I. Introduction

Schools and districts face many challenges with regard to the commitment, instructional quality, and effectiveness of new teachers. Students’ achievement levels in language arts and mathematics are closely related to teachers’ ability to help them acquire basic knowledge and engage in advanced thinking, analytical writing, and problem solving (Desimone et al., 2002; Hill, Rowan, & Ball, 2005; Phelps & Schilling, 2004; Pressley, Duke, & Boling, 2004). But several studies indicate that early career teachers struggle to help students perform at high levels in reading, writing, and math (e.g., Decker, Mayer, & Glazerman, 2004; Grossman et al., 2007). Further, in their first five years, high percentages of beginning teachers migrate to other schools and districts or leave the profession (Henke, Chen, & Geis, 2000; Smith & Ingersoll, 2004). In response to concerns about new teacher commitment and quality, many school districts and states have implemented induction programs (Education Week, 2006) and 8 out of 10 beginning teachers in 1999-2000 reported participating in an induction program (Smith & Ingersoll, 2004). Designed to help novices acclimate to their positions and grow professionally, these programs typically feature mentoring, orientations, workshops, and opportunities for collaboration.

Recent research indicates that both mentoring and collaboration with colleagues are related to higher levels of retention among first-year teachers (Smith & Ingersoll, 2004). In addition, several qualitative studies have found that mentoring, school culture, and district policies seem to influence the nature and quality of the instructional assistance that beginning teachers receive (Achinstein, Ogawa, & Speiglman, 2004; Grossman & Thompson, 2004; Kardos et al., 2001; Youngs, 2007a). A number of studies in this volume build on recent research on induction in important ways. For example, they include larger sample sizes than much of the previous research in this area; they feature a broader range of outcomes including teachers’ instructional practices, teacher retention, and student learning; and they
adequately control for other factors that could affect these outcomes, such as teacher and school characteristics (see, for example, Glazerman et al., 2005; Grossman, Loeb, & Myung, this volume; Strong, this volume). Findings from these studies indicate that mentoring and induction programs can have significant effects on teachers’ practices and retention decisions and that they seem to contribute to student learning gains.

At the same time, few large-scale studies of induction account for the fact that schools are fundamentally social organizations characterized by social psychological processes (Bidwell, 2000; Zhao & Frank, 2003; Kennedy, 2005; Pogodzinski & Youngs, under review). For early career teachers in particular, there can be considerable tensions between a) their beliefs about what they need to do to teach effectively and b) the beliefs or expectations (regarding what they should do) held by other individuals who define the social system of their schools. The first of these aspirations is associated with psychic rewards related to teaching (Bandura, 1977; Hargreaves, 1993; Lortie, 1975) while the latter involves the degree of social fit between oneself and colleagues (Bidwell, 2000; Zhao & Frank, 2003; McLaughlin & Talbert, 2001).

The extent and resolution of these tensions can affect key outcomes for beginning teachers including their commitment, instructional quality, and effects on student learning. For example, a main goal for each teacher is to help students learn (i.e., acquire human capital), and their contribution to learning is a function of the product of their effort and the results or payoffs associated with effort. But teachers must resolve differences between their own beliefs about effective teaching (i.e., their individualistic motivation) and others’ beliefs and expectations regarding their practice. Drawing on economics, this fundamental tension can be expressed by a utility function. The utility for teacher $i$, given membership in a given context $C$, is

$$U_i(C) = f(\text{effort, payoffs of effort, expectations of others})$$

(1)

Note that others’ expectations may be consistent with the beliefs of a given teacher. In this case, there is alignment for the individual teacher, and there is little professional tension. But the absence of alignment
can cause tensions that can be especially troubling for an early career teacher. Further, the degree of alignment can affect a novice teacher’s commitment, instruction, and impact on student learning.

But what about the effects of district mentoring and induction programs on early career teachers? In research on a variety of topics, one of the most striking and robust results is that across studies 66 to 90 percent of the variation in student or teacher outcomes is within schools (Frank, 1998; Frank & Zhao, 2005; Rowan, Camburn, & Correnti, 2004). Characteristics of students and teachers, such as socioeconomic background, gender, race, education, and experience explain a portion of the variance within schools. But what accounts for the remaining variation? In this chapter, we develop a theory to explain the effects of mentoring and induction activities on new teachers’ commitment, instructional quality, and effectiveness and we describe how utility functions can express variation in these outcomes. Then we explicate the role of three-level models (i.e., with random effects) in estimating the effects of effort on commitment, instructional quality, and student achievement with teachers nested within subgroups within schools. Unlike fixed effects models, multilevel models do not merely control for effects of social contexts (e.g., subgroups in schools); instead, they feature the capacity to simultaneously test effects at multiple levels as well as cross-level interactions. Thus, multilevel models are ideal for testing the effects on commitment, instruction, and achievement of a) effort at the individual novice teacher level and b) conformity at the subgroup level (Frank et al., under review).

The next section of this chapter describes the value of using utility functions to specify theory related to mentoring and induction and to determine how schools and districts can promote high levels of commitment, instructional quality, and effectiveness among beginning teachers. In the third section, we present our conceptual framework, define several terms that are key parts of the framework, place them in the context of the existing literature, and explain their relationship to mentoring and induction. Here we introduce the notion of subgroups to scholarship on induction and explicate how they function in relation to mentoring and other school and district factors. The fourth section defines teacher efficacy as well as several factors that influence the payoffs of effort, situates them in the relevant research literature, and
explains their relationship to effort and various teacher and student outcomes. Finally, this chapter considers how multilevel models can be used to estimate the effects of mentoring, subgroups, and other contextual factors on student learning by testing the effects on achievement of effort at the individual novice teacher level and of conformity at the subgroup level.

II. A Formal Model of Teacher Effort

New teachers can gain access to resources, expertise, and support through their interactions with formally assigned mentors, colleagues, and principals and through their participation in induction and professional development activities (Coleman, 1988). At the same time, these individuals and activities can place expectations on beginning teachers or even exert pressures on them (Bidwell, 2000; Frank, Zhao, & Borman, 2004; Kennedy, 2005; Portes, 1998). As noted, there can be tensions between an early career teacher’s beliefs about effective teaching and the expectations that mentors, colleagues, administrators, and district policies have for or place on them. Further, the extent to which mentoring and induction will affect new teacher commitment or instructional quality seems related to a) the degree of social psychological fit between a beginning teacher and key individuals in their subgroup or school and b) how, if at all, mentoring and induction affect this degree of social psychological fit.

Drawing on research on adolescents by Akerlof and Kranton (2002) and Frank et al. (under review), we describe a way to model the tensions between new teachers’ own beliefs about effective teaching and others’ beliefs and expectations regarding their practice. Elaborating the expression in equation (1) above, the utility for teacher i, given membership in a given context C, is

\[ U_i(C) = \rho \left[ e_i k_i - \frac{1}{2} e_i^2 \right] + (1 - \rho) \left[ -\frac{1}{2} \left( e_i - X(C) \right)^2 \right] . \]

In this expression, C refers to relevant contexts for beginning teachers such as mentoring, subgroups, grade-level teams, departments, or school faculties. Effort is represented by \( e_i \), while \( k_i \) represents the payoffs in, for instance, adolescent human capital associated with a teacher’s effort. For example, one
element in \( k \) would be the ability of students to learn. The greater their ability, the greater the return on a teacher’s effort. According to equation (2), the contribution to relevant outcomes (i.e., instructional quality, student learning, teacher commitment) is a function of the product of effort \( (e_i) \) and the payoffs associated with effort \( (k_i) \). This contribution is then balanced off against effort \( \left( -\frac{1}{2} e_i^2 \right) \) in the terms associated with \( (\rho) \).

At the same time, the teacher must resolve their individualistic motivation to develop student human capital with the desire to conform with expectations of members of their subgroups, school faculties, etc.: \( (1 - \rho) \left[ -\frac{1}{2} (e_i - X(C))^2 \right] \).

In this part of the utility function, \( X \) refers to the expectations of those individuals who make up social context \( C \) (e.g., subgroup members, other teachers in the school). As noted, an early career teacher may feel little professional tension when her expectations for herself are consistent with group norms because she can produce human capital and conform by exerting effort on a given dimension. When her expectations are not aligned with group norms, though, she may be more likely to experience significant tensions that can have negative effects on her commitment, instruction, and effectiveness.

Although the expression for the utility in equation (2) may appear awkward involving squared terms and coefficients of 1/2, it yields simple expressions when maximized with respect to effort (known as the first order condition for effort). This can also be understood as the minimum amount of effort required to achieve a given utility (Deaton and Muellbauer 1980). Therefore, assuming a budget constraint in the form of a fixed amount of time/effort, utility is maximized with respect to effort when

\[
e_i = \rho k_i + (1 - \rho) e(C)
\]  

(3)

The implications of (3) are fairly straightforward. Assuming payoffs for effort based on \( k_i \), expectations of others as represented by \( e(C) \) and that teachers act based on their preferences, equation (3) expresses
the relative importance of payoffs to effort (associated with $\rho$) and conformity to the social context (associated with $1 - \rho$). We can then estimate parameters such as $\rho$ and $(1 - \rho)$ in a model with effort as the dependent variable.

Expressing theory through a utility function has three distinct advantages for developing a theory of teacher effort and response to expectations within a social context. First, utility functions represent a way of ordering preferences for different quantities of non-monetary goods (e.g., effort, expectations of mentors and colleagues, school characteristics). This ordering facilitates an interdisciplinary understanding of factors that influence novice teachers’ commitment, instructional quality, and effectiveness. In addition, this ordering operationalizes the assumption of rational action without reduction to monetary terms – utility is a function of one’s own beliefs about effective teaching as well as the sociological value of conformity with others’ expectations.

Second, as Coleman (1995) noted, utility functions can be used to evaluate conditions at equilibrium, thus showing the systemic implications of individual behavior. For example, one can model separately the characteristics of mentoring, subgroups, and induction activities and generate ideals (for their effects on teachers’ effort) through the aggregate of individual attributes. Third, the utility function can be maximized with respect to any given quantity (e.g., interactions with mentor) to develop expressions for the pursuit of that quantity. For example, Akerlof and Kranton (2002) also use their functions to express how schools can elicit maximum student effort with regard to learning by modifying the standards associated with social categories. Above, we showed how a teacher’s utility could be maximized with respect to effort.

In theorizing the effects of mentoring, subgroups, and other factors on teacher and student outcomes, it is important to note two related issues. First, an individual teacher’s instructional practice is actually a set of practices and, following equation (2), these practices are shaped by that teacher’s background and characteristics as well as the context in which they work. In terms of the former, a teacher’s instructional practices are informed by their personal and professional backgrounds, years of
experience, curricular knowledge, teaching expertise, and out-of-work responsibilities. With regard to the latter, as discussed above, a teacher’s practices can also be influenced by the practices and expectations of their mentor, colleagues, administrators, and others.

Second, teacher effort regarding instruction and student learning can be multidimensional in a number of ways. For example, most elementary and some middle school teachers teach different subjects (e.g., reading, writing, mathematics, social studies, science) to one or more groups of students. For their part, most high school teachers and some middle school teachers teach different courses within one or two content areas (e.g., algebra, geometry, pre-calculus within math) to several groups of students. In addition, within a given subject, teachers vary in the ways in which and the extent to which they emphasize basic literacy, numeracy, and scientific knowledge and skills as well as analytical writing, higher-order thinking, problem-solving, and investigation. Further, teachers vary in the ways in which and the extent to which they emphasize authority, moral issues, relationships with students, and student-centered learning in their teaching (Bidwell, Frank, & Quiroz, 1997).

The fact that teacher effort with regard to instruction is often multidimensional in these ways can be expressed as $e_{id}$, representing the amount of effort teacher $i$ devotes to activity $d$ with $d$ connoting a) subject taught, b) relative emphasis on basic skills vs. higher-order skills, c) relative emphasis on authority, moral issues, etc. The utility function in (2) can then be modified to represent effort in any particular area:

$$U_{id}(C) = \rho_d \left[ e_{id} k_{id} - \frac{1}{2} e_{id}^2 \right] + (1 - \rho_d) \left[ -\frac{1}{2} \left( e_{id} - X_d(C) \right)^2 \right].$$  (4)

The corresponding maximization for equation (4) would be:

$$e_{id} = \rho_d k_{id} + (1 - \rho_d) e_i(C)$$  (5)

In sum, in order to understand the effects of mentoring and induction activities on early career teachers, we argue that it is important to consider the relationship between a given teacher’s effort to
teach according to her own beliefs about effective teaching and her effort to conform to the expectations of others in her subgroup and throughout her school. In the next section, we define several terms that are key parts of our conceptual framework, describe their relationship to mentoring and induction, and explain how the utility function on which this framework is based can help researchers to better measure and understand the effects of mentoring and induction on beginning teachers.

III. The Social Context for Beginning Teachers

From equation (2) above, our conceptual framework suggests that in a given social context C, early career teachers’ efforts to teach effectively must be balanced against their efforts to conform to the expectations of key individuals in that context. For beginning teachers, their social context can be defined by formal parts of the organization such as assigned mentors, grade-level teams and departments, and principals; by informal subgroups; and by district and state policies related to student testing and accountability. In this section, we describe several aspects of the social context for new teachers and explicate the ways in which they can place expectations on novices and exert pressures on them to conform with group norms. In the following section, we explicate a) how teacher efficacy represents the relationships between effort and outcomes such as instruction and student learning and b) how a number of teacher- and school-level factors can mediate these relationships.

Mentoring. Many districts and schools provide formal mentoring programs in which a new teacher is matched with an experienced teacher. Research indicates that formal mentors typically address a variety of issues in their interactions with beginning teachers including curriculum, instructional planning, student assessment, psychological support, and access to resources (Feiman-Nemser, 2001; Gold, 1996; Johnson & PNGT, 2004. Youngs, 2007a). In addition, recent studies have investigated the effects of mentoring on teacher retention and student learning. In a study using the 1999-2000 Schools and Staffing Survey (SASS), Smith and Ingersoll (2004) reported that having a helpful mentor who taught
in the same field significantly reduced the likelihood that a new teacher would leave the profession. In another study, Strong et al. (this volume) found that certain types of mentoring activities were associated with student learning gains. Finally, in a large-scale experimental study, Glazerman et al. (this volume) reported that certain types of induction activities were related to higher levels of teacher retention and student learning gains.

At the same time, there has been little research on the degree of fit between beginning teachers and their mentors with regard to their beliefs about effective teaching or their instructional practices. Further, researchers have not examined how mentoring affects the tension between new teachers’ beliefs about teaching and their effort to conform to the expectations of their subgroups or other teachers in their schools. According to our conceptual framework, higher levels of alignment between early career teacher’ beliefs and practices and those of their mentors can a) help novices resolve tensions between their own expectations and the norms in their subgroups or schools and b) help strengthen new teacher commitment, instructional quality, and effectiveness.

**Grade-Level Teams and Departments.** In addition to being assigned to mentors, early career teachers are usually part of grade teams or departments that are formally defined as organizational units within their schools. In a typical elementary school, for example, a grade team would consist of two or more teachers at the same grade level and possibly one or more specialists in such areas as special education, bilingual education, English as a Second Language, or Reading Recovery. In a typical high school, for example, the math teachers would be formally organized as members of the math department. Some middle schools formally group teachers according to the subjects they teach while others organize them based on the grades or groups of students they teach. When teachers collaborate on instructional issues over time with members of their grade teams, departments, or other formal units, their beliefs and practices about teaching are likely to converge (i.e., the conformity effect).

Researchers have examined the effects on teachers of elementary grade-level teams and high school departments characterized by collegial relations. In a national study of elementary schools, for
example, Newmann, King, and Youngs (2000) found that schoolwide professional development had a
greater influence on teachers’ instructional practices in schools with high levels of collaboration within
grade teams. In a study of reading instruction in California elementary schools, Coburn (2001) reported
that teachers’ responses to reading reforms were shaped by their professional backgrounds, interactions
with grade-level and other colleagues, and district and state policies. At the high school level, Johnson
(1990) and Siskin (1991) analyzed how academic departments shaped teachers’ beliefs, instructional
practices, and opportunities to collaborate with colleagues. More recently, McLaughlin and Talbert
(2001) described how the work of teaching varied across different types of communities found in subject
departments and explained the role that departmental cultures can play in classroom settings and
expectations. Taken together, these studies indicate that grade teams and high school departments can
shape teachers’ practices. At the same time, the mechanisms by which these formal units affect student
learning – and the relationship between instruction and learning – are not fully understood.

Principals. Research indicates that school leaders can influence early career teachers in their
direct interactions with them and by facilitating their work with mentors and colleagues. For example,
studies indicate that principals with substantive knowledge of subject matter can help new teachers plan
instruction and analyze student learning during classroom observations, post-observation conferences,
and other direct contact with them (Burch & Spillane, 2003; Stein & D’Amico, 2002). In addition, school
administrators can support beginning teachers by matching them with trained mentors with teaching
expertise in the same content area and grade level and providing opportunities for them to meet with,
observe, and be observed by their mentors (Feiman-Nemser, 2001; Johnson & PNGT, 2004; Youngs,
2007b).

The structures and conditions created by school leaders can strongly shape new teachers’
experiences. Regular meeting times can be established by principals for novices to meet with mentors,
grade team members, and/or subject-area colleagues (Smylie & Hart, 1999). Further, when administrators
foster social trust between themselves and staff members, teacher collaboration and development are
likely to be enhanced (Bryk & Schneider, 2002). Research indicates that trust develops when school leaders support teachers’ work on a consistent basis and share responsibility for decisions related to curriculum, hiring, and professional development (Louis, Kruse, & Marks, 1996; Spillane, Halverson, & Diamond, 2001). At the same time, though, principals can exert pressures on beginning teachers through their expectations regarding curriculum and instruction and their approaches to teacher evaluation and professional development. When a new teacher’s beliefs about instruction or professional development are not aligned with those of their principal, this can cause tension for the novice and have deleterious effects on their commitment and effectiveness.

Subgroups. Similar to members of most other social systems, actors in schools organize themselves (or are organized) into subgroups in which relations, or ties, are concentrated (Bidwell, 2001; Burt, 2000; Frank & Zhao, 2005). Within a large high school, for example, a new Algebra teacher at such a school might be part of a subgroup featuring her mentor and other Algebra teachers. Alternatively, a new Algebra teacher might form a subgroup with beginning teachers in other content areas at her school. At all school levels, subgroups can be based on such things as years of experience, teaching philosophy, gender, race, and age. With regard to veteran teachers, most are likely to identify with one primary subgroup within their school. In contrast, teachers who are relatively new to a school (or new to the profession) may be more likely to have tenuous affiliations with multiple subgroups.

Teachers often turn to their subgroups to discuss challenging issues, make sense of competing demands, and/or diagnose problems in their work (Bidwell & Yasumoto, 1999). An important aspect of the subgroup is that it is defined in terms of the relations, or ties, among its members. In comparison to ties within most grade teams or departments or among school faculties, ties among subgroup members are characterized by greater density due to the frequency of their interactions. Further, strong ties among subgroup members are often associated with normative agreements about curriculum, instructional practice, and assessment (Yasumoto, Uekawa, & Bidwell, 2001). But subgroups are not necessarily isolated entities within schools as an actor may access expertise or resources throughout the organization.
through a direct tie with a non-subgroup member or through an indirect tie mediated by a subgroup member (Frank & Zhao, 2005).

Research indicates that cohesive subgroups are associated with knowledge transfer (Reagans & McEvily, 2003), the implementation of technology (Frank & Zhao, 2005), progressive, student-centered instruction (Bidwell & Yasumoto, 1999), and student learning gains (Yasumoto, Uekawa, & Bidwell, 2001). Building on this literature, our framework posits that subgroups can have significant effects on early career teachers’ instructional practices and commitment levels, and student achievement. In particular, the strength of novices’ ties to other subgroup members may, in some cases, be stronger than their ties to mentors, principals, or staff development providers. For example, when beginning teachers’ beliefs and practices are closely aligned with those of other subgroup members (as compared with those of mentors or administrators), they may be more likely to turn to their subgroups to address challenges and solve problems in their work. As noted, though, the absence of alignment between new teachers and their subgroups can cause significant tensions for novices and can have a negative impact on their commitment, instructional quality, and effectiveness.

Policies Involving Standards and Testing. Districts and states can also place expectations on early career teachers and exert pressures on them through student learning standards, high-stakes testing, and accountability policies. When standards and tests are consistent with a novice’s approach to curriculum and instruction, there is less likely to be professional tension for the beginning teacher. When standards and tests represent conflicting approaches, though, this can pose challenges to a novice’s instruction, commitment, and effectiveness. In particular, several researchers have reported that high-stakes testing can lead to a narrowing of the curriculum where teachers focus primarily on the knowledge and skills that are likely to be tested (e.g., Lipman, 2004; McNeil & Valenzuela, 2001; Shepard, 2000).

Other researchers have examined whether student testing and school accountability programs influence teacher retention rates. Using data from North Carolina from 1994-95 through 1996-97, for example, Clotfelter et al. (2004) investigated the retention rates of elementary teachers in schools that had
been labeled as “low-performing” by the state (i.e., more than half of their students were below grade level on state reading or math tests). In North Carolina, high-stakes student assessments were implemented in the mid-1990s in several grades in reading, writing, and mathematics. Clotfelter et al. (2004) reported that after the implementation of the accountability system, attrition rates increased for new and experienced teachers in low-performing schools.

In sum, several aspects of the social context can provide guidance and resources to early career teachers including mentors, principals, grade teams and departments, informal subgroups, and policies related to student testing and accountability. At the same time, these individuals, groups, and policies can establish norms and exert pressures on beginning teachers. When a new teacher’s beliefs about effective teaching are consistent with the expectations that others have for them, they are able to devote most of their time and effort to instruction. When there is a lack of alignment, though, between a novice and those around them, the new teacher must devote time and effort to conform to the expectations of colleagues, administrators, and/or policies, and this can have harmful effects on their commitment, instruction, and impact on student learning.
IV. The Impact of Effort

From equation (2) above, our conceptual framework indicates that the utility of teacher I, given membership in a given context C, can be maximized when her beliefs and practices are aligned with the norms and expectations of those individuals who make up context C. The relationship between the teacher’s effort and the payoffs \( k_i \) of her effort (e.g., her ability to produce human capital in students) represents the teacher’s efficacy. Further, a number of teacher- and school-level factors can mediate the payoffs of teacher effort for instructional quality and effectiveness including job manageability, collective responsibility, and collective efficacy (see Diagram 1 in the Appendix). This section defines teacher efficacy as well as several of the factors that affect the payoffs of effort, places them in the relevant research literature, and explains their relationship to effort and important teacher and student outcomes.

Teacher Efficacy. The term “teacher efficacy” was first defined by researchers at RAND as the degree to which teachers believe influence over the reinforcement of their actions was under their control or lay in their environment (Rotter, 1966). In contrast, Bandura (1977, 1997) posited that teacher efficacy was a cognitive process in which individuals develop beliefs about their ability to perform at particular levels. In his view, such beliefs influenced teachers’ willingness to put forth effort, their persistence and resilience, and how much stress they experience in dealing with challenging situations. More recently, Tschannen-Moran, Hoy, and Hoy (1998) proposed a model of teacher efficacy that drew on the work of Bandura and the RAND researchers while placing greater emphasis on the nature of a given teacher’s work situation. In their words, “(t)eacher efficacy is the teacher’s belief in his or her capacity to organize and execute courses of action required to successfully accomplish a specific task in a particular context” (Tschannen-Moran, Hoy, & Hoy, 1998). We employ this definition of teacher efficacy\(^3\) in our conceptual framework, emphasizing the task of developing the human capital of students.

Studies indicate that teachers’ sense of efficacy appears related to student motivation and achievement (e.g., Ashton & Webb, 1986; Midgley, Feldlaufer, & Eccles, 1989). Further, some studies
suggest that teacher efficacy may be related to teacher commitment and retention (e.g., Coladarci, 1992; Glickman & Tamashiro, 1982). At the same time, few studies have investigated the development of efficacy beliefs among beginning teachers or the relationship of new teachers’ sense of efficacy to their effort and commitment (Tschannen-Moran, Hoy, & Hoy, 1998). According to our conceptual framework, teacher efficacy represents the relationship between effort and the payoffs associated with effort. When exerting effort enables a teacher to help students learn demanding content and achieve at high levels, this would likely be associated with high teacher efficacy (i.e., belief in her own ability to perform actions necessary to help students learning). Further, when a teacher believes that she is capable of accomplishing specific tasks in her school context, she is more likely to exert whatever effort is necessary to accomplish them. If, for example, a teacher’s subgroup expects her to enact certain math instructional practices, having a higher level of efficacy increases the likelihood that she will do so.

Job Manageability. While teacher efficacy represents the relationship between teacher effort and outcomes such as instruction and student learning, other factors can affect the payoffs from effort on these outcomes. For one, job manageability refers to factors that can influence planning and classroom teaching. For early career teachers, these factors can include access to technology, materials, and resources; administrative duties and paperwork; meetings; student behavior; interactions with parents, guardians, and other family members; and degree of stress or burnout (Gold, 1992, 1996). For example, access to technology can help teachers with planning units and lessons, providing instruction, and maintaining data on student performance. Similarly, access to materials and resources such as books, lab equipment, and math manipulatives can facilitate instruction and student learning. On the other hand, early career teachers’ work responsibilities can become less manageable when they have significant administrative duties, they must attend frequent meetings with colleagues, they have copious amounts of paperwork to complete, and/or they must regularly address student behavioral issues with students and/or their families. Further, the degree of stress or burnout experienced by an early career teacher can affect
their planning and teaching. On both an individual and collective basis, these factors can mediate the influence of teacher effort on the quality of their instruction and student learning.

*Collective Responsibility.* Collective responsibility refers to the degree of shared agreement among the faculty in a school to improve instruction, school organization, and other practices in order to promote high levels of learning and achievement among all students (Bryk & Schneider, 2002; Newmann & Associates, 1996). According to our conceptual framework, high levels of collective responsibility in a school can strengthen the effects of effort on new teacher commitment by increasing new teachers’ sense of efficacy and making their work more manageable. Further, collective responsibility can promote instructional quality by strengthening the impact of mentoring and subgroups on beginning teachers’ instructional practices. Finally, research indicates that high levels of collective responsibility can augment the impact of teacher effort on student learning. In research on secondary students, Lee and Smith (1996) found that the mean achievement gains of students in schools with high levels of collective responsibility were significantly greater than the gains of students in low-responsibility schools. Similarly, in a study of 23,000 6th- and 8th-graders and almost 5,000 teachers in Chicago, Lee and Loeb (2000) reported that collective responsibility was positively related to student learning in mathematics.

*Collective Efficacy.* Collective efficacy is conceptually distinct from collective responsibility and refers to “the judgment of teachers in a school that the faculty as a whole can organize and execute the courses of action required to have a positive effect on students” (Goddard, Hoy, & Hoy, 2004, p.4). In education, one commonly accepted way of measuring collective teacher efficacy is to combine individual teachers’ perceptions of group-referent ability (Goddard, Hoy, & Hoy, 2004). In its focus on teachers’ perceptions of the abilities of their colleagues, this construct differs from collective responsibility which addresses perceptions of shared agreement (i.e., responsibility). Researchers have found strong connections between perceived collective efficacy in schools and variations in student achievement (Bandura, 1993; Goddard, Hoy, & Hoy, 2000).
These studies also suggest a potential relationship between perceptions of collective efficacy and individual teachers’ sense of efficacy. Further, research suggests that the influence of mentoring and subgroups on new teachers’ instruction can be strengthened when novices and their colleagues share the belief that their faculties are capable of promoting student learning. In our framework, then, we posit that high levels of collective teacher efficacy will have direct effects on early career teachers (e.g., by strengthening their sense of efficacy) and indirect effects (by augmenting the impact of mentoring and subgroups on their instruction). Through these mechanisms, our framework suggests that high levels of collective teacher efficacy can positively affect the learning of beginning teachers’ students.

In sum, when early career teachers’ beliefs and practices are aligned with those of their mentors and subgroups, the payoffs of effort for teacher instructional quality and student learning are likely to be enhanced. In this situation, high levels of teacher efficacy, job manageability, collective responsibility, and/or collective efficacy can augment the impact of effort on these outcomes. But these teacher- and school-level factors may have less impact on the payoffs of effort when new teachers are not aligned with their mentors or subgroups.

V. The Relationship Between Teacher Effort and Commitment

Teacher commitment can refer to one’s commitment to continue in a) their current teaching assignment, b) their current school, c) their current district, and/or d) the teaching profession (Ebmeier, 1999; Ingersoll, 2001). For example, a beginning middle school math teacher may feel strongly committed to continuing to teach the same subject at the same school or grade level, but they may prefer to move to another school or district at the end of the school year. Alternatively, another new middle school math teacher may feel little commitment to their assignment, school, district, or profession, and may intend to leave the profession at the conclusion of the year.
According to our framework, commitment is a function of the size of one’s utility. More specifically, a teacher’s commitment is based on a) the outcomes of her effort to promote student learning and b) the extent to which she must exert effort to conform to the expectations of others. Following equation (4), a teacher’s level of commitment to their assignment, school, district, and profession is likely to be high if her effort leads to high levels of student learning and her beliefs and practices are aligned with those of her subgroup members or other school colleagues. On the other hand, her commitment level may be lower if her beliefs and practices are not aligned with those of her subgroup members or other colleagues, she has to exert high levels of effort to conform to their expectations, and/or her effort related to instruction does not lead to high levels of student achievement.

VI. Measuring Instructional Effectiveness

Aside from a teacher’s commitment to her assignment, school, district, and/or profession, her effort may well impact her instructional effectiveness, as indicated for example by her ability to foster learning among her students. Using student test scores as evidence of a teacher’s instructional effectiveness requires considerable care. The critical issue is not so much the fact that student test scores are an imperfect measure of how much students know, but how a measure of a teacher’s instructional effectiveness may be built from such scores. Past research on the use of test scores as indicators of instructional quality has strongly argued against the use of the classroom average score because it represents a “snapshot” that reflects not only students’ instructional histories but also their socio-economic conditions (Bryk & Schneider, 2002; Meyer, 1997)

Consistent with current thinking about the use of student academic performance as a core piece of evidence for effective instruction, we propose defining the instructional effectiveness of a teacher with regard to how much learning has taken place among her students. Employing district and state student testing data that are individually associated with teachers, we would estimate the teacher’s instructional
effectiveness from the combined performance of the students she has had the opportunity to teach using a series of multilevel growth models (Thum, 2003).

For example, suppose that we use \( y_{1ij}, y_{2ij}, \ldots, y_{nij} \) to denote the math scores \((t = 1, 2, \ldots, T_{ij})\) of the students \(i = 1, 2, \ldots, n_j\) in teacher \(j\)’s classroom. We would then construct measures of a student’s achievement status \( \pi_{0ij} \) at time \( T_{ij} \) and her average rate of learning gains \( \pi_{1ij} \) using a suitable growth model, such as
\[
y_{ij} = \pi_{0ij} + \pi_{1ij}(t - T_{ij}) + \sum_{l>0} \delta_l A_{ijl} + \epsilon_{ij}
\]
for each available testing outcome for each teacher in the sample. The estimates would also control for the time-varying covariates, denoted by \( A_{ijl} \), that reflect the magnitude of the corresponding coefficients \( \delta_l \); for example, the influence of changes in test form or language program status. In most instances, we would assume that these effects do not vary from student to student, hence \( \delta_l \) are among the so-called “fixed-effects” that represent uniform influence of these control variables over students.

Since learning growth tends to vary from student to student, a measure of how teacher \(j\)’s students were achieving would be the precision-weighted average of the measurable amounts of individual learning \(i\) over all her \(n_j\) students, as represented by the next equation set
\[
\begin{align*}
\pi_{0ij} &= \beta_{00j} + \sum_{p>0} \beta_{0p0}(X_{ijp} - \bar{X}_{ijp}) + \rho_{0ij} \\
\pi_{1ij} &= \beta_{10j} + \sum_{p>0} \beta_{1p0}(X_{ijp} - \bar{X}_{ijp}) + \rho_{1ij}
\end{align*}
\]
where an estimate of \( \beta_{00j} \) is the average of expected attainments and an estimate of \( \beta_{10j} \) gives the average growth rates of her students controlling for student covariates \(X_{ijp}\), such as gender, minority status, etc. This allows for further adjustments (if necessary) to a student’s growth profile given by \((\pi_{0ij}, \pi_{1ij})\). Together, these estimates define for each teacher the pattern of academic performance of her
students. Estimates are easily obtained from the solution of the implied mixed-effects model under the assumptions that a) the residual errors $\epsilon_{ij}$ are identically and independent normal with mean 0 and variance $\sigma_j^2$, and b) the parameter residuals $\eta_{0ij}$ and $\eta_{1ij}$ are distributed bi-variate normal with 0 means, variances $\tau_0$ and $\tau_1$ respectively, and covariance $\tau_{01}$. The “value-added” estimates, $\beta_{00j}$ and $\beta_{10j}$, describe the combined learning growth experienced by teacher $j$’s students.4

VII. Correlates of Commitment and Instruction

After controlling for factors such as aggregate student demographics, English language proficiency, and Title I status, we would then explore how the newly deduced measures of instructional effectiveness for our novice teachers and their commitment levels might be influenced by the social forces that constrain their professional conduct. That is, we are interested in a) how teachers resolve differences between their own beliefs about effective teaching and the expectations of their subgroups or schools, and b) how the maximization of utility with respect to effort (based on the resolution of the differences in a)) affects student learning gains. The investigation would deploy a series of multi-level models in estimating the effects of effort on commitment, instructional quality, and student achievement with teachers nested within local subgroups within schools. As noted earlier, in contrast to fixed effects models, multilevel models do not merely control for effects of social contexts (e.g., subgroups in schools); instead, they are able to simultaneously test effects at multiple levels as well as cross-level interactions. Thus, multilevel models are optimal for testing the effects on commitment, instruction, and student performance of effort at the individual novice teacher level and of conformity at the subgroup level (Frank et al., under review).

Our theory highlights the impacts on key outcomes (e.g., teacher instructional effectiveness and commitment) for a given novice teacher that are conveyed through their subgroups and school contexts. With several novice teachers in the same school, we would expect the existence of a number of different subgroups in that school. A three-level model would appear to be well-suited for exploring the nested
nature of the data. That is, if we denote a teacher outcome generically as \( y_{jgsy} \) for teacher \( j \) in subgroup \( g \) and school \( s \), we can explore the influence of \( l \) teacher covariates \( A_{jgsy} \), \( p \) subgroup mediators \( X_{pgs} \), and \( s \) school contextual measures \( W_{qs} \) on teacher outcomes by

\[
\begin{align*}
    y_{jgsy} &= \pi_{0gs} + \sum_{i>0} \pi_{igs} A_{jgsy} + \varepsilon_{jgs} , \\
    \pi_{lg} &= \beta_{l0s} + \sum_{p>0} \beta_{lps} X_{pgs} + r_{lgs} , \quad \text{and} \\
    \beta_{lps} &= \gamma_{lp0} + \sum_{q>0} \gamma_{lpq} W_{qs} + u_{lps} , \\
\end{align*}
\]

where \( \pi_{0gs} \) is the intercept for the teacher outcome for mentoring group \( g \) in school \( s \), \( \beta_{l0s} \) is the intercept in modeling the mentoring group effects \( \pi_{lg} \), and \( \gamma_{lp0} \) is the intercept at the school level. As for the remaining coefficients, \( \pi_{lg} \) now represent specific effects due to the joint set of teacher variables (and controls) on the outcome, \( \beta_{lps} \) measure the joint influences of mediating factors associated with subgroups on the respective effects on subgroup factors on the outcome, and \( \gamma_{lp} \) indicates the strength and direction of the association between each school-level covariate and \( \beta_{lps} \). The residual terms in each equation are assumed, if the model is appropriate, to be independently and identically distributed normal with mean 0 and variance \( \sigma^2 \) at the teacher level, multivariate normal with means \( \mathbf{0} \) and variance-covariance matrix \( \mathbf{T}_x \) between subgroups and means \( \mathbf{0} \) and variance-covariance matrix \( \mathbf{T}_y \) between schools. We expect the dimensionality of the covariance structure, given the size of the study, to be greatly constrained.

A model for change, hence increasing the number of levels by one, is also an important tool when researchers are able to follow teachers and their subgroups over time. This is crucial to the empirical test of the notion that the mentor, subgroup and school-level correlates of teacher commitment, as well as her instructional quality and effectiveness, may in fact evolve with time. Extension of the above three-level
model to accommodate a growth process within teachers would be straightforward, as discussed in Raudenbush and Bryk (2002, pp. 237-251), and is not reviewed here due to space limitations.

VIII. Conclusion

In conclusion, this chapter argues that in order to understand the effects of mentors and induction activities on beginning teachers, it is necessary consider novices’ experiences with mentoring and induction in the context of their schools. More specifically, new teachers’ mentors, subgroups, other colleagues in their schools, and administrators can provide support to them, but these individuals can also set expectations and exert pressures on them. When beginning teachers’ beliefs and practices are aligned with those of their mentors, subgroups, and other colleagues, they may feel little professional tension and may be able to promote student learning and respond to others’ expectations by exerting effort on a single dimension. But when novices are not aligned with their mentors, subgroups, or administrators, they may need to exert effort simply to meet others’ expectations and they may experience significant professional tensions. Such tensions, in turn, can have negative effects on early career teachers’ commitment, instruction, and effectiveness.

The utility functions and multi-level models presented in this chapter provide guidelines for future research on beginning teachers and have the potential to explain variation in teacher and student outcomes. In current research in Michigan and Indiana, we employ these utility functions and test these models in order to better understand how mentoring, induction activities, subgroups, and other contextual factors shape novices’ commitment and instruction as well as the learning gains of their students.
Diagram 1. The Social Context for Beginning Teachers

Mentors
Grade Teams
Departments
Principals
Subgroups
Policies

(1 - ρ)
Others’ Expectations

(ρ)
Human Capital

-effort
Utility
Commitment

Job Manageability
Collective Responsibility
Collective Efficacy
References


1 Teacher commitment can refer to one’s commitment to continue a) in their current teaching assignment, b) in their current school, c) in their current district, and/or d) in the profession (Ebmeier, 1999; Ingersoll, 2001).

2 Alignment can refer to beginning teachers having similar teaching assignments, beliefs about teaching, and/or instructional practices as their mentors or colleagues (Bidwell, Frank, & Quiroz, 1997).

3 We distinguish individual teacher efficacy from collective teacher efficacy, which is defined below.

4 The approach may be applied to scales of different “strengths”, or “coarseness”, as long as scale values are consistent in an acceptable way in representing varying magnitudes on a criterion. That is, the statistical growth model of the variety exploited here may be applied to any such useful scales as in conventional linear models (of which it is a generalization). Thus, generally speaking, an interval-scaled outcome measure is not a strict requirement and may also be used to describe changes in performance levels (“below standard”, “meets standard”, “proficient”) if these scale values are found to consistently meet the same standard across grades, tests, etc. Of course, the one exception is the known drawback that because these scales contain far less information (in their ability to distinguish finer differences), significant learning may, as a result, go undetected unless the gain in question traverses a performance threshold.

5 No further attempt will be made here to supply the specific meanings of the coefficients defined. This is because while the structure of a general multi-level model may be easily stated, as above, the specific meaning of each coefficient will depend on how the specific covariates are deployed (e.g., choice of centering). The interested reader should consult, for example, Raudenbush and Bryk (2002).