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## Predicting Elementary Student Outcomes from Student and Teacher Characteristics

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### *Abstract*

*Structural equation modeling analyses of data from a longitudinal study of elementary students (N=5094) examined the relationships and pathways among individual characteristics of students and teachers at the beginning of 3<sup>rd</sup> grade to student achievement at the end of 3<sup>rd</sup> and 5<sup>th</sup> grade. The proposed model for predicting student outcomes provided a good fit to the data. The results demonstrated that the level of 3<sup>rd</sup> grade students' learning motivation and social skills and teachers' positive attitude at the beginning of school year were significant predictors of student academic achievement at the end of 3<sup>rd</sup> grade. Students' perceived competence and their academic achievement during 3<sup>rd</sup> grade were strong predictors of their academic achievement in the 5<sup>th</sup> grade. These results highlighted the role of teachers' efficacy beliefs, which facilitate students' academic achievement by impacting teachers' attitude directly and by increasing indirectly their instructional planning.*

The achievement of schoolchildren depends substantially on the teachers they learn from and on the children themselves (Wayne & Youngs, 2003). The field of education agrees increasingly that teacher and student characteristics have a significant impact on student outcomes (Shores & Shannon, 2007). An important element among student and teacher characteristics is the linkage between these characteristics, especially regarding students' academic achievement. Numerous studies have estimated the effects of student and teacher characteristics on students' academic achievement using a variety of techniques, and these have provided a valuable picture for the educational field of the associations among these variables (i.e., Cassidy, Buell, Hugh-Poese, & Russel, 1995; Good, McCaslin, Tsang, Wiley, Bozach, & Hester, 2006; O'Neil, Welsh, Parke, Wang, & Strand, 1997). However, there is no comparable literature that explores the relationships and pathways among the individual characteristics of 3<sup>rd</sup> grade students and teachers on 3<sup>rd</sup> and 5<sup>th</sup> grade academic achievement.

Studies have shown that some student characteristics are significant predictors of students' later academic achievement while others are not. Among the significant predictors of academic achievement, researchers agree that students' self-perception is a stronger predictor than intelligence, prior achievement, or intrinsic values relative to that achievement (Spinath, Spinath, Harlaar, & Plomin, 2006). Guay, Larose, and Boivin (2004) studied three cohorts of students in elementary school grades 3, 4, and 5 in a longitudinal study that explored the effects of perceived self-competence on academic achievement. Using structural equation modeling, they found that perceived competence is a stronger predictor of future academic success than prior academic achievement. The researchers showed that students who hold higher academic perception about their self-competence achieved higher levels of educational attainment 10 years later. According to the researchers, the association between academic self-perception and level of educational

attainment was still significant when controlled for by prior academic achievement. As such, students who hold a stronger perception of their competence are shown to have better achievement outcomes (Guay, Boivin, & March, 2003).

In general, studies have suggested that students who are motivated achieve better grades and standardized test scores at various grade levels; however, such motivation decreases from 3<sup>rd</sup> grade (Lepper, Iyengar, & Corpus, 2005). Yet when students' perception of their abilities is explored together with their motivation (McCombs, Daniels, & Perry, 2008), it provided a different perspective. Bouffard, Marcoux, Vezeau, and Bordeleau (2003) explored the relationship of perceived competence and motivation to academic achievement among elementary school students. The researchers found that perceived competence rather than intrinsic motivation was a stronger predictor of academic achievement. While students motivation—especially intrinsic motivation—did not contribute significantly to academic achievement either across early schooling years or in any academic domain, perceived competence was significantly related to achievement in each school grade in both reading and mathematics. Therefore, the results of these studies indicate that children's self-perception of their abilities or perceived competence is a relatively stronger predictor than level of motivation or earlier academic achievement. Given that elementary students who are highly motivated tend to hold stronger competence beliefs in themselves over a two-year period (Spinath & Spinath, 2005), there is a need to explore further and clarify the relationships between these important characteristics and the impacts they make on students' academic achievement.

While students' perceived competence and motivation are important aspects of their individual characteristics, children's social skills in school settings are also worthy of exploration. In a study that investigated the relationship of children's social skills with cognitive development and academic achievement, Graziano, Reavis, Keane, and Calkins (2007) reported that children's social skills—especially their regulation of emotion—facilitate their development of a positive student-teacher relationship as well as cognitive processing and independent learning behavior, all of which are important for academic motivation and success. Focusing on first grade students, Downer and Pianta (2006) studied children's academic and cognitive functioning in association with earlier home and child care predictors and with classroom experiences. They found that children's social skills prior to school entry are important characteristics that predict children's academic functioning. Social skills played a significant mediating role between early experience and elementary school academic functioning. When Miles and Stipek (2006) investigated the longitudinal associations between social skills and literacy achievement in a sample of low-income elementary school children, they found significant results in relation to academic achievement. Their results emphasized consistent associations between social skills and literacy achievement in the 1<sup>st</sup>, 3<sup>rd</sup>, and 5<sup>th</sup> grades. As described above, students' perception of their own competence, motivation, and social skills are all notable individual characteristics relative to children's academic achievement. Nonetheless, the results provide a mixed view at various grade levels; the interrelationships among the three characteristics are not explicit and could benefit from greater clarification (Crowson, 1998; Higginson, Phillips, & Uptis, 1997; Kessel, Epstein, & Keynes, 2002; Lin & Yan, 2005).

A body of research suggests that teacher characteristics are also important elements of student achievement in the early years. For instance, Burchinal, Howes, Pianta, Bryant, Early, Clifford, and Barbarin (2008) found that teachers' instructional quality in pre-kindergarten classrooms

predicted the acquisition of language, pre-academic, and social skills through the end of the kindergarten year. The study highlighted the importance of instructional quality in relation to young children's academic achievement. Among various teacher characteristics in elementary schools, teachers' individual teaching efficacy is an important variable that reflects the influence exerted by teachers on elementary students' academic achievement. Teachers' efficacy beliefs tend to explain a significant portion of teachers' instructional and classroom behaviors. Tournaki and Podell (2005) found that teachers display different patterns of interaction with students according to the level of teaching efficacy they held. According to the researchers, teachers with high efficacy beliefs make fewer negative predictions about students and adjust their predictions when student characteristics change, while low efficacy teachers appear to pay attention to a single characteristic when making such predictions. Therefore, teachers who believe they are efficacious on teaching appear to be more confident and open to various classroom situations. Allinder (1995) supports this view by suggesting that teachers with high personal and teaching efficacy increased the end-of-year goals for their students more often.

The relationship among teachers' personal sense of efficacy, their professional practice, and their attitudes toward student achievement have been explored in past research (Goddard & Skrla, 2006; Goddard, Hoy & Hoy, 2004). Goddard, Hoy, and Wookfolk-Hoy (2000) observed that teachers with high efficacy beliefs increase student achievement. Mulder, Tyler, and Conner II (2008) found significant correlations between teaching efficacy and teaching attitude. They confirmed that teacher's efficacy and their attitudes are closely related.

Relative to the relationship between teacher efficacy and attitudes, the findings suggest that teacher efficacy could influence student achievement indirectly through its association with teachers' other individual characteristics including attitudes (Goddard et al., 2004). According to Rokeach (1975), attitude is "a relatively enduring organization of beliefs around an object or situation predisposing one to respond in some preferential manner" (p. 112). Simpson and others (1994) agreed that an attitude is "a predisposition to respond positively or negatively to things, people, events or ideas" (p. 212). Hence, attitude is a significant indicator of behavioral intentions (Pancer, George, & Gebortys, 1992) and "predispositions to act" (Katz & Raths, 1985, p. 302). In teaching situations, it may be said that teachers' attitudes serve as the predictor for teachers' teaching behaviors and student achievement. Kosoko-Oyedeko (2008) confirmed that positive teacher attitudes may contribute to the formation of positive student attitudes and academic performance. In other words, if the teacher's attitude toward teaching is not positive, then this may negatively affect student achievement. Quinn (1997) also reported that when teachers improved their attitudes toward the subject area, student achievement increased. However, the relationship between teaching efficacy and teaching attitude is still unclear. Are they independent factors or is teacher efficacy a reflection of some deeper attitudes—or vice versa? This is worth exploring relative to students' academic achievement. However, past research did not specify whether teachers' attitudes and efficacy beliefs are independent factors, if teacher efficacy is a reflection of some deeper attitudes (or vice versa), or if their relationship is bidirectional.

Studies have found that teachers are quite different in their professional development activities and instructional planning (Louis, Kruse, & Raywid, 1996; McLaughlin & Mitra, 2000; McMunn, McColskey, & Butler, 2004). Generally, teachers' professional development has included attending teaching conferences, participating in seminars or workshops, and taking

short courses (Rodrigues, 2005). The assumption is that these development activities would influence classroom practice and thus ultimately affect the learning experience of students. However, no research has explored the relationship between teacher professional development activities in conjunction with other teacher and student characteristics on elementary students' academic achievement over several years. In general, research has found that teacher professional development occurs most often in schools where more collegial professional communities exist, thus indicating that school environment is an important factor with regard to teacher professional development activities (McLaughlin & Talbert, 2001; Newmann & Whelage, 1995).

Teacher's instructional planning is essential to teaching because it is the process through which teachers link curriculum to learning (Clark & Yinger, 1987). In the instructional planning elements, the time-related factor is important as it impacts teacher planning (White & Williams, 1996). As with teacher's professional development activities, their instructional planning tends to be a very individualized process. Teachers employ many different approaches to planning, and their plans tend to reflect their individual characteristics (Wilen, Ishler, Hutchinson, & Kindsvatter, 2000). On average, teachers spend 10 to 12 hours per week on instructional planning (Clark & Yinger, 1980; Willen et. al., 2000).

Although a series of research initiatives have explored student and teacher characteristics, studies have not been conducted to explore the interactions among all these characteristics. Previous studies yielded mixed results for various grade levels in relation to academic achievement (i.e., Crowson, 1998; Higginson, Phillips, & Upitis, 1997; Kessel, Epstein, & Keynes, 2002; Lin & Yan, 2005) and few consistent relations between these characteristics and students' learning are reported (i.e., Ellis, Jones, Okpala, & Smith, 2000; Hoy, Tarter, & Hoy, 2006). Whether the distinctiveness of the student and teacher characteristics clusters hold across subgroups of elementary students is indeed worth exploring. Therefore, the relationships between student and teacher characteristics on students' academic achievement during the elementary years should be examined.

This study seeks to expand the body of research on student and teacher characteristics by investigating the effects of selected significant student characteristics (perceived academic competence, motivation, and social skills) and teacher characteristics (instructional planning, professional development activities, attitudes toward teaching, and teaching efficacy) on academic achievement. To that end, we assess students' achievement growth based on academic scores (reading and mathematics) from 3<sup>rd</sup> grade to 5<sup>th</sup> grade in elementary schools. In addition, the relationships and pathways of the overall interaction among these characteristics are explored using structural equation modeling. We seek to present a well fitting model to explain the latent structures of these student and teacher characteristics in relation to elementary schoolchildren's growth in their middle years (Darling-Hammond, 1998; Wayne and Young, 2003). Disentangling students' and teachers' learning-related behaviors and social characteristics is crucial to the ability of teachers, parents, and administrators to conceptualize how children's learning may be impacted during the school year. The following two research questions guided the study.

- (1) How much of the student academic outcomes at the end of 5<sup>th</sup> grade is predicted by students' characteristics in 3<sup>rd</sup> grade, including 3<sup>rd</sup> grade academic outcomes, learning motivation, perceived competence, and social skills?
- (2) How much of the student academic outcomes at the end of 5<sup>th</sup> grade is predicted by the 3<sup>rd</sup> grade teacher's characteristics, including instructional planning, professional development, teacher attitude, and their efficacy beliefs?

### *Method*

#### *Participants*

The research questions were addressed using a sample of 5,094 children in the Early Childhood Longitudinal Study- Kindergarten Class of 1998-1999 (ECLS-K) sponsored by the National Center for Education Statistics. The ECLS-K is a longitudinal study that includes a wide range of family, school, and classroom variables in relation to children's development and achievement in school. In the ECLS-K study, rounds of data collection have spanned across kindergarten, 1<sup>st</sup>, 3<sup>rd</sup>, and 5<sup>th</sup> grades. For this study, based upon the research questions that focus on 3<sup>rd</sup> and 5<sup>th</sup> grade students in their elementary years, data from the spring 2002 to spring 2004 surveys were used. Notably, only students who were 5<sup>th</sup> graders in 2004 were included in the study. Per the user's manual, the weight of C1\_6FC0 was used. For this study, half of the sample was used to develop the model and half was reserved to test the final structural model. Data were drawn from two different sources of students and teachers.

#### *Measures*

For the measures, the 3<sup>rd</sup> Grade Spring Teacher Questionnaire parts B & C, the 3<sup>rd</sup> Grade Student Questionnaire, and the 3<sup>rd</sup> and 5<sup>th</sup> grade Direct Cognitive Assessments were used. In this study, all of the constructs were assessed with multi-item indices, and all had Cronbach coefficient alphas above 0.70.

The student *Direct Cognitive Assessment at third grade* was measured using a 2-item index (reading and math scores, standardized,  $\alpha = .82$ ). Student *Direct Cognitive Assessment at fifth grade* was measured with a 2-item index (reading and math scores, standardized,  $\alpha = .82$ ). Student *Perceived Competence* was measured with a 4-item index (perceived interest/competence in reading, math, all subjects, and peer relations,  $\alpha = .85$ ). Student *Social Skills* (teacher report) was measured with a 6-item index (approaches to learning, self-control, interpersonal, externalizing problem behaviors, internalizing problem behaviors, combination of self-control and interpersonal,  $\alpha = .80$ ). Student *Motivation* (teacher report) was measured using a 3-item index (motivation level, cooperation, and attention level,  $\alpha = .78$ ).

Teacher's *Instructional Planning* was measured with a 4-item index (times met to engage in lesson planning, discuss curriculum, discuss a child, and meet with a special education teacher,  $\alpha = .73$ ). Teacher *Professional Development* was measured using a 4-item index (reading workshop, math workshop, science workshop, and social studies workshop,  $\alpha = .76$ ). Teacher's *Attitude* was measured with a 3-item index (i.e., staff have school spirit, child misbehavior affects teaching, children incapable of learning,  $\alpha = .89$ ). Teacher *Efficacy* was measured through

a 3-item index (i.e., teacher enjoys present teaching job, teacher makes a difference in children's lives, teacher would choose teaching again,  $\alpha = .94$ ).

The latent factors for the study were similar to the following: F1 = Perceived Competence (Student); F2 = Social Skills (Student); F3 = Motivation (Student); F4 = Instructional Planning (Teacher); F5 = Professional Development (Teacher); F6 = Teacher Attitude (Teacher); F7 = Teacher Efficacy (Teacher); F8 = 3<sup>rd</sup> Grade Academic Achievement (Student); and F9 = 5<sup>th</sup> Grade Academic Achievement (Student).

### *Analytic Procedures*

The principal analysis consisted of confirmatory latent-variable structural modeling using the EQS program (Bentler, 2000). With respect to the model's goodness of fit, Normed Fit Index (NFI), Non-Normed Fit Index (NNFI), and Comparative Fit Index (CFI) are reported below. Values that exceed 0.90 for those indices are considered to provide acceptable fit (Bollen, 1989). For the root mean square error of approximation (RMSEA), values lower than 0.10 indicate acceptable fit.

### *Results*

To determine the extent to which the observed variables are linked to the latent factors mentioned above, a measurement model was specified and tested on the data. The goodness of fit indices indicated that the hypothesized model fit the data well. Specifically,  $X^2$  was 592.53, degree of freedom was 210,  $X^2/df$  was 2.82, NFI was 1.00, NNFI was 1.00, CFI was 1.00, and RMSEA was .062.

To specify the regression structure among the latent variables, a structural model was specified and tested. This model also fit the data well. Here,  $X^2$  was 302.485, degree of freedom was 189,  $X^2/df$  was 1.60, NFI was 1.00, NNFI was 1.00, CFI was 1.00, and RMSEA was .063.

As shown in the figure below (all the significant paths are bold), students' perceived competence in 3<sup>rd</sup> grade predicted their achievement after 2 years; that is, 5<sup>th</sup> grade achievement ( $\beta = .22$ ). However, their perceived competence did not predict their 3<sup>rd</sup> grade achievement. Students' social skills in 3<sup>rd</sup> grade predicted their academic achievement at 3<sup>rd</sup> grade ( $\beta = .18$ ); however, it did not predict achievement after 2 years at 5<sup>th</sup> grade. Student motivation was a significant predictor of student academic achievement at 3<sup>rd</sup> grade ( $\beta = .50$ ), yet it showed a negative relationship with student achievement after 2 years at 5<sup>th</sup> grade ( $\beta = -.15$ ). Notably, students' motivation and perceived competence were significantly correlated ( $r = .38$ ). As mentioned earlier, students' perceived competence at 3<sup>rd</sup> grade predicted academic achievement at 5<sup>th</sup> grade, and 3<sup>rd</sup> grade academic achievement predicted 5<sup>th</sup> grade achievement ( $\beta = .28$ ). In other words, students who achieved well in the 3<sup>rd</sup> grade also achieved well in the 5<sup>th</sup> grade.

Relative to teachers' characteristics, 3<sup>rd</sup> grade teachers' attitude predicted students' 3<sup>rd</sup> grade academic achievement ( $\beta = .10$ ); however, teachers' attitude did not predict students' academic achievement at 5<sup>th</sup> grade. When 3<sup>rd</sup> grade teachers held a high level of efficacy beliefs, they also had more positive attitudes toward teaching ( $\beta = .65$ ). Thus, teachers' attitude became a predictor of 3<sup>rd</sup> grade students' academic achievement. As seen in the model, teacher's efficacy

beliefs and attitudes toward teaching were two separate constructs investigated in the study. The teachers who had higher self-efficacy and positive attitudes were more frequently involved in instructional planning activities ( $\beta = .26$ ,  $\beta = .29$ , respectively); however, instructional planning activities did not predict students' academic achievement at either the 3<sup>rd</sup> or 5<sup>th</sup> grade.

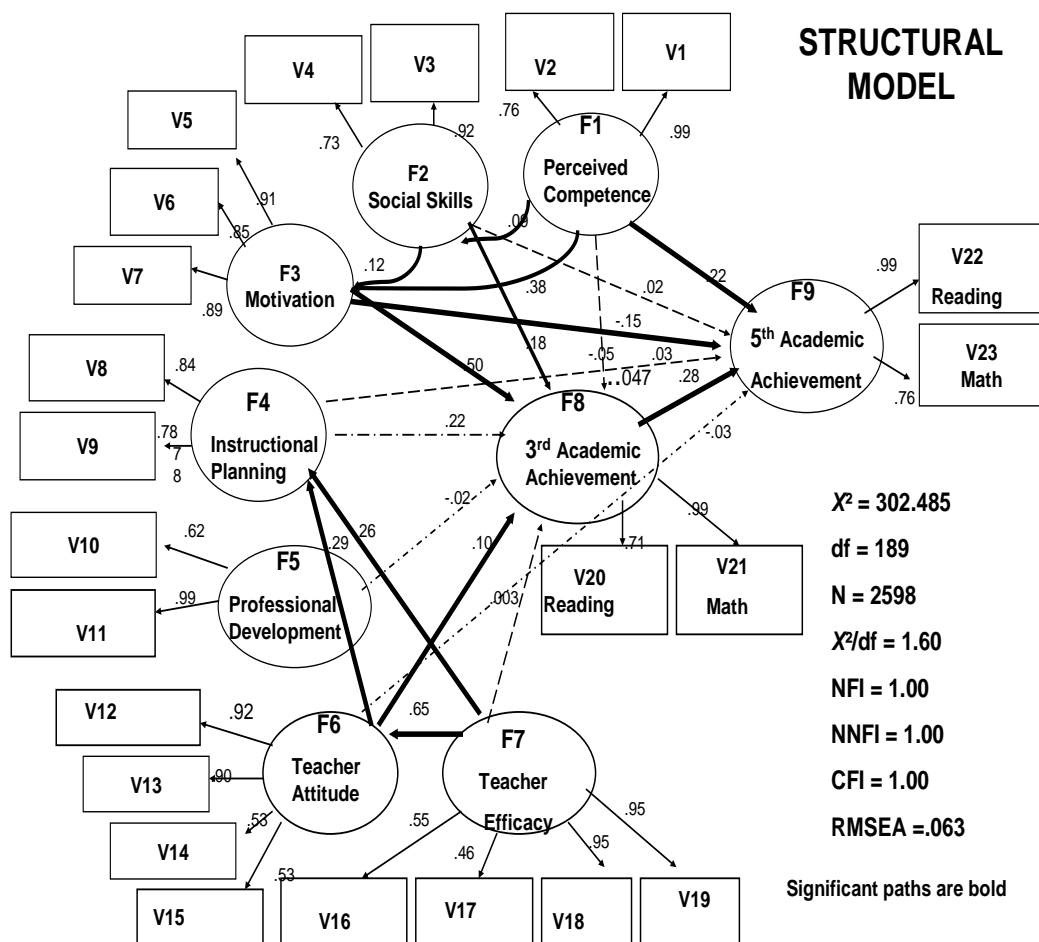


Figure 1. Standardized path coefficients representing effects of perceived competence, social skills, motivation, instructional planning, professional development, teacher attitude, teacher efficacy on 3<sup>rd</sup> grade academic achievement and 5<sup>th</sup> grade academic achievement. All the paths in solid bolded lines are statistically significant at  $p < 0.05$ .

### Discussion

The present study was designed to investigate, over the course of the 3<sup>rd</sup> grade to 5<sup>th</sup> grade years, the degree to which student characteristics (perceived competence, social skills, and motivation) and teacher characteristics (instructional planning, professional development activities, teacher attitude, and teacher efficacy) predicted the academic achievement outcomes of those grades.

Among student characteristics, motivation and social skills predicted 3<sup>rd</sup> grade achievement. The results suggest that students who are motivated and have positive social skills tend to achieve better academic outcomes. It is important to note that students who achieve well during 3<sup>rd</sup> grade



tend to continue to achieve well in the 5<sup>th</sup> grade. This suggests that schools should support the implementation and expansion of programs that contribute to the readiness of all students, since students who ended 3<sup>rd</sup> grade with a lower level of academic achievement tend to have lower achievement at the end of the 5<sup>th</sup> grade than students who ended at a higher level.

It was noteworthy that students' perceived competence at 3<sup>rd</sup> grade predicted 5<sup>th</sup> grade academic achievement but not 3<sup>rd</sup> grade achievement. Students' perceived competence was measured through students' self-reports at the beginning of third grade. While this did not predict 3<sup>rd</sup> grade academic achievement, it was strongly associated with 5<sup>th</sup> grade academic achievement. Guay, Larose, and Boivin (2004) also reported that students' perceived competence predicted their academic achievement longitudinally. While Spinath and colleagues (2006) indicated as well that perceived competence is a strong predictor of students' academic achievement, it was interesting to note that perceived competence did not predict 3<sup>rd</sup> grade achievement but predicted achievement after 2 years. This highlights the importance of students' perceived competence.

Among teacher characteristics, it was worth mentioning that teacher efficacy did not have a direct effect on students' academic achievement. As the path showed, teacher efficacy had a strong impact on teacher attitudes, and teacher attitudes thus had a significant and strong impact on students' academic achievement—but *not* vice versa. This result supports the outcomes of earlier studies, which indicated that teachers' efficacy might influence student achievement indirectly through its relationship with the other characteristics of individual teachers (Goddard, Hoy, & Hoy, 2004). It was also noteworthy that teachers' efficacy and attitudes represent two distinct characteristics that have a distinct path between the two. This demonstrates the importance of supporting teachers in the field to hold strong efficacy beliefs in teaching and in their schools. Parents, teachers, and school administrators should collaborate to focus greater effort on creating school environments that will empower individual teachers' efficacy to transform academic learning in their classrooms.

Another notable result was that although teachers with high self-efficacy and positive attitudes had more instructional planning opportunities, such activities did not lead to improved student academic achievement. As noted above, teachers' instructional planning was measured according to the time teachers invest in planning instruction, meeting with other teachers, and the like. While this time-related factor is important in developing curriculum (Clark & Yinger, 1987) and overall teaching planning (White & Williams, 1996), instructional planning as a function of individual teacher characteristics was not related to students' academic achievement in this study.

The results of this study suggest the importance of attending to the complexity of the characteristics each student and teacher brings into the classroom. Therefore, it is crucial for parents, teachers, and administrators to conceptualize how children's learning may be impacted during the school year. Findings from the present study can inform teacher education, professional development, and administrative support to enhance teaching effectiveness.

The study is not without limitations. This study used only two time points to determine the impact of student and teacher characteristics. A longer term longitudinal model should be used to estimate the changes and contributions of the constructs. More in-depth analysis for each construct and their causality are also in order. In addition, although teacher's instructional planning was used as the indicator variable for teachers' practices, increasingly detailed

indicators for teacher's instructional practices should be used to discover more about the causality between teacher characteristics and student achievement.

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