Social scientists who study school effects on individuals' development and life chances tend to specialize in one or another level or on one kind of education context and, within one of these, in particular lines of theory and research. Some study classroom structure and processes in lines of work on, for example, the social organization of the classroom or classroom discourse. Others concentrate on the school organization environment, working in research traditions on student tracking or school ethos, for example. Other researchers analyze conditions such as governance structures or policy cultures at the district, state, or federal levels of the school system. Some researchers look outside the formal school system at, for example, the parent community, teachers' professional organizations, and higher education institutions to assess their interface with school processes and student outcomes.

Crosscutting these levels and lines of school-context research are methodological traditions that foster specialized knowledge about how
school environments shape individual development. Quantitative researchers generally estimate the average effect of a particular variable across a large number of cases and seek to isolate its effect from confounding context and individual variables. Causal importance of a context variable is judged by the size of its independent effect. In contrast, qualitative researchers tend to conceptualize school context as the syndrome of conditions that describe a particular case. The significance of an environment condition is judged in terms of its meaning and effects on a particular context; interdependence among environment conditions is assumed. Each methodological tradition has its shortcomings; meta-effects quantitative research demonstrate relationships, and case study methods afford little opportunity to examine diversity across contexts or to specify interaction effects among particular context variables.

In this chapter, we sketch rudiments of an integrative paradigm for school-effects research. Our conception of the school environment embraces multiple system levels and multiple theoretical perspectives on the school environment. We assume that students' educational experiences and outcomes are situated in school settings that are embedded in multiple-system levels and broader education environments. Students' realities in school, then, are inherently multilevel. The relevance and power of particular environment conditions vary across class and school settings. For example, new professional standards for mathematics instruction are relevant just to math lessons and classes, and their effects on classroom processes depend on how teachers and schools respond to them.

With this general conception of school effects, the analyst's task is to explain differences in students' realities across school settings in terms of multiple and interactive environment conditions. What contexts shape the character of proximal processes in schools? (Bouffordhen, chapter 1, this volume), the quality of a sustained interaction among students, teachers, and subject matter?

We describe a bottom-up research strategy for measuring school effects—a strategy that begins with students' educational experiences (the dependent variable) and works upward to identify which and how multiple school contexts shape a phenomenon of interest. The relevance of a particular level of context, or unit of analysis, is treated as an empirical question. In bottom-up analyses, the researcher asks, for instance, How much does students' agency vary between particular kinds of school contexts (e.g., classes, schools, social classes, policy systems, and subject areas?)? What particular conditions combine or intersect to generate these differences? Like other contributors to this volume, we reject simple mass-effects views of environment effects on individual development.

Our research on the school environment has focused mainly on the ecosystem of the ecological model (Bouffordhen, 1993, p. 24), or the interface between proximal processes in classrooms and schools and higher
level school contexts. On theoretical and empirical grounds, we emphasize the role of adults in school settings, and particularly teachers’ professional communities, to translate school context conditions into action. How teachers and administrators perceive and respond to myriad local and remote conditions of schooling, including the students’ own social and academic resources, significantly shapes students’ school experiences. A key interest in our research, then, is to measure how school context variables interact with teaching cultures to affect classroom processes.

We begin this chapter with a brief critique of two common genres of research on the school environment: social background/main effects research and research on school culture. We then describe our conception of the embedded contrasts of schooling and research strategies suitable for assessing their effects on students’ educational experiences and outcomes. Finally, we illustrate a bottom-up analysis of school environment effects, using students’ effort in mathematics class as the criterion.

CRITIQUE OF SCHOOL EFFECTS RESEARCH

Prominent approaches to assessing the school environment include analysis of social background variables with large-scale survey databases and field studies of school effectiveness. In the first genre, researchers assess school effects on student outcomes in terms of specific nominal or structural descriptors of the school environment, such as school sector (private vs. public) or school size. The effective schools research examines aspects of life inside schools, most particularly the strength and character of school community, that relate to students’ educational outcomes. Each has particular strengths and limitations in its conception and measurement of the school environment that inform our efforts to develop an integrative research paradigm.

Social-Background/Main-Effects Research

This research genre uses measures of students’ locations in the education system, and their position in the socioeconomic system, as indicators of environmental factors thought to influence student outcomes. Principal lines of research have estimated consequences of school sector (private vs. public) and course track assignment for student learning and educational attainment.

Research on school sector uses national longitudinal surveys of secondary-school students to estimate effects of private versus public schools on learning outcomes and persistence in schooling, while control-
ling statistically for a variety of individual background variables. A few highly publicized studies in which the researchers used these databases reached the conclusion that private schools do better than public schools to promote students’ academic achievement, after other variables relevant to educational success have been controlled (see Chubb & Moe, 1990; Coleman & Hoffer, 1987; Coleman, Hoffer, & Kilgore, 1982).

Research on student tracking estimates effects of an individual’s placement in academic versus general versus remedial courses in high school on his or her educational attainment (the attribution effects of tracking) or on his or her cognitive achievements (the facilitation effects of tracking). In general, the line of work finds that students assigned to low-track classes achieve at lower rates than do those peers assigned to high-track classes, after prior academic performance has been taken into account.

These prominent lines of research are information on the individual’s location in the educational system or in the school curricular structure as the central measure of his or her school environment. These researches commonly sum to explore effects of the social address on educational outcomes by statistically controlling for prior educational achievements and confounded variables such as the student’s social class background. By design, social-address research areas to simplify measurement and explanation through categorization, or all else equal, assumptions about environments inside and outside of the school.

Problems With Social-Address Research

As an explanation of relations between educational environment and student outcomes, social-address research is highly limited. One problem is the small size of effects found by much of this research. Although simplicity of social-address research yields the standard for social science and education policy research to isolate effects of particular variables, main-effects models offer questionable statistical significance. For example, the statistically significant differences in student achievement, out-

1Three generations of longitudinal observation were being conducted by the National Center for Education Statistics. They include the National Longitudinal Survey of the Class of 1972 (NELS:72), the High School and Beyond (HSB:80) survey, and the National Education Longitudinal Survey of 1988 (NELS:88). Each of these surveys is a nationally representative sample of students in grades 7-12 enrolled in public and private school systems in 1972 (NELS:72), 1980 (HSB:80), and 1988 (NELS:88). In 1990, the NLS:82 and the NELS:88 surveys have reported considerably social science research, estimating effects on educational achievement of school social and other social-address variables for additional information about the development of these surveys, technical information, key reports, and user manuals, contact the Center for Education Statistics, U.S. Department of Education, Office of Educational Research and Improvement, Washington, DC 20208.

2Research on the consequences of student tracking attempts at a long-standing tradition in the sociology of education (e.g., Astin, Eckle, & Busey, 1976; Biddle, 1984; Frank et al., 1972; Brinton, 1976).
comes reported by Cliburn and Mce (1900), which were the basis for their conclusion that private schools were more effective educational settings than public schools, represented differences of only two test items on a reading assessment—a difference few teachers would consider meaningful in terms of learning.

Weak effect sizes found in social-address studies are symptomatic of a more fundamental problem. Such measures of the school environment mask enormous diversity in conditions within the address categories. For instance, private schools are quite diverse in their governance structures and in their missions (cf. Berk, Lee, & Holland, 1993), and public schools range from college-preparatory academies in elite suburbs to career academies in large urban districts to poorly equipped and poorly staffed urban and rural schools.

A second limitation of main-effects models of social address variables is that researchers cannot say how or why observed effects occur. Such research cannot determine conditions or processes that interpret the structural effects on student outcomes. Is the lower achievement observed for lower track students a direct outcome of track placement, as this research suggests, or does it reflect other factors that create with track assignment? Is it the "privatization" of private schools that supports higher student achievement, or is some other factor at work?

Research that shows educational effects of a particular kind of social address variable, at best, sets the stage for full studies of school processes. Process-focused research on student tracking, for example, documented differences in the average quality and character of instruction between academic and general classes in the high school curriculum (cf. Gamoran, 1986, 1987; Oakes, 1985). Many teachers believe that low-achieving students are "behind" and need to catch up before going on to the material and skills being mastered by high-achieving peers (Oakes, 1985; Rosenbaum, 1976; Wallow & Schmitt, 1978). Thus, some researchers have shown that instructional low-track classes emphasize rote memorization of facts and high-structured assignments, whereas high-track classes emphasize complex tasks that require analytic thinking (Englehart, 1967; Metz, 1978; Oakes, 1985). Students assigned to lower tracks, in other words, perform relatively poorly because they are offered less.

Furthermore, causality in social-address models is problematic. Did school governance structures "cause" differences in student achievement, or did the types of students and families enrolling in an independent school generate the outcomes or the particular governance arrangements? In terms

7Teachers are generally unaware of students from regular schools that have been rejected for admission to private schools.

8On the other hand, the evidence that private schools are selective is not universally strong. The evidence that private schools are superior is also not universally strong. In the end, it is not the students who choose private schools that are the most important factor, but it is the parents who choose private schools. In terms of student achievement, private schools are superior to public schools. In terms of the quality of education, private schools are superior to public schools. In terms of the social environment, private schools are superior to public schools.
of standards for this research paradigm, how adequate are the events for
deciding different? In tracking research, how much of the effect of
learning outcomes is due to parents of teacher assignment, in opposed
is the significance of this structural arrangement? In fact, research has shown that
students relatively weak in their subjects are more likely there to well-
preparation collaborates to be assigned to low-track classes (Ball & Lee, 1984;
Faulk, 1984; Lott, 1970; Johnson, 1976) and to be marginally in their
goods community (Faulk, 1984; Talbert, 1989).
Main-effect models with social address measures of the school en-
vironment are useful in detecting features in further investigate issues
of process and causality. However, such studies provide little insight re-
garding differences in the character of school settings or in the relationships
between the settings and students’ experiences. (For further review and
outline, see Talbert, McLaughlin, & Rosen, 1993.)

Effective-Schools Research

Another line of research considers internal school organization and
structure as sources of variation in student educational success. An early
and influential study conducted by Rotter, Maughan, Menninger, Osgood,
and Smith (1979) in inner-city English schools and the team school effort
to describe the syndrome of values and beliefs conducive to high achieve-
ment. Their work highlighted the cultural underpinnings of schools’ success
in promoting or inhibiting student learning and engagement in school.

In the United States, a significant number of research on school
effectiveness developed during the late 1970s and early 1980s. Research on
“effective schools” sought to identify school policies, norms, and practices
developed relatively successful from relatively unsuccessful schools
(see Parker & Smith, 1983, for review). The criteria of school effectiveness
in most studies was the mean of students’ scores on a standardized
achievement test. Research in this genre focused much of the level effects
on principal leadership, good consensus, and collegiality, high faculty expecta-
tions for student success, and extended teacher roles (curriculum integrated
with students) in context of average student achievement.

Problems With Effective-Schools Research

Although this line of work addresses some of the shortcomings of the
social-address models and actually gets inside schools to consider organiza-
tional processes, how it represents relations between educational settings
and student outcomes is also problematic. The reliance of these studies on
average test scores as criteria of school effectiveness ignores variation in
students’ experiences and access within a school. Researchers know this.
within-school variance on academic achievement is much greater than between-school variance (cf. Jencks et al., 1972). The tracking literature, for example, also shows that “school” is different for students entered in advanced placement and remedial classes. Conceptions and practices of the school environment are that bounded by school walls, and that ignore differences in the microcultures of classrooms or tracks or grade levels or subject areas, are limited for capturing students’ school experiences and educational outcomes. In one research, we found that even within the same high school and same curriculum track, students encountered very different learning environments within their different classes, depending on teachers’ ideas about students’ role and academic potential (McLaughlin & Talbert, 1990). In short, substantial within-school variation on teachers’ professional cultures and in students’ academic performance argue against the monolithic view of school community embraced in the school effects literature.

AN EMBEDDED-CONTEXTS VIEW OF THE SCHOOL ENVIRONMENT

Our conception of the school environment places the classroom at the core of multiple embedded contexts of schooling. The model illustrated in Figure 4 represents three kinds of school environments and analytic lenses for assessing environment effects on students’ educational experiences. We distinguish between school settings and personal education processes, administrative system units and structures, and institutional contexts and cultures.

The classroom core of our embedded-context model is the primary school setting—the locus of regular and sustained interactions of students and teachers around subject matter. Other kinds of school settings, or sites for ongoing adult-student interaction or interactions among school adults, can be defined beyond classroom boundaries. Most common among them are extracurricular activities in secondary schools, such as clubs and sports teams; homerooms or other kinds of classes not framed by educational content; and subject departments and other counselor units that can be important settings for teacher interaction and communication.

Social systems theory provides a general analytic framework and research literature that focus inquiry on proximal processes within school settings. This perspective considers social norms as a powerful source of differences in teaching and learning between classrooms, for example. It highlights the role of school communities to define and enforce particular values and norms for teaching and learning.

With this notion of embedded contexts, we posit that the meaning and effects of school-context conditions are embedded in and
Figure 1: Multiple and embedded settings and contexts of teaching.
community values, beliefs, and standards for teaching and learning. A social system perspective on the school environment challenges a view of school contexts as nested, highlighting the intersection between proximate professional norms and cognate variables.

School administrative contexts are local or official units in the school organization system. Administrative contexts are what researchers generally consider when they evaluate school effects on student outcomes. We distinguish among sector, state, district, and school policy systems. Within secondary schools, the subject department is another part of the formal organization system. As shown in Figure 1, we regard school and department settings as both administrative units and potential boundaries for district teacher communities and cultures.

The theoretical lens of social organization theory describes these contexts in terms of administrative policies, resource levels and allocation patterns, and program and governance structures. Although the structural hierarchy of the school administrative system presents a nested model of school organization, the policy system does not operate in a linear and hierarchical manner. Instead, there are intersecting and overlapping, sometimes coalescing, as well as competing, policy systems. Policies in school systems and administrative contexts are not necessarily mediated by lower system units.

Institutional contexts in our model refer to educational environments outside of the school system, such as the traditions and norms specific to different subject areas, cultures, higher education institutions, and labor markets. The institutional environment of K–12 (kindergarten through grade 12) schooling, as seen in state and school policies, frames the work and rules of teachers and students in ways quite independent of official school policies and community preferences. The relevance of particular institutional contexts can vary across classroom settings. For example, academic and nonacademic classes within the same high school are operated in different institutional environments. Academic classes, aspects of the higher education arena frame teachers' and students' work, while vocational and general track classes, local labor markets and economic conditions can be important contexts of schooling.

The theoretical model of schools as institutional organizations frames much of what goes on in schools as efforts to obtain legitimacy by adhering to organizing roles in the broader environment. For example, John Meyer and Brian Rowan (1977) analyzed school organization structure in terms of coalescing roles of effective organizations embedded by occupational organizations in the institutional environment. En
tending this perspective to teachers' roles, we consider contexts and processes through which institutional roles of scholars, in the education environment and in the broader cultural arena, can affect educational processes. Potential institutional effects come from, for example, conceptions of subject matter and student learning process in disciplinary cultures (Greenwood & Stodolsky, 1984), subject matter instances, outside of the school system (e.g., the National Council of Teachers of Mathematics, 1989, 1991, 1995), and parent preferences for programs or pedagogy. Our embedded-contexts model assumes that teaching is practiced by conditions in the institutional environment of K–12 schooling.

In summary, our notion of embedded school contexts seeks to consider kinds of school contexts that combine in nonlinear ways to shape classrooms processes. First, institutional environments permeate school settings and teachers' work, they are not mediated by formal school policy. Second, school administrative policies do not directly affect lower levels of the system, nor do their effects on teaching and learning depend on a "chain of command." Third, school and teacher communities interpret and mediate effects of conditions in their institutional and administrative environments—students' experiences of the broader school contexts depend on the variable ways in which adults in their classroom and school respond to those conditions.

The embedded-contexts model challenges assumptions of additivity implicit in much policy-oriented research on schooling and outcomes. Estimating average effects of a particular context variable on student outcomes is also requires going beyond typical case study designs. Our conception of the school environment calls for research designs that enable comparative analysis of embedded school contexts. Synthesizing, bottom-up measurement of school context effects on students' educational experiences is essential because school settings are amino in particular combinations of relevant contexts and because their effects are mediated by educators and school communities.

STRATEGIES FOR ASSESSING EMBEDDED SCHOOL ENVIRONMENTS

Research compatible with our conceptual framework aims to describe the interplay of multiple levels of the school environment as they shape students' educational experiences and outcomes. Fundamental embedded-context research asks questions of which and how different levels of units of analysis are relevant at particular school settings, and kinds of students' experiences and outcomes. For example, the school unit might be the appropriate setting for studies of students' social integration in school or of
post-substantive, whereas the classroom and subject department units would be central in studies of academic outcomes.

The statistical issue of where differences in students' experiences are located is a starting point in our bottom-up analysis strategy. Although some school-effect studies have advanced strong theoretical arguments with weak statistical support, we recommend first focusing on what they show about between-unit variance and then using theory and prior research to identify variables that could account for the variance.

In our model, context of analysis will also differ according to the research problem. For example, parent cultures might be important contexts for research on student tracking, whereas local teacher networks would be more important contexts for studies of subject tracking reforms. Detecting which contexts and conditions matter for a particular student outcome or classroom environment for learning depends on the strategic choices in sampling as well as on a bottom-up approach to measurement and analysis. As available, prior research focuses on particular context levels and variables and sets sampling parameters.

**Sampling Design**

A sampling design consistent with our conceptions of the school environment does prescript the need for both survey and ethnographic research. Survey research standards call for independent case sampling. The more sampled the case, the better. The large, nationally representative samples of students and schools enabled for national longitudinal studies in education maximize dispersion of school environments and are considered by many to be ideal for estimating context effects on student outcomes, even if they offer only superficial measures of context conditions. These samples provide good estimates of population parameters for U.S. students and schools as measured samples. However, in our view, the standard of independent sampling does not constitute the opportunity to study how environments of schooling affect teaching and learning. This is because context variables under analysis have been extracted from their own contexts.

Ethnographic research standards call for samples of students or schools small enough to afford intensive and sustained case analyses. These in-depth case studies provide rich descriptions of behavior within syndromes of context conditions. However, they provide little opportunity to isolate effects of particular embedded contexts of the case.

We recommend a sampling design that aims to represent both diverse across school environments and capacity to conduct in-depth, multi-level analyses of embedded-school contexts. Design choices are guided by prior research and the aim to represent important contexts in any level of the embedded-context model. Apart from typical resource constraints, re
numbers are constrained to simple few enough contrasts to enable embedded-context analysis.

What kind of embedded-context sample provides the best opportunities to understand context effects on teaching and learning? How many and what kinds of cases are needed in particular school settings and contexts?

Relatively large numbers of schools and their teachers or proximate levels of the school environment are needed to produce reliable measures of variation in school classroom, department, and school settings. It is this variation that broadens context analysis works to explain. Depending on school boundaries for analysis, at least five individuals randomly sampled from each unit is recommended. Whole-samples of teachers are recommended for measuring departments or grade-level subcultures of teaching. Samples of at least five students per class are needed to measure students' experiences of this setting, and samples of at least five classes per school are needed to worry class effects on student outcomes.

The question of numbers of higher-level cases depends on contrasts that are important for the scope of inquiry. Given limited degrees of freedom, the selection of contrasts to represent an embedded-context study is a core issue for theory and design. Selection of higher level cases needs to represent contrasts in context variables of theoretical and practical interest, such as student characteristics and state policy cultures. Contrasts represented in the sample design need to be few enough to allow for quantitative and qualitative data collection at all levels of the embedded sample.

In our (McLaughlin, 1993; McLaughlin & Fullarton, 1993a, 1993b; Fullarton & McLaughlin, 1994) longitudinal research program on secondary education, a sample size of 16 high schools represented contrasts at multiple context levels:

- state contexts on centralization and reform activity: California, a centralized state and leader in K-12 systemic reform throughout the 1980s, and Michigan, a decentralized, non-reform state during the period of our research;
- within each state, two metropolitan areas with contrast on economic conditions;
- within each metropolitan area, one urban school district and one suburban school district or one independent school;
- within each urban school district, "typical" schools within relatively middle-class and relatively poor neighborhoods;
- within each school, all teachers in surveys and most teachers by interviews, and
- within a sample of typical urban schools, random samples of 12 students from each school to represent ethnic-race and academic diversity at the 10th grade.

298 (Fullarton and McLaughlin)
This embedded sampling design enabled us to observe specific effects on teaching within comparable school settings and, consequently, to analyze differences in school or subject department settings within a particular school system. In this way, we were able to test our conditions in particular contexts that influenced teaching practices. For example, in our research on mathematics education, we saw that California's math curriculum framework provided context-and strategies for math departments to promote all students' success. In contrast, math departments in Michigan were conducting "business as usual." We saw this difference in our interviews with math teachers across schools in these states and in the results of statistical analysis showing differing effects of professional community on teachers' readiness to adopt instruction for all students. (See the Illustration: A Bottom-Up Line of Analysis section.)

An embedded sampling design makes it possible to examine diversity in students' school environments and to assess how layers and conditions of school context combine to affect educational processes and outcomes. In research usually focused at the student and classroom levels, denser samples of students than in the Centre for Research on the Context of Teaching (CRTC) design are desirable.

Clearly, an embedded sampling design can never represent all important context variables, nor can it adequately represent all combinations of conditions represented at each level. Rather, it creates variation on context conditions likely to be important for educational outcomes of interest, and it captures the embeddedness of students' school environments. It combines strengths of both large-sample surveys and in-depth case studies and aims to overcome weaknesses of each.

Measurement Strategies

We recommend measurement strategies that integrate large-scale survey research and in-depth case studies of school environments and comparative analyses of quantitative and qualitative field data. General strategies that guide our research to embedded-school samples are summarized in Figure 2 and include the following:

- longitudinal data collection in the embedded-context sample to ensure sufficient depth of analysis in a large field sample;
- interactive development of quantitative and qualitative data for students, teachers, and contexts to refine conceptions of relevant environments and estimate their effects on teaching and learning;
- emphasis on subjective measure of processes and contexts within school settings to capture differential experiences and constructions of embedded contexts and

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Figure 2: Strategies for bridging quantitative and qualitative measures of school context. NELS:88 = National Educational Longitudinal Survey of 1988.

- establishment of "bridges" between field and national survey measures and samples by drawing lessons for avoiding sampling biases and for calibration of quantitative scores within the field sample.

An iterative approach to generating survey and interview data, with common and unique themes across sites. The qualitative data describe meanings of particular contexts conditions for individuals, groups, and school cultures. Successive development of survey instruments reflects measure of variability in the sample. In our study of teachers, for example, we refined measures of collegiality in school and department settings to record overall contexts among our sites and to capture conditions in the race-teacher-learning communities found in our sample (McLaughlin, 1991, McLaughlin & Talbert, 1993a, 1993b, Talbert & McLaughlin, 1994).

Our approach to measuring the school environment emphasizes stu-
depts' and teachers' subjective realities. It differs from that of researchers and policymakers, who look at practice and school outcomes from the outside in, from the frame of social science theory, without fully assessing the relevance of contexts or variables to proximal processes of schooling. Teachers' and students' perspectives on schools and classrooms often yield a strategically different view of what matters most in a particular educational setting.

We establish a rough link between field data and large representative samples of students, teachers, and schools by replicating questionnaire items included in national and state teacher surveys in our field instruments. For example, by replicating HSSEB national survey measures of "colligiality" and "principal leadership" in our field instruments, we could locate our sites in national school distributions on these variables. This measurement strategy provides a basis for judging sampling and effect-estimate biases, thus overcoming some limitations of a purposeful field sample. It considerably extends the analytic capacity of field research and small-scale studies of students' responses to school environments.

Analysis Strategies

A bottom-up strategy for assessing the school environment aims to identify first, which settings and contexts account for particular student experiences or outcomes and, second, what conditions in the relevant environments affect the criterion. Rather than deciding a priori which level of analysis to adopt for a given study, one should use analysis of variance (ANOVA) techniques, as well as interview data, to address the empirical question of which context levels or units of analysis are significant for a particular criterion. For example, across what level of analysis, at kind of schooling context, do researchers observe significant variation in students' academic effort or perceptions of adult support? Can patterns shown by the survey data be validated and interpreted by interview data?

Results of bottom-up analyses also point to cases that deviate from a general pattern. For example, ANOVAs in teachers' collegiality scores for our 16-high-school study showed that independent schools and one public school in the sample had strong schoolwide communities, whereas most schools had substantial variation within schools and across subject departments (McLaughlin, 1993; McLaughlin & Tilton, 1993a, 1993b; Tilton & McLaughlin, 1994). This pattern directed us to pursue case studies of the strong school communities while pursuing analysis of internal school communities for the other schools. The bottom-up strategy enables one to detect when and where multiple units and lines of inquiry should be pursued.

Of course, this inquiry is guided by prior research and theory. Our emphasis on teachers' social norms as mediating context effects on learning

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is grounded in considerable research, for example. Also, once contexts that affect particular outcomes are identified, prior research helps to specify variables for measurement and analysis. The bottom-up analysis strategy is both a dialogue of quantitative and qualitative data and a dialogue of data and theory.

ILLUSTRATION: A BOTTOM-UP LINE OF ANALYSIS

Our research on the school environment documents considerable diversity in teachers’ work lives and professional behavior across secondary schools (McLauglin, 1993; McLauglin & Talbert, 1993a, 1993b; Talbert & McLauglin, 1994). Here, we illustrate how a bottom-up analysis of students’ experiences in academic classes identifies multiple, interactive context effects.

As part of our research in the 16-school sample, we conducted a longitudinal study of 54 students in two metropolitan high schools (12–14 students in each school; McLauglin, 1993; McLauglin & Talbert, 1993a, 1993b; Talbert & McLauglin, 1994). The students were purposely sampled to represent a range of academic achievement in the 10th grade. (See Pelham, Davidson, & Cano, 1991, for further description of the sample and sites.) These students were interviewed at least three times a year and a subsample of students in each school were “shadowed” (or accompanied by a CRC researcher) for several days each year during a 2-year period. In addition, the students completed the full NELS:88 10th-grade student questionnaire, and we obtained their high school transcripts. Our bottom-up analysis proceeds through dialogue between the ethnographic and the quantitative data.

Student Engagement

Though interviews with students in our sample, we heard about ways in which individual teachers had helped them to connect with a subject or had supported them to stay in school. The students also told us how some teachers put them down and how they dreaded those class periods. By talking with these students, attending their classes, and listening to their conversations with peers, we learned that their experiences of school varied considerably from class to class, or from teacher to teacher, throughout the day. In particular, the levels of trust among students in the classroom are a support for academic learning established by teachers varied substantially across classes for most of these students.

Through interviews with teachers, we learned that different teachers also viewed the same student differently. The profile of a student varied across classes, just as the portrait of “school” varied for students across

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classes. For example, in one high school, a teacher we shadowed found himself criticized as "probably overachieving" and "unlikely to succeed" in his very traditional social studies class, where the teacher took center stage, and in the next hour was praised as a "promising writer" and as having "academic potential" by his English teacher, whose classrooms count students in active roles as learners. His different experiences of school, and of himself as student, stemmed from his teachers' different ideas about the ways in which students should involve themselves in subject area content and concepts. These data raised important questions about tests of school environments that are meaningful for students.

We pursued the issue with statistical ANOVAs for a variety of academic and affective outcomes, using survey and tracking data for the students in the longitudinal field sample. Included were the subset of students for whom we had NELS:88 survey data, student ratings of classes and teachers, and teacher survey data. Availability of teacher data was essential so that we would be able to relate class-level variance in student outcomes to teacher and teaching variables being addressed in our broader research project. The sample for this analysis included 80 academic classes of 20 students in four subjects in four schools. We considered course grades for 3 years and student survey measures of their levels of understanding and effort in each of their classes (NELS:88, lower-left scale) and their ratings of how much they liked the class and the teacher (5-point scales).

ANOVA's for these measures of student performance, with reports on class behavior, and affective ratings addressed the issue of which unit of analysis accounts for a particular kind of student behavior. Is variation mainly between students, or between schools, or between particular academic subjects, or between departments in a high school, or between classes for a student? As shown in Table 1, we found considerable variance at the class level that was a function of student differences or higher level school differences. Although academic grades varied mainly between students, we also observed considerable between-class variation for individual students. Students' reports of the level of effort they invested in a class were almost entirely (94%) a matter of variation between classes.

The bottom-up analysis focused on between-class variance in student effort. What class variables and context conditions account for differences in student effort? We focused on the peer group to simplify the analysis, to control for institutional culture differences across subjects.

*Note that the B* for Model 3 in Table 1 is not the sum of variance explained by Models 1-4. This is because the sum of the variance explained in this model are not mutually exclusive. For example, the set of student factors included in Model 1 sums to the four schools represented in Model 2; the assignment factors, variable in Model 4 summing the four schools of Model 2 and the 4 participants of Model 3. If between-teacher variables were also included then this set was independent of variance related to subjects and school boundaries, then the B* for Model 5 would equal the sum of Model 3 (student-level variance) and Model 4 (the Student School Environment variance).
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<td>Understanding (n = 68)</td>
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<td>CRC measure</td>
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<tr>
<td>Class rating (n = 79)</td>
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<td>0.07</td>
<td>0.17</td>
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<tr>
<td>Teacher rating (n = 79)</td>
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<td>0.00</td>
<td>0.12</td>
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</table>

Note: Data indicate adjusted R² variance for each dummy variable. NELS = National Educational Longitudinal Survey; CRC = Center for Research on the Context of Teaching.

*1 - R² for Model 5.
Teacher Professionalism and Students' Effort

Through longitudinal research on teachers and teaching, we developed a global survey measure of teacher professionalism. This scale correlates highly with a number of indexes of teacher professionalism, such as a strong service ethic toward students (Talbert & McLaughlin, 1994), and it predicts a range of student experiences and outcomes. Figure 4 shows the strong correlation between students' efforts in mathematics classes as predicted by their math teachers' scores on the Professional Commitment Scale (1.00 = 1.00; n = 71).

Survey items that make up the Professional Commitment Scale correspond to students' comments about conditions that make them want to do well in a class. Teachers who scored high on the scale put extra effort, felt that they were improving as a teacher, loved the subject they teach, were eager to learn about ways to improve teaching, and were loyal to the teaching profession. Conversely, students tend to tune out of a class in which the teacher lacks engagement with his or her subject matter and students; when knowledge is transmitted in routine and impersonal ways, students are neither motivated nor able to make the subject matter personally meaningful.

What school environments support or undermine teachers' professional commitment? In our bottom-up analysis strategy, we looked to other proximate settings and external contexts of schooling to address this question.

Settings for Teachers' Professionalism

The next stage of analysis began with the question of which levels of the school context account for variation in teachers' professional commitment. Again we used a dialogue between qualitative and quantitative data to pursue the issue. Our investigation included the ANOVA strategy illustrated for measures of student engagement. We examined variance in teachers' scores on the Professional Commitment Scale and on other relevant indicators of teacher professionalism. We found that sector, district, school, and department contexts represented in our sample each accounted for some variance in teacher commitment (Talbert & McLaughlin, 1994). We then turned to the issue of what variables at each system level predicted the differences in teacher professionalism.

The strength of teacher community was a strong correlate of teachers' professional commitment and varied systematically at multiple levels of the
Figure 3. A bottom-up analysis of embedded school contexts that influence student effort in mathematics.

School system. Figure 4 shows the embedded-context boundaries of our 16-school sample and mean school scores on the Professional Commitment Scale and on a Collegiality Scale, a global measure of the strength of teacher community. These scores are reported in standard deviation units.

*This scale and other reported data were developed by C.R.C. See Talbert and McLaughlin (1994) for issues making up the commitment scale and other CRC measures.
Figure 4. Regression of student-reported effort in mathematics on teacher commitment. Effort scores are standardized according to each student's reported efforts in all of his or her core academic subjects.
with the individual level for the full teacher sample.) The graph of school scores on teachers' commitment and collective efficacy shows that schools in our sample differed substantially in providing students access to professionally engaged teachers.

Qualitative case studies of the strong teacher communities in the independent schools (Schools 5, 9, and 4 in Table 4) and in three California schools (Schools 1, 7, and B) documented the kinds of interactions among teachers that supported their professionalism. We observed in each case that schoolwide norms encouraged teachers to solve problems collectively, to value teaching resources, and to share information about particular students' needs. Also common across these schools was a norm of "personalization" for teacher-student relations—the expectation that teachers and students come to know one another as whole people and that individual interests, prior knowledge, and needs are central to the teaching and learning process (McLaughlin & Talbert, 1993b; McLaughlin, Talbert, Kahne, & Powell, 1999).

ANOVA results also directed us to look at subject departments within the typical comprehensive high schools as source of variable teacher community and professionalism. We found substantial differences in the strength and character of subject departments in many of these schools. Indeed, in four of the comprehensive high schools, we found subject departments in which their means on our survey scale of collegiality differed by more than one standard deviation. Normal norms for this score provided a metric for judging the significance of between-departments and between-schools differences observed in our sample.

Case studies of the continuing department communities revealed ways in which teachers' work and relations with students differed in the strong and weak departments. These comparisons included consisting department communities within the same school and comparing departments across schools in the same subject (math and science). Our interviews with teachers in urban high schools indicated how department communities moderated teachers' responses to changing student populations and shaped their sense of professional career and commitment. For example, teachers in weak departments tended to see the students on the same level, of academic income than did their school colleagues in strong departments in the same school. They saw the same students, differently and brought different expectations and levels of commitment into their classes.

We observed that differences in teachers' attitudes toward students were related to their opportunities to learn from colleagues and, in turn, to improve their classes for success with students, in strong department communities, when a teacher was struggling, he or she turned to colleagues instead of giving up on the student. Qualitative analyses conducted at the department level for 36 departments in eight typical public schools corroborated these findings from interviews and observations. The Teacher
Commitment Scale correlated .52 with departmental community and .29 with a measure of teachers’ sense of responsibility for students (Ebbert & McLaughlin, 1994).

Policy Contexts of Student-Teacher Relations

The strong schoolwide communities in our sample were, with one exception (School 7 in Figure 5), special mission schools. Through specialized charters, programs, and policies, the mission schools forged a sense of community, which built a base for teacher commitment.
of shared goals and interests among teachers and students. These conditions fostered teacher professionalism and supportive personalized relations between teachers and students. Particularly in the performing arts public school in our sample (School B in Figure 3), we also saw that key role played by the principal and other school leaders in sustaining the school mission and community.

Apart from communicating school goals and expectations, the mission school leaders challenged institutional norms in the context of schooling that operate against the development of the school's community. For example, subject identities among teachers promoted departmental versus school loyalties in large high schools, regardless of whether the department community is strong or weak. Furthermore, given a general status order among subjects (with math usually at the top and vocational subjects at the bottom in the status hierarchy), a sense of social inequalities among teachers can undermine community (Litke, 1990). Site-level policies and norms to counter these tendencies are essential to sustaining a schoolwide community. (See Tilhurt, 1993, for elaboration of this point.) Another way in which system policies can promote teachers' commitment and responsibility toward students, we saw, is by challenging norms of subject cultures that can inhibit teachers' responsiveness to their students. In particular, we saw the power of a standards-based reform policy for mathematics education challenge taken-for-granted beliefs about math teaching and learning and encourage teachers to rethink ways of constructing student and content. This reconsideration prompted classroom adaptations that enhanced teachers' responsiveness to their students and their capacity to personalize approaches to teaching and learning. We observed this effect in contexts in both states for the state policy context represented in our sample: California, with strong math reform policies and support, versus Michigan, with no reforms in math underway during the 1980s. Specifically, we observed that math teachers' adaptation to students—a survey scale measuring teachers' belief that they can promote all students' learning—was related to teacher community in California but not in Michigan. This interaction effect is shown in Figure 6.

Quantitative and qualitative analyses of math teachers and departments in the two policy contexts revealed that strong teacher communities tended to either enforce or challenge institutional norms for math instruction that constrained adaptation to students. In strong traditional math departments, teachers generally regarded high rates of student failure as a sign that high teaching standards were being upheld. However, in a policy system aiming to reform mathematics teaching to support all students' success, we found strong departments and teacher networks in and outside of the schools in which teachers were developing new practices and conceptions of effective math education. In these teacher communities, student failure was regarded as the educator's failure to adapt instruction in ways
Figure 4: Adaptation of Practice by the Board of Trustees at Princeton Graduate School after 1967. The graph illustrates the adaptation of practice from high to low collegiality, with the y-axis representing the level of collegiality and the x-axis representing the adaptation of practice. The graph shows that as the level of collegiality decreases, the adaptation of practice increases.
that promote learning for all students. Students in these teachers' classrooms had qualitatively different experiences with mathematics than did their peers in traditional math classes. In each case, students' realities were embedded in a complex and interactive environment of teacher communities, institutional norms for mathematics education, and curriculum policies at the school administrative level.

EXTENDING A BOTTOM-UP PERSPECTIVE ON THE SCHOOL ENVIRONMENT

In this chapter we described our conception of the school environment as multiple embedded contexts and illustrated a bottom-up, multi- method approach to assessing context effects on students' educational experiences and outcomes. Compared with the social address and school community research discussed in the first section, which frame analysis in terms of particular levels and kinds of variables, our approach analyzes students' realities as embedded in multiple settings and contexts of schooling.

As illustrated by our analysis of students' efforts in high school classes, we analyzed the relevance and interplay of particular contexts and variables from the bottom-up, or from the inside out—from the core classroom setting to broader social, administrative, and institutional contexts. By locating our analysis at the bottom of the school system and in the daily experiences of students and their teachers, we could identify particular units of analysis and cases that shaped differences in students' educational behavior. Multiple theoretical lenses allowed us to see how situated realities of school settings were constructed from situational, administrative, and social system conditions and processes.

A hierarchical model assuming additive effects across levels would miss the permeability of embedded contexts and the ways in which environments combine to affect proximal processes. Contexts do not simply "add up" for students. A strong district, and a strong principal, for example, do not sum to a positive school experience for a student in a class taught by a professionally disengaged teacher who believes that the students cannot learn the course material. On a shift in the broader policy context (e.g., higher standards for high school graduation) may boost student accomplishment in a school setting where faculty ethics and capacity can support more rigorous academic work for all students but can diminish it in the school down the street where faculty are unwilling or unable to enable student success with higher standards. Indeed, our illustration revealed that math teachers in weak communities in the reform state were least likely to adopt instruction to meet all students' needs; this interaction effect spanned multiple levels of school organization.

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Our various notions of embeddedness refer to the kind of interplay we observed between types and levels of school environments. For example, our research on mathematics teaching indicated that subject culture beliefs and standards were enacted in math classrooms and departments and that they differed substantially from the cultures governing science or English teaching. High school teaching, in this view, is embedded in distinct subject cultures that direct professional practice. We observed, however, that teaching is embedded in social networks of teachers who make sense of the multiple contexts in which they teach the students' capacities and needs, the subject matter and teaching norms, and the policy system and professional environment. We saw that some math departments, for example, rejected norms from their subject culture to construct more successful approaches to teaching their students. Finally, we saw that such community offices were embedded in a broader policy environment, so that the inclination or authority of teacher communities to challenge routines of subject instruction appeared to depend on policies and resources supporting change.

Further research using an embedded-context model of schooling and bottom-up analyses might extend our conceptual model to consider cumulative and longitudinal perspectives on students' school experiences. The model represents a vertical slice of multiple contexts and settings that shape students' school experiences. Our work thus far has not addressed the issue of how multiple settings and experiences—considered as a day and school year or sequential over years of schooling—combine to affect individually educational outcomes.

We learned that high school students experienced substantial diversity across their classes throughout the school day and that students' engagement in a class was strongly related to their teachers' professional attitudes and behaviors. However, in increasing the school environment, we have not taken into account that for the sum of situations experienced by a student. The salience and significance of a particular positive or negative classroom experience conditioned by other concurrent school experiences! How do students' out-of-school involvements, with community-based organizations or activities, for example, play out for students in diverse school settings? Given students' comments in our interviews, we can hypothesize that a positive school environment matters more to students whose other life settings are unsupportive or are barren of resources for development. Conversely, a school setting experienced as inhospitable or negative will likely matter less to students who find support in their families or community.

A longitudinal perspective on students' school environments would include successive classroom and school settings and contexts, or pathways, across years and developmental stages. How do elementary grade students respond to transitions between qualitatively different classroom settings?
How much weight does a supportive versus competitive setting have over the years, and does this vary with developmental stages? For example, does a child who experienced a strong class learning community one year remain a confident and active learner the next year in a class that promotes different and more teacher-directed work? Does the recent wording and experience supplant the former? How lasting or temporal are effects of particular school situations on students' long-term engagement with education or with a particular subject?

Bottom-up measurement strategies are essential to developing longitudinal perspectives on students' school environments and outcomes. Profiles of students' cumulative school environments and patterns of engagement could be constructed, ideally, through longitudinal research or through retrospective interviews and school records. Short of constructing cumulative profiles of students' school environments, research could target common grades—such as the first grade of middle or junior high school or the first grade of high school—to study students' adaptations to particular kinds of changes in their school environments. Evidence that school transitions are important periods in individuals' educational biographies, often marking decline or improvements in academic performance, suggests that changes in quality of the school environment may be particularly potent at these school career stages.

Horizontal and longitudinal perspectives on embedded school contexts promise advances in theory on school effects and in educational policies to promote positive educational outcomes for all students. Analyses located in continuities and discontinuities in students' educational experiences and outcomes would afford refinements of notions of embeddedness central to our conceptual model. In this case, the student's educational background would be among the contexts in which school experiences are embedded. Furthermore, analyses focused on students' cumulative experiences in particular school environments would help to identify the higher level contexts and conditions that create continuities, for better or worse, in individuals' educational careers.

REFERENCES


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