4-8-2018

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Citation: Hernández, M. M., Eisenberg, N., Valiente, C., Thompson, M. S., Spinrad, T. L., Grimm, K. J., VanSchyndel, S. K., Berger, R. H., Silva, K. M., Pina, A. A., Southworth, J., & Gal, D. (in press). Trajectories of the expression of negative emotion from kindergarten to first grade: Associations with academic outcomes. *Journal of Educational Psychology*. doi: 10.1037/edu0000213

Trajectories of the Expression of Negative Emotion from Kindergarten to First Grade: Associations with Academic Outcomes

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Research reported in this publication was supported by the *Eunice Kennedy Shriver* National Institute of Child Health & Human Development of the National Institutes of Health under Award Number R01HD068522, awarded to Nancy Eisenberg and Carlos Valiente. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. We thank the participating families, schools, staff, and research assistants who took part in this study.

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Abstract

We examined individual trajectories, across four time points, of children's (N = 301) expression of negative emotion in classroom settings and whether these trajectories predicted their observed school engagement, teacher-reported academic skills, and passage comprehension assessed with a standardized measure in first grade. In latent growth curve analyses, negative expressivity declined from kindergarten to first grade with significant individual differences in trajectories. Negative expressivity in kindergarten inversely predicted first grade school engagement and teacher-reported academic skills, and the slope of negative expressivity from kindergarten to first grade inversely predicted school engagement (e.g., increasing negative expressivity was associated with lower school engagement). In addition, we examined if prior academic functioning in kindergarten moderated the association between negative expressivity (level in kindergarten and change over time) and academic functioning in first grade. The slope of negative expressivity was negatively associated with first grade school engagement and passage comprehension for children who had lower kindergarten school engagement and passage comprehension, respectively, but was unrelated for those with higher academic functioning in kindergarten. That is, for children who had lower kindergarten school engagement and passage comprehension, greater declines in negative expressivity were associated with higher first grade school engagement and passage comprehension, respectively. The findings suggest that negative emotional expressivity in school is associated with academic outcomes in first grade and, in some cases, this association is more pronounced for children who had lower kindergarten academic functioning.

Keywords: academic achievement; elementary school; latent growth curve analysis; observed negative emotional expressivity; school engagement.

Educational Impact and Implications Statement

Children's observed expression of negative emotion in the classroom predicted lower academic functioning in first grade. In some instances, this association was particularly strong for children who had lower academic functioning in kindergarten. Thus, reduced negative emotion expressivity in the classroom may be helpful for improving academic functioning, especially for children who show academic difficulties in kindergarten. The findings add to our understanding of the potential role of children's emotional expressivity in academic functioning in elementary school.

Trajectories of the Expression of Negative Emotion from Kindergarten to First Grade: Associations with Academic Outcomes

Individual differences in children's expression of negative emotion (also labeled negative emotional expressivity throughout the manuscript) have been associated with social adjustment (Eisenberg et al., 2005). Emotional development and expression are also proposed to relate to school readiness and academic-related skills (Pekrun, 2006; Valiente, Swanson, & Eisenberg, 2012). Consequently, the role of emotion in the school context has received increasing empirical attention (Pekrun & Linnenbrink-Garcia, 2014). Nonetheless, the extant research typically has not examined how emotions measured in school relate to academic functioning across time (for an exception with an adolescent sample, see Ahmed, van der Werf, Kuyper, & Minnaert, 2013). Thus, the purpose of the current study was to evaluate change (or trajectories) in children's observed negative emotional expressivity in school across four time points from kindergarten (K) through first grade (G1), and to examine how these trajectories related to measures of academic engagement and performance in the spring of G1. Examining predictors of academic functioning is of particular importance given that early academic achievement is a strong predictor of later academic achievement and attainment (Darney, Reinke, Herman, Stormont, & Ialongo, 2013), including adult economic status (Ritchie & Bates, 2013).

Children's academic adjustment in the transition from K to G1 warrants close examination given the changing demands. For example, there are shifts in type of instruction and expectations across this transition (La Paro, Rimm-Kaufman, & Pianta, 2006). One study showed that in G1, compared to K, there was increased time in seatwork, increased teacher-directed instruction, less instructional support such as discussing ideas and potential solutions to activities, and fewer opportunities for children to take on responsibility (La Paro et al., 2006).

Emotional expressivity also shifts across development and there are individual differences in the degree to which children express emotions in the early years of life (Duchesne, Larose, Vitaro, & Tremblay, 2010; Rothbart & Bates, 2006). Parents or teachers have reported that young children's negative emotions generally increase in intensity and/or frequency from infancy to childhood (Lipscomb et al., 2011; Snyder et al., 2009; Yew & O'Kearney, 2015). In contrast, some researchers have found that children's negative emotional expressivity, as reported by parents, declines between the ages of four and six (Yew & O'Kearney, 2015), and children's negative emotional expressivity, as reported by parents or teachers, decreases across six years after K (Sallquist et al., 2009). Thus, evidence suggests that children decline in negative emotional expressivity at the start of formal schooling (Sallquist et al., 2009; Yew & O'Kearney, 2015), possibly because of associated increases in regulation (Murphy, Eisenberg, Fabes, Shepard, & Guthrie, 1999; Sallquist et al., 2009).

Because negative emotionality is considered a temperamental characteristic (Rothbart & Bates, 2006), one would expect individual differences in the extent to which children are prone to expressing negative emotionality in different settings, including academic settings, but also individual differences in change in negative expressivity across development (Duchesne et al., 2010). Thus, although there is some stability of individuals' emotional expressivity across time (Sallquist et al., 2009), examining trajectories could help clarify the role of individual differences in the development of emotion expressivity as children adapt to the transition into formal schooling.

The Relation of Emotional Expressivity to Academic Outcomes: Theoretical Perspectives

Researchers have hypothesized that emotional expressivity, which often relates substantially to emotionality (Eisenberg et al., 1994), is associated with academic functioning

(Fernández-Vilar & Carranza, 2013; Linnenbrink, 2007; Valiente, Swanson, & Eisenberg, 2012). In the control-value theory of achievement emotions, Pekrun (2006) proposed that achievement emotions (i.e., "emotions directly tied to achievement activities or achievement outcomes," Pekrun (2006), p. 317) impact cognitive resources, motivation to learn, learning strategies, and self-regulated learning, and subsequent academic achievement. Researchers have proposed that temperament more generally, including emotionality, contributes to how children experience school (Rothbart & Jones, 1998; Valiente, Swanson, & Eisenberg, 2012). Consistent with this view, numerous studies indicate that test anxiety negatively predicts academic performance (Pekrun, 2006; Valiente, Swanson, & Eisenberg, 2012). However, other unpleasant emotions also may be associated with children's academic experience. Specifically, negative emotions expressed often and intensely are thought to limit attention and interest (Fredrickson, 2001), which has implications for engaging in and performing academic tasks. Children who are able to regulate and understand their emotions are thought to productively process emotional events in school and recruit useful cognitive processes during learning tasks (Garner, 2010).

Temperament theorists posit that emotional arousal (including negative emotionality and expression) plays a role in cognitive processing (Blair & Dennis, 2010; Blair & Raver, 2015). Although moderate levels of emotional expressivity may increase attention and regulation, high levels of negative emotional expressivity are more likely to impair attention and regulation (Valiente, Swanson, & Eisenberg, 2012). As such, emotion and its expression are thought to contribute to children's level of school readiness, including academic achievement (Blair & Raver, 2015).

In fact, high arousal associated with experiencing negative emotion has been related to lower performance on complex executive functioning tasks (Blair & Dennis, 2010). Moreover,

studies show that experiencing negative emotion impairs working memory retrieval (e.g., Fartoukh, Chanquoy, & Piolat, 2014; Gray, Braver, & Raichle, 2002). For example, in an experimental study, adults exposed to an unpleasant mood induction scored lower on working memory during a word task compared to adults induced to experience pleasant or neutral moods (Gray et al., 2002). Similar findings have been obtained for children: Induced negative emotion was associated with worse working memory in a phonological task (Fartoukh et al., 2014). As such, experiencing negative emotion, which would be expected to be reflected to some degree in individuals' expression of emotion, may interfere with children's cognitive and working memory task performance at school. Furthermore, increases in negative emotions and their expression may further impair children's daily and cumulative learning across time through their effect on quality of children's social interactions (Hernández, Eisenberg, Valiente, Spinrad, et al., 2017; Hernández et al., 2016).

It is possible that children who express more negativity receive less optimal instruction by teachers (Stuhlman & Pianta, 2001) and have more negative interactions with school peers (Eisenberg, Eggum, Sallquist, & Edwards, 2010). Thus, temperamental dispositions may help shape children's school experiences and opportunities for learning from teachers and peers across time (Blair & Raver, 2015). Overall, there are multiple theoretical perspectives suggesting that negative emotion and its expression undermine cognitive processes, attention capacities, and social interactions that scaffold learning activities and promote engagement.

Empirical Associations between Negative Emotions and Academic Outcomes

Emerging empirical evidence points to a link between the level of children's negative emotionality or its expression and academic outcomes, including achievement and engagement (Linnenbrink, 2007). For example, observed negative expressivity in preschool or K has been

associated with lower school adjustment in K – encompassing measures of cooperation, school liking, engagement, and achievement (Denham et al., 2012; Denham, Bassett, Zinsser, & Wyatt, 2014; Hernández et al., 2016). Similarly, Valiente, Swanson, and Lemery-Chalfant (2012) found that children's dispositional anger, reported by parents and teachers, was negatively associated with classroom participation in K. Among middle school students, self-reported and teacher-reported negative mood negatively predicted academic achievement (Gumora & Arsenio, 2002). However, there are exceptions to these general findings. For example, Berhenke, Miller, Brown, Seifer, and Dickstein (2011) found that observed negative affect (e.g., sadness, anger, frustration) during challenging tasks was not associated with teacher-reported academic competence among kindergarteners. Thus, further examination of the association between children's negative expressivity and a variety of academic outcomes is warranted.

Measures of emotion regulation and functioning, which often include reverse-coded items on negativity or anger, have been positively associated with attention to academic tasks in G1 (Trentacosta & Izard, 2007), with academic achievement in K (Howse, Calkins, Anastopoulos, Keane, & Shelton, 2003), and with academic competence and achievement among adolescents (Roeser, Eccles, & Sameroff, 1998). Correspondingly, Herndon, Bailey, Shewark, Denham, and Bassett (2013) found that emotion dysregulation (i.e., negative expressivity reactions to emotionally arousing problem situations [p. 648]) was negatively associated with concurrent levels of engagement in preschool. Together, these studies on negative emotional expressivity and emotion regulation represent important contributions to research on emotions in academic settings. However, as described previously, emotion expressions vary across individuals and development (Yew & O'Kearney, 2015), and researchers have only begun to examine individual differences in negative emotionality or its expression over time as predictors

of achievement outcomes in childhood.

In one of the few longitudinal studies examining individual differences available, Ahmed et al. (2013) examined the longitudinal trajectories of academic emotions among seventh grade students across the year and found that increasing self-reported anxiety predicted lower mathematics achievement over time. Although not assessing negative emotional expressivity per se, Sawyer et al. (2015) found that trajectories of increasing parent-reported emotion regulation (which included reverse-coded measures of anger, frustration, and sadness) from age two to seven were positively associated with literacy scores at ages six to seven. These two studies suggest that individual differences in change in children's expression of negative emotion might relate to some academic outcomes. Thus, an important question is how individual differences in early-elementary trajectories of observed negative emotional expression relate to academic outcomes, controlling for prior demographic (e.g., age, sex, ethnicity, maternal education) and academic factors (e.g., prior achievement; representing a stricter test of effects compared to many prior studies; see Ahmed et al., [2013], Roeser et al. [1998], and Trentacosta and Izard [2007] for exceptions). Furthermore, examining negative emotional expression specifically in the classroom context, we propose, has more direct and negative implications for classroom functioning than examining children's general negative emotional expressivity.

The Moderating Role of Prior Academic Functioning

Another aim of this study was to examine whether prior academic functioning moderated the associations between trajectories of children's negative emotional expression and academic factors in G1. As previously discussed, academic achievement is one of the strongest predictors of future academic achievement (Darney et al., 2013; Morgan, Farkas, Hillemeier, Hammer, & Maczuga, 2015). Children who have high levels of initial academic functioning may have an

easier transition into school, have more positive experiences with teachers, and be more apt to meet new academic demands (Hernández et al., 2016; Morgan et al., 2015). Thus, differences in initial academic adjustment may be associated with the extent to which negative emotional expressivity is associated with later achievement and associated learning processes (Bohn-Gettler & Rapp, 2014). For example, prior research has shown that interventions for social competence are most effective for children with higher initial levels of behavioral problems (Morris et al., 2014). For these children, there is more opportunity to improve because they have lower behavioral functioning. Relatedly, classroom organization predicted higher academic skills for kindergarteners with lower, but not higher, prior achievement (Cadima, Leal, & Burchinal, 2010). Together, these results preliminarily suggest that children, especially those high in typical risk factors, may show more robust improvements in social or academic competence.

The Present Study

We examined the trajectory of expressed negative emotion in the school classroom from the beginning of K through G1, a critical but seldom studied period, using a longitudinal growth modeling framework. Based on prior research (Sallquist et al., 2009; Yew & O'Kearney, 2015), a decline in negative expressivity across this period was predicted, although the potential stress and adjustment period to entering formal schooling could result in an initial increase in negative emotion at school entry. In addition, we assessed the association between emotions and academic outcomes and addressed a gap in the literature regarding how change in negative emotion during this period relates to academic outcomes during the beginning of formal schooling. We examined whether both level (spring, K) and growth of negative emotional expression predicted observed school engagement, academic skills, and passage comprehension in G1, controlling for prior levels of these academic outcomes. Given prior research (Denham et al., 2012; Trentacosta &

Izard, 2007; Valiente, Swanson, & Lemery-Chalfant, 2012) and theory (Pekrun, 2006; Rothbart & Jones, 1998; Valiente, Swanson, & Eisenberg, 2012), we predicted that children's baseline level of negative emotion would be negatively associated with academic outcomes. Furthermore, we expected a greater decline in negative emotion to be associated with better academic outcomes whereas increases in negative emotion would be associated with worse academic outcomes. We considered whether K level of academic functioning would moderate the association of the K level and change in negative expressivity from K to G1 with academic functioning in G1. We tested the possibility that negative expressivity would be inversely associated with academic functioning for children with lower academic functioning in K, whereas for children with higher initial academic functioning, negative expressivity would be less associated with academic functioning in G1 (which would remain comparatively higher). This approach, combined with the use of multi-informant reports to reduce shared method variance bias and observations of negative emotion in longitudinal models, represents a relatively strong test of study hypotheses.

Method

Participants

Participants were kindergarteners (N = 301; 52% girls; M_{age} = 5.48 years, SD_{age} = 0.35 years) from five schools in a southwestern metropolitan area in the United States (Hernández, Eisenberg, Valiente, Diaz, et al., 2017). Two cohorts of children were drawn from 26 classrooms at the beginning of the school year, one year apart. Participating children were from various ethnic backgrounds (53% Hispanic, 34% White, 3% Asian, 2% American Indian/Alaska Native backgrounds, 2% Black, 1% Other, 6% Unknown [percentages are rounded]) and had parents with varied education (30% of mothers and 39% of fathers completed high school or less, 31%

of mothers and 24% of fathers attended some college, and 39% of mothers and 37% of fathers graduated from college). For the study variables used in this study, data were collected from 301, 294, 255, and 256 children at Waves 1 (fall, K), 2 (spring, K), 3 (fall, G1), and 4 (spring, G1), respectively.

Procedure

Teachers received a survey for each participating child during the spring semester of K and G1 assessing children's academic skills. Observers rated children's emotional expressivity in the classroom and engagement in school during the fall and spring semesters of both K and G1. Observer training (lasting 3-4 weeks) included rating child interactions in pilot preschool settings and on pre-coded videos (after the first year for the first cohort) of interactions among children. On a bi-weekly basis, checks of validity were made for agreement with the coding supervisor. Observations were conducted in schools two to three times each week for nine to twelve weeks each semester, depending on the number of children in the class. Two or three observers rated each child. Observers had a list of participants for each class and coded a child's emotional expressivity and engagement after 30 s of observation. The first child observed was randomly selected and individual children were not coded again until the entire list of children, if present, was coded. Observers may have rated the same set of children across two semesters within the same school year because the Institutional Review Board required that observers be changed minimally within the school year to avoid possible distress for teachers and children resulting from having new people in the classroom. A separate group of trained assistants administered standardized assessments of achievement, as described in the Woodcock-Johnson III Examiner's Manual (Mather & Woodcock, 2001), in designated rooms in spring of K and G1.

Measures

Negative emotional expressivity. Observers rated the intensity, frequency, and duration of children's negative (e.g., sadness, anger, frustration) expressivity exhibited in class (e.g., classroom, art/music/computer lab, library) in the fall and spring semesters of K and G1. Negative expressivity was based on facial expressions (e.g., pouted lips or lips downturned in a frown), behavior (e.g., brows down or arched in sadness, crying), vocal tone (e.g., whining) and content (e.g., "S/he made me feel bad"), and vocalizations (e.g., slow, gentle sighs). Emotion was coded on a 0 to 3 scale: 0 = *no evidence of emotion*; 1 = *minimal evidence* (e.g., emotion indicator seen once, small intensity and brief [< 3 s]); 2 = *moderate evidence* (e.g., two indicators of emotion, small intensity, and brief; one indicator of emotion, small intensity, lasting 4 to 9 s; one indicator, medium intensity, lasting < 5 s); 3 = *strong evidence* (e.g., three or more indicators, small intensity, and brief; two or more indicators, medium intensity; one or more indicators, small intensity, lasting more than 10 s; one or more emotional displays, medium intensity, lasting more than 5 s; any high intensity indicator). This observational coding system has been used in prior research (e.g., Fabes, Leonard, Kupanoff, & Martin, 2001; Spinrad et al., 2004) and shows adequate predictive validity. Reliability ratings were obtained from pre-coded videos (used only for reliability) and randomly selected live observations (9.23% of observations across waves) rated simultaneously with supervisors. Inter-observer reliabilities (intraclass correlations [ICCs]), were .96 for the fall semester of K (.97 [spring, K], .95 [fall, G1], and .97 [spring, G1]). For each child, observers' ratings were averaged across all observations for negative emotion within each wave (M_{time} = 39 min 39 s [fall, K], 46 min 4 s [spring, K], 47 min 47 s [fall, G1], 54 min 26 s [spring, G1]), representing negative emotional expressivity levels in class from K to G1.

School engagement. During the fall semester of K and spring semester of G1, observers

rated the degree to which the child was attentive and/or participated in academic-related activities (e.g., lectures, group tasks, library, story time; Hernández et al., 2016). In analyses, the school engagement score measured in the fall semester of K was used as a control variable. Children were observed in 30 s intervals and rated for engagement if they were working on an academic task (including listening to the teacher). Engagement was coded as follows: 0 = *no evidence of engagement* (e.g., not paying attention, not participating, off-task behaviors); 1 = *minimally or passively engaged* (e.g., paying attention but not participating); 2 = *moderately engaged* (e.g., attends to the teacher during at least half of observation or attends to the teacher during the majority of the observation but becomes disruptive); 3 = *highly engaged* (e.g., attends to the teacher during the majority of the observation, is not disruptive). Reliability ratings were obtained from pre-coded videos and randomly selected live observations (9.2% of observations for fall of K and spring of G1) that were simultaneously rated by a second observer (ICCs = .91 [fall, K] and .94 [spring, G1]). Scores were averaged across all observations (M_{time} = 33 min 54 s [fall, K] and 40 min 46 s [spring, G1]), representing observed engagement in school.

Academic skills. In the spring semesters of K and G1, teachers rated children's reading, math, spelling, and language skills (1 = *far below grade level* to 5 = *far above grade level*; 4 items; αs = .96 [K] and .94 [G1]). Researchers previously have obtained adequate reliability on similar teacher-reported measures of academic skills (Iyer, Kochenderfer-Ladd, Eisenberg, & Thompson, 2010).

Passage comprehension. In the spring semesters of K and G1, students completed the passage comprehension test of the Woodcock-Johnson III Tests of Achievement (Woodcock, McGrew, & Mather, 2001), in English or Spanish. Two children completed the assessment in Spanish (one in K, another in G1). We used the tests' *W* scores that represent equal-interval units

in a Rasch scale. Passage comprehension scores in K and G1 were correlated ($r = .62$, $p < .001$).

Covariates. We used the following control variables: age, ethnic minority (0 = *non-Hispanic white*; 1 = *minority* [i.e., Asian, American Indian/Alaska Native, Black, Hispanic), sex (0 = *girl*; 1 = *boy*), and maternal education (1 = *less than high school diploma*; 2 = *completed high school or equivalent*; 3 = *attended some college*; 4 = *graduated from college or higher*). Four variables, indicating school level fixed-effects, were also included as control variables in the analytical models.

Results

Table 1 provides the descriptive statistics for the study variables. Before testing our proposed models, the percent of missing data on each measure was examined and ranged from 0% (e.g., for observed negative emotional expression and engagement in the fall of K) to 22% (i.e., for teacher-reported academic skills). Children who did not have data on measures across all waves did not differ from the rest of the children who did have some missing data, based on a comparison of background measures using independent samples *t* tests (e.g., maternal education, age, ethnic minority, male). Full-information maximum-likelihood estimation was used in subsequent analyses. Four cases had passage comprehension scores that were more than three standard deviations above or below the mean. To reduce the possible bias of outliers, these four outlier passage comprehension scores were recoded to be three standard deviations from the mean to use in Model 4 (see below, Tabachnick & Fidell, 2007). Transforming these four cases did not alter the pattern of results and thus we kept the transformed scores to include all possible data points.

Correlations among Primary Study Variables

Negative emotional expressivity was correlated across waves (*r*s = .17 to .46; see Table

1). Negative emotional expressivity in K was negatively correlated with passage comprehension in K. Negative emotional expressivity in K and G1 were negatively correlated with school engagement in K and G1 (with one exception, negative emotional expressivity in the fall of K was negatively [but not significantly] correlated with school engagement in G1).

Growth Model Specification and Selection

Models were tested using M*plus* Version 7.4 (Muthén & Muthén, 1998-2015). The chi-square test of model fit (χ^2), the Comparative Fit Index (CFI; Bentler, 1990; Little, 2013; corrected for longitudinal data which may yield values over 1), the Tucker-Lewis Index (TLI; Little, 2013; Tucker & Lewis, 1973; corrected for longitudinal data), and root mean square error of approximation (RMSEA; Browne & Cudeck, 1993) were used to assess model fit. Full-information maximum-likelihood estimation with robust standard errors (MLR) was used to accommodate missing data and nonnormality (Muthén & Muthén, 1998-2015). We used the TYPE=COMPLEX command to account for the non-independence of observations due to multiple students sampled in each classroom; K classroom was designated as the cluster variable due to having more students per classroom in K. Because the classrooms were nested within five schools, we included four fixed-effect (dummy-coded) variables in the analytical models (i.e., Models 1A-3B).

First, we fit unconditional growth models to test whether individuals followed random trajectories (Curran, Bauer, & Willoughby, 2004). Unconditional (1) no growth, (2) linear, and (3) quadratic change models were fit and compared (see Table 2). The linear model of change (Model 2) best fit the change trajectories observed (see Figure 1) based on the scaled χ^2 difference test (Satorra & Bentler, 2001) and the rule of parsimony (Bollen & Curran, 2006)[1].

[1] Preliminary analyses were performed examining individual growth in negative emotional expressions with a free-fitting model in which the first two time points were linear and the last two time points were freely estimated.

The linear growth model was specified to have a random intercept (centered at the spring of K because the majority of academic predictors were collected in spring of K; see supplemental material for additional centering analyses) and random slope (individual rate of change across four semesters). Based on this model, the intercept mean, intercept variance, and intercept-slope covariance are interpreted specifically for spring of kindergarten. In addition, residual variances were freely estimated (rather than constrained to be equal, which would have resulted in worse model fit) across the four measurement occasions. This linear growth model demonstrated good fit, MLR χ^2 (5, N = 301) = 4.716, p = .45, with strong fit indexes: CFI = 1.002, TLI = 1.006, and RMSEA = .00 (see Table 2).

Based on the unconditional linear growth model, the predicted mean negative emotional expressivity score in the spring of K was 0.051 (see Table 3; the average level in fall of K was .059). The estimated rate of change in negative emotional expressivity by semester was significant. On average, negative emotional expressivity scores declined 0.008 points from one semester to the next. There was significant variability across students in the intercept and slope of negative emotional expressivity. The intercept was negatively correlated with the slope indicating that students with higher levels of negative emotional expressivity in the spring of K tended to evidence steeper declines in negative emotional expressivity from K to G1. This finding was corroborated graphically in Figure 1 (students who were high on negative emotional expressivity in K were unlikely to remain high or to increase their expression of negative emotion substantially through G1). This linear growth model is henceforth used as a baseline model for predicting the academic outcomes of interest in three different sets of analyses.

Negative Expression Trajectory Predicting School Engagement

However, this specification did not characterize the data as well as the linear-only function. Specifically, the AIC and BIC values were higher in the free growth unconditional model, compared to the linear growth unconditional model (ΔAIC = 3.23; ΔBIC = 9.64).

First, we tested a model identifying whether the negative emotional expressivity intercept and slope additively predicted observed classroom engagement in G1, controlling for classroom engagement in K and background covariates[2], MLR χ^2 (25) = 25.23, p = .45, CFI = 1.00, RMSEA = .01 (see Model 1a, Table 4). Predictors were grand-mean centered in this model (and subsequent models) per typical practice (Bollen & Curran, 2006). In this model, the intercept (b_1 = -1.82, p = .01) and linear slope (b_2 = -4.72, p = .02) of negative expressivity significantly and inversely predicted school engagement. Higher levels of negative expressivity in spring of K predicted lower subsequent school engagement (Figure 3a), above other modeled effects. Furthermore, negative expressivity trajectories (slopes) were predictive of engagement in the expected inverse direction (see Model 1a, Table 4). Prior school engagement (in the fall of K) positively predicted school engagement in spring of G1.

In follow-up models, interactions between school engagement in K and either the intercept or slope of negative expressivity were specified in two separate models using a latent moderated structural technique (Klein & Moosbrugger, 2000; Muthén & Asparouhov, 2015). Only the interaction between the slope of negative emotion and initial school engagement near significantly predicted G1 school engagement (see Model 1b, Table 4; b_{23} = 12.62, p = .06). In latent moderated analyses, typical fit indices are not available, except for the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). We compared the estimated interaction model and a model with the interaction effect set to zero and the interaction model had lower (and thus, better) AIC and BIC values (ΔAIC = -3.89; ΔBIC = -.19). Next, simple slopes analyses (all on an unstandardized metric) were conducted for prior school engagement values at the mean, and at 1 *SD* above and below the mean (Preacher, Curran, & Bauer, 2006). The standard deviation was based on the square root of the variance of school engagement in

[2] Adding cohort as a covariate did not alter the pattern of results and thus was not included in subsequent analyses.

kindergarten. As depicted in Figure 3b, the negative expressivity slope was negatively associated with school engagement in G1 for children with low (i.e., 1 *SD* below the mean; b_2 = -6.9, p < .001) and average school engagement in kindergarten (b_2 = -4.68, p = .01). The negative expressivity slope was not associated with school engagement in G1 for children with high initial school engagement (i.e., 1 *SD* above the mean; b_2 = -2.46, p = .42).

Negative Expression Trajectory Predicting Academic Skills

We then tested whether negative emotional expressivity intercept and slope predicted teacher-reported academic skills in G1, controlling for academic skills in K and covariates. This model fit the data well (see Model 2a, Table 4), MLR χ^2 (25) = 25.333, p = .44, CFI = .999, RMSEA = .01. In this model, the negative expressivity intercept (but not linear slope) predicted lower academic skills in G1 (b_1 = -3.149, p = .02; see Figure 4). In subsequent latent moderated structural analyses, interactions between the intercept or slope of negative emotional expressivity and academic skills in K in two separate models did not significantly predict academic skills in G1 (see Model 2b, Table 4).

Negative Expressivity Trajectory Predicting Passage Comprehension

We then computed a model to examine if the intercept and slope of negative expressivity predicted G1 passage comprehension, controlling for passage comprehension in K and background covariates, MLR χ^2 (25) = 27.213, p = .35, CFI = .997, RMSEA = .02 (see Model 3a, Table 4). In this model, the intercept did not significantly predict G1 passage comprehension. The linear slope of negative expressivity inversely predicted passage comprehension at a marginally significant level (b_2 = -147.867, p = .06; see Model 3a, Table 4).[3] Using a latent

[3] We tested whether an interaction between the negative emotion expressivity intercept and growth factors significantly predicted passage comprehension achievement, as well as school engagement and academic skills. Although the interaction was significant, simple slope tests revealed that the intercept of negative emotion did not alter the effect of growth on the academic outcomes in this study. Thus, we continued to examine the unique effects

moderated structural technique, interactions were specified between K passage comprehension and either the intercept or slope of negative emotional expressivity in two separate models. Only the interaction between the slope and prior passage comprehension predicted G1 passage comprehension (see Model 3b, Table 4; $b_{23} = 7.36$, $p = .01$).[4]

To further examine the interaction, we compared the interaction model and a model with the interaction effect set to zero and the interaction model had lower AIC (ΔAIC = -7.3) and BIC (ΔBIC = -6.81) values. Simple slopes analyses were conducted at high (1 *SD* above the mean), average (0 *SD*), and low (1 *SD* below the mean; Preacher et al., 2006) levels of passage comprehension in K. The negative expressivity slope was negatively associated with passage comprehension in G1 for children with lower passage comprehension in K (1 *SD* below the mean; $b_2 = -309.79$, $p < .001$; see Figure 5b), but not for children with average (0 *SD*; $b_2 = -155.73$, $p = .14$) or higher passage comprehension in K (1 *SD* above the mean; $b_2 = -1.68$, $p = .99$).

Discussion

The present study tested whether negative emotional expressivity in the classroom from K to G1 would predict later academic adjustment, even when controlling for prior levels of the academic outcomes and key background variables. Guided by the theories on emotions in academic settings, including the control-value theory of achievement emotions (Pekrun, 2006) and theories of temperament in school settings (Rothbart & Jones, 1998; Valiente, Swanson, & Eisenberg, 2012), this study extends previous research by examining how trajectories of negative emotional expression relate to academic outcomes in early elementary school. Findings from this

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of the intercept and growth factors on the academic outcomes in this study given that non-additive effects did not characterize the data well.

[4] We included a covariate indicating Hispanic status background variable instead of ethnic minority status in all analyses, which resulted in the same pattern of results as when we used ethnic minority status as a covariate.

study contribute to research on emotions and academic outcomes in childhood, which has focused primarily on specific academic-related emotions (e.g., enjoying math) among adolescents (Ahmed et al., 2013) or college students (Pekrun, Elliot, & Maier, 2009) and generally has not examined longitudinal changes.

Overall, expression of negative emotion typically declined from K to G1, consistent with prior research on parent-reported or teacher-reported negative emotionality (Sallquist et al., 2009; Yew & O'Kearney, 2015). Thus, despite the challenges of entering formal schooling, the expression of negative emotion, even at school, declined. It is likely that part of the reason for this decline is the increase in the ability to regulate emotion across this age (Murphy et al., 1999; Sawyer et al., 2015) and children's increased adaptation to school (Sawyer et al., 2015), which might reduce the frequency of negative emotion in children. Importantly, there was significant individual variability for both the intercept and growth of negative emotion. The level and growth of negative emotions expressed in class predicted different aspects of academic adjustment.

Negative Emotional Expression Predicts Academic Outcomes

Although children expressed relatively low levels of negative expressions across time (the average scores across waves were less than .06 on a scale from 0 to 3), the individual differences observed were significant and predicted academic functioning. We found main effects of negative emotional expressivity on observed school engagement. Consistent with earlier research on emotional expressivity (Denham et al., 2012; Trentacosta & Izard, 2007; Valiente, Swanson, & Eisenberg, 2012), both level (in the spring of K) of negative expressivity and its growth were associated with lower engagement in academic tasks. In addition, the negative expressivity slope was associated with lower passage comprehension achievement in

G1. Negative emotional expression may tax attention in the classroom and, as a result, meeting the demands of academic tasks may be more difficult (Rothbart & Jones, 1998).

Level of negative expressivity in K was negatively associated with academic skills, reported by teachers, similar to prior research on negative emotionality and school outcomes (e.g., Denham et al., 2012; Gumora & Arsenio, 2002; Trentacosta & Izard, 2007). However, negative emotional expressivity trajectories were not associated with academic skills in G1. It is possible that predicting academic skills in G1 might be more difficult than predicting engagement given that academic skills in K were already a strong predictor (as reflected by a relatively high regression coefficient in Model 3). The development of academic skills is possibly more incremental than the development of engagement and based on a prior academic knowledge base. Thus, individual differences in levels in the spring of K, rather than trajectories, of negative expressivity may be most predictive of declines in academic skills, suggesting the importance of children's emotional adjustment to kindergarten for academic experiences and skill development. It is possible that change in negative expressivity relates to only certain academic functioning measures or instead relate at different grade ranges.

Research suggests that children who exhibit higher levels of negativity tend to have lower regulatory capacities (Eisenberg et al., 2010) and more difficulties with social relationships (e.g., Ladd, Birch, & Buhs, 1999; Stuhlman & Pianta, 2001; Valiente, Swanson, & Lemery-Chalfant, 2012). Thus, there are likely mediator variables not measured in this study that could help explain the mechanisms by which negative emotional expressivity trajectories related to lower engagement or passage comprehension in G1. For example, children who exhibit more negative emotional expression over time could have more difficult social interactions in school and, as a result, the social environment may be less than optimal for learning for these children (Valiente

et al., 2011). Also, children's expressive tendencies could be shaped by early relationship experiences with peers and teachers in school (Fabes et al., 2001) and future research could consider possible indirect pathways to academic outcomes from early relationship experiences. Children who have difficulty forming and maintaining positive social relationships may have fewer opportunities to develop emotion regulation abilities, leading to more frequent unregulated negative expression in school and increasing emotional burden to a level that may be unproductive for learning.

Prior Academic Functioning as a Moderator

We found that prior academic functioning in kindergarten moderated the association between individual differences in negative expressivity across time (but not its intercept) and academic functioning in G1. That is, there were conditional associations between negative emotional expressivity and school engagement or passage comprehension in G1, depending on children's school engagement or passage comprehension in kindergarten. Specifically, among children who had lower school engagement or passage comprehension in kindergarten, compared to those with higher school engagement or passage comprehension, the negative association between the trajectory of their negative expressivity and later academic outcomes was significant. However, among children who had higher school engagement or passage comprehension in kindergarten, there was no association between children's negative expressivity trajectories and their later school engagement or passage comprehension, respectively. These findings support the hypothesis that the association between negative emotional expressivity trajectories and later academic adjustment is most pronounced for children who show greater initial academic risk. Decreasing negative emotional expression may be a resilience-promoting process among children with low levels of school engagement or

passage comprehension in K as they transition into G1.

Study Strengths, Limitations, and Future Directions

The present study utilized a range of measures, including standardized assessments, observed emotion and school engagement, and teachers' reports, to reduce shared method variance bias. The present study extends earlier research by examining how both levels and trajectories of emotional expressivity observed in the classroom predict academic adjustment. Furthermore, we controlled for prior levels of academic adjustment and key background variables, including school fixed-effects. Thus, the study findings were present even when controlling for earlier levels of the academic variables and background characteristics. Given multiple assessments across time, a considerable methodological strength of the current study is that we were able to examine individual differences in the emotion expression trajectories of children. Examining the associations between overall trajectories of negative emotion and academic outcomes has been rarely performed in studies of children (Ahmed et al., 2013). Also, study participants were from diverse ethnic and socioeconomic backgrounds, extending the generalizability of study results to some degree.

Some study limitations are the inclusion of only a few academic outcome measures. Future research may consider a wider range of academic measures. For example, other measures of academics (e.g., peer collaboration during academic tasks, cognitive strategy flexibility) may offer more detail about the processes by which negative emotional expressivity trajectories relate to academic outcomes across time. Furthermore, we presented results for one vocabulary-focused standardized assessment of academic achievement (i.e., passage comprehension). In supplementary analyses, we examined a standardized mathematics measure (i.e., applied problems) and the results were not significant; that is, negative emotional expressivity levels and

trajectories both did not significantly predict applied problem scores in G1 (similar to null findings from Sawyer et al. (2015) on emotion regulation and math achievement). Future research may untangle associations across school subjects and under what conditions emotionality relates to various academic outcomes across childhood. Another study limitation is that, given the study variables' assessment times, we were unable to describe possible transactional associations between negative emotional expressivity and the academic variables of interest. For example, examining possible trajectories in the academic variables of interest would have required at least three time points of measurement, which was not available in this study. Additionally, one theorized process for why negative emotions predict academics is via working memory and attention (Fartoukh et al., 2014; Garner, 2010; Gray et al., 2002), and future research could investigate this more closely within experimental and developmental frameworks.

In terms of modeling the longitudinal distributions of negative emotion observed in school, we averaged the observations by semester to capture more stable predispositions for expressing negative emotion within a school term. A potential limitation of modeling negative emotion by semester is that within-semester variability in the child's typical emotion states, a potentially informative aspect of negative emotion, was not modeled explicitly. Alternative ways of modeling the data, such as averaging observed emotion per week, would have resulted in a less steady representation of negative emotion in school but could be examined in future research designed to model more fluctuating representations of emotion.

Research examining the association between negative emotions and social adjustment usually has been based on parent- or teacher-report measures (e.g., Spinrad et al., 2004; Valiente, Swanson, & Lemery-Chalfant, 2012; Yew & O'Kearney, 2015), lab observations (e.g., Olino et al., 2011), or naturalistic observations of emotional expression (e.g., Denham et al., 2012; Fabes

et al., 2001; Spinrad et al., 2004). In the present study, we were interested in how naturalistic observations of negative emotional expressivity specifically in the classroom, which is a salient learning environment, changed across time and varied across children from K to G1. However, one important future question is how negative emotional expressivity relates across contexts (e.g., within school) and between school and home contexts. We would expect measures of expressivity to be at least moderately related across different sources and contexts given underlying temperamental foundations (Howse et al., 2003; Rothbart & Jones, 1998). However, there is some preliminary evidence that emotional expressivity in different contexts uniquely predicts different measures of social relationships in school (Hernández et al., 2016). Thus, future research could investigate the extent to which measures of emotional expressivity predict social relationships in school as they relate to academic adjustment across development.

The current study adds to growing research on the links between emotion and academic functioning (Pekrun & Linnenbrink-Garcia, 2014) and on the potential for school readiness initiatives that consider emotional development (albeit experimental research in this area is needed to evaluate the feasibility of intervention effectiveness). Future research may consider whether and how interventions could foster both regulation of negative emotional expressivity and academic development simultaneously, as suggested by Pekrun (2006), particularly for children who are at higher risk of emotional and academic difficulties (Denham et al., 2014; Schonfeld et al., 2015). Furthermore, providing adequate instructional opportunities (La Paro et al., 2006) and emotional support to students (Frenzel, Goetz, Lüdtke, Pekrun, & Sutton, 2009) may help promote a positive classroom climate conducive for children's adjustment to the early school years.

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Table 1

Descriptive Statistics and Correlations among Study Variables (N = 301)

	Variable	Source	Time	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*
1.	Negative emotional expressivity	Observer	Fall K	---													
2.	Negative emotional expressivity	Observer	Spring K	.42***	---												
3.	Negative emotional expressivity	Observer	Fall G1	.23***	.41***	---											
4.	Negative emotional expressivity	Observer	Spring G1	.17**	.24***	.46***	---										
5.	Passage comprehension	WJ	Spring K	-.17**	-.10^{+}	-.07	-.01	---									
6.	Passage comprehension	WJ	Spring G1	-.08	.04	-.03	-.05	.62***	---								
7.	School engagement	Observer	Fall K	-.36***	-.40***	-.19**	-.11^{+}	.18**	.17**	---							
8.	School engagement	Observer	Spring G1	-.09	-.14*	-.12^{+}	-.30***	-.11^{+}	.28***	.33***	---						
9.	Academic skills	Teacher	Spring K	-.03	-.01	-.02	.01	.63***	.66***	.20***	.11^{+}	---					
10.	Academic skills	Teacher	Spring G1	-.11	-.05	-.06	-.07	.59***	.68***	.22***	.21**	.65***	---				
11.	Maternal education	Parent	Fall K	-.04	.00	.00	-.02	.40***	.41***	.08	.11^{+}	.27***	.32***	---			
12.	Ethnic minority	Parent	Fall K	-.04	-.05	-.06	-.23***	-.17**	-.23***	-.08	-.03	-.13*	-.08	-.26***	---		
13.	Male	Parent	Fall K	-.08	-.16**	-.02	-.03	.03	.01	-.03	-.18**	.09	.06	.08	-.07	---	
14.	Age	Parent	Fall K	-.09	-.05	.03	-.03	.02	-.09	.08	-.02	.05	-.04	-.09	.10^{+}	.12*	---
	M			0.06	0.05	0.04	0.03	428.53	464.67	2.78	2.70	3.05	3.07	2.99	0.64	0.49	5.48
	SD			0.08	0.06	0.05	0.04	20.96	18.47	0.18	0.22	0.82	0.84	1.02	0.48	0.50	0.35
	% available data			100%	98%	85%	85%	96%	83%	100%	85%	95%	78%	98%	94%	100%	99%

Note. Male (1 = *boy*; 0 = *girl*); Ethnic minority (1 = *ethnic minority* 0 = *non-Hispanic white*); WJ = Woodcock-Johnson assessment; K = kindergarten; G1 = first grade.

$^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table 2
Negative Emotional Expressivity in Class: Growth Model Fit Comparisons

		CFI*	TLI*	AIC	BIC	RMSEA	χ^2	df	*p*	χ^2 test
1.	No growth	0.751	0.626	-3209.519	-3187.277	.110 [.076, .147]	37.394	8	.000	
2.	Linear	1.002	1.006	-3267.569	-3234.205	.000 [.000, .078]	4.716	5	.452	1 vs **2**, 35.16 (3) ***
3.	Quadratic	1.008	1.101	-3269.295	-3221.103	.000 [.000, .000]	0.004	1	.951	**2** vs 3, 4.49 (4), *ns*

Note: CFI = Confirmatory Fit Index, TLI =Tucker Lewis Index, AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion, RMSEA = Root Mean Square Estimate of Approximation, χ^2 test is based on the Satorra-Bentler scaled correction. The unconditional no growth model assumes a flat trajectory (i.e., 0, 0, 0, 0 at Waves 1, 2, 3, and 4). The unconditional linear growth model assumes a linear trajectory (i.e., -1, 0, 1, 2). The unconditional quadratic curvilinear growth model assumes a quadratic trajectory (i.e., 1, 0, 1, 4). CFI* and TLI* are corrected for longitudinal data.
*** $p < .001$.

Table 3

Unconditional Linear Growth Model: Negative Emotional Expressivity in the Classroom

Parameter	*Estimate*	*S.E.*	*Variance*	*S.E.*
Intercept at spring of kindergarten	0.0511	0.0040 ***	0.0016	0.0004 ***
Linear slope	-0.0081	0.0025 ***	0.0003	0.0001 ***
Covariance between intercept and slope	-0.0004	0.0002 *		
Level-1 Residual Variance				
Negative Emotional Expressivity at Wave 1	0.004	0.002 *		
Negative Emotional Expressivity at Wave 2	0.002	0.010 ***		
Negative Emotional Expressivity at Wave 3	0.002	0.000 ***		
Negative Emotional Expressivity at Wave 4	0.001	0.000 *		

Note. Estimates calculated using maximum likelihood with robust standard errors.
* $p < .05$, *** $p < .001$.

Table 4

Maximum Likelihood Estimates of Linear Growth Effects of Negative Emotion on Academic Outcomes in First Grade

	Model 1a. School Engagement Main Effects Model		Model 1b. School Engagement Moderation Model		Model 2a. Academic Skills Main Effects Model		Model 2b. Academic Skills Moderation Model		Model 3a. WJ Passage Comprehension Main Effects Model		Model 3b. WJ Passage Comprehension Moderation Model	
Parameter	*Estimate*	*S.E.*	*Estimate*	*S.E.*	*Estimate*	*S.E.*	*Estimate*	*S.E.*	*Estimate*	*S.E.*	*Estimate*	*S.E.*
Primary Linear Growth Estimates:												
Negative emotion intercept (b_1)	- 1.822 **	0.692	- 2.010 **	0.634	- 3.149 *	1.344	- 3.049 *	1.352	- 28.394	22.984	- 30.050	20.450
Negative emotion linear slope (b_2)	- 4.718 *	2.008	- 4.683 *	1.894	- 2.522	3.328	- 2.914	3.354	- 147.867 †	78.673	- 155.733	105.017
Prior level of academic outcome (b_3)	0.436 **	0.158	0.578 **	0.210	0.677 ***	0.067	0.666 ***	0.078	0.456 ***	0.043	0.500 ***	0.055
Slope * prior level of outcome (b_{23})	---	---	12.618 †	6.728	---	---	- 2.684	5.197	---	---	7.362 **	2.624
Covariates:												
Maternal education	- 0.002	0.015	0.006	0.013	0.102 *	0.046	0.103 *	0.047	1.474	0.906	1.243	1.105
Ethnic minority	- 0.034	0.021	- 0.039 †	0.022	0.097	0.067	0.094	0.069	- 3.869 **	1.379	- 3.927 *	1.539
Male	- 0.079 ***	0.025	- 0.088 ***	0.026	- 0.008	0.076	- 0.011	0.078	- 0.647	1.316	- 0.488	1.320
Age	0.004	0.036	- 0.014	0.037	- 0.062	0.119	- 0.052	0.119	- 2.798	2.396	- 3.168	2.276
Variance estimates:												
Negative emotion intercept	0.002 ***	0.000	0.002 ***	0.000	0.001 ***	0.000	0.001 ***	0.000	0.001 ***	0.000	0.001 ***	0.000
Negative emotion linear slope	0.000 ***	0.000	0.000 ***	0.000	0.000 ***	0.000	0.000 ***	0.000	0.000 ***	0.000	0.000 ***	0.000
Covariance: intercept and slope	0.000 *	0.000	0.000 *	0.000	0.000 *	0.000	0.000 *	0.000	0.000 *	0.000	0.000 *	0.000
Negative emotion at wave 1	0.004 *	0.002	0.004 *	0.002	0.004 *	0.002	0.004 *	0.002	0.004 *	0.002	0.004 *	0.002
Negative emotion at wave 2	0.002 ***	0.000	0.002 ***	0.000	0.002 ***	0.001	0.002 ***	0.001	0.002 ***	0.001	0.002 ***	0.001
Negative emotion at wave 3	0.002 ***	0.000	0.002 ***	0.000	0.002 ***	0.000	0.002 ***	0.000	0.002 ***	0.000	0.002 ***	0.000
Negative emotion at wave 4	0.000 *	0.000	0.000 †	0.000	0.001 **	0.000	0.001 **	0.000	0.001 *	0.000	0.001 *	0.000
Model Fit: χ^2	25.234		---		25.333		---		27.213		---	
df	25		---		25		---		25		---	
χ^2 *p*-value	.449		---		.444		---		.345		---	
CFI*	1.000		---		.999		---		.997		---	
TLI*	.999		---		.998		---		.989		---	
RMSEA	.006		---		.007		---		.017		---	

Note. Negative emotion expressivity was modeled with a linear function, allowing for individual differences in the level at intercept (spring, kindergarten) and the linear change rate. Estimates calculated using maximum likelihood with robust standard errors. In latent moderated analyses, typical fit indices are not available. WJ = Woodcock Johnson test. CFI* and TLI* are corrected for longitudinal data.

† $p \leq .10$, * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

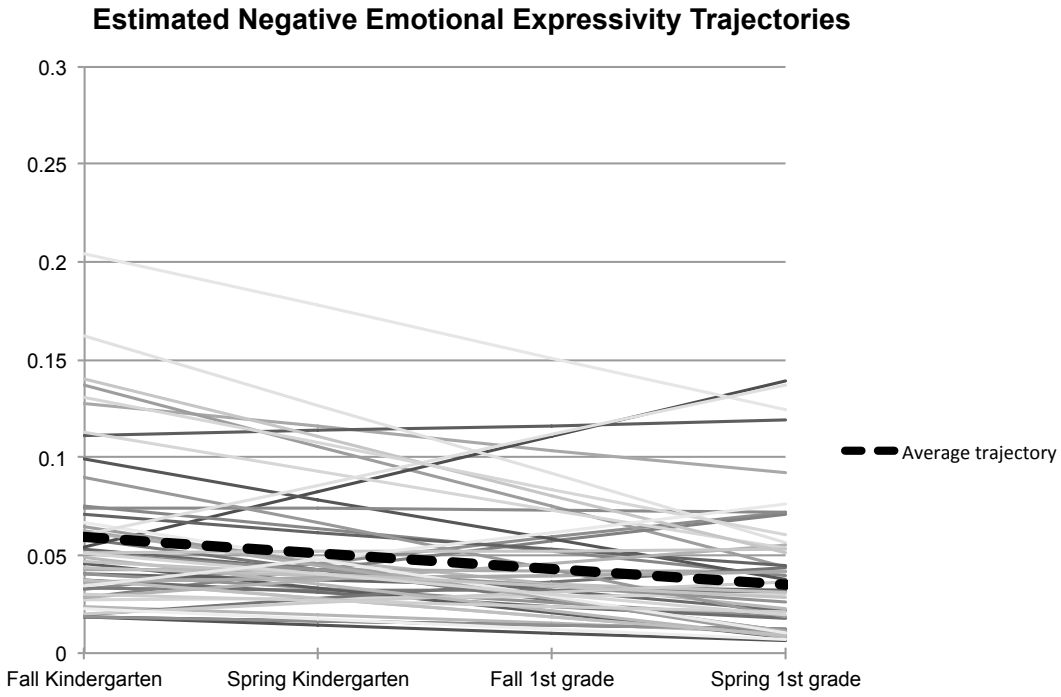


Figure 1. Estimated trajectories of negative emotional expressivity for a random sample of 50 children. The estimated intercept was centered at the spring of kindergarten. The solid thin lines represent individual estimated trajectories and the bold dashed line represents the average estimated trajectory across individuals (*b* = -.008).

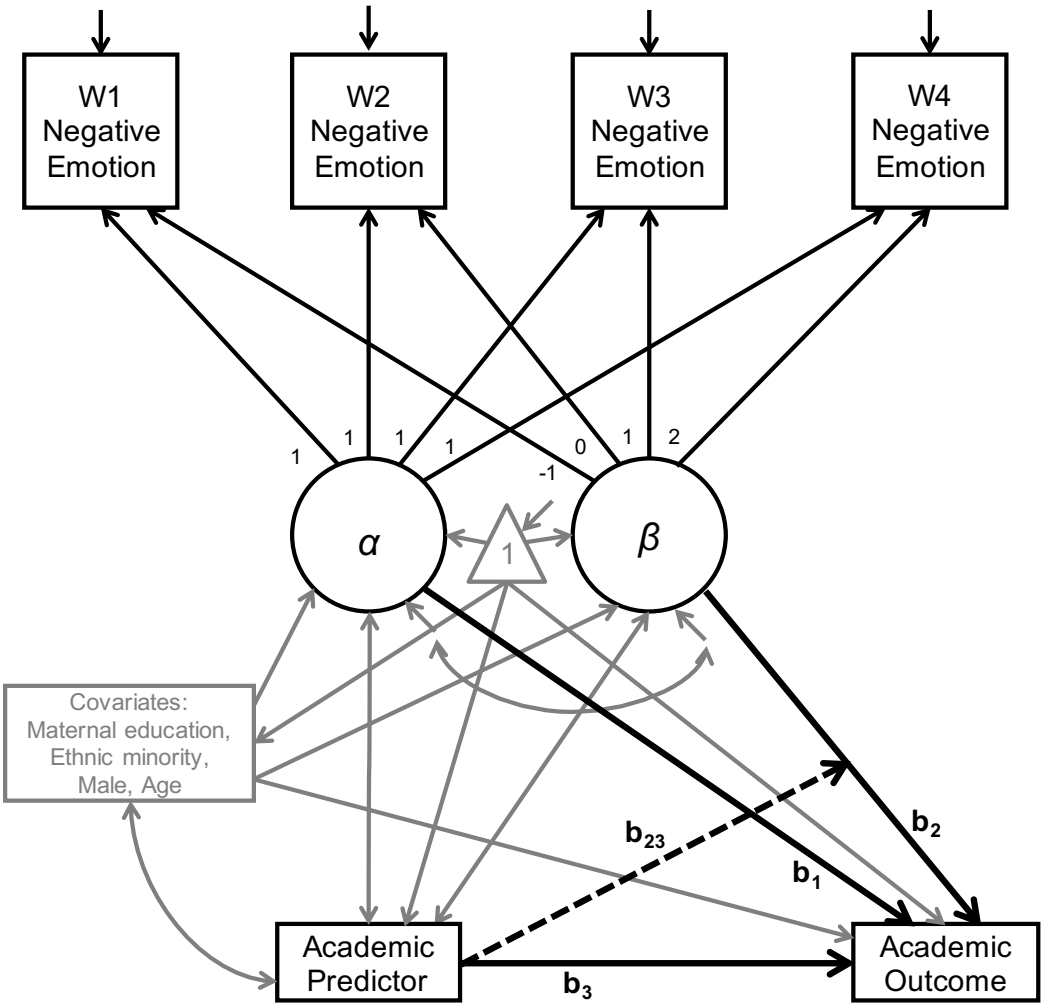
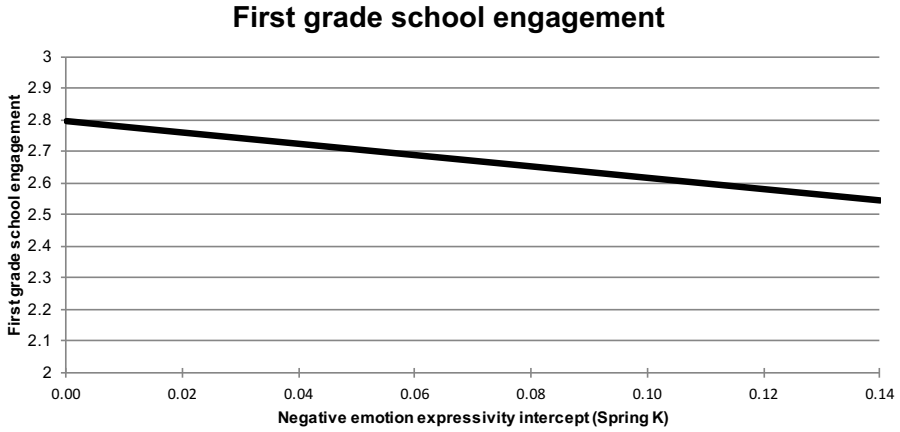


Figure 2. Latent growth model of negative emotional expressivity across Waves 1 (W1; fall, kindergarten), 2 (W2; spring, kindergarten), 3 (W3; fall, first grade), and 4 (W4; spring, first grade) and associations with academic variables (i.e., school engagement, academic skills, or passage comprehension). α = intercept of negative emotional expressivity at Wave 2; β = average growth of negative emotional expressivity from Waves 1 to 4. The dashed line, only specified in the latent interaction models, represents the latent interaction between growth of negative emotional expressivity and prior academic level predicting the academic outcome (e.g., school engagement, academic skills, passage comprehension) at Wave 4.

A.



B.

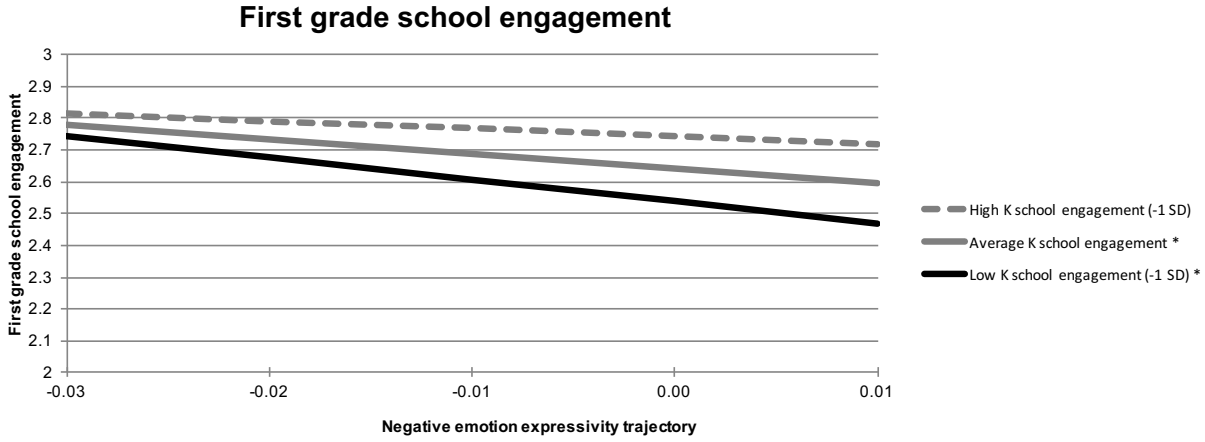


Figure 3. (A) Model 1A, Negative emotional expressivity intercept predicting school engagement. (B) Model 1B, Negative emotional expressivity trajectory (slope) predicting school engagement in first grade, at varying levels of school engagement in kindergarten. Dashed lines represent non-significant paths. Covariates included school fixed-effects, maternal education, ethnic minority (versus non-Hispanic white), male (versus female), and age.

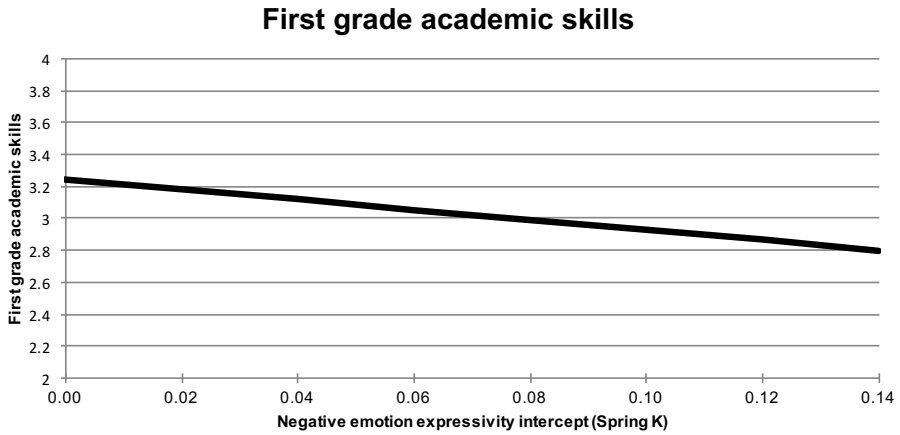


Figure 4. Results based on Model 2a. Negative emotional expressivity intercept predicting academic skills. Covariates included school fixed-effects, maternal education, ethnic minority (versus non-Hispanic white), male (versus female), and age.

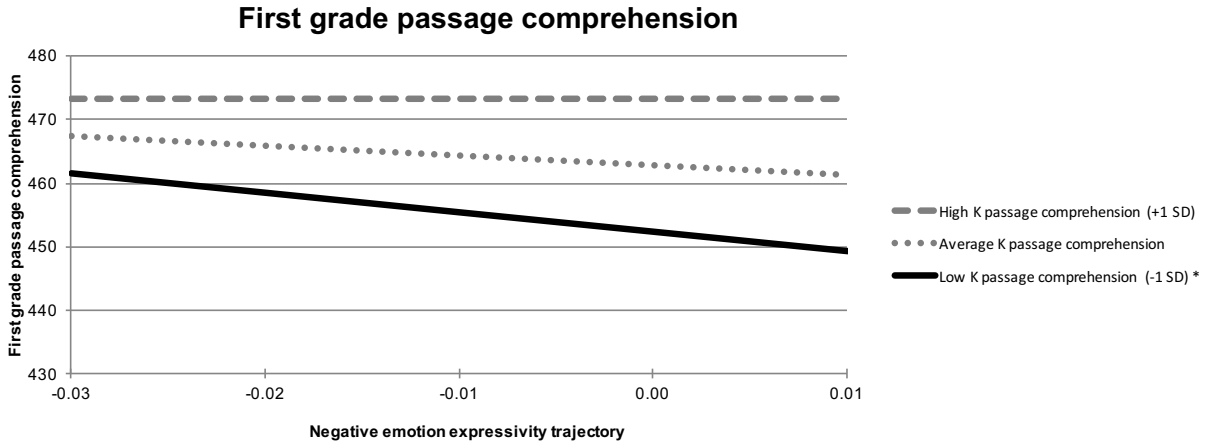


Figure 5. Results based on Model 3b. Negative emotional expressivity trajectory (slope) predicting passage comprehension in first grade, at varying levels of passage comprehension in kindergarten. Dashed lines represent non-significant paths. Covariates included school fixed-effects, maternal education, ethnic minority (versus non-Hispanic white), male (versus female), and age.

Supplementary Material

Additional Centering Analyses

For all analyses presented in Table 4, we centered the intercept factor in the spring of K because this is when most of the academic variable predictors were assessed (e.g., passage comprehension was assessed in the spring of K). We also examined how centering the intercept at different time points may have yielded different results for the effects of interest. For the academic skills and passage comprehension models, the effects when the intercept was centered at the fall of K, fall of G1, and spring of G1 were the same as when the intercept was centered in the spring of K. Thus, the results were the same for the academic skills and passage comprehension models regardless of where the intercept was centered. For school engagement, when the intercept was centered in the fall of K, the negative emotion slope similarly predicted school engagement. When the intercept was centered in the fall or spring of G1, the negative emotion slope did not significantly predict school engagement in the main effects model. The interaction effects, however, remained significant when the intercept was centered in the fall or spring of G1.