Published in final edited form as:
Elem Sch J. 2009 March 1; 109(4): . doi:10.1086/593939.

Classifying Academically At-Risk First Graders into Engagement Types: Association with Long-Term Achievement Trajectories

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Abstract

Based on a sample of 480 academically at-risk first graders, we used a cluster analysis involving multimethod assessment (i.e., teacher-report, peer-evaluation, and self-report) of behavioral and psychological engagement to identify subtypes of academic engagement. Four theoretically and practically meaningful clusters were identified and labeled as cooperative (n = 95), resistive (n =96), enthusiastic (n = 188), and disaffected (n = 101). The four types did not differ in IQ measured with the Universal Nonverbal Intelligence Test. The cooperative group consisted of more female and Hispanic students, whereas the resistive group consisted of more male and African American students. The cooperative group was the most popular among peers, followed by the enthusiastic group. The disaffected and resistive groups had more emotional symptoms than the cooperative and enthusiastic groups. Academic engagement types also differed in growth trajectories of academic achievement measured with Woodcock Johnson III Tests of Achievement from second to fourth grade. For reading, the cooperative and enthusiastic groups outperformed the resistive and disaffected groups at the beginning. However, the growth rate was similar across engagement types. For math, the engagement types did not differ at the beginning. However, the cooperative group developed at a faster rate and had higher math achievement by fourth grade than the other types. The findings support the importance of teaching temperament-based regulatory skills and of providing a positive psychological climate for children's academic learning.

A key developmental task for the child making the transition to formal schooling is constructive engagement with learning (Perry & Weinstein, 1998). The construct of engagement in learning is widely viewed as multidimensional, encompassing behavioral (persisting on tasks, following classroom rules), affective (liking school, sense of school belonging), and cognitive (believing that one is academically capable, possessing a learning or mastery orientation) dimensions (Alexander, Entwisle, & Dauber, 1993; Appleton, Christenson, Kim, & Reschly, 2006; Brophy, 2004; Finn, 1989; Fredricks, Blumenfeld, & Paris, 2004). Although different researchers have posited different numbers and types of engagement, most nomenclatures distinguish between the outwardly observable aspects of engagement, often referred to as behavioral engagement or learning behaviors, and aspects of engagement that are more psychological in nature, for which the student's perspective may be necessary, such as liking for or interest in school, perceptions of academic efficacy, or intrinsic motivation (Alexander et al., 1993; Appleton et al., 2006; Finn, 1989; Fredricks et al., 2004). Appleton et al. (2006) described the psychological aspects of engagement as motivational processes that drive “the direction, intensity, and quality of one's energies,” and behavioral engagement as “energy in

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action" (p. 428). Perry and Weinstein (1998) referred to the emotional and cognitive dimensions of engagement as fueling the will to learn and task persistence (p. 179).

Both behavioral and psychological engagement are linked to elementary students' success in school. Behavioral engagement, defined in terms of time on task, persistence or effort on learning tasks, or cooperative participation, is associated concurrently and prospectively with higher academic achievement, above measures of general cognitive ability (Alexander et al., 1993; Birch & Ladd, 1997; Greenwood, 1991; Hughes & Kwok, 2006; Hughes, Luo, Kwok, & Loyd, 2008; Ladd, Birch, & Buhs, 1999; McWayne, Fantuzzo, & McDermott, 2004; Miles & Stipek, 2006; Normandeau & Guay, 1998; Rimm-Kaufman, La Paro, Downer, & Pianta, 2005). For example, Ladd et al. (1999) found that both prosocial and antisocial behavioral styles of classroom engagement early in the kindergarten years uniquely predicted children's end-of-year achievement, above children's cognitive maturity and family background.

Research on psychological aspects of engagement in the early elementary grades has focused on children's attitude toward school (including sense of school belonging and liking for school), academic self-efficacy beliefs, and learning goal orientation. Alexander et al. (1993) found that teachers' ratings of first grade children's interest and participation in the classroom (enthusiastic, usually in a happy mood, interested in a lot of different things), but not teachers' ratings of children's cooperative-compliant participation, predicted achievement test score gains over a 3-year period. Using cross-sectional, correlational analyses, Valeski and Stipek (2001) found that first graders' perceived liking for school was positively associated with academic skills assessments. Ladd, Buhs, and Seid (2000) noted that school liking in kindergarten fosters classroom participation and achievement.

Research has documented links between students' beliefs about their academic competence, self-regulated learning, and achievement (Bandura, 1986; Zimmerman & Martinez-Pons, 1990). Research on developmental changes in children's academic self-efficacy beliefs has shown changes in the mean level, structure, and correlates of children's academic self-efficacy beliefs. Specifically, from kindergarten to fourth grade, children's self perceptions of competence become less positive, more differentiated, and more aligned with objective or performance-based indicators of ability (Eccles, Wigfield, Harold, & Blumenfeld, 1993; Harter, 1990; Marsh, 1989; Marsh, Craven, & Debus, 1998; Wigfield et al., 1997). Despite these developmental shifts, as young as first grade, children's perceptions of their academic ability are positively related to their academic skills (Liew, McTigue, Barrois, & Hughes, 2008; Herbert & Stipek, 2005; Valeski & Stipek, 2001; Wigfield et al., 1997). In a sample of second graders, academic self-efficacy beliefs predicted academic achievement test scores the following year, controlling for the prior year's test scores (Hughes, Dyer, Luo, & Kwok, in press).

Learning goal orientation refers to a student's tendency to adopt one of two general patterns of response to challenging achievement situations. Students who adopt a performance goal orientation are motivated to maintain a sense of self-worth through performing well (Ainley, 1993; Ames, 1992; Dweck, 1986). Students with a performance goal orientation view learning as a way to demonstrate ability, and they direct energy toward achieving normatively defined success (Nicholls, 1984). In contrast, students who adopt a mastery goal orientation attribute success to effort and focus on developing new skills and improving their competence (Ames, 1992). Students with a mastery goal orientation show greater persistence and less negative affect in the face of failure and prefer more challenging tasks (Dweck, 1986; Elliott & Dweck, 1988). Research with adolescents has demonstrated links between learning goal orientation, strategy use, and achievement (Ainley, 1993; Pintrich, 2000). However, as young as first grade, children's goal orientations can be observed reliably (Burhans & Dweck, 1995; Smiley & Dweck, 1994; Ziegert, Kistner, Castro, & Robertson, 2001). Goal orientation is independent

of general cognitive ability (Smiley & Dweck, 1994). First graders rated by their teachers as demonstrating a mastery orientation gained more in reading and math skills during the year than children rated as having a performance, or task-avoidant, orientation (Onatsu-Arvilommi & Nurmi, 2000).

Variable-Centered versus Person-Centered Approaches to Engagement Despite a multidimensional understanding of engagement, researchers have rarely examined multiple dimensions of engagement in young children. Furthermore, researchers who have incorporated multiple dimensions have typically adopted a variable-centered rather than a person-centered approach (Alexander et al., 1993; Normandeau & Guay, 1998). Variable-centered approaches are concerned with the relation between two or more variables. They are useful in exploring and making statements about the relationship between and among variables or constructs. However, a variable-centered approach is limited in furthering the understanding of the patterning, or organization of these constructs within individuals (Bergman & Magnusson, 1997).

A person-centered approach takes a holistic approach to classification and is concerned with the patterns of factors, or variables, within individuals. Developmental science has increasingly included multivariate, organizational approaches to better understand developmental processes and outcomes (Cicchetti & Richters, 1997; Lerner, 1989). Such an organizational view of human functioning assumes that the relations within and across levels of organization, not the univariate components of these relations, are the focus of developmental analysis. Cluster analysis is an example of a person-centered approach that classifies individuals into similar subtypes, based on multiple dimensions. Cluster analysis is well suited to identifying how different dimensions of behavior come together to create meaningful classes of individuals.

Identification of subtypes of students based on such configural approaches has a long and productive history in child and educational psychology (Hindson et al., 2005; Kim, Kamphaus, & Baker, 2006; McKinney & Speece, 1986; Youngman, 1978). For example, among kindergarten children with high levels of physical aggression, greater prosocial behavior and anxiety buffered them from later delinquency (Haapasalo, Tremblay, Boulerice, & Vitaro, 2000). These and other results led Haapasalo et al. to conclude that “the predictive value of physical aggression in kindergarten, for early onset delinquency, must be interpreted in the light of the whole behavior profile” (p. 363).

The Present Study

We expected that the pattern, or configuration, of performance on different dimensions of engagement might have important implications for future achievement. Specifically, we predicted that first graders would differ on their patterning of behavioral and psychological dimensions of engagement in theoretically meaningful ways, and that these patterns would differentially predict achievement trajectories over the course of the next 3 years, above children's intelligence. Furthermore, based on research indicating that temperament-based dimensions of self-regulation and personality are relatively independent of measured intelligence (Izard, 2002), we expected engagement types would not differ on measures of intelligence. That is, we predicted that engagement types would be independent of general cognitive ability.

We expected to identify four groups that were distinctive in terms of their highest or lowest scores on either behavioral or psychological engagement and thus to identify a positive and a negative behavioral engagement cluster and a positive and a negative psychological engagement cluster. However, because dimensions of behavioral and emotional engagement have been found to be moderately correlated in the elementary grades and to influence each other in a reciprocal manner over time (Ladd & Dinella, 2007), we predicted that the positive

behavioral engagement cluster would be at least average on psychological engagement and that the positive psychological engagement group would be at least average on behavioral engagement.

Because dimensions of engagement are not functionally independent (i.e., all the possible combinations of the dimensions are unlikely to actually occur in people), identifying engagement types and their associations with achievement outcomes, above the effect of children's intelligence, holds promise for informing the design and implementation of effective policies and interventions aimed at serving groups of students. For example, knowing what engagement types are most likely to experience less academic growth would have implications for early intervention. The engagement variables investigated in this study are considered malleable and, thus, amenable to intervention efforts.

In this study we aimed to identify theoretically and practically meaningful subtypes of engagement in first grade based on a multimethod assessment of behavioral and psychological engagement. Teachers rated students' effortful engagement and prosocial and antisocial behavioral orientations; mastery orientation was observed; children reported on their academic self-efficacy beliefs and liking for school, and peers reported the child's relatedness with the teacher. We used cluster analysis to identify groups of children who had similar profiles across the seven engagement variables. We give evidence of the reliability and validity of the cluster solution. Because both gender and ethnic differences have been found in school-related outcomes (Asbury, 1974; Stanovich, Cunningham, & Feeman, 1984), we examined the association between cluster membership and both gender and ethnicity. Finally, we predicted children's individual growth trajectories for reading and math over the following 3 years based on cluster membership in first grade.

We investigated these questions in a culturally and linguistically diverse sample of academically at-risk first graders. Children were deemed academically at-risk on the basis of scoring below their school district median on a measure of literacy given at the beginning of first grade. Children with relatively low literacy skills in first grade are at substantially increased risk of low achievement trajectories (Alexander, Entwisle, & Horsey, 1997; Campbell, Helms, Sparling, & Ramey, 1998). Furthermore, children with lower academic readiness skills at entrance to kindergarten tend to have lower behavioral engagement, which is largely responsible for their lower growth in achievement over the early elementary grades (Bodovski & Farkas, 2007). This group has special significance to efforts to reduce educational disparities among children at risk for school failure at school entrance. Among the factors associated with low literacy skills, some variables, such as poverty or general cognitive ability, appear less malleable than others, such as a child's effort and liking for school. We were interested in examining the influence of more malleable aspects of engagement with schooling in first grade on reading and math achievement trajectories through grade 4.

Method

Participants

Participants were drawn from a larger sample (N = 784) of children who participated in a longitudinal study examining the effect of grade retention on academic achievement. Children were recruited across two sequential cohorts in first grade during the fall of 2001 and 2002 from three school districts (1 urban, 2 small city) in southeast and central Texas. Children were eligible for the longitudinal study if they scored below the median score on a state-approved measure of literacy administered by the district in either May of kindergarten or September of first grade and had not been retained previously in first grade. Based on school records, 1,374 children were eligible. Teachers sent consent forms home in children's weekly folders. Children were offered small incentives for returning the consent form, regardless of the consent decision.

Of 1,200 parents returning consent forms, 784 (65%) gave consent. The ethnic composition was 23% African-American, 37% Hispanic, 34% Caucasian, and 6% other. Children with and without consent to participate did not differ on age, gender, ethnicity, bilingual class placement, or literacy test scores. Students who were eligible for free or reduced-price lunch were somewhat more likely to give consent (68%) than children who were not eligible (45%), perhaps because of the monetary incentives.

The sample of analysis consisted of 480 participants (52.7% male) who had complete data on the clustering variables. The ethnic composition was 22.3% African American, 37.1% Hispanic, 35.4% Caucasian, and 5.3% other. To determine whether the 480 children with complete data differed from the 304 children without complete data on any of the six demographic variables (age, gender, ethnicity, limited English proficiency, eligibility for free or reduced-price lunch, highest adult educational level in the home) and on all study variables at baseline, we conducted chi-square contingency analyses for categorical dependent variables and independent-sample *t*-tests for continuous dependent variables. None of the tests was statistically significant with Bonferroni correction for Type I error. At entrance to first grade, the participants' mean age was 6.57 (SD = .37) years. Their mean intelligence, as measured with the Universal Nonverbal Intelligence Test (Bracken & McCallum, 1998), was 93.63 (SD = 14.26), and their mean W scores on Woodcock Johnson III (Woodcock, McGrew, & Mather, 2001) Broad Reading and Broad Math Scales were 436.58 (SD = 25.61) and 464.02 (SD = 12.46), respectively. Based on family income, 56.7% of participants were eligible for free or reduced-price lunch. For 37.1% of the participants, the highest educational level in the household was a high school diploma or less.

Procedures

We conducted assessments annually for 4 years, beginning when participants were in first grade. Teacher questionnaires assessing teachers' perceptions of effortful, prosocial, antisocial, and emotional symptoms were administered in the spring of first grade. Teachers received $25.00 for completing and returning the questionnaires. Each year, research staff administered measures of math and reading achievement individually at school at varying times during the school year, with the constraint that at least 8 months separated each annual assessment. Children's perceived school belonging and observed mastery orientation were obtained in individual assessment sessions conducted by research staff at school between February and May of year 1.

We obtained peers' perceptions of classmates following procedures widely recommended in the peer assessment literature (Cillessen & Bukowski, 2000). In individual interviews, children were presented a roster with the names of all classmates. The interviewer read all classmates' names and asked the child if he or she knew each child. Then the interviewer asked children to nominate as few or as many classmates as they wished who fit each descriptor (e.g., aggressive or prosocial). Each class member received a score for each descriptor based on the number of nominations that child received. Sociometric scores were standardized within classrooms. We obtained written parent consent for each child who participated in the sociometric interview. However, all children in a classroom were eligible to be rated or nominated. Terry (1999) reported that reliable and valid sociometric data can be collected using the unlimited nomination approach when as few as 40% of children in a classroom participate. When participation rates fall below 40%, results may not generalize to those that would have been obtained under conditions of full participation. Thus, we computed sociometric scores only for children located in classrooms in which more than 40% of classmates participated in the sociometric assessment. The mean rate of classmate participation in sociometric administrations was .65 (range .40 to .95). Sociometric assessments were conducted in 180 of 198 classrooms in year 1.

Measures

Clustering measures

Effortful engagement: This teacher-report, 10-item scale is comprised of eight items from the conscientious scale of the Big Five Inventory (BFI; John & Srivastava, 1999) and two items from the Social Competence Scale (Conduct Problems Prevention Research Group, 1999) that were consistent with our definition of academic engagement (effort, attention, persistence, and cooperative participation in learning). Although the BFI is conceptualized as a measure of personality traits, the selected items from the conscientious scale are similar to items other researchers have used to assess academic engagement (Ladd et al., 1999; Ridley, McWilliam, & Oates, 2000). Example items are “Is a reliable worker”, “Perseveres until the task if finished”, “Tends to be lazy” (reverse scored), and “Is easily distracted” (reverse scored). The two items from the Social Competence Scale were “Sets and works toward goals” and “Turns in homework.” Items are rated on a 1-5 Likert-type scale. The internal consistency of these 10 items for our sample was .95.

Antisocial engagement: Teachers completed two questionnaires that assessed externalizing problems. The Strengths and Difficulties Questionnaire (SDQ; Goodman, 2001) is a brief (25-item) screening measure for psychopathology. Each item is rated on a 0-2 scale (i.e., not true, somewhat true, certainly true). The SDQ yields five scales comprised of five items each: conduct problems, hyperactivity, emotional symptoms, peer problems, and prosocial behaviors. Research has documented that the SDQ produces reliable and valid scores (Dickey & Blumberg, 2004; Goodman, 2001; Hill & Hughes, 2007). Example items on the conduct problems scale are “Often fights with other children or bullies them” and “Generally well-behaved, usually does what adults request” (reverse scored). The internal consistency of these five items for our sample was .84.

Teachers also completed a 24-item questionnaire adapted from the California Child Q-Sort (Caspi, Block, Block, & Klopp, 1992). These 24 items were selected based on previous research demonstrating that they were consistently rated as prototypical of children with high levels of impulsivity and externalizing behaviors (Funder, Block, & Block, 1983). Exploratory and confirmatory factor analysis of this 24-item scale (hereafter referred to as the Ego Control Questionnaire) on this longitudinal sample showed good support for four factors: prosocial, antisocial, ego resiliency, and ego brittle (Kwok, Hughes, & Luo, 2007). Example items on the four-item antisocial factor include “physical or verbal aggression” and “tries to take advantage of others.” The internal consistency of these four items for our sample was .86. Scores on this factor were highly correlated with the conduct scale of the Strengths and Difficulties Questionnaire ($r = .76$).

We used peer sociometric procedures to obtain peer evaluations of children's aggression (see above). The aggressive descriptor was “These children start fights, say mean things, or hit others.” This item was moderately correlated with the conduct scale of the Strengths and Difficulties Questionnaire ($r = .52$) and the antisocial scale of the Ego Control Questionnaire ($r = .43$).

Due to the relatively high agreement between the two teacher ratings of externalizing behaviors, and the relation between peer-rated aggression and the two teacher ratings of externalizing problems, to reduce the number of variables, we calculated a composite antisocial engagement score as the mean of the standardized scores on the conduct scale of the Strengths and Difficulties Questionnaire, the antisocial scale of the Ego Control Scale, and the peer-rated aggression score.

Prosocial engagement: Teacher-rated prosocial engagement was assessed by the four items on the prosocial factor of the Ego Control Scale (see above). Example prosocial items include "considerate and thoughtful" and "gets along well with other children." The internal consistency of the four items for our sample was .93. Peers also evaluated children's prosocial engagement. The peer nomination descriptor was "These children help others, play fair, and share." Based on the significant relation between teacher and peer evaluations of prosocial behavior ($r = .38$), we calculated a composite prosocial score as the mean of the standardized scores on the teacher and peer evaluations.

Teacher-student relationship support: Peers were asked to nominate children who best fit a description of a supportive teacher-student relationship: "These children get along well with their teachers. They like to talk to their teachers, and their teachers enjoy spending time with them." In the current sample, peer nomination scores correlated .29 with a teacher-report measure of teacher-student relationship support and -.26 with a teacher-report measure of teacher-student conflict.

Child academic self-efficacy beliefs: The cognitive competence scale of the Pictorial Scale of Perceived Competence and Social Acceptance for Young Children (PSPCSA; Harter & Pike, 1981) assessed children's academic self-efficacy beliefs. The cognitive competence subscale consists of six items. For each item, children are presented with pictures of two children who are described in contrasting ways (e.g., "This girl is good at spelling; this girl is not good at spelling"). Then children are asked which child is more like them. After making their choice, children are asked if that child is a little or a lot like them. The procedure yields a four-point scale for each item. Example items are "good at numbers," "knows a lot in school," and "can read alone." The internal consistency of these six items for our sample was .78.

Liking for school: We used an experimenter-developed measure to evaluate children's perception of liking for school. In individual interviews, children were asked to indicate how they felt in response to five statements about school by pointing to one of five faces whose expressions ranged from 1 (very sad) to 5 (very happy). Example items include "How much does your teacher enjoy spending time with you?", "How much do you like to go to school?", "How do you feel when you are at school". This scale had an internal consistency of .61 for our sample.

Mastery orientation: Children's mastery goal orientation was assessed with the Puzzle Task (Burhans & Dweck, 1995). In brief, in individual sessions, children are asked to complete a series of wooden cut-out puzzles of cartoon figures. The first three puzzles are too difficult to complete in the time allowed (failure puzzles). The child is capable of completing the fourth puzzle (success puzzle), because it is easier and the child is given as much time as needed to solve it successfully. After the fourth puzzle, the experimenter brought out all four puzzles (three uncompleted and one completed just as the child had left them) and asked the child to choose one puzzle to work on again. After the choice (one of the failure puzzles or the success puzzle), children were asked to give the reason for their choice (coded as challenge-seeking or non-challenge seeking). In addition to the choice and reason questions, the child's self-rated affect (liking to work on puzzles) and perceived puzzle-solving ability were assessed prior to any puzzles and after each failure and success puzzle. After each failure puzzle children were also asked if they thought they could finish the puzzle if they had more time. After the fourth puzzle children were also asked how many puzzles they thought they could solve if they were given four more puzzles to work on.

Dweck (1986) classified children as learning-goal oriented (or mastery-goal oriented) if they chose to work on one of the failure puzzles or as performance-goal oriented if they chose to work on the success puzzle. We developed a helplessness composite based on procedures

Ziegert et al. (2001) described, which included not only choice and reason but also decrement across the four puzzles in perceived puzzle-solving ability, affect, and expectation that one would solve future puzzles. Confirmatory factor analysis on our sample provided evidence for a single factor labeled as helplessness with indicators of persistence (a dichotomous variable scored as 0 if the child chose a failure puzzle and gave a challenge or "like" reason or as 1 if the child chose a success puzzle and gave an avoidance or "like" reason), decrement in affect, perceived puzzle-solving ability, and expectation of future success. A helplessness composite was computed as the mean of the standardized scores for each of these four indicators. Helplessness composite scores in kindergarten predicted helplessness scores on developmentally appropriate challenge tasks 1 and 5 years later as well as teacher ratings of helplessness 5 years later (Ziegert et al., 2001). The helplessness score was multiplied by -1 to provide a measure of mastery orientation, so that a higher score means being more mastery oriented.

Covariates and criterion measures

Emotional symptoms: Teacher-rated emotional symptom was assessed by the five items on the emotional symptoms scale of the Strengths and Difficulties Questionnaire (see above). Example items include "Nervous or clingy in new situations, easily loses confidence" and "Often unhappy, downhearted or tearful." The internal consistency of the five items for our sample was .74.

Academic achievement: The WJ-III Tests of Achievement (Woodcock et al., 2001) is an individually administered measure of academic achievement for individuals 2 years of age to adulthood. The WJ-III Broad Reading W Scores (letter-word identification, reading fluency, passage comprehension subtests) and the WJ-III Broad Math W Scores (calculations, math fluency, and math calculation skills subtests) were used. Because W scores are based on the Rasch measurement model, yielding an equal interval scale, they are well-suited for the analysis of longitudinal change. Research has demonstrated the reliability and construct validity of scores on the WJ-III and its predecessor (Woodcock & Johnson, 1989; Woodcock et al., 2001).

The Batería Woodcock-Muñoz: Pruebas de aprovechamiento - Revisada (Woodcock & Munoz-Sandoval, 1996) is the comparable Spanish version of the Woodcock-Johnson Tests of Achievement—Revised (WJ-R; Woodcock & Johnson, 1989), the precursor of the WJ-III. If children or their parents spoke any Spanish, children were administered the Woodcock-Munoz Language Test (Woodcock & Munoz-Sandoval, 1993) to determine the child's language proficiency in English and Spanish and selection of either the WJ-III or the Bateria-R. The Woodcock Compuscore (Woodcock & Munoz-Sandoval, 2001) program yields scores for the Bateria-R that are comparable to scores on the WJR. The Broad Reading and Broad Mathematics W Scores were used in this study.

Cognitive ability (IQ): Children were individually tested at school at first grade with the Universal Nonverbal Intelligence Test (UNIT; Bracken & McCallum, 1998). The UNIT is a nationally standardized nonverbal measurement of the general intelligence and cognitive abilities of children and adolescents. The test assesses general intelligence by measuring complex memory and reasoning abilities using culturally and linguistically universal hand and body gestures rather than receptive or expressive language. We used the abbreviated version of the UNIT that yields a full-scale IQ that is highly correlated with scores obtained with the full battery (r = .91) and has demonstrated good test-retest and internal-consistency reliabilities as well as construct validity (Bracken & McCallum, 1998; Hooper, 2003).

Peer acceptance: Peers were asked to name all the children in their classrooms whom they "liked the most." Each child in the classroom received a standardized liking score. Children also were asked to indicate their liking for each child in the classroom on a five-point scale. Specifically, the interviewer named each child in the classroom and asked the child to point to one of five faces ranging from sad (1 = don't like at all) to happy (5 = like very much). Following Coie, Dodge, and Coppotelli (1982), we computed social preference scores as the standardized liked-most nomination scores minus the standardized liked-least scores. To avoid asking children to nominate disliked children, a rating of "1" was considered equivalent to a "liked-least" nomination score (Asher & Dodge, 1986).

Analyses

K-means clustering with random starts—Cluster analysis is a generic name for a number of procedures used to classify objects into similar entities, or groups. "More specifically, a clustering method is a multivariate statistical procedure that starts with a data set containing information about a sample of entities and attempts to reorganize these entities into relatively homogeneous groups" (Aldenderfer & Blashfield, 1984, p. 7). Among the standard clustering methods, hierarchical agglomerative and the *k*-means iterative partitioning methods are the most frequently used in behavioral sciences. Hierarchical agglomerative methods start the clustering process by searching for the two most similar entities in a similarity matrix and then build entities step-by-step into larger and larger nested clusters (Borgen & Barnett, 1987). The *k*-means iterative partitioning methods begin with an initial partition of the data into some specified number of clusters. The centroids of the clusters are computed, and each data point is allocated to the cluster with the closest centroid. Then the new centroids are computed and the data points are reassigned to the cluster whose centroid is the closest. The previous two steps are repeated until no data points change clusters (Anderberg, 1973). We adopted the *k*-means iterative partitioning methods because they can handle significantly more data than hierarchichal methods and they make more than one pass through the data and can adjust for a poor initial partition of the data (Aldenderfer & Blashfield, 1984). In addition, the cluster types expected to be present in the data were nonhierarchical, for which the *k*-means iterative partitioning methods were more suitable because they produce single-rank clusters that are not nested.

A major drawback of the *k*-means iterative partitioning methods is the problem of suboptimal solutions or local optima. Steinley (2003) developed a MATLAB (MathWorks, 1999) routine to avoid local optima. The MATLAB routine automatically repeats standard *k*-means algorithm (i.e., use of squared Euclidean distance as the distance measure, single-object reallocation, and use of error sum of squares as the loss criterion to minimize) many times with random starts and selects the classification that occurs most frequently. According to Steinley's (2003) simulation study, the MATLAB routine recovers a greater percentage of the known cluster structure than other starting methods. We ran the MATLAB routine with 100 replications using the seven standardized clustering variables (i.e., effortful engagement, antisocial engagement, prosocial engagement, teacher-student relationship support, child academic self-efficacy beliefs, liking for school, and mastery orientation).

Latent growth models (LGMs)—Because one of our primary objectives was to determine whether children's academic engagement types predicted their growth in math and reading achievement, we used latent growth models (LGMs) with engagement types predicting growth factors. The LGM consists of two latent growth factors with grade 2, 3, and 4 achievement scores as the indicators (see Fig. 1). The first factor represents the intercept or the initial status. The loadings of the indictors on the intercept factor were fixed to 1. The second factor represents the slope or growth rate. The factor loadings of the indictors on the slope factor define the form or shape of the growth curve. The zero loading of grade 2 achievement score on the slope factor

indicated that the grade 2 achievement score was the reference point. The loading of 1 for the grade 3 achievement score indicated that a 1-unit change in time was equivalent to the interval between grade 2 and grade 3 assessments. The loading of grade 4 achievement score is unspecified and estimated from the data to accommodate curvilinear trajectories. We used engagement type to predict the growth factors controlling for IQ. Dummy variables were created to represent the engagement type. We centered IQ so that the means of the latent intercept and slope represent the predicted mean initial status and growth rate of the reference group when IQ equals to the grand mean of the sample. The residuals of intercept and the slope are allowed to covary.

The LGMs were estimated using Mplus 4.2.1 (Muthén & Muthén, 2006). About 22% of the participants had incomplete observations of WJ-III reading and WJ-III math scores from grade 2 to 4 (8% of the analysis sample had missing WJ-III reading and math scores at grade 2, 12% at grade 3, and 17% at grade 4). An examination of the data indicated that the missingness was not related to any of the study variables. Hence, we assumed that the data were missing at random and used the full information maximum likelihood estimation method, which performs well under this assumption (Schafer & Graham, 2002). To account for the dependency among observations (children) within cluster (classrooms), we conducted analyses using the "complex analysis" feature in Mplus 4.2.1.

Results

Four Types of Engagement

Table 1 shows the descriptive statistics and correlations of the study variables. We ran the MATLAB routine with two-, three-, four-, five-, and six-cluster models. In determining the best number of clusters, information criteria are commonly used, such as Akaike's information criterion (AIC; Akaike, 1987), Schwarz's Bayesian Information Criterion (BIC; Schwarz, 1978), and samplesize-adjusted BIC (ABIC; Sclove, 1987). The model with the smallest value of AIC, BIC, or ABIC is considered best.

Results showed that the four-cluster solution had the lowest AIC and ABIC, whereas the three-cluster solution had the lowest BIC. For both empirical and theoretical reasons, we selected the four-cluster solution. Yang (1998) found that ABIC is more desirable than BIC when comparing latent-class models in a psychometric context. Lin and Dayton (1997) suggested that AIC performs better than BIC for more complex models. Additional support for the 4-cluster solution was provided by the analysis of variance conducted on each of the clustering variables. The three-cluster solution failed to distinguish the clusters on mastery orientation, whereas the four-cluster solution distinguished the clusters on all seven variables. Finally, the four-cluster solution conformed to our theoretical model predicting that groups would differ on a behavioral engagement and a psychological engagement dimension.

The resulting clusters 1, 2, 3, and 4 contained 95, 96, 188, and 101 children (19.8%, 20%, 39.2%, and 21%), respectively. Table 2 summarizes the mean values of the clustering variables across clusters. For concreteness, Figure 2 presents a bar chart of the mean values across clusters. Children in cluster 1 had the highest scores on effortful engagement, prosocial engagement, and teacher-student relationship support and the lowest score on antisocial engagement. They were mastery oriented and liked school. We labeled this group as cooperative.

Children in cluster 2 had the lowest score on effortful and prosocial engagement, and the highest score on antisocial engagement. Compared with children in cluster 1, they had lower teacher-student relationship support and lower scores on mastery orientation. However, their academic

self-efficacy beliefs and school liking were similar to children in cluster 1. We labeled this group as resistive.

Children in cluster 3 had the highest academic self-efficacy beliefs and liked school the most. Compared to children in cluster 1, they were less effortfully engaged and prosocial, and more antisocial. In addition, their desire for mastery was not as strong as children in cluster 1, and they did not get as much support from teachers. We labeled this group as enthusiastic.

Children in cluster 4 had the lowest scores on academic self-efficacy beliefs and liking for school. They tended to fall between cluster 1 and cluster 2 on measures of behavioral engagement. On mastery orientation they were similar to children in clusters 1 and 3 but higher than children in cluster 2. Their teacher support was similar to that of students in clusters 2 and 3 but lower than that of students in cluster 1. We labeled this group as disaffected.

Reliability of Cluster Solution

To assess the reliability of the four-cluster solution, we randomly split the sample into halves (n_1 = 244 and n_2 = 236) and reran the clustering procedure for each half sample. We examined the four-cluster solution in each half sample and found that 91.9% of the participants (236 from the first half and 205 from the second half) were classified into the same clusters as those in the original cluster analysis.

Demographic Differences between Clusters

The cooperative group included more female [χ^2 (3) = 38.5, p < .001] and Hispanic students [χ^2 (9) = 28.7, p = .001], whereas the resistive group included more male and African American students (see Table 3).

Validity of Cluster Solution

To assess the validity of the four-cluster solution, we compared the four clusters on five criterion variables: IQ, peer acceptance, teacher-rated emotional symptoms, and grade 1 WJ-III reading and math scores. We expected that the clusters would differ on achievement but not on IQ, because we viewed engagement variables as distinct from general cognitive ability but facilitating early academic skills. We also expected that engagement groups would differ on peer acceptance, and teacher-rated emotional symptoms. We predicted that students classified as disaffected would be rated by their teachers as having more emotional symptoms. We also predicted that children classified as cooperative and enthusiastic would enjoy more peer acceptance.

The four clusters did not differ on intelligence [$F_{(3,467)}$ = 2.45, p = .063] or grade 1 WJ-III math scores [$F_{(3,467)}$ = .69, p = .562]. However, the clusters varied on grade 1 WJ-III reading scores [$F_{(3,468)}$ = 13.01, p < .001] The cooperative group had the highest reading scores, followed by the enthusiastic group. The resistive and the disaffected group had the lowest reading scores.

The clusters also varied on peer acceptance [$F_{(3,470)}$ = 31.90, p < .001]. The cooperative group was the most popular among peers, followed by the enthusiastic group. The disaffected group was third, and the resistive group was least popular. In addition, the disaffected and resistive groups had more emotional symptoms than the enthusiastic and cooperative groups [$F_{(3,372)}$ = 10.52, p < .001].

Difference in Growth Trajectories between Clusters

We used two dummy-coding schemes. In the first, the cooperative group was designated as the reference group and was assigned a value of 0 for all code variables. The code variable D2

contrasts resistive with cooperative, D3 contrasts enthusiastic with cooperative, and D4 contrasts disaffected with cooperative. In the second coding scheme, the enthusiastic group was designated as the reference group. The code variable D1 contrasts cooperative with enthusiastic, D2 contrasts resistive with enthusiastic, and D4 contrasts disaffected with enthusiastic.

Table 5 shows the parameter estimates of the latent growth models under the two dummy coding schemes. For math achievement, the loading of grade 4 math on the latent growth rate (λ_3) was 1.92, which indicates that the math growth trajectories were almost linear. IQ had a significant positive effect on the initial level of the trajectories ($\beta_{IQ\rightarrow I}$ = .31 , p<.001) but did not affect the growth rate.

None of the path coefficients from the dummy variables to the latent intercept was significant, which indicates that the contrast groups were not different from the reference groups in terms of the latent intercept. When the cooperative group was the reference group, the dummy variable representing the resistive (D2), the enthusiastic (D3), and the disaffected group (D4) had statistically significant negative effects on the latent growth rate, which indicates that the growth rates of the resistive, enthusiastic, and disaffected groups were significantly lower than that of the cooperative group. For statistically significant results, standardized effect sizes are computed using the method Raudenbush and Liu (2001) proposed[1]. The standardized effect sizes of the differences in growth rate were .61, .60, and .63, respectively. For concreteness, the math growth trajectories of the four clusters are presented in Figure 3. The four clusters had similar starting levels; however, the cooperative group had a faster growth rate and higher scores by grade 4. The standardized effect size of the difference on grade 4 math scores between the cooperative and the enthusiastic group is .30, that between the cooperative and the disaffected group is .44, and that between the cooperative and the resistive group is .55.

For reading achievement, the loading of grade 4 reading on the latent growth rate ($l\lambda_3$) was 1.73, which indicates that the growth trajectories were curvilinear with the growth rate decreasing over time. Similar to math growth, IQ had a significant positive effect on the initial level of the trajectories ($\beta_{IQ\rightarrow I}$ = .27, p<.001), but not on the growth rate. The latent intercepts of the cooperative and the enthusiastic group were significantly higher than those of the resistive and the disaffected group. The standardized effect size was .59 for the difference between cooperative and resistive, .62 for the difference between cooperative and disaffected, . 37 for the difference between enthusiastic and resistive, and .41 for the difference between enthusiastic and disaffected. On the other hand, no difference was found in the growth rate between the contrast and the reference groups. Figure 4 shows the reading growth trajectories of the four clusters. The four lines are almost parallel to each other, with the trajectories of the resistive and the disaffected group almost overlapping.

Discussion

Our findings indicate that we could empirically identify four meaningful subtypes of academic engagement that consist of different configurations of self-regulatory traits and self-beliefs. Specifically, we identified traits and beliefs that corresponded well to the positive and negative dimensions of behavioral and psychological engagement (resulting in four types of academic

[1]The standardized effect size of the mean difference in the growth rate between groups is defined as $\delta_1 = \frac{\beta_1}{\sqrt{\tau_{11}}}$, where β_1 is the mean difference in the growth rate between two groups and τ_{11} is the variance of the growth rate. Similarly the standardized effect size of the mean difference in the intercept is defined asw $\delta_0 = \frac{\beta_0}{\sqrt{\tau_{00}}}$, where β_0 is the mean difference in the intercept between two groups and τ_{00} is the variance of the intercept.

engagement). Furthermore, we were able to replicate the four clusters even when randomly dividing the sample in half and conducting cluster analysis on each sub-sample. Thus, members of the four types of academic engagement likely share certain features and outcomes. Indeed, our results indicate differences among cluster groups in both reading and math.

Identification and Replicability of Meaningful Engagement Types

The four academic engagement profiles that were identified indicate that behavioral and psychological dimensions give rise to meaningful types of engagement within classrooms. Effortful, prosocial behavior, and antisocial engagement and teacher support were the key characteristics that distinguished the cooperative and resistive groups. Academic self-efficacy beliefs and liking for school distinguished the enthusiastic from the disaffected group. Having identified four engagement types, we randomly split the sample into halves and replicated the four engagement types in each sub-sample. This gave us confidence that, at least within the current sample, the four types of academic engagement are relatively robust with an overwhelming majority of participants (91.9%) being re-classified into the same clusters as in the original cluster analysis.

Beyond identification and replication, we expect these types of academic engagement to be associated with context- or domain-specific patterns of beliefs and actions in the school setting. In essence, we view the organization and development of various temperamental or personality traits and self-belief systems as affecting children's successful academic engagement, which in turn influences learning and achievement (Liew et al., 2008). Such a notion is consistent with temperament or personality theories and research showing that dispositional or trait-like qualities contribute to specific, context-dependent patterns of beliefs and behavior (Mischel, 1990). Of interest is that we did not find a cluster consisting of positive behavioral engagement and negative psychological engagement styles. Perhaps those characteristics are relatively incompatible so that students who are self-regulated (e.g., exhibiting effortful, high prosocial and low antisocial engagement) tend to be psychologically engaged (e.g., exhibiting academic self-efficacy beliefs and liking for school). Consistent with these findings, in a study with a sample overlapping with the current sample in first to third grade, evidence suggested that temperamental self-regulation at first grade predicted both academic self-efficacy beliefs at second grade and reading achievement at third grade (Liew et al., 2008). Thus, enhancing students' behavioral engagement could increase their concurrent or future psychological engagement by fostering school-related confidence and competence (Liew et al., 2008; Pajares, 2005).

Engagement Types and IQ

With the exception of the cooperative engagement type scoring marginally higher than other types on IQ at first grade, there was no significant difference in the four academic engagement types on IQ. There is some evidence that early self-regulatory abilities such as attention are associated with cognitive functioning. For example, Kopp and Vaughn (1982) found that infants' abilities for sustained attention predicted scores on certain cognitive functioning tests in early childhood. But generally, behaviorally or psychologically engaged students do not necessarily possess greater general cognitive ability than their less engaged peers. Furthermore, our major analyses controlled for children's IQ. Thus, non-intellectual (e.g., socioemotional, psychosocial, and behavioral) traits or skills appear to contribute to self-regulated learning and achievement that cannot be explained simply by students' intellectual capacity. This finding highlights the importance of promoting social and emotional factors that contribute to children's development and learning (Taylor & Dymnicki, 2007).

Engagement Types and Sociodemographic Factors

Consistent with previous literature showing that girls tend to be better behaved and less aggressive than boys (Dodge, Coie, & Lynam, 2006), we found that the cooperative group consisted of more girls and the resistive group consisted of more boys. The resistive group also consisted of more African American students. Thus, male and African American students in our sample were particularly at risk for resistive styles. Such a finding has implications for male and African American students' academic achievement, because there is an association between childhood behavioral problems and adolescent academic problems (Campbell, Spieker, Burchinal, & Poe, 2006). To alter such negative academic trajectories, supportive teacher-student relationships may be especially important for male and African American students who exhibit early behavioral problems (Meehan, Hughes, & Cavell, 2003). Of interest is a study indicating that African American students were rated by Hispanic and non-Hispanic Caucasian teachers as significantly higher on behavioral problems than African American students rated by African American teachers (Zimmerman, Khoury, Vega, Gil, & Warheit, 2006). Unexpectedly, the cooperative group in our study included more Hispanic students. Although this finding was unexpected, Bae, Holloway, Li, and Bempechat (2007) found that Mexican American students tended to believe that effortful behavior (e.g., working hard) and compliance with social norms (e.g., being a polite student who listens to the teacher and follows the teacher's instructions) exemplified being a good student. Thus, effortful engagement appears to fit the cultural model of education that many Mexican American parents endorse (Bae et al., 2007) and may partly explain why there were a greater number of Hispanic students in the cooperative engagement group.

Engagement Type and Academic Achievement

We examined engagement types both in terms of students' reading and math performance in first grade and their rate of growth from second to fourth grade. The results differed based on academic domain. For reading, the groups differed in achievement in first grade, with the cooperative group outperforming the enthusiastic group, which outperformed the resistive and disaffected groups. However, contrary to expectations, the rate of growth in reading from second to fourth grade was similar across engagement groups. Academic engagement style was associated with children's early reading performance but did not predict growth in reading in grades 2 to 4. Group differences in reading achievement in first grade may reflect a reciprocal relation between achievement and engagement as early as kindergarten, such that coopertive engagement in kindergarten and first grade promote early academic skills (Bodovski & Farkas, 2007; Hughes et al., 2008). The initial differences in reading achievement among engagement groups remained fairly constant through grade 4.

For math, there was no engagement group difference in achievement in first grade. However, consistent with the view that the organization of multiple traits predicts developmental outcomes and trajectories (Hart, Atkins, & Fegley, 2003), we found that the cooperative group developed at a faster rate and had higher math achievement by fourth grade than the resistive, enthusiastic, and disaffected groups.

These differences across reading and math in the timing of the effect of engagement on achievement may be due to differences in instruction in reading and math from first to fourth grade. Our interviews with curriculum supervisors for these schools indicated that reading and literacy instruction consumes approximately twice the classroom time in these first-grade classrooms as does math instruction. Furthermore, the fact that these schools are required by the state to assess first graders' literacy outcomes, but not their math outcomes, on a state-approved measure of reading achievement may signal a greater emphasis on reading achievement than math in the first grade. The greater time devoted to reading than math suggests that there may be more opportunities for a student's effort and attention to influence

reading outcomes than math outcomes in first grade. By the time we assessed reading in first grade, temperamentally-based individual differences in behavioral regulation may have already contributed to individual differences in achievement. As students move into the middle elementary grades, time devoted to math instruction increases. At third grade, the state requires that schools assess reading and math achievement on a state-mandated test, results of which have implications not only for students but also for teachers and school districts. As the focus on math skills increases from grades 2 to 4, individual differences in behavioral classroom engagement may contribute to individual differences in the rate of math learning. In this regard, a study of math achievement from kindergarten to third grade (Bodovski & Farkas, 2007) showed an interaction between time spent on instruction and academic engagement in predicting math skills, such that the positive association between academic engagement and third-grade math skills was stronger in classrooms in which more time was spent on math instruction.

Differences in instructional strategies for reading and math may also account for differences in results for reading and math. Math instruction through at least grade 3, relative to reading instruction, involves more independent seat work and less teacher-led group instruction (Mason & Good, 1993; Moats, 2001). Because instruction in math places greater demands on students' self-regulation, individual differences in students' abilities to regulate their own learning by focusing their attention, trying hard, and persisting may predict students' math trajectories more than their reading trajectories. For reading instruction in the early grades, the teacher provides a level of structure that may minimize the influence of individual differences in self-regulated learning on achievement.

We noticed that the differences in academic performance at grade 4 between engagement types had only small to medium effect sizes; however, we believe that small achievement differences could still have important implications for children's academic functioning. For example, studies involving the “Matthew effect” have shown that early success in reading is associated with later successes in reading and that reading difficulties in the early school grades, without intervention, are associated with future academic failure and school drop-out. Thus, even relatively small but cumulative effects could be accentuated over time so that small achievement discrepancies observed in the early grades could widen and result in significant achievement gaps by middle or high school.

We were somewhat surprised that the enthusiastic group's rate of achievement in reading and math did not surpass that of the resistive and disaffected groups. Recall that academic self-efficacy beliefs and liking for school distinguished the enthusiastic from the disaffected group (with the enthusiastic group being higher on those key characteristics). In fact, the enthusiastic group was the highest in their academic self-efficacy beliefs and liking for school relative to the other groups. In retrospect, this finding appears consistent with the notion that liking for school does not necessarily contribute directly to future achievement when other child factors such as emotional and behavioral competencies are considered. Undoubtedly, children's academic self-efficacy beliefs and liking of school contribute to their academic engagement, self-regulated learning, and achievement. But early effortful control as indicated by a cooperative engagement style appears important for shaping academic self-efficacy beliefs and liking for school as well as future academic performance (Liew et al., 2008). If aspects of psychological engagement such as academic self-efficacy beliefs are due, in part, to differences in early successes in meeting the academic and social challenges of school, we might expect that with increasing age psychological engagement would be a stronger predictor of learning trajectories.

Limitations and Future Research

Study results need to be interpreted in light of certain limitations. First, we selected students in the current sample on the basis of scoring below their school's median on a measure of literacy administered in kindergarten or first grade. Thus, results may not generalize to populations that are more representative of the communities from which they are drawn. Nevertheless, academically at-risk students represent a special challenge for schools, and understanding the role of engagement in their achievement trajectories is particularly important to schools' efforts to prevent school failure and reduce educational disparities.

Second, 22% of participants did not have complete observations of their academic achievement from grade 2 to grade 4. By examining the relation of missingness and observed study variables, we suspected that the missingness was ignorable (i.e., the missingness depends on observed response, but not the unobserved response) and adopted a likelihood-based approach to obtain valid inferences under this assumption. However, because it is not possible to detect non-ignorable missingness (i.e., the missingness depends on unobserved response) by examination of the data, we could not rule out the possibility of non-ignorable missingness. It should be noted that when the missingness is non-ignorable, the likelihood-based approach does not warrant valid inferences. Instead, a complete specification of the non-response model is generally required for valid inferences (Laird, 1988).

Third, our assessment of the cognitive dimension of engagement was limited to a single task, Dweck's puzzle task. It would have been preferable to include additional measures of the cognitive aspect of engagement, such as measures of self-regulated learning (Schunk & Zimmerman, 1994) or academic control beliefs (Wellborn, Connell, & Skinner, 1989). However, the availability of measures of these constructs with evidence of validity for this age group is limited (Ainley, 1993). It will be important to follow this sample of children as they move into middle school to determine if similar engagement types are identified in late elementary grades. Beginning around grade 4, measures of psychological engagement, including measures of intrinsic motivation and self-regulated learning, are more available than they are in first grade (Ainley, 1993; Connell, Spencer, & Aber, 1994; Patrick, Ryan, & Pintrich, 1999; Wolters, Pintrich, & Karabenick, 2005). With improved measurement of dimensions of psychological engagement, different patterns of engagement may be identified. With increased age and the greater demand on self-regulated learning strategies at older ages (Wigfield & Eccles, 2002), students classified as enthusiastic may demonstrate different growth trajectories.

Implications for Policy and Practice

These findings have implications for educational practice. By demonstrating the unique contribution of temperament-based regulatory skills and affective responses to achievement, above measures of IQ, results support the importance of teaching these skills and of providing a positive psychological climate for children's academic learning (Hamre & Pianta, 2005). The finding that children's engagement patterns in first grade predict achievement trajectories through grade 4 underscores the importance of intentional and early remediation of self-regulatory difficulties, so that children at risk for poor behavioral regulation have a better chance of succeeding in school. Emerging evidence suggests that poor inhibitory control skills can be remediated in young children (Dowsett & Livesey, 2000; Klingberg et al., 2005) through intentional training. Because children with poor regulatory control are most likely to benefit from a warm and supportive relationship with their teacher (Chen, Liew, & Hughes, 2007), efforts to assist teachers in creating such relationships with students may be critical to reducing risk of academic failure for children with poor temperament-based regulatory control (Hughes et al., 2008). Programs such as the Positive Alternative Thinking Strategies intervention (PATHS; Kusche & Greenberg, 1995) that have been shown to increase first graders'

concentration and behavioral self-regulation (Conduct Problems Prevention Research Group, 1999) are additional promising strategies for preparing all children for successful engagement in school and for academic success.

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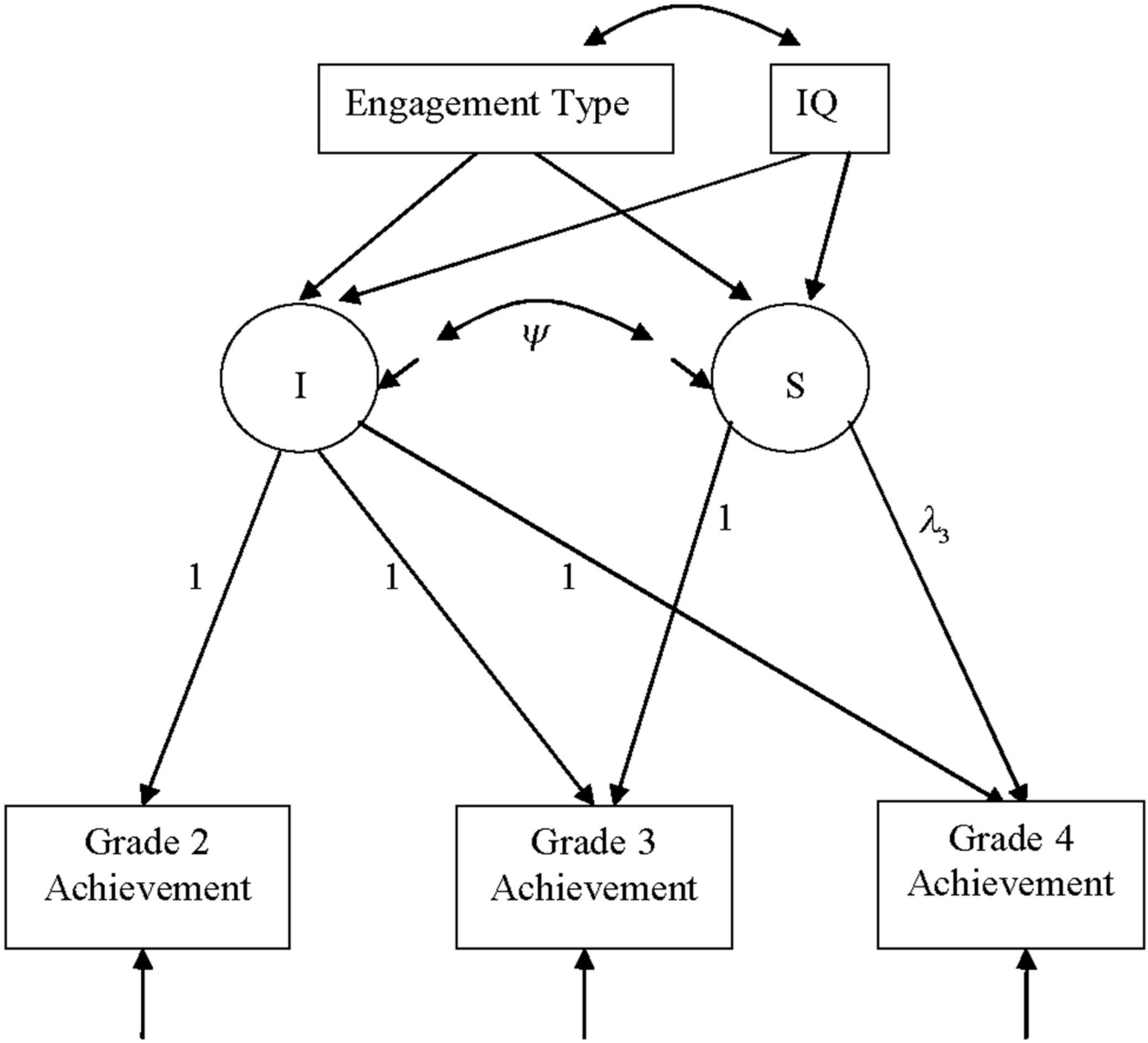

Figure 1.
Latent growth model.

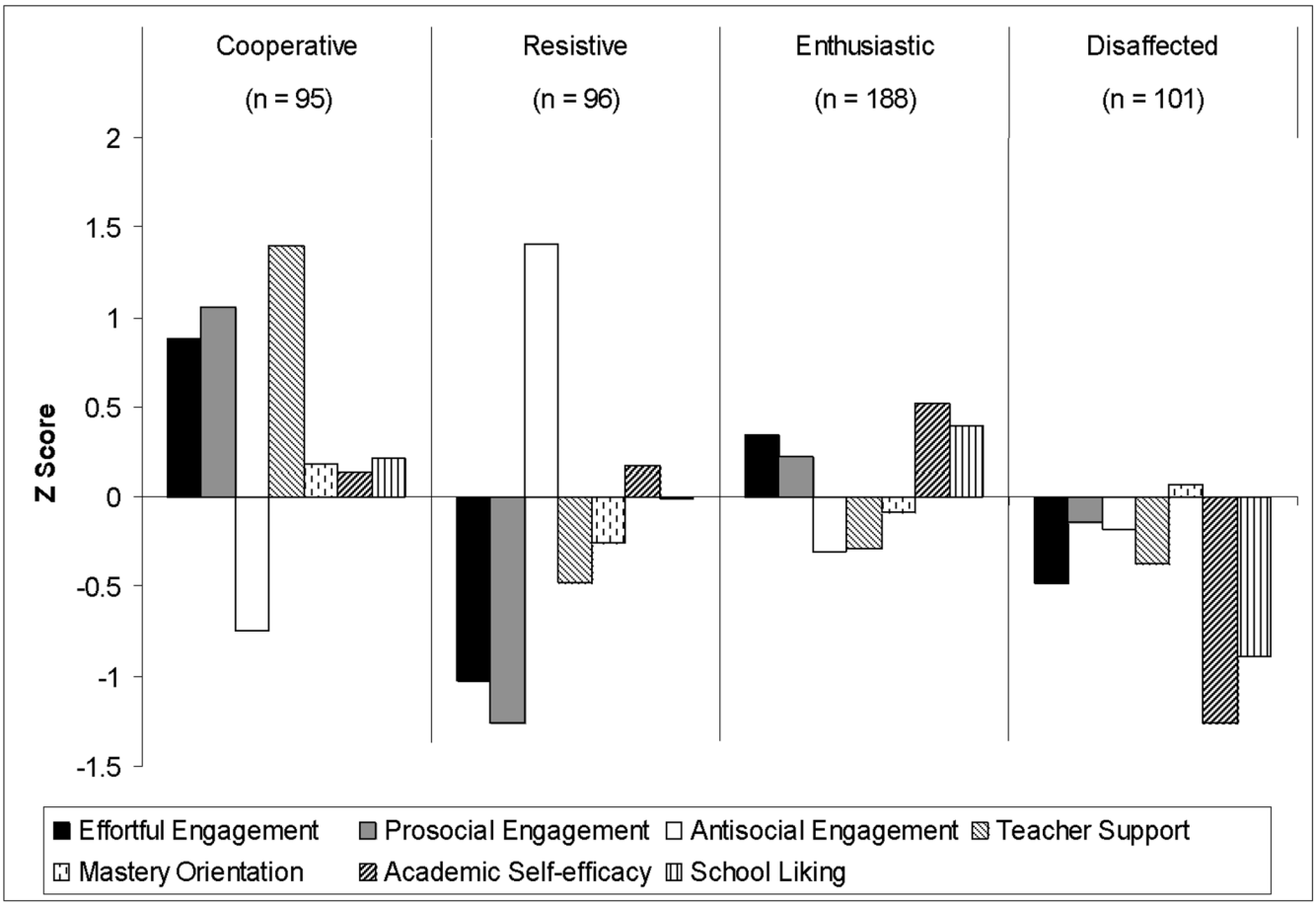

Figure 2.
Mean values of the clustering variables across clusters.

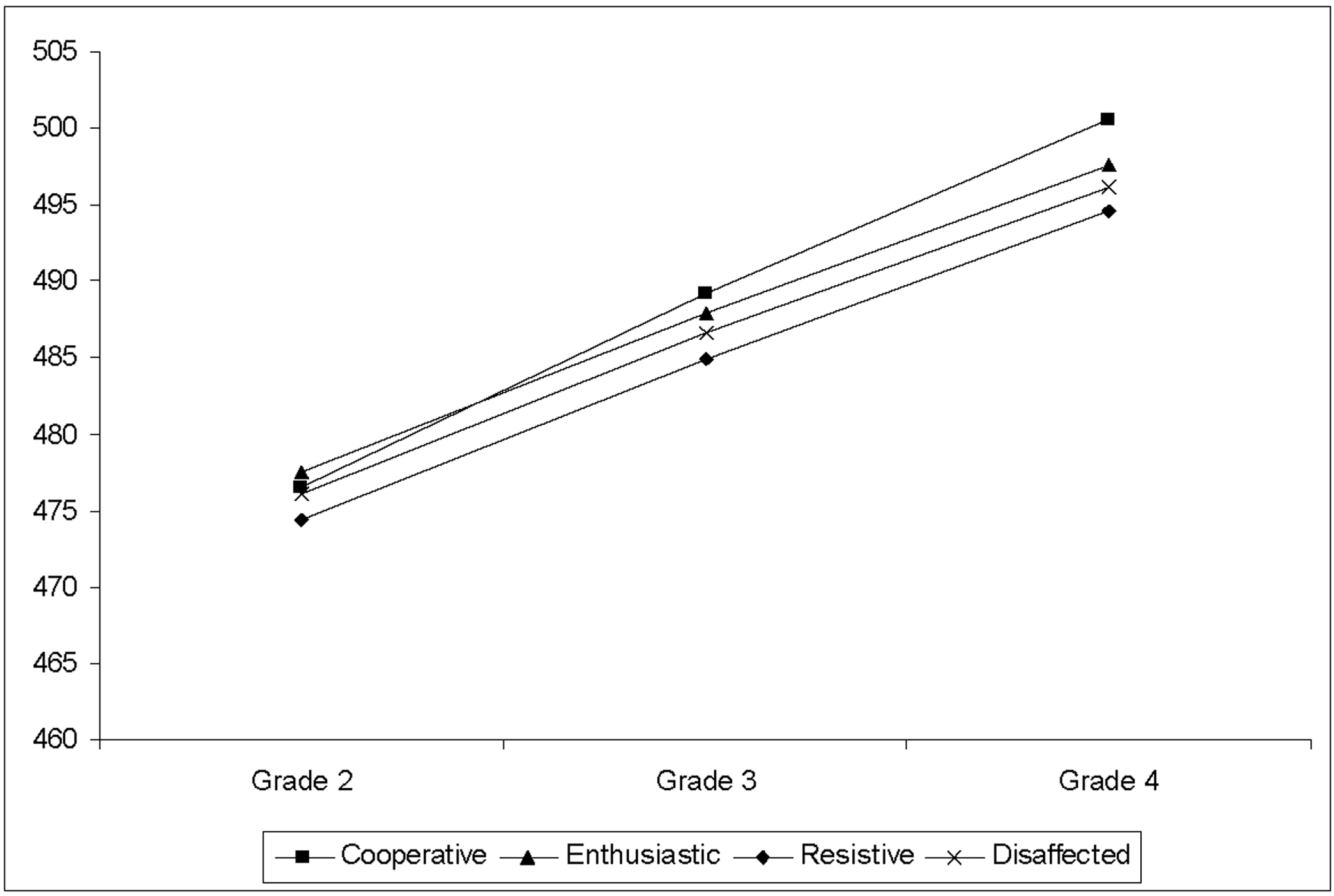

Figure 3.
Math growth trajectories of the four clusters.

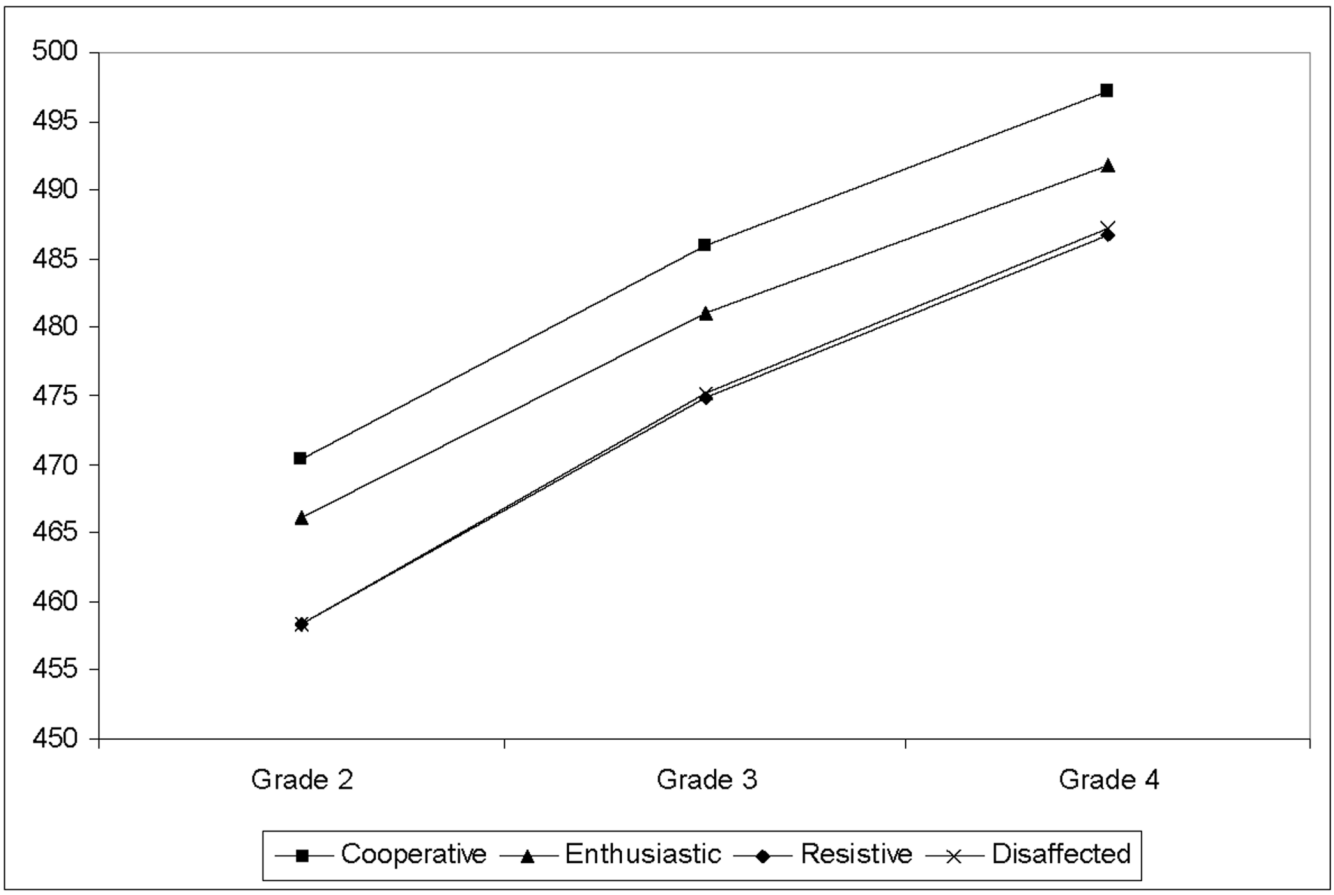

Figure 4.
Reading growth trajectories of the four clusters.

Table 1

Correlation and Descriptive Statistics of Analysis Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. TENG1[a]	1																	
2. PROS1	.64	1																
3. ANTI1	-.52	-.70	1															
4. MAST1	.10	.08	-.11	1														
5. ACSB1	.19	.10	-.01	.00	1													
6. SCHL1	.20	.13	-.05	.05	.30	1												
7. TSUP1	.34	.48	-.28	.04	.09	.11	1											
8. IQ1	.21	.16	-.16	.10	-.02	-.02	.07	1										
9. PREF1	.38	.50	-.38	.02	.13	.06	.30	.09	1									
10. EMOT1	-.34	-.19	.27	-.08	-.20	-.12	-.07	-.09	-.13	1								
11. READ1	.38	.24	-.18	.03	.18	-.01	.23	.19	.12	-.16	1							
12. READ2	.39	.21	-.15	.01	.16	-.04	.12	.20	.13	-.28	.71	1						
13. READ3	.36	.19	-.13	.00	.15	.02	.15	.22	.15	-.18	.63	.82	1					
14. READ4	.36	.17	-.12	.03	.14	-.09	.19	.25	.16	-.22	.57	.77	.85	1				
15. MATH1	.13	.05	-.08	.05	.05	-.13	-.07	.34	.07	-.10	.29	.16	.19	.21	1			
16. MATH2	.20	.06	-.13	.01	.04	-.12	.09	.28	.11	-.19	.19	.32	.33	.35	.66	1		
17. MATH3	.25	.14	-.19	.03	.05	-.08	.04	.31	.13	-.17	.30	.40	.49	.45	.62	.73	1	
18. MATH4	.36	.13	-.13	.06	.05	-.09	.09	.32	.12	-.23	.32	.44	.50	.54	.44	.66	.79	1
Mean	.01	.01	-.02	-.03	.00	.01	-.01	94	-.09	-.03	437	464	479	490	464	477	487	498
S.D.	1	.94	.96	.96	1	.96	1	14	.93	.99	26	21	18	17	12	10	10	10

Note. TENG=Effortful engagement; PROS=Prosocial; ANTI=Antisocial; TSUP=Teach support; MAST=Mastery orientation; ACSB=Academic Self-efficacy Beliefs; SCHL=School liking; IQ=Intelligence; PREF=Social preference; EMOT=Emotional symptom; READ=WJ-III reading; MATH=WJ-III math.

[a]The number following the variable name indicates the year of assessment.

Table 2

Mean Values of the Clustering Variables across Clusters

Clustering Variables	Cooperative (n = 95)	Resistive (n = 96)	Enthusiastic (n = 188)	Disaffected (n = 101)	F	p
Effortful engagement	.88 $_{a}$	-1.02 $_{d}$	.35 $_{b}$	-.48 $_{c}$	133.8	<.0001
Prosocial	1.05 $_{a}$	-1.26 $_{d}$	.22 $_{b}$	-.14 $_{c}$	273.9	<.0001
Antisocial	-.74 $_{c}$	1.41 $_{a}$	-.30 $_{b}$	-.18 $_{b}$	239.8	<.0001
Teach support	1.40 $_{a}$	-.48 $_{c}$	-.29 $_{b}$	-.37 $_{bc}$	155.2	<.0001
Mastery orientation	.18 $_{a}$	-.26 $_{c}$	-.08 $_{bc}$	.07 $_{ab}$	3.8	<.0001
Academic self-efficacy beliefs	.14 $_{b}$	.17 $_{b}$	.52 $_{a}$	-1.26 $_{c}$	120.8	<.0001
School liking	.21 $_{ab}$	-.01 $_{b}$	.39 $_{a}$	-.89 $_{c}$	53.7	<.0001

Note. Means in the same row that do not share subscripts differ at p<.05 in Fisher Least Significance Test.

Table 3

Demographic Profiles across Clusters

Categories	Cooperative (n = 95)	Resistive (n = 96)	Enthusiastic (n = 188)	Disaffected (n = 101)
Gender:[a]				
Female	30.4	12.3	38.8	18.5
Male	10.3	26.9	39.5	23.3
Ethnicity:[a]				
African-American	11.2	33.6	37.4	17.8
Hispanic	28.1	14.0	38.8	19.1
Caucasian	17.1	19.4	39.4	24.1
Other	16.0	8.0	48.0	28.0

Note. The numbers indicate percentages that sum to 100 percent horizontally.

[a] indicates Pearson χ^2 significant at $p < .01$.

Table 4

Mean Values of the Criterion Variables across Clusters

Criteria Variables	Cooperative (n = 95)	Resistive (n = 96)	Enthusiastic (n = 188)	Disaffected (n = 101)	F	p
Intelligence	95.9	90.5	94.3	93.2	2.5	.063
Reading	448.9 $_{a}$	429.5 $_{c}$	437.4 $_{b}$	429.9 $_{c}$	13.0	<.0001
Math	465.2	464.3	463.1	464.5	.685	.562
Peer acceptance	.50 $_{a}$	-.64 $_{d}$	.02 $_{b}$	-.30 $_{c}$	31.9	<.0001
Emotional symptom	-.37 $_{b}$	.41 $_{a}$	-.17 $_{b}$	.18 $_{a}$	10.5	<.0001

Note. Means in the same row that do not share subscripts differ at p<.05 in Fisher Least Significance Test.

Table 5

Parameter Estimates of the Latent Growth Curve Models

	Cooperative as Reference	Enthusiastic as Reference
Math:		
λ_3	1.92***	1.92***
ψ^a	-.33***	-.33***
IQ→I	.31***	.31***
IQ→S	.02	.02
D1→I	--	-1.21
D2→I	-1.09	-2.30
D3→I	1.21	--
D4→I	.14	-1.07
D1→S	--	2.04**
D2→S	-2.00*	.05
D3→S	-2.04**	--
D4→S	-2.12**	-.08
Mean of intercept	476.11	477.45
Mean of slope	12.56	10.51
Reading:		
λ_3	1.73***	1.73***
ψ^a	-.57***	-.57***
IQ→I	.27***	.27***
IQ→S	-.01	-.01
D1→I	--	3.87
D2→I	-10.60**	-6.73*
D3→I	-3.87	--
D4→I	-11.34***	-7.47***
D1→S	--	.66
D2→S	.90	1.56
D3→S	-.66	--
D4→S	1.23	1.88
Mean of intercept	470.46	466.17
Mean of slope	15.45	14.81

Note. The path coefficients are unstandardized.

Dummy variables D1, D2, D3, and D4 represent the cooperative, resistive, enthusiastic, and disaffected groups, respectively.

-- indicates that the corresponding cluster is the reference group and the dummy variable representing that cluster is not included in the prediction model.

*** $p < .001$;

** $p < .01$;

* $p < .05$.

[a] ψ is the correlation between the errors of the intercept I and the growth rate S.