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Longitudinal Effects of Perceived Control on Academic Achievement

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ABSTRACT. It is well established that perceived control plays an important role in student academic achievement, but little is known about its longitudinal stability, ethnic variation, and developmental effects on subsequent achievement during adolescence. Findings from this study indicated (a) perceived control remains stable during adolescence for each of the four major ethnic groups in the United States; (b) perceived control has a direct effect on subsequent academic achievement as well as an indirect effect, which is mediated by high school student's academic engagement behaviors for all 4 ethnic groups; (c) regarding social contextual factors, students' perception of teacher and parental support had a positive effect on perceived control, which ultimately impacted the academic achievement of high school students across all 4 ethnic groups.

Keywords: academic achievement, ethnicity, perceived control, school engagement, structural equation modeling

Perceived control has been shown to play a central role in motivational and cognitive accounts of behavior. Of particular concern regarding perceptions of control is how these perceptions affect the outcomes (successes or failures) of the events with which they are associated (Bandura, 2000). The body of research on perceived control grew out of Rotter's (1954) social learning theory, which states that individuals with an internal locus of control believe that they are personally responsible for what happens to them. In contrast, individuals with an external locus of control believe that forces beyond their control have power over the outcomes in their lives. Research that followed refined the construct, and multidimensional measures of perceived control that were domain-specific were developed (e.g., Connell, 1985; Lefcourt, 1976; Skinner, 1995; Weiner, 1979). Perceived control has commonly been studied for its relation to achievement in the academic domain. The findings of these studies consistently show a positive correlation of perceived control with academic achievement (Findley & Cooper, 1983; Wigfield, Eccles, Schiefele, Roeser, & Davis-Kean, 2006). That is, students with a higher level of perceived control tend to have higher academic achievement. These findings have important implications for psychological and educational research as well as practical implications for schools.

Developmental Effects

Perceived control and achievement. Few studies have examined the developmental effects of perceived control on academic achievement. The relation between perceived control and student academic achievement appears to hold true for different age groups (Findley & Cooper, 1983; Ross & Broh, 2000; Sisney et al., 2000; Stipek & Weisz, 1981). In a study on preschool children, Walden and Ramey (1983) found that a belief in personal control over academic success was a significant predictor of academic achievement. In a study of high school students, Sterbin and Rakow (1996) demonstrated a significant effect of locus of control on student achievement for high school students. Finn and Rock (1997) investigated whether locus of control explained differences between resilient and nonresilient low socioeconomic status (SES) minority high school students and found internal locus of control to be a determinant of success for low SES minority students for the resilient and nonresilient groups. Sisney et al. (2000) reported that high school students have shown significant association between external locus of control and lower academic achievement, as well as higher dropout rates. Locus of control is considered to be an important factor in levels of academic achievement for college students as well (Grimes, 1997; Nelson & Mathias, 1995). In a recent study, Gifford, Briceno-Perriott, and Mianzo (2006) found a significant relationship between internal perceived control and grade point average (GPA) for first-year students. In their extensive literature review of studies on locus of control and academic achievement using elementary through college level samples, Findley and Cooper (1983) found a significant and positive relationship between the two constructs. Although the studies reviewed by Findley and Cooper were not longitudinal, the

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magnitude of the relationship was small to medium, with stronger associations found for the adolescent samples than for the adult samples.

The relationship between perceived control and academic achievement has largely been established via correlational studies. Little is known about the long-term effects of perceived control on academic achievement. In one of the few longitudinal studies conducted, Ross and Broh (2000) examined reciprocal effects of perceived control and self-esteem (measured at Grade 10) on academic achievement (measured at Grades 8 and 12). They found that perceived control significantly influenced subsequent academic achievement, but self-esteem did not. Additionally, results indicated that previous academic achievement and parental support in Grade 8 had a positive impact on subsequent perceived control and self-esteem. More longitudinal studies are needed to replicate the developmental effect of perceived control on subsequent academic achievement.

Stability of perceived control during adolescence. During the adolescent period, students undergo a number of physical and psychological changes (Wigfield et al., 2006). Such changes may include students' self-concept, self-esteem. Although the stability of self concept and self-esteem have been extensively studied (e.g., Harter, 1998; Marsh & Hattie, 1996; Shapka & Keating, 2005), less is known about the stability of perceived control during adolescence (Lewis, Ross, & Mirowsky, 1999). The few longitudinal studies that have examined the stability of locus of control among adolescents revealed mixed results. Some studies reported that perceived control became more internal (i.e., attributing more personal control) during this developmental period (Chubb, Fertman, & Ross, 1997; Lewis et al., 1999). For example, Chubb et al. (1997) conducted a longitudinal study on 174 ninth-grade students and found that between Grades 9 and 12, locus of control became less external each year. In contrast, using two time points, Cairns, McWhirter, Duffy, and Barry (1990) found locus of control to be relatively stable during an 18-month period. Similar results of stability were reported in Kulas's (1996) 3-year longitudinal study of locus of control using a sample of 84 middle school students. Further investigations using a large representative sample across a longer period of adolescence are needed to provide a more accurate assessment of the stability or change of perceived control.

Cross-cultural Differences

Culture has been found to be an important predictor of perceived control. Some suggest that culture is a stronger predictor of perceived control than other variables such as age and social class (Jensen, Olsen, & Hughes, 1990). Therefore, many studies considered cultural variations in attempts to understand perceived control and academic achievement. One line of research has focused on cross-cultural differences in perceived control in academic domains. Many studies showed that cross-national differences between Asian and American students. In a comparative study on the causal attributions of academic achievement in samples of fourth-grade students from China, Japan, and the United States, Tuss, Zimmer, and Ho (1995) found cultural differences on a number of attribution dimensions, including effort and ability, task difficulty, and controllability. Attribution patterns for subgroups within the Asian population were similar; however, these patterns were markedly different from the U.S. sample. Yan and Gaier (1994) compared causal attributions for success and failure in a sample of 358 college students of American, Chinese, Japanese, Korean, and Southeast Asian background and found a differential pattern in causal attributions between Asian and American students but similar patterns among the four Asian subgroups. Compared with Asian students, American students appeared to believe that ability was important for academic success and failure. Although these studies and others found that Caucasian students are more likely to have an internal locus of control than their Asian counterparts (Sastry & Ross, 1998), some studies suggest that Asian students' perception of control are less external than their American peers (Hamilton, Blumenfeld, Akoh, & Miura, 1989; Si, Rethorst, & Willimczik, 1995). Furthermore, some studies found no cultural differences; Chandler, Shama, Wolf, and Planchard (1981) found no cultural differences on effort attributions and overall internality on a sample of 684 college students from five countries (India, Japan, South Africa, United States, Yugoslavia).

Although the first line of research focuses on the construct of locus of control, a second line of research has focused on the cross-cultural differences in the relationship between perceived control and academic performance. Ho et al. (2000) examined cross-national and gender variations in the relationship between perceived control and mathematics achievement for samples of sixth-grade students from China, Taiwan, and the United States. Results of nation and gender differences varied with respect to sources of control (internal, powerful others, and unknown) as well as specific domains (cognitive and social). For example, in the cognitive domain, there were significant positive correlations between internal locus of control and mathematics achievement for U.S. boys only, whereas the U.S. girls followed the same pattern as Asian boys and girls in terms of the association between sources of perceived control and mathematics achievement.

Little and his colleagues conducted a number of studies on cross-cultural differences in perceived control and its relationship with school performance on a sample of children and adolescents (see Little, 1998; Little & Lopez, 1997; Little et al., 2003). For the sample of elementary school children (Grades 2–6), they found that actual school performance was significantly predicted by control beliefs and intellectual skills with a relatively higher magnitude for German and Japanese children when compared to U.S. children (Little

et al., 2003). Another interesting finding came from Grob, Little, Wanner, Wearing, and Euronet (1996), who found that Western adolescents showed less personal control than their Eastern peers.

Although many cross-national investigations have been made examining the relation between perceived control and academic achievement, relatively little is known about how the relationship between perceived control and student achievement varies across major ethnic groups within the United States. To date, most of the studies that investigated perceived control and its relation to academic achievement have focused on Caucasian, middle-class, Western samples.

Process Model of Perceived Control

Although past studies have consistently reported the positive effects of perceived control on academic achievement, the process by which perceived control influences student performance is not well understood (Stipek & Weisz, 1981). Researchers have attempted the challenging task of understanding the process of perceived control in many ways. Some have focused on the motivational aspect of perceived control and investigated the pathway by which perceived control influences outcomes through motivational effects on student behavior. Studies also examined the antecedents of perceived control. In addition, research on children and adolescents has closely examined the family and school contexts that may influence perceived control.

Mediating effects of student engagement. The motivating factor for behavioral patterns has received the most attention due to its possible role in achievement outcomes that stem from perceived control. The motivational aspects of behavior have received the most attention as the proximal outcomes of perceived control. Researchers have provided evidence for the effect of perceived control on behavior in achievement contexts such as performing tasks with greater intensity, persisting in task situation, and spending time in achievement related activities (Skinner, 1995; Weiner, 1979). When students believe they can exercise control over important outcomes such as academic performance in the school setting, they engage in more active learning behaviors, and all of these achievement related behaviors should maximize learning in an achievement situation (Stipek & Weisz, 1981).

Perceived control may have an indirect effect on academic achievement via mediating patterns of action such as student behavioral engagement. Issues related to student engagement in the school context have attracted attention because of its influence on developmental trajectories and academic success. School engagement has been associated with school achievement, school motivation, and dropout rates (Finn, 1989). Increasing students' engagement in school has been and continues to be a goal of many school systems. Behavioral engagement is the extent to which a student regularly participates in classroom and school activities. At the most basic level, participation includes students' attending school, attending to the teacher, participating in classes, and spending time on homework. Students who fail to meet these basic requirements for school (e.g., being late for class, not attending to the teacher, not completing class assignments) are likely to encounter immediate and future learning difficulties (Finn & Rock, 1997). School engagement has been found to be an essential component of dropout prevention and academic resilience, and the investigation of school engagement is often found in research related to school dropout and at-risk students. Student engagement, in the form of regular participation in class and school activities, can play in important role in mediating the effects of perceived control on academic achievement. That is, a higher sense of personal control leads to greater school participation, and the more students engage in classroom and school activities, the higher their academic achievement.

Social contextual effects on student perceived control. A second important line of research has focused on the socializing influence of significant adults in the student's lives. In Garmezy's (1985) review of research on stress-resistant children, he concluded that the availability of external support systems encourage and reinforce a child's coping efforts. Students' learning and development are influenced not only by individual propensities but also by the interpersonal relationships and social environments within which they develop. Parents and teachers are important social figures in students' multiple worlds. Supportive and positive relationships with important figures in students' lives optimize students' motivation to be actively engaged in learning. Students' interpersonal relationships with their parents and teachers can be powerful social contexts that motivate student behavior. Several researchers have shown that support from parents and teachers was positively associated with students' achievement and motivation (Grolnick, Ryan, & Deci, 1991; You, 2005).

The present study draws together and extends previous work from these two lines of research. A previous study conducted by Skinner, Welborn, and Connell (1990) merged these two lines of research together. In their process model using correlational and path analyses approaches, Skinner et al. found student behavioral engagement served as a mediator between elementary students' perceived control and academic achievement. Additionally, they examined the role of teacher behavior as a potential social context for students' control beliefs and found students' perception of teacher support to positively influence their perceived control beliefs. However, in their process model, the study used a relatively small sample, the data were not longitudinal, and the direction of effects was not clear. There is a dearth of longitudinal studies that have examined the process by which perceived control affects student achievement. Furthermore, little is known about this process model for the adolescent period. Longitudinal designs are needed in order to accurately investigate potential mediating and social context effects

in the relationship between perceived control and actual achievement.

The present study advances the research on perceived control and academic achievement by addressing the longitudinal and ethnic variation in adolescent students in the United States. The study used methodologies including latent growth modeling and structural modeling approach on the National Education Longitudinal Survey (NELS; 1994) data to adequately address these issues. The NELS database is ideal for addressing these objectives because (a) it provides a set of psychometrically valid measures of perceived control assessed across various time points, (b) it provides a sufficiently long time span during adolescence and thus permits the examination of long-term effects of perceived control on academic achievement, and (c) it provides a sufficient sample of individuals across four major ethnic groups in the United States to permit analysis of ethnic group differences. Specifically, our research questions are as follows:

Research Question 1: Do students' perceived control remain stable during the adolescent period (from Grades 8 to 12)? Does this stability or change vary across ethnic groups?

Research Question 2: Is there a long-lasting effect of perceived control on subsequent academic achievement? Does this effect hold across ethnic groups?

Research Question 3: For each ethnic group, does student engagement in school serve as an important mediator between students' perceived control and academic achievement?

Research Question 4: For each ethnic group, does teacher and parental support serve as an important social contextual factor of student perceived control?

Method

Data Source

This study investigated the longitudinal relationship between perceived control and student academic achievement using data drawn from NELS (1994). NELS is the third in a series of national longitudinal educational studies conducted by the National Center for Education Statistics at the U.S. Department of Education. The base-year study used a stratified, clustered national probability sample of 24,599 eighth-grade students from 1,052 schools in the United States, who were asked to complete questionnaires regarding schoolwork, relationships, family, attitudes, and behaviors. Follow-ups were conducted 2 and 4 years after the base year when most respondents were in Grades 10 and 12, respectively. The age range for eighth-, 10th, and 12th-grade students are 12–13, 14–15, and 16–17 years, respectively. These age ranges are based on conventional ages in the American school system (Ingels et al., 1994).

This study randomly selected 1,500 students from each of the four ethnic groups or 6,000 students from the NELS (1994) data set to minimize the impact of clustering in the data. The NELS data set is hierarchical with three levels: repeated measures (Level 1) are nested within students (Level 2) and students are nested within schools (Level 3). This study, however, employs two-level modeling, thus ignoring the clustering effect at Level 3. Although students in the same school are likely to produce common sources of variation, the impact of the violation of independent observation assumption may not be serious when the size of the design effect is less than 2.0 according to the simulation study by Muthén and Satorra (1995). Given the interclass correlation of .2, which is a typical level for achievement scores due to school components (Muthén, 1997), the design effect is larger than 2.0 when the average number of students per school is larger than 6. Because the average number of students per school is less than 3 for the each of the four ethnic groups, the impact of the clustering in the data is likely to be minimal.

Measures

The variables drawn from the NELS (1994) data set for this study included items on perceived control, school engagement, teacher and parental support, and students' academic achievement. In the present study, we used the version of perceived control that was adapted for use as part of NELS. These items are based on the Pearlin Mastery Scale (Pearlin, Menaghan, Lieberman, & Mullan, 1981), which measures the degree to which people believe that reinforcement is a result of their own behavior (internal control) or a result of fate or chance (external control). Six items, each answered on a 4-point Likert-type scale ranging from 1 (*strongly agree*) to 4 (*strongly disagree*), were used to indicate a latent construct of perceived control: (a) "I don't have enough control over the direction my life is taking"; (b) "In my life, good luck is more important than hard work for success"; (c) "Every time I try to get ahead, something or somebody stops me"; (d) "My plans hardly ever work out, so planning only makes me unhappy"; (e) "When I make plans, I am almost certain I can make them work" (reverse coded); and (f) "Chance and luck are very important for what happens in my life." All items were coded so that higher scores indicate a higher sense of control. The reliability coefficient using Cronbach's alpha coefficient for the items were .70, .71, and .74, respectively, for the three waves (1988, 1990, and 1992).

School engagement includes two composite factors: (a) behavioral engagement and (b) homework. For behavioral engagement, three items were used. These items are based on Finn's (1989) taxonomy of engagement or participatory behaviors, which measures students' actual involvement in schoolwork (such as coming to class prepared, completing assignments, and class participation). All items were coded so that higher scores indicate a higher level of engagement. Cronbach's alpha coefficient for this scale was .65. For the homework time measure, two items were used: "How much time spent on homework in and out of school." Cronbach's alpha coefficient for this scale was .76.

TABLE 1. Descriptive Statistics and Correlations Among Subscales of the Student's Perceived Control, Academic Engagement, Perceived Teacher and Parental Support, and Academic Performance Outcomes

Variable	*M*	*SD*	Missing rate (%)	1	2	3	4	5	6	7	8
1. Perceived control 88	2.97	0.47	11.46	—							
2. Perceived control 90	3.01	0.47	13.16	.83*	—						
3. Perceived control 92	3.02	0.48	7.95	.82*	.82*	—					
4. Homework time	2.71	1.77	3.45	.62*	.69*	.67*	—				
5. Behavioral engagement	3.24	0.57	5.76	.54*	.55*	.53*	.55*	—			
6. Teacher support	2.86	0.55	2.70	.64*	.62*	.69*	.65*	.47*	—		
7. Parental support	2.39	0.55	3.40	.70*	.64	.64*	.69*	.52*	.62*		
8. Academic achievement	53.42	9.75	22.30	.66*	.69*	.60*	.64*	.53*	.60*	.69*	—

*$p < .05$.

For teacher support, four items were used as an indicator of students' perception of teacher support. Items included "Teachers are interested in students"; "Teachers praise my effort"; "In class, I feel put down by my teachers"; and "Most of my teachers listen to what I say." All items were coded so that higher scores indicate a higher level of teacher support. Cronbach's alpha coefficient for this scale was .73. For parental support, three items were used to identify the extent to which parents discussed school related activities with their child. Items included "I discuss programs at school with parents," "I discuss school activities with parents," and "I discuss things studied in class with parents." All items were coded so that higher scores indicated a higher level of parental support. Cronbach's alpha coefficient for this scale was .71. Students' Grade 12 reading, mathematics, and science IRT scores were used to measure academic achievement.

As in many studies using survey methods, our data set contained missing responses. Missing response rates for all the variables that were examined in this study are shown in Table 1. Because listwise deletion and pairwise deletion can result in pairwise–listwise deletion and substitution with a sample estimate (e.g., mean, median) are often used for handling missing data. However, these common methods tend to produce incorrect estimates (Schafer, 1997). In order to obtain unbiased estimates of the parameters of interest despite the incompleteness of the data, this study employed a maximum likelihood (ML) estimation that uses full information from all observations (Yuan & Bentler, 2000).

Overview of the Statistical Analyses

In order to test the hypotheses in the present study, analyses were conducted in two stages. In stage 1, a second-order latent growth model (see Figure 1) was developed to capture the developmental trajectory of perceived control. When

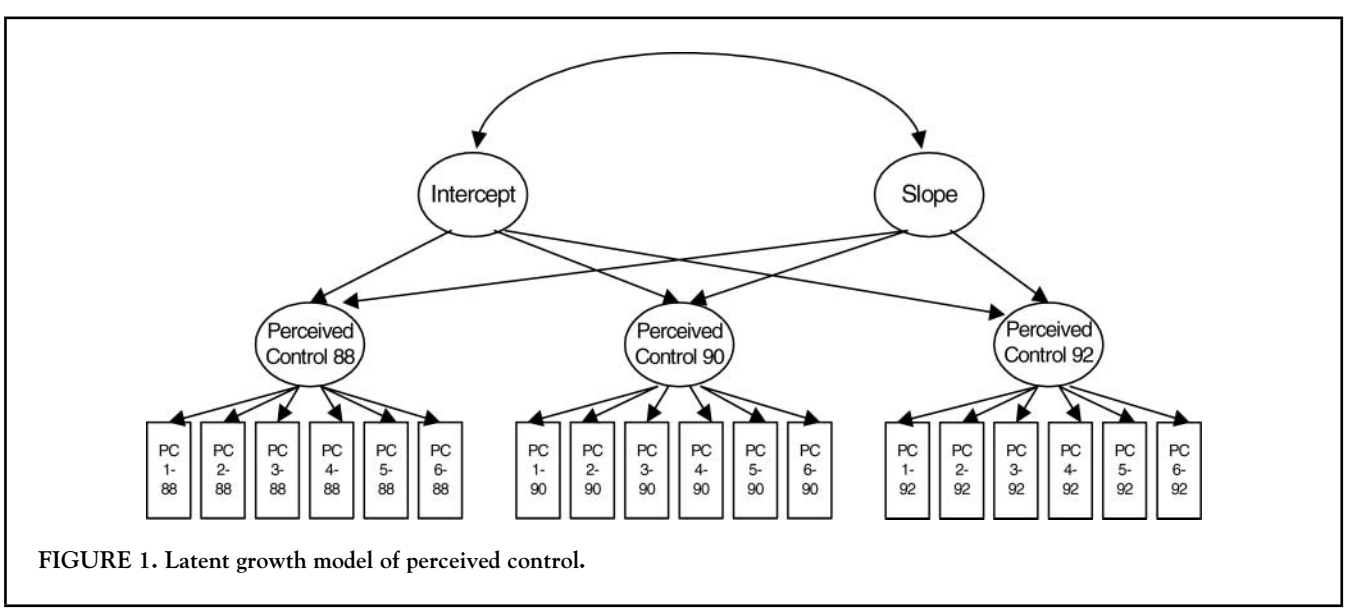

FIGURE 1. Latent growth model of perceived control.

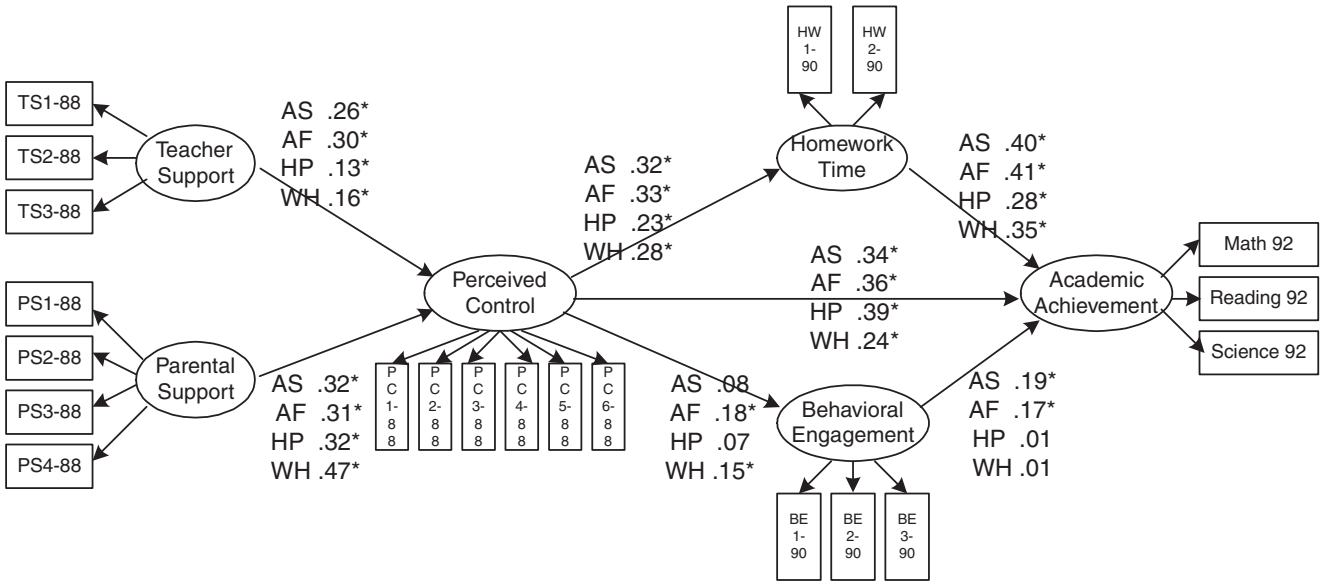

FIGURE 2. Final structural model. AS = Asian American; AF = African American; HP = Hispanic; WH = Caucasian. $^{*}p < .05$.

dealing with issues of quantitative change or heterogeneity in growth and change of some outcome variable, latent growth modeling (LGM) is one of the most appropriate models. LGM not only describes each individual's developmental trajectory, but it also captures individual differences in these trajectories over time (Ho, O'Farrell, Hong, & You, 2006; Meredith & Tisak, 1990). If, for example, these trajectories produced a collection of straight lines for a group, LGM reflects individual differences in the intercepts and slopes of those lines (Duncan & Duncan, 1995). The mean of the intercept factor represents the group initial status parameter, and its variance reflects individual differences in initial status. The mean of the slope factor represents the group growth parameter and its variance reflects individual differences in change over time.

In most LGM applications, a first-order LGM (in which repeatedly measured scores are observed scores) is used to investigate change across time. Typically, these scores are summed composites of multiple indicators (or items). However, this approach fails to take into account the measurement errors of the multiple indicators. Thus, we employed a second-order LGM approach in which change was modeled in the repeated latent variables with multiple indicators. The major advantage of a second-order LGM approach is that true change is modeled while controlling for measurement error. Another major advantage is that the assumption of measurement invariance across time can be tested. The assumption of measurement invariance indicates that the construct measured repeatedly retains the same interpretation across waves. The test of the assumption is essential to ensure that it is the outcome of a theoretical factor that is changing rather than the scale used to measure the construct (Sayer & Cumsille, 2001).

In stage 2, we proceeded with the assessment of the hypothesized structural relationships among latent variables. Using the final structural model (see Figure 2), differential effects of perceived control on academic achievement across ethnic groups as well as differential mediation and social context effects across ethnic groups were tested. All procedures were performed using the EQS structural equation modeling (SEM) program (Bentler, 2006).

Model Evaluation

Results show that data were multivariately kurtose; all analyses were based on robust statistics. When data are nonnormally distributed, ML estimation can produce distorted results (Curran, West, & Finch, 1996). Therefore, the Satorra-Bentler scaled statistic (S-B χ^2) was used because it provides a correction to test statistics and standard errors when data are nonnormally distributed. We paid less attention to chi square due to its sensitivity to sample size, particularly when the sample size is large (Anderson & Gerbing, 1988; Steenkamp & Baumgartner, 1998). Instead we assessed the data model fit using the combinational rule recommended by Hu and Bentler (1999): comparative fit index (CFI; Bentler, 1990) and root mean square error of approximation (RMSEA; Steiger & Lind, 1980) with 90% confidence interval (CI). Values of .90 and .95 can be defined as acceptable and good fit, respectively, in assessing fit

according to CFI (Hu & Bentler, 1999). Values of RMSEA and 90% CI of .05 indicate close fit, values in the vicinity of .08 indicate fair fit, and values of .10 and larger indicate poor fit (Browne & Cudeck, 1993).

Results

Descriptive Statistics

A summary of means and standard deviations, missing response rates, and intercorrelations among the eight subscales are presented in Table 1. The findings suggest perceived control scores from three waves and other study variables were highly related with each other. Within-group correlations among study variables yielded findings similar to those for the combined analyses in Table 1.

Stage 1. LGM Analysis

To test if perceived control was stable or changed during the period of adolescence, we conducted a univariate linear LGM (see path diagram in Figure 1) for each ethnic group. In this LGM, the first item ("I don't have enough control over the direction my life is taking") was selected as the reference indicator, and its loading was fixed to the value of 1 at each time point to scale the perceived control latent variable. The loadings of the intercept factor were set to 1.0, which represent the starting point of the growth curve at Time 1, and the loadings of the slope factor were set to 0, 1, and 2 for three time points, which represent linear growth function. The linear Model PC1 were acceptable for each of the four ethnic groups in terms of CFI, RMSEA, and 90% CI for RMSEA. The values of CFI were over .98 and the values of RMSEA and its CI ranged from .07 to .09 (see Table 2).

In order to ensure that the latent variable has the same interpretation at each time point, we also tested latent growth models (Model PC2) for each of the four ethnic groups, where factor loadings of the identical items were constrained to be equal across the three time points. Establishing measurement invariance across time is required because measurement invariance constitutes evidence that the same construct is being measured across time and measured with the same precision, which in turn allows meaningful direct interpretations of growth trajectories (Chan, 1998). The comparison between the two models in terms of CFI, RMSEA, and 90% CI for RMSEA demonstrates that Model PC2 fits better than Model PC1, indicating the equality constraints of factor loadings over time are valid. We then specified error covariance (Model PC3) among identical items across time because when consecutive measurements are closely spaced in time, errors may also be correlated, especially for identical measures. A failure to adequately model the error covariance structure could lead to biased estimates of the magnitude of true change and even misspecification of the true change patterns (Chan, 1998). For each of the four groups, the fit of Model PC3 improved in RMSEA by adding the parameters for error covariance. To achieve parsimony of the measurement model, we constrained the error covariance to be equal across time in Model PC4, and the model fit in CFI, RMSEA, and 90% CI for RMSEA further improved. We therefore chose Model PC4 as the final measurement model for perceived control. The parameter estimates obtained from Model PC4 are presented in Table 3.

With regard to intercept and slope factor of perceived control, adolescent students scored moderately high average points (ranged from 2.97 to 3.10) in Grade 8 given that this scale ranged from 1 to 4. However, the nonsignificant slope mean across four ethnic groups showed that adolescents' perceived control did not increase or decline from Grades 8 to 12, and, furthermore, the nonsignificant slope variances confirmed that adolescents did not vary in their perceived

TABLE 2. Latent Growth Model of Perceived Control: Model Fit

Group	S-B χ^2	*df*	CFI[a]	RMSEA[a] (CI)
PC1–Asian	974.48	148	.98	.09 (.08, .09)
PC2–Asian	1064.71	158	.98	.08 (.08, .09)
PC3–Asian	831.30	146	.99	.07 (.07, .08)
PC4–Asian	840.88	152	.99	.07 (.07, .08)
PC1–African	548.28	148	.98	.07 (.07, .08)
PC2–African	621.65	158	.98	.07 (.06, .08)
PC3–African	490.58	146	.98	.06 (.06, .07)
PC4–African	494.19	152	.99	.06 (.05, .07)
PC1–Hispanic	721.61	148	.98	.08 (.07, .08)
PC2–Hispanic	792.14	158	.98	.08 (.07, .08)
PC3–Hispanic	629.35	146	.99	.07 (.06, .08)
PC4–Hispanic	642.34	152	.99	.07 (.06, .08)
PC1–Caucasian	1033.03	148	.98	.09 (.08, .09)
PC2–Caucasian	1129.34	158	.98	.08 (.08, .09)
PC3–Caucasian	924.82	146	.98	.08 (.07, .09)
PC4–Caucasian	939.05	152	.99	.08 (.07, .08)

Note. S-B χ^2 = Satorra-Bentler scaled chi-square statistic; CFI = comparative fit index; RMSEA = root mean square error of approximation; CI = confidence interval.
[a]Robust values.

TABLE 3. Latent Growth Model of Perceived Control: Parameter Estimates

Parameter	Asian American	African American	Hispanic	Caucasian
Intercept factor				
M	2.97	3.10*	2.99*	3.06*
SD	0.07	0.10*	0.09*	0.10*
Slope factor				
M	0.04	−0.02	0.01	0.01
SD	0.01	0.01	0.01	0.04

*$p < .05$.

TABLE 4. Effect Size for Perceived Control

Group	Effect size (Cohen's *d*)
Intercept	
Asian–African	−.41
Asian–Hispanic	−.08
Asian–Caucasian	−.33
African–Hispanic	.30
African–Caucasian	.07
Hispanic–Caucasian	−.23
Slope	
Asian–African	.79
Asian–Hispanic	.01
Asian–Caucasian	.06
African–Hispanic	−.28
African–Caucasian	−.44
Hispanic–Caucasian	.02

Note. A positive effect size value indicates that the former group has a higher mean value and a negative value indicates the former group has a lower mean value. For example, Asian–African = −.41 for intercept parameter indicates that the Asian American group has a lower mean value.

control across all groups. Based on the results of the latent growth modeling, we can answer Research Question 1 and conclude that the perceived control was stable for all ethnic groups.

As a next step, Cohen's *d* index of effect size (Cohen, 1988) was computed to evaluate the magnitude of the mean differences in the intercept and slope factors across the four ethnic groups. By computing effect size, the mean differences can be converted to a common and familiar metric. The *d* index indicates the difference between the means of the two groups divided by the pooled standard deviation across groups. The computed values of *d* are presented in Table 4. According to Cohen's (1988) guidelines, $d = .2, .5$, and .8 are defined as small, medium, and large, respectively. With respect to the initial status of perceived control (i.e., assessed at Grade 8) where African American students showed the highest scores (indicating the highest sense of control), followed by Caucasian, Hispanic, and Asian American students, small mean differences in the intercept factors were found for the following group pairs: Asian American and African American, Asian American and Caucasian, African American and Hispanic students. Test of group mean differences in the rate of change showed a large difference for Asian American and African American and small differences for the following group pairs: African American and Hispanic, African American and Caucasian.

Stage 2. Multigroup Structural Model Analysis

After testing the latent growth model for perceived control, we tested the hypothesized process model to examine structural relationships among the latent constructs of perceived control, academic engagement, social context, and academic achievement. By using the social contextual variables and student perceived control variable at Wave 1(1988), mediating variables at Wave 2 (1990), and the achievement variables at Wave 3 (1992), it was possible to determine whether perceived control indeed has lasting effects on student achievement through the mediating variables. Note that we used the perceived control at Wave 1 and did not use growth model for the variable because it remained similar across time and there was no significant variance in the slope factor across all groups.

The present study hypothesized that the relationship between perceived control and academic achievement is mediated by academic engagement. To assess the plausibility of our hypothesis, we tested the two hypothesized structural models across the four ethnic groups. The initial structural model (Model 1), reflecting full mediation, was specified with indirect paths from perceived control to academic achievement through academic engagement as mediators. The full mediation models were acceptable for each of the four ethnic groups in terms of CFI, RMSEA, and 90% CI for RMSEA. The values of CFI ranged from .91 to .93, and the values of RMSEA and its CI ranged from .03 to .05 (see Table 5). As a second structural model, a partial mediation model (Model 2) was assessed. The partial mediation model is identical to the full mediation model with the exception of a direct path from perceived control to academic achievement (see Figure 1). The partial mediation model showed a better fit compared to the full mediation model in all groups.

Because the partial mediation model (Model 2) is nested within the full mediation model (Model 1), S-B χ^2 difference test was also performed. Because the S-B χ^2 difference value is not chi-square distributed, a corrected S-B χ^2 difference value was computed to judge for statistical significance. The corrected ΔS-B χ^2 values for the Asian, African American, Hispanic, and Caucasian samples were 22.45, 10.80, 9.08, and 14.76, respectively. All values were statistically significant at the .05 level (Cronbach's α), indicating that the partial mediation model was supported for all ethnic groups. Therefore, we chose the partial mediation model as the final structural model.

The standardized parameter estimates for this model are provided in Table 6. Results showed differential patterns of relationships among the constructs across groups. Specifically, effects of perceived control on academic achievement varied across ethnic groups as well as mediation effects of academic engagement across four ethnic groups. The significance of these standardized estimates provided evidence for both direct and indirect effects. Note that for evidence of an indirect effect of perceived control on academic achievement via two student engagement factors, the paths from perceived control to student engagement and from student engagement to student achievement must be significant.

As a next step, we tested whether each effect is statistically different across ethnic groups using multigroup SEM. The estimation of structural models involves no between-

TABLE 5. Summary of Model Fit Statistics

Group	S-B χ^2	*df*	CFI[a]	RMSEA[a] (CI)
Stage 1. Tests for alternative structural models				
Model 1: Full mediation model				
Asian	348.83	180	.93	.04 (.04, .05)
African	282.29	180	.92	.04 (.03, .05)
Hispanic	390.89	180	.91	.05 (.04, .05)
Caucasian	410.05	180	.93	.05 (.04, .05)
Model 2: Partial mediation model				
Asian	333.09	179	.94	.05 (.03, .05)
African	274.12	179	.93	.04 (.03, .04)
Hispanic	371.71	179	.91	.04 (.04, .05)
Caucasian	392.56	179	.93	.04 (.04, .05)
Stage 2. Tests for invariance				
Model 3: Baseline model	1372.76	716	.93	.04 (.03, .04)
Model 4: Full metric invariance	1401.73	761	.93	.04 (.03, .04)
Model 5: Full metric and structural path invariance	1427.88	782	.93	.04 (.03, .04)

Note. S-B χ^2 = Satorra-Bentler scaled chi-square statistic; CFI = comparative fit index; RMSEA = root mean square error of approximation; CI = confidence interval.
[a]Robust values.

group constraints, and thus the data were analyzed separately for each ethnic group. However, in testing for group differences, equality constraints are imposed on particular parameters; therefore, the data for all groups are analyzed simultaneously. Multigroup SEM encompasses a series of hierarchical steps that begin with the baseline model. In the present analysis, the partial mediation model represented a baseline model for all ethnic groups. With an established baseline model for all groups, we tested the multigroup model in which baseline models were tested simultaneously with no parameter constraints imposed. Results from the testing of this model (Model 3 in Table 5) revealed a well-fitting model. The 716 degrees of freedom represent the summed degrees of freedom associated with the final baseline model for all ethnic groups. It should be noted that when ML estimation is used, the chi-square statistics are additive so that the overall chi-square value for the multigroup model equals the sum of the chi-square values from the all-baseline model

TABLE 6. Standardized Estimates of the Final Structural Model

Parameter	Asian	African	Hispanic	Caucasian
Parental Support → Perceived Control	.32*	.31*	.32*	.47*
Teacher Support → Perceived Control	.26*	.30*	.13*	.16*
Perceived Control → Homework Time	.32*	.33*	.23	.28*
Perceived Control → Behavioral Engagement	.08	.18*	.07	.15*
Perceived Control → Academic Achievement	.34*	.36*	.39*	.24*
Homework Time → Academic Achievement	.40*	.41*	.28*	.35**
Behavioral Engagement → Academic Achievement	.19*	.17*	.01	.01

*$p < .05$.

across each group. However, when the estimation is based on the robust statistics (in the present case), the S-B χ^2 statistic for each group is not necessarily summative across the groups.

After establishing the multigroup baseline model, the next step involves the equality of measurement model. This is called the metric invariance. Group differences can be estimated only if the latent variables are on the same scale in all groups (Steenkamp & Baumgartner, 1998). Thus, metric invariance tests were performed to examine whether the prerequisite conditions for testing the differences in structural coefficients could be met. Equality constraints were placed on all factor loadings that are freely estimated. With full metric invariance, the multigroup model exhibited a good fit to the data and showed improvement in model fit from that of the baseline model in terms of CFI, RMSEA, and 90% CI for RMSEA (Model 4 in Table 5). Because the metric invariance model (Model 4) is nested within the baseline model (Model 3), a S-B χ^2 difference test was also performed. Because S-B χ^2 difference, corrected ΔS-B $\chi^2(45, N = 6{,}000) = 31.94$, was not statistically significant at $\alpha = .05$, metric invariance was supported.

Given that the metric invariance was met, we finally tested whether each pair of structural coefficients was different across groups. Thus, the structural portion of the model was constrained to be equal across groups. The equality constraints were imposed when two or more groups had significant estimates for a particular parameter. LM test modification indices were examined to pinpoint which paths were significantly different across groups. To determine evidence of noninvariance, we examined univariate incremental chi-square values with probability values of less than .05. The results from the LM tests of equality constraints showed significant groups differences for most parameters, except three parameters: Perceived Control → Behavioral Engagement, Homework Time → Academic Achievement, and Behavioral Engagement → Academic Achievement. Specific details are discussed subsequently.

Based on the results of the multigroup SEM, we can answer Research Questions 2–4. For Research Question 2, we found that the higher the students' perceived control in Grade 8, the higher the later academic achievement in Grade 12. The long-lasting effects of perceived control on subsequent academic achievement held across all ethnic groups. Group differences were found between Asian American and African American students and between Asian American and Hispanic students. That is, the effect is stronger for African American and Hispanic students than for Asian American students.

For Research Question 3, we examined the indirect effect of perceived control on student academic achievement via two mediators of academic engagement. In the case of indirect effects via homework time, the results identified consistently for each of the four ethnic groups, the significant indirect effect of perceived control on students' academic achievement. For the structural path from perceived control to homework time, the estimates were significantly different across all ethnic groups at $\alpha = .05$. That is, the effect was strongest for African American students, followed by Asian American, Caucasian, and Hispanic students. For the structural path from homework time to achievement, no group differences were found.

In the case of indirect effects via behavioral engagement, the results identified the significant indirect effect of perceived control on students' academic achievement for only the African American sample. However, for the Asian American sample, perceived control had a significant effect on students' behavioral engagement only, but there was no effect from behavioral engagement to subsequent academic achievement. For the Caucasian sample, perceived control had no significant effect on students' behavioral engagement, but there was a significant effect from behavioral engagement to subsequent academic achievement.

For Research Question 4, teacher and parental support served as important social contextual factors of student perceived control across all ethnic groups. Results showed that the more students perceive support from their parents and teachers, the higher their perceived control. The effect of both contextual factors showed significant between-group differences across all ethnic groups at $\alpha = .05$. Specifically, for the effect of teacher support, the effect was strongest for African American students, followed by Asian American, Caucasian, and Hispanic students; for the effect of parent support, the effect was strongest for Caucasian students, followed by Hispanic, Asian American, and African American students.

Discussion

In summary, with the use of LGM and SEM on a large-scale longitudinal survey, the present study contributes to the literature on perceived control and academic achievement in a number of ways. First, the study provides unique information regarding the growth trajectory of perceived control during adolescence. The present study was conducted on a large representative sample of U.S. students and found that perceived control remains stable during adolescence for each of the four major ethnic groups (i.e., Asian American, African American, Hispanic, and Caucasian) in the United States. This result is consistent with a recent study conducted by Crosnoe and Huston (2007). With regard to mean differences between ethnic groups, our findings showed that the Asian American group was more external than the African American and Caucasian groups. These findings are parallel with the results of Dyal (1984) and Smith, Trompenaars, and Dugan's (1995) extensive cross-cultural research into locus of control. Their studies showed that Asian students tend to be more external than Caucasian students. One possible explanation for the consistent findings is that Caucasian respondents scored more internally than Asian respondents due to their tendency toward individualistic values. The Asian collectivistic culture tends to emphasize

selfless subordination to family and community, which may decrease levels of personal control. For Asian Americans, the tendency for believing that life events, talent, or skills are shaped by external forces rather than within individual control has possible connections to educational experiences. For example, within the classroom, teachers may find that Asian American students are likely to attribute their success to luck or influence of others. Pedagogically, teachers are often encouraged to promote and foster student's personal efforts and diligence in the development of knowledge and skills. Although focusing on students' internal processes (e.g., spending time mastering a skill, putting more effort into learning difficult material) is effective in improving academic performance, findings that some students have external attribution regarding their experiences suggest that teachers and educators need to broaden the scope of teaching strategies. In particular, for Asian American students who are likely to attribute their success to the influence of others, for example, teachers can utilize the role of significant others as a learning resource to supplement classroom learning.

Further, the process model was found to be relevant for all four ethnic groups, but the magnitude of the effects varied somewhat across ethnic groups. Results provided support that perceived control has a direct effect on subsequent academic achievement as well as the indirect effect, which is mediated by student's academic engagement behaviors (especially homework time) for all four ethnic groups. Once students are aware that academic success is a result of their own efforts and abilities, they become more engaged and do well in school. On the other hand, students are not likely to attempt educational tasks when they feel they cannot control the outcome of their efforts. In particular, the direct effect of perceived control on academic achievement was most effective for the Hispanic sample and mediating effect was the strongest for African American students. Academic achievement as directly effected by perceived control, as in the case of Hispanic students, indicates that students' beliefs about their ability to control learning situations significantly factors into academic outcomes. Educational programs or classroom instruction that allow students to develop a sense of control over their own learning may positively impact student performance. Teachers, for example, can encourage students to become peer tutors and help explain the instructional materials to others as they understand and apply the knowledge. In the processes of explaining or relating the material to others, students are able to gauge their personal role in determining the direction of learning. This is also relevant for the mediating effects of student engagement behaviors on academic achievement.

Recognizing that students are active players in forming the teaching and learning relationship, educators can incorporate more student-centered strategies that emphasize student efforts, talents, and skills. In doing so, students feel more in control of the learning process, which can increase positive learning behaviors, thereby improving academic performance.

Regarding the influence of social contextual factors, students' perception of both teacher and parental support had a positive effect on perceived control, which ultimately impacted the academic achievement of students. This link was consistent across all four ethnic groups; specifically, the effect of teacher support was strongest for the African American sample and the effect of parental support was strongest for the Caucasian sample of students. Parental involvement studies have consistently found the positive effects of parents as an educational resource for students (Nguyen, You, & Ho, 2009). An extension of this is the support of teachers. Because the educational process has many layers and participants, there is a dynamic relationship between students and their support system. In this case, the significance of teachers and parents function as mechanisms for improving achievement. Students who believe they have the classroom and home support (through teachers and parents) may be more confident and secure in their ability to shape their education and specifically, their range of academic abilities. Thus, overall schooling experiences may be more positive because students perceive they have a network of support influencing their achievement.

One advantage of this study is that we employed the second-order LGM to accurately capture the developmental pathway of perceived control across ethnic groups. Past studies have used relatively small sample sizes of mainly Caucasian students and have reported mixed results. In addition, results of these past studies are based on raw score responses in different languages and thus the interpretation of the meaning of raw score differences are equivocal. With the advantage of multigroup LGM, the present study expands the knowledge on ethnic variation in perceived control across the four major ethnic groups in the United States. Further, an integrated process model was applied to examine linkages among social context, beliefs about control, patterns of action, and the actual performance outcomes. Studies of the relationship between locus of control and global measures of achievement contribute little to the understanding of why such a relationship exists. Testing of an integrated process model has important contributions to our understanding of why such a relationship exists, that is, what kinds of behaviors do children with internal motivation exhibit that lead to their overall higher achievement. Furthermore, examination of ethnic variation in the significance and magnitude on structural paths in the process model add more information in utilizing the current findings in educational settings.

The evaluation of the integrated process model with mediating and social context effects across ethnic groups poses promising avenues for further research as well as for intervention efforts. One of the most important implications of understanding perceived control as it affects student achievement is to improve the ability of teachers and educators to foster an academically supportive environment. We found that significant others in the social context—supportive teachers and parents—were key to enhancing the development of perceived competence and engagement. The

findings also suggest that the supportive influence of social context exerted immediate and long-term effects. Teachers and parents whom students see as supportive (e.g., who listen to students and discuss school activities) and who reinforce positive academic behaviors (e.g., who praise efforts) create an atmosphere in which students feel in control and confident about their ability to succeed in future educational endeavors. Adolescents' perception of their social environment is of considerable importance because of the educational implications in the timing of personal empowerment programs that are implemented by schools and the community. Developing training strategies to assist teachers and parents to create collaborative as well as supportive environments may be useful in helping children with forming higher control beliefs.

Future Directions

The results of our study suggest further areas of future research. The finding of the stability of perceived control during the adolescent period suggests the need for studies on preadolescent age groups to examine the development of this important social cognitive construct. Future researchers should include other relevant variables to increase knowledge of how ethnic differences in perceived control and academic achievement develop. Educators and researchers must understand the viewpoint of various cultures regarding beliefs about control and the important effects that divergent self-views can have on aspects of cognition and motivation. As assessed in the NELS (1994) data set, perceived control is a one-dimensional bipolar (internal–external) measure of perceived control that may not be as sensitive in capturing ethnic group differences or developmental changes. Further large-scale research should employ a multidimensional approach, which systematically varies situations, sources of action, outcomes, and consequences to more sensitively measure perceived control. Future researchers should also investigate gender differences in the relationship between perceived control and academic achievement as well as the process by which this relation takes place. With respect to social contextual variables, future researchers should include other factors that are relevant to cultural groups including peer and family support. The investigation of students' perception of control and its role in motivation and achievement within cultural contexts has important implications for the classroom context. Finally, a limitation of this study concerns the reliability of scales (ranging from .65 to .76). Traditionally Cronbach's alpha of .8 or higher is deemed good and .7 or higher is acceptable; these values are closely related to the number of items in the scales. For example, when creating a scale consisting of a few items, it is usually difficult to generate a scale with a high alpha value (Nunnally & Bernstein, 1994). The reported Cronbach's alpha values for the subscales used in this study are generally acceptable, given the relatively small number of items (i.e., 2–6 items) used for each subscales. Because more reliable scales would provide greater potential to identify significant association with other factors, we encourage the use of more precise measures with a greater number of items in future studies.

Conclusion

In determining effective educational strategies to improve student academic achievement, perceived control of situations and experiences suggest that there is a motivational factor involved in the process. As it affects children's academic achievement, if a change in perceived control is as likely a significant factor as change in student ability, then educational programs and instruction may benefit from strategies and practices that focus on the psychosocial and motivational aspect of the learning process. The effect of success or failure on children's subsequent behavior in academic settings depends on how they perceive the causes of those experiences. That is, if students believe that their success or failures are not a consequence of their own actions, they may have low academic expectations and not academically engage in school, and therefore suffer in learning. The supportive strategies in forming higher control beliefs may be sufficient to boost their children's perceived capacity for success, thus increasing their subsequent engagement in school and learning. Increased awareness of the underlying pathway by which social context variables affect students' belief about control, school engagement, and their actual performance may help parents, educators, and policymakers assist youth in their educational process.

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