them in contexts. Students also leave artifacts of their feelings and relationships online (e.g., Facebook, Twitter), which could be coded and analyzed. Nonetheless, attitudes, feelings, and perceptions of students, teachers, parents, and significant others are still valuable—possibly even more valuable with the supporting location and biomarker data—and must still be acquired from self-reports. Again it is worth mentioning that these new data will likely bring advances in methodology, and also a much richer understanding of what happens in schools.

Along with rapidly changing technology are heated political debates about whether and how data from our daily lives should be maintained, retained, and used. What is technically possible may be politically complicated, and both landscapes are changing rapidly. For any new study design it would be helpful to work with experts who have not traditionally consulted on designs of NCES studies, for example, technology experts from Silicon Valley or persons involved in marketing or analysis of big data who are already familiar with methods for compiling data into useable forms. The point is that with the methodology in place to measure both school context and within-school contexts, and to link the contexts to individuals, rich possibilities to assess how schools affect students become possible.

Characterizing Contexts with Perspectives from Multiple Actors

Obtaining reports from multiple actors in a school is an additional source of heterogeneity that has proven valuable for tapping school context. The secondary longitudinal studies have parent components, teacher reports on sampled students, and administrator reports. Obtaining multiple perspectives to characterize the school context is an approach being adopted in the new school climate studies and was refined on a large scale for the Measures of Effective Teaching (MET) study (Measures of Effective Teaching Project, 2014), which also employed multiple modes of data collection. Another notable application of measuring context through perspectives of multiple actors was employed in an implementation study of a program designed to increase social capital in schools (Gamoran et al., 2012). Because the program was designed to improve the social context of the school, it was imperative to measure the context from the perspectives of all actors in the school. Furthermore, this approach allowed the researchers to gauge effects of context for diverse students. Certainly it would be possible to combine an approach such as estimating local positions with the approach of measuring multiple perspectives.

Network methods can also be used to estimate the flow of information and adoption of innovation and school reforms within teacher networks as a way to understand heterogeneity within schools (Penuel et al., 2009). It should be possible to estimate the nature of structural relationships of students around their coursework (e.g., local positions) and of teachers around the organization of their work, and the relationships between these two sets of actors within the school. The advantage of such an approach is the emphasis in directly estimating the context from features of the school that can be shaped by policy.

Sampling

NCES and others have used the CCD, PSS, and the Quality Education Data (QED) as sampling frames for two-stage designs that first sample schools and then sample students within schools from school rosters. This two-stage stratified random sampling approach has been the foundation of most NCES studies that involve samples. In theory, the state administrative data systems could provide a much richer portrait of schools, their contexts, and students in the context. These censuses of schools and students in them can provide a rich sampling frame by providing indicators of structural features of the schools and variation between and within them. A limitation of state data systems is that they only include public schools. Nonetheless, using this information should make it possible to draw samples that are more closely tailored to the purposes of a study, and especially to provide information relevant for targeting oversamples. For example, state data systems provide rich information about students' learning and growth in learning, how students move and transition between schools, the courses that they take, and attributes of teachers, all by students' race/ethnicity, gender, and age. These possible indicators of opportunity to learn and other aspects of the school process and context could be used in sample selection or for possible interventions using a randomized control design.

SPECIAL CONSIDERATIONS IN MEASUREMENT

As suggested above, measuring the effects of school context is not only valuable but is best accomplished by considering the context or set of contexts in a school along with the individuals within the context. The challenges to measurement involve gathering appropriate data, estimating within-school heterogeneity, and linking the context(s) to individual students. Two additional factors are worth consideration.

First, a well-recognized source of variation in how a particular student responds to a context concerns the student's age and developmental stage. Barber, Eccles, & Stone (2001) found that the stage–environment fit varies along racial and ethnic lines. As students age they are better able to handle more and more complex social arrangements, but this pattern also varies according to race and ethnicity, with African American students benefiting longer from the less complex social settings. A good example is in the transition from elementary to middle school, which for many students means transitioning to larger classes and classes taught by many different teachers. Although such an arrangement allows students to be taught by teachers with more specialized academic knowledge, it also places higher demands on the student to navigate more relationships and possibly more complex relationships with teachers who may form more superficial impressions of students if they have fewer opportunities to get to know them as individuals. African American students may face greater risk in navigating these transitions, at least in some settings. Thus, in measuring the context it is important to take into account the age, developmental stage, or other characteristics that might shape the way a student experiences a particular context.

A second consideration is that, although it is impossible to measure all contexts to which a student is exposed, it is important to recognize that students are members of multiple contexts, in different spaces and across time. A failure to properly measure these multiple contexts can result in the mismeasurement of the effects of a focal context. A special challenge is to measure transitions between contexts over school years, or effects of multiple contexts because students transition between them over time. Measures of context based on institutional indicators, such as school characteristics or even local positions within schools (which are based on course-taking patterns and, indirectly, on a school's master schedule), are unlikely to change as quickly as a student develops. Thus, promising approaches to dealing with these multiple contextual effects over the years of schooling may be found in methods that rely on the school's structure to estimate school contexts.

PRIORITIES FOR FUTURE MEASUREMENT OF SCHOOL CONTEXTS

The purpose of this paper is to discuss approaches to measuring school contexts as they relate to students' experiences, development, and outcomes, broadly defined. Structural features of the school context have important implications for students, yet they are often poorly measured in large-scale national studies. Rapid changes in technology and big data along with new methodologies for collecting and analyzing data, contemporary challenges to gaining cooperation for conventional data collection, and the changing needs and nature of students' lives must all be considered in assessing priorities for future data collection. Together, technological advances and new challenges suggest that there would be a substantial benefit from rethinking the traditional

models of data collection and analysis for measuring context. The following priorities take these considerations into account:

1. Collect sufficient data about students within a school to systematically measure within-school heterogeneity and to make it possible to locate a focal student's position relative to other students in the school.
2. Collect data from other members of the school community, for example, teachers, counselors, and parents, such that their data can be (a) linked to focal students and (b) used to characterize the subcontexts within the school.
3. Examine the potential of collecting and processing nontraditional sources of data, including but not limited to administrative records from various sources.
4. Explore innovative approaches to survey methods that use newly available technology and possibly involve passive cooperation of respondents, for example, through wearing or carrying technology that collects data or by monitoring online activity.

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