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The Specificity of Parenting Effects: Differential Relations of Parent Praise and Criticism to Children's Theories of Intelligence and Learning Goals

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Abstract

Individuals who believe that intelligence can be improved with effort (an *incremental theory of intelligence*) and who approach challenges with the goal of improving their understanding (a *learning goal*) tend to have higher academic achievement. Further, parent praise is associated with children's incremental theories and learning goals. However, the influences of parental criticism, as well as different forms of praise and criticism (e.g., process vs. person), have received less attention. We examine these associations by analyzing two existing datasets (Study 1: $N = 317$ 1st- to 8th-graders, Study 2: $N = 282$ 5th- and 8th-graders). In both studies, older children held more incremental theories of intelligence, but lower learning goals, than younger children. Unexpectedly, the relation between theories of intelligence and learning goals was non-significant, and did not vary with children's grade level. In both studies, overall perceived parent praise positively related to children's learning goals, whereas perceived parent criticism negatively related to incremental theories of intelligence. In Study 2, perceived parent *process praise* was the only significant (positive) predictor of children's learning goals, whereas perceived parent *person criticism* was the only significant (negative) predictor of incremental theories of intelligence. Finally, Study 2 provided some support for our hypothesis that age-related differences in perceived parent praise and criticism could explain age-related differences in children's learning goals. Results suggest that incremental theories of intelligence and learning goals may not be strongly related in childhood, and that perceived parent praise and criticism have important, but distinct, relations with each motivational construct.

Keywords

Theories of intelligence; learning goals; parent praise; parent criticism; feedback; parenting

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Beliefs about intelligence and goal orientations related to academic performance are thought to form coherent "motivational frameworks" that influence academic success (e.g., Dweck & Leggett, 1988; Gunderson et al., 2013; Gunderson, Sorhagen, et al., 2017). Implicit *theories of intelligence* (Dweck, 2006) fall onto a spectrum ranging from a strong belief that intelligence is fixed and unchangeable (an *entity theory*), to a strong belief that intelligence is malleable and can be improved with effort (an *incremental theory*). Incremental theories of intelligence lead to more adaptive approaches to academics, including persistence in the face of challenges, enjoyment of difficult tasks, and higher grades in school (e.g., Aronson, Fried, & Good, 2002; Blackwell, Trzesniewski, & Dweck, 2007; Yeager et al., 2016). Entity theories, on the other hand, are associated with maladaptive responses, including avoiding challenging tasks and lying to inflate one's score on a test (Mueller & Dweck, 1998). Similarly, goal orientation theory has identified two major motivational goals that students adopt: *learning goals*, which focus on improving mastery and competence, often for intrinsic enjoyment, and *performance goals*, which focus on proving competence to others and avoiding the appearance of having low ability (e.g., E. M. Anderman & Midgley, 1997; Elliott & Dweck, 1988; Nicholls, 1984). Learning goals lead to higher intrinsic motivation, persistence after failure, and higher academic achievement (e.g., Elliott & Dweck, 1988; Grant & Dweck, 2003). In contrast, performance goals lead to lower intrinsic motivation, lower self-worth and less effort after failure, and ultimately, lower academic achievement.

Traditionally, researchers have argued that incremental theories of intelligence lead to learning goals (e.g., Blackwell et al., 2007; Dweck & Leggett, 1988), but some studies have raised questions about whether this is true for young children (Pomerantz & Saxon, 2001). In the present studies, we investigate age differences in theories of intelligence and learning goals, as well as perceived parent praise and criticism among 1st to 8th graders with three overarching goals: 1) to understand age-related differences in incremental theories of intelligence and learning goals, and their relation to each other, 2) to investigate how each construct is related to parents' praise and criticism, and 3) to determine whether age-related differences in parent praise and criticism can help explain age-related differences in theories of intelligence and learning goals. Understanding how praise and criticism are associated with young children's academic motivation has substantial practical implications for parents and other caregivers who seek to provide academic feedback that will enhance children's motivation and achievement.

Our approach draws on multiple theoretical perspectives on motivation, including Dweck and colleagues' social-cognitive theory of motivation integrated with attribution theory (Dweck & Leggett, 1988; Hong, Chiu, Dweck, Lin, & Wan, 1999) and cognitive evaluation theory (a sub-theory of self-determination theory) (Deci & Ryan, 1980). We also draw on expectancy-value theory, especially when considering parents as socializers (Wigfield & Eccles, 2000). All three theoretical perspectives have substantial empirical support. Thus, we make our specific predictions in cases when these theories and prior research align, as described below. In cases where these theories are in tension with one another, or do not make clear predictions, we present exploratory hypotheses that rely on additional assumptions.

Age Differences in Theories of Intelligence

A substantial body of research on age differences in conceptions of intelligence has concluded that older children are more likely than younger children to view intelligence as stable over time and situations (for a review, see Stipek & Mac Iver, 1989). However, the belief that intelligence is stable over time and situations is distinct from the belief that intelligence is internally controllable (Pomerantz & Saxon, 2001). In a cross-sequential study of 4th-6th-graders, older children were more likely than younger children to view intelligence as internally controllable – i.e., to hold an incremental theory of intelligence (Pomerantz & Saxon, 2001). Pomerantz and Saxon (2001) theorized that the age-related increase in the belief that intelligence is controllable stems from children's experiences, and that as most children transition through elementary school, they increasingly acquire evidence that their ability is contingent on their own actions. An alternative explanation, that we return to in the Discussion, is that this increase reflects a more general reduction in essentialism and categorical rigidity with age (Heyman & Gelman, 2000).

Indeed, although there are few studies focusing on age-related differences in entity and incremental theories of intelligence (i.e., degree of internal controllability of intelligence), and most involve restricted age ranges, they typically find age-related increases in incremental theories in the 1st to 8th grade range. For example, one study found that 5th & 6th-graders had higher levels of incremental theories than 1st & 2nd-graders (Gunderson, Hamdan, Sorhagen, & D'Esterre, 2017). Others showed that entity beliefs declined from 3rd to 6th grades (Haimovitz, Wormington, & Corpus, 2011; Pomerantz & Saxon, 2001; Stipek & Gralinski, 1996) and incremental theories increased from 5th to 6th grades (Gonida, Kiosseoglou, & Leondari, 2006). To our knowledge, the present study is the first to examine age differences in theories of intelligence from 1st to 8th grades using a consistent method across ages. Based on previous research, we predict that theories of intelligence will become more incremental across this age range.

Age Differences in Learning Goals

If learning goals are part of the same motivational framework as incremental theories of intelligence, we might expect to find similar age-related differences, i.e., that older students have higher learning goals. However, theoretical considerations and empirical evidence suggest that learning goals decline across elementary and middle school. Expectancy-value theory has identified age-related differences in children's school environments (e.g., a stronger focus on performance at older ages) that lead to a reduction in intrinsic motivation and self-concept over time (Eccles, Midgley, & Adler, 1984). Supporting this, a large body of work reports that learning goals decrease with age starting in late elementary school and beyond (e.g., L. H. Anderman & Anderman, 1999; Gonida & Cortina, 2014; Midgley, Anderman, & Hicks, 1995).

However, it is less clear whether this decline in learning goals begins at the transition to middle school, or earlier. We suggest this decline should depend on when the school (and possibly home) environment begins to emphasize performance. Accordingly, we predict that it will occur gradually across the elementary and middle school years, and may be reflected

in the home environment as well as the school, as parents begin to focus more on their child's academic performance and become more critical. A reduction in praise and an increase in criticism from parents and teachers may reduce children's learning goals over time, especially at the transition from late elementary to middle school. Although evidence specifically examining age differences in learning goals is sparse in early elementary school, academic motivation and optimism decline over the course of elementary school (Freedman-Doan et al., 2000; Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002). Based on these theoretical and empirical considerations, our second main hypothesis is that older children will have lower learning goals than younger children.

Relation Between Theories of Intelligence and Learning Goals

According to Dweck and colleagues' attribution/social-cognitive theory of motivation, theories of intelligence form the conceptual framework through which individuals interpret achievement-related events; individuals' achievement-related emotions, attributions, goals, and behaviors flow from this conceptual framework (Dweck & Leggett, 1988; Elliott & Dweck, 1988). In this model, incremental theories of intelligence lead directly to learning goals, and correlational studies (e.g., Blackwell et al., 2007; Robins & Pals, 2002), a meta-analysis (meta-analytic correlation = 0.19) (Burnette, O'Boyle, VanEpps, Pollack, & Finkel, 2013), and experimental evidence support this prediction (Dinger & Dickhäuser, 2013). However, the limited findings in children are inconsistent: one study found the expected correlation among 2nd and 3rd-graders (Schwinger, Steinmayr, & Spinath, 2016), but a longitudinal study with 4th-6th-graders found that higher learning goals predicted lower entity theories over time, not the other way around, as has been found in adults (Pomerantz & Saxon, 2001).

Given the mixed evidence, we conduct an exploratory analysis with the expectation that the relation between incremental theories and learning goals will be stronger at older than younger ages. Students' conceptions of academic performance may not yet be stable in 1st and 2nd grades, when children first enter formal schooling (Eccles et al., 1984; Wigfield et al., 1997). With each additional year, students have more opportunities to integrate information about their performance, effort, and ability from their experiences and from socializers including parents, teachers, and peers (Eccles et al., 1984). Relatedly, prior work based on expectancy-value theory has found that components of motivation (competency beliefs, task values, and interest) are more strongly inter-related in late elementary school than early elementary school (Wigfield et al., 1997).

Parent Praise and Criticism

Expectancy-value theory emphasizes that parents are important socializers whose attitudes and behaviors are consistently related to their children's motivation (e.g., Frome & Eccles, 1998). Indeed, substantial evidence shows that parents' expectations and beliefs about their children's success impact children's motivation and achievement (Wigfield et al., 2015). However, this research has not typically focused on specific parental behaviors, such as praise and criticism. Here, we draw on two theoretical perspectives that focus on praise and

criticism, and integrate and extend these models to make predictions about the role of parents' praise and criticism in children's motivation.

Praise

First, according to cognitive evaluation theory (CET), the needs for self-determination and competence lead to intrinsic motivation; further, positive feedback (praise) in a context of self-determination always leads to higher intrinsic motivation (Deci & Ryan, 1980). Learning goals and intrinsic motivation are deeply related as both involve the desire to learn for its own sake (Grant & Dweck, 2003; Schwinger et al., 2016), and we believe that CET's predictions about intrinsic motivation can be extended to learning goals. In most contexts, CET predicts positive effects of praise on intrinsic motivation, and by extension, learning goals (Cameron, Banko, & Pierce, 2001; Henderlong & Lepper, 2002; Kelley, Brownell, & Campbell, 2000; Schwinger et al., 2016).

Second, according to attribution/social-cognitive theory of motivation (Hong et al., 1999), different types of praise communicate different success attributions and values, which directly affect children's theories of intelligence. Specifically, process praise, which attributes success to effort (e.g., "You must have worked hard at these problems"), or directly praises a child's effort, actions, or strategies (e.g., "You did a good job drawing"), leads students to adopt the belief that their effort can change their ability (an incremental theory) and to adopt stronger learning goals; experimental and longitudinal studies support these effects (Cimpian, Arce, Markman, & Dweck, 2007; Gunderson et al., 2013; Mueller & Dweck, 1998; Zentall & Morris, 2010). In contrast, person praise (praise that attributes success to a fixed trait, e.g., "You must be smart at these problems" or uses generic language to label a child as having a positive trait, e.g., "You are a good drawer") encourages children to view their intelligence as fixed and uncontrollable (an entity theory) (Cimpian et al., 2007; Mueller & Dweck, 1998; Pomerantz & Kempner, 2013; Zentall & Morris, 2010).

Using these theories and empirical findings, we make predictions about the effects of parent praise. Both CET and attribution/social-cognitive theory are aligned in strongly predicting positive effects of process praise on learning goals and incremental theories (Gunderson et al., 2013), and we expect to find these relations in the present studies. For person praise, however, the prediction is not so straightforward. Attribution/social-cognitive theory predicts negative effects of person praise on incremental theories and learning goals in some contexts (i.e., after failure), but positive or neutral effects in others (i.e., after success). CET suggests that any kind of praise – including person praise – can increase intrinsic motivation (and thus, we expect, learning goals) if it is provided in a self-determined context. Given the potentially conflicting effects of person praise in different situations and on different motivational processes, we did not expect a strong association between parents' person praise and learning goals or incremental theories.

Next, we consider the effects of overall amount of praise on children's theories of intelligence. According to attribution/social-cognitive theory, the impact of praise on theories of intelligence depends on the type of praise. In the real world, children receive a mix of person and process praise from their parents (Gunderson et al., 2013). Thus, our exploratory hypothesis is that the positive effects of person praise may counteract the

negative effects of process praise, thereby generating a weak (or no) overall association between praise and children's theories of intelligence. Consistent with this, parents' overall amount of praise to their toddlers in an observational study was unrelated to children's motivational frameworks 5 years later (Gunderson et al., 2013).

Finally, we consider the effects of overall praise on learning goals. As noted previously, CET predicts positive effects of praise on learning goals, and attribution/social-cognitive theory also predicts positive effects of praise on learning goals in most situations (with only one exception – situations in which person praise is followed by a failure experience) (Mueller & Dweck, 1998). We suspect that situations in which person praise is followed by failure are likely a small portion of overall praise contexts, especially in elementary school (Pomerantz & Kempner, 2013). Thus, our exploratory hypothesis is that we will find an overall positive relation between parent praise and children's learning goals.

Criticism

The impact of criticism has received much less attention than praise. In fact, the association between parents' criticism and children's theories of intelligence and learning goals has never, to our knowledge, been tested. Nevertheless, we can again derive predictions from the literature. According to CET, negative feedback (criticism) leads to lower feelings of self-determined competence and therefore lower intrinsic motivation (and by extension, lower learning goals and, possibly, more entity-oriented theories of intelligence) (Deci & Ryan, 1980). Consistent with this, parents' criticism predicted high school students' concern over mistakes and higher performance-avoidance goals (Madjar, Voltsis, & Weinstock, 2015).

According to attribution/social-cognitive theory, criticism that attributes failure to lack of ability (person criticism) should be especially problematic because it encourages a maladaptive entity theory of intelligence. In contrast, process criticism, which attributes failure to lack of effort, may lead to more incremental theories. Consistent with this, after an experimenter gave 5-6-year-olds person-based criticism (e.g., "I'm very disappointed in you"), children showed substantially lower persistence and more negative affect – behaviors associated with a fixed theory of intelligence - than after process-based criticism (although this was not compared to no criticism) (Kamins & Dweck, 1999). Based on this alignment of multiple theories and evidence, one of our main hypotheses is that person criticism will relate to lower incremental theories of intelligence.

When considering the impact of overall criticism, we see that CET predicts that all forms of criticism should negatively impact motivation (especially learning goals, but possibly extending to theories of intelligence as well). Attribution theory predicts especially negative effects of person criticism on incremental theories, but less negative (or possibly positive) effects of process criticism on incremental theories. We speculate that process criticism may be a small percentage of overall criticism in parent-child interactions, and therefore, present a tentative hypothesis that overall parent criticism will negatively relate to both learning goals and incremental theories.

Mediation of Age-Related Differences

In addition to exploring whether parents' praise and criticism impact individual differences in children's theories of intelligence and learning goals, we also ask whether age-related differences in learning goals or theories of intelligence can be explained by age-related differences in parents' praise and criticism. To our knowledge, few studies have examined differences in parents' praise and criticism based on children's age. As noted previously, expectancy-value theorists have argued that school environments become more performance-oriented at older ages (Eccles et al., 1984), and children's perceptions of their parents as holding performance goals increase over the transition to middle school (Friedel, Cortina, Turner, & Midgley, 2010). We speculate that as parents receive increasingly realistic (sometimes negative) feedback from teachers about their child's academic performance, they may react with more criticism (and less praise) out of displeasure and/or in an effort to encourage their child to work harder. Thus, a major and unique prediction of the present research is that lower parent praise and higher parent criticism among older versus younger students can help explain lower learning goals among older versus younger students. However, given that we expect theories of intelligence to be more incremental among older students than younger ones (the opposite of our expectation for learning goals), we do not expect age-related differences in parent praise and criticism to explain age-related differences in theories of intelligence.

The Present Research

The present research aims to elucidate age differences in incremental theories of intelligence and learning goals over a broad age range. We also examine parent praise and criticism as a potential source of both *individual differences* and *age-related differences* in these two motivational constructs. We examine the relations of each motivational construct to overall perceived parent praise and criticism, as well as to person and process praise and criticism.

We adopt a secondary-data-analysis approach with two existing cross-sectional datasets. Each contains measures of all relevant variables (child theories of intelligence, child learning goals, perceived parent praise, perceived parent criticism) among children in the target age range (Study 1: 1st to 8th-graders; Study 2: 5th and 8th-graders). We note that Study 1 only included items assessing parents' overall praise and criticism, whereas Study 2 included items assessing ability (person) and effort (process) praise and criticism. Therefore, our main hypotheses relating to specific types of praise and criticism could only be tested in Study 2.

Each study used children's reports of their parents' praise and criticism. Prior research has shown that children's reports of their parents' behaviors are better predictors than parents' self-reports of children's outcomes on a variety of measures (e.g., Barry, Frick, & Grafeman, 2008; Haines, Neumark-Sztainer, Hannan, & Robinson-O'Brien, 2008). The datasets were collected in 1997–1999, prior to the broad public dissemination of research on theories of intelligence. This is beneficial in avoiding response biases associated with children's or parents' knowledge of research in this area; we discuss potential limitations in the Discussion.

To summarize, we tested five main hypotheses and four exploratory hypotheses derived from theory and prior research:

Main Hypotheses

1 Among older versus younger students, theories of intelligence will be more incremental and learning goals will be lower.

2 Parent process praise will positively relate to both learning goals and incremental theories of intelligence.

3 Parent person criticism will negatively relate to incremental theories of intelligence.

4 Lower parent process praise and higher parent person criticism among older versus younger students will partially account for lower learning goals among older versus younger students.

Exploratory Hypotheses

6 There will be a positive relation between incremental theories of intelligence and learning goals that is weaker among younger students and stronger among older students.

7 Overall parent praise will positively relate to children's learning goals.

8 Overall parent criticism will negatively relate to both learning goals and incremental theories of intelligence.

9 Lower parent overall praise and higher parent overall criticism among older versus younger students will partially account for lower learning goals among older versus younger students.

Study 1

Method

Participants—Participants were 1st-8th-graders (N = 317; M_{age} = 10.66, SD_{age} = 2.44; 177 girls) drawn from 31 classrooms from one school in a suburban area in Northern California. (See Appendix Table B.1 for details by grade level.)

Procedure—All students who received signed parental consent were invited to participate. Children completed all measures in a one-on-one session as part of a larger study of socio-emotional development and achievement during the 1997–1998 school year (REMOVED FOR BLIND REVIEW). Children completed the questions on a laptop with headphones while an animated wizard read each item. Items were intermixed across scales and presented in a single order. There was missing data only on the measure of perceived parent criticism (n = 4 missing). Path analyses were conducted using MPlus 7.11 (Muthén & Muthén, 1998–2012).

Measures—All items are listed in Appendix A.

Incremental theories of intelligence: Incremental theories of intelligence were assessed using three items on a scale from 1: Not at all true to 5: Very true, adapted from Dweck, Chiu, and Hong (1995). Reliability was ω = 0.68 (Dunn, Baguley, & Brunsden, 2014). Responses were reverse-coded, with higher scores indicating a stronger incremental theory.

Learning goals: Learning goals were assessed using three items on a scale from 1: Not true at all to 5: Very true (adapted from E. M. Anderman & Midgley, 1997; Midgley, Feldlaufer, & Eccles, 1989). Items assessed preference for challenge and persistence after failure (ω = 0.54). Higher scores indicated stronger learning goals.

Perceived parent praise: Perceived parent praise was assessed using a single item, "My parents often give me praise for doing well," rated from 1: Not true at all to 5: Very true.

Perceived parent criticism: Perceived parent criticism was assessed using a single item, "My parents sometimes criticize me for not doing well," rated from 1: Not true at all to 5: Very true.

Analytic plan—In order to reduce the potential for Type I error given the large number of hypotheses we test, we have set our alpha level to .01 for all analyses. To account for measurement error, we used latent variables to model theories of intelligence and learning goals. Mean scale scores are presented in Tables 2 and 3 only for descriptive purposes. Structural equation models (SEMs) and path analyses were conducted in Mplus 7.11 using full information maximum likelihood (FIML) estimation, which uses all available data to estimate model parameters (Muthén & Muthén, 1998–2012). In each study, Model 1 tested relations between grade level, learning goals, and theories of intelligence. Model 2 examined relations of overall parent praise and criticism to grade level, learning goals, and theories of intelligence. Model 3 (Study 2 only) tested the relations of person and process praise and criticism to grade level, learning goals, and theories of intelligence. Models 2 and 3 also modeled indirect relations of grade level to learning goals and theories of intelligence via parent praise and criticism.

Model fit was assessed using the root mean square error of approximation (RMSEA), values < 0.06 considered good fit; the comparative fit index (CFI), with values ≥ 0.95 indicating good fit (> 0.90 acceptable); Tucker-Lewis index (TLI) values and values ≥ 0.95 considered good (> 0.90 acceptable); and standardized root mean square residual (SRMR), values < 0.08 considered good (Hu & Bentler, 1999). Preliminary analyses established scalar invariance across grades (see Appendix C). Model fit statistics for all models are presented in Table 1.

Results

Descriptive statistics for all measures, as well as correlations with grade level, are presented in Table 2 (see Appendix Table B.2 for correlations). The correlation between grade level and incremental theories of intelligence ($r(315) = 0.39$, $p < .001$) significantly differed from the correlation between grade level and learning goals ($r(315) = -0.16$, $p = .004$; test of difference between dependent correlations, $t = 7.5$, $p < .001$) (Revelle, 2017).

Relations among theories of intelligence, learning goals, and grade level—We conducted a path analysis with grade level as a predictor of latent factors for theories of intelligence and learning goals (Figure 1, Model 1). Grade level was positively related to incremental theories intelligence, with an increase of one grade level associated with an increase of 0.20 standard deviations in theories of intelligence (SE = .02, p < .001). In contrast, an increase of one grade level was associated with 0.08 standard deviation lower learning goals (SE = .03, p = .010). Theories of intelligence and learning goals were not significantly related after accounting for grade level (correlation = −0.07, SE = 0.09, p = .433).

To examine the hypothesis that theories of intelligence would be more strongly related to learning goals at older than younger ages, we regressed learning goals on grade, theories of intelligence, and the grade × theories of intelligence interaction using the XWITH command for latent variable interactions in MPlus. The grade × theories of intelligence interaction was not significant, B = .06, SE = .04, p = .089. (Fit statistics are not available for this type of analysis.)

Role of perceived parent praise and criticism—To simultaneously assess our exploratory hypotheses regarding relations among overall parent praise, parent criticism, child learning goals, child theories of intelligence, and grade level, we conducted path analysis Model 2 (Figure 1). Consistent with Hypothesis 7, overall perceived parent praise was a significant positive predictor of learning goals (β = 0.31, SE = 0.07, p < .001) but not theories of intelligence (β = 0.02, SE = 0.06, p = .703). Partially consistent with Hypothesis 8, perceived parent criticism was a significant negative predictor of theories of intelligence (β = −0.18, SE = 0.06, p = .002), but not learning goals (β = −0.16, SE = 0.07, p = .024). Finally, contrary to Hypothesis 9, there was no significant relation between grade and perceived parent praise or perceived parent criticism, ps > 0.50. Such a relation is a prerequisite for mediation; therefore, Hypothesis 9 was not supported in this sample.

Study 2

In Study 1, among 1st- to 8th-graders, incremental theories of intelligence were higher whereas learning goals were lower among older versus younger children. Further, overall perceived parent criticism was associated with lower incremental theories of intelligence, whereas overall perceived parent praise was associated with higher learning goals. Study 2 extends Study 1 by including items assessing children's perceptions of their parents' praise and criticism of their effort and ability (rather than simply overall amount of praise and criticism). This allows us to test our hypotheses regarding the specific types of perceived praise and criticism.

The Study 2 dataset also differed from Study 1 in that it included only 5th and 8th graders (rather than 1st through 8th graders). This is because the Study 2 dataset was originally designed to capture the transition from elementary to middle school, which has been shown to be influential in the development of academic motivation (Blackwell et al., 2007; Wigfield, Eccles, Mac Iver, Reuman, & Midgley, 1991). We consider the implications of these differences between Study 1 and Study 2 further in the Discussion.

Method

Participants—Participants were 5th and 8th-graders (N = 282; M_{age} = 12.53; SD_{age} = 1.56; 154 girls). (See Appendix Table B.3 for details.) Fifth-graders were recruited from two schools in the same school district in Northern California. School 1 was the same school that was observed in Study 1[1]. School 2 was a K-8 school. Eighth-graders were recruited from School 2. Participants were from 12 classrooms, with an average of 23.5 students per classroom (SD = 4.1, range = 16 to 32).

Procedure—All students who received signed parental consent were invited to participate. The participation rate was approximately 75%. Students completed paper-and-pencil questionnaires in a group setting as part of a larger study of motivation and socio-emotional development (Donnellan, Trzesniewski, Robins, Moffitt, & Caspi, 2005). The items were intermixed with items from other scales. Data collection took place in the spring of the 1998–1999 school year.

Measures

Incremental theories of intelligence: Incremental theories of intelligence were assessed using three items on a 5-point scale from 1: Strongly disagree to 5: Strongly agree, adapted from Dweck (1999). All items were reverse-coded so that higher scores indicate more incremental beliefs (ω = 0.68).

Learning goals: Learning goals were assessed using four items on a 5-point scale from 1: Strongly disagree to 5: Strongly agree (ω = 0.70), adapted from Midgley and colleagues' task goal orientation scale (Midgley et al., 1998).

Perceived parent praise: Perceived parent praise was reported by children using two items on a 7-point scale from 1: Never to 7: Always (ω = 0.81). The items assessed the frequency of perceived parent praise of children's "effort in school" (*process praise*), and "academic abilities" (*person praise*).

Perceived parent criticism: Perceived parent criticism was reported by children using two items on a 7-point scale from 1: Never to 7: Always (ω = 0.80). The items assessed the frequency of perceived parent criticism of children's "effort in school" (*process criticism*) and "academic abilities" (*person criticism*).

Analytic plan—Our analytic plan was the same as in Study 1. We used a significance criterion of $p < .01$ and used latent variables and FIML estimation in MPlus version 7.11. We also conducted two separate models with perceived parent praise and criticism: Model 2 included two latent variables for praise and criticism, to assess relations with overall praise and criticism, and Model 3 used four manifest variables, to assess relations unique to each

[1]There were n = 58 children who completed Study 1 and Study 2. To assess whether these children impacted the pattern of results in Study 2, we re-ran the Study 2 models with these children excluded. The results did not significantly differ from those reported in the main text (i.e., there were no significant differences in model fit comparing models that were freely estimated versus models constrained to match the main text path coefficients).

type of praise and criticism. Preliminary analyses established scalar invariance across age on all measures (see Appendix C).

Results

Descriptive statistics for all measures are presented in Table 3 (see Appendix Table B.4 for correlations).

Relations among theories of intelligence, learning goals, and grade level—We conducted a path analysis (Figure 2: Study 2, Model 1) with grade level as a predictor of the latent variables for theories of intelligence and learning goals. Path coefficients were standardized on the y-variable only to allow for easy interpretation of grade-level effects, and to make these effects comparable to Study 1. A one-grade-level increase was associated with 0.24-SD lower learning goal (SE = .04, p < .001), and with a 0.11-SD higher incremental theory of intelligence, although this effect did not reach significance (SE = .05, p = .020). Controlling for grade level, theories of intelligence and learning goals were not significantly related (correlation = −0.10, SE = 0.08, p = .208).

We next tested whether the grade × theories of intelligence interaction was a significant predictor of learning goals, using the XWITH command to test latent variable interactions in MPlus. The grade × theories of intelligence interaction was not significant (B = .08, SE = .05, p = .159).

Overall perceived parent praise and criticism—We tested our exploratory hypotheses using two latent variables for overall perceived parent praise and criticism (Figure 2: Study 2, Model 2). Perceived parent praise was a significant predictor of learning goals (β = 0.46, SE = 0.08, p < .001) but not theories of intelligence (β = −0.11, SE = 0.09, p = .230). In contrast, perceived parent criticism was a significant negative predictor of incremental theories of intelligence (β = −0.33, SE = 0.10, p = .001), but was not significantly related to learning goals (β = −0.06, SE = 0.09, p = .467). Grade level was a significant direct predictor of both theories of intelligence (β = 0.17, SE = 0.05, p = .001) and learning goals (β = −0.15, SE = 0.05, p = .001).

Further, an increase of one grade-level was associated with a 0.19-SD increase in perceived parent criticism (SE = .04, p < .001), and a 0.17-SD decrease in perceived parent praise (SE = .04, p < .001). Consistent with Hypothesis 9, there was a significant indirect effect from grade level to perceived parent praise to learning goals (bias-corrected bootstrap estimation with 1,000 draws, 99% CI = [−0.118, −0.014]). Unexpectedly, there was also a significant indirect effect from grade level to perceived parent criticism to theories of intelligence (99% CI1,000bootstraps = [−0.144, −0.004]).

Specific types of perceived parent praise and criticism—Finally, we tested our main hypotheses about specific types of parent praise and criticism by modeling perceived parent process praise, person praise, process criticism, and person criticism as separate manifest variables (Figure 3: Study 2, Model 3). Grade level was positively related to both types of praise, and negatively related to both types of criticism (ps < .01). Perceived process praise was a significant predictor of learning goals (β = 0.28, SE = 0.09, p = .002), whereas

the other types of praise and criticism were not ($ps > .01$)[2]. Perceived person criticism was a significant predictor of theories of intelligence ($\beta = -0.26$, $SE = 0.10$, $p = .007$), but the other types of praise and criticism were not ($ps > .01$). Grade level had a significant, positive relation to theories of intelligence ($\beta = 0.15$, $SE = 0.05$, $p = .002$) and a negative relation to learning goals ($\beta = -0.16$, $SE = 0.04$, $p < .001$). Significant indirect effects were found from grade level to perceived process praise to learning goals (99% $CI_{1,000bootstraps} = [-0.078, -0.005]$) and from grade level to perceived person criticism to theories of intelligence (99% $CI_{1,000bootstraps} = [-0.109, -0.002]$).

Discussion

Data from two large cross-sectional studies of students in elementary through middle school shed light on age-related differences in two motivational constructs – theories of intelligence and learning goals – and the role of parents' praise and criticism in explaining both individual differences and age-related differences in motivation. We tested five main hypotheses and four exploratory hypotheses derived by integrating attribution/social-cognitive theory, CET, and expectancy-value theory. Our results suggest that incremental theories of intelligence and learning goals may not be strongly related in childhood, and perceived parent praise and criticism have relatively specific associations with theories of intelligence and learning goals. Below, we describe several findings that are particularly noteworthy, and discuss their implications for theory, future research, and practice.

Theories of Intelligence and Learning Goals

This is the first paper, to our knowledge, to chart age-related differences in theories of intelligence and learning goals from 1st to 8th grade, and to show their divergent relations with children's age in a single study. Specifically, among older versus younger students, theories of intelligence were more incremental, whereas learning goals were lower. In light of prior research and theory indicating that incremental theories of intelligence lead to learning goals (e.g., Blackwell et al., 2007; Dweck & Leggett, 1988), this result may appear surprising.

The disconnect between theories of intelligence and learning goals is further bolstered by our finding that these motivational constructs were not significantly correlated in either study, suggesting this connection may be weaker in young children than in adults. Moreover, the association did not seem to grow stronger with age in our studies, suggesting it may not be until high school age or older that theories of intelligence and learning goals become more cohesive. We should also note, however, that their relation is not large even among adults ($r = .19$) (Burnette et al., 2013), suggesting that individuals hold more nuanced combinations of beliefs about academic abilities and goal orientations than might be expected given existing theorizing. More research is needed to understand the consequences

[2]We also tested a model in which the relation of perceived process praise to learning goals and theories of intelligence was moderated by grade level. This was motivated by prior research suggesting that older children are more likely than younger children to believe that effort and ability are inversely related (Barker & Graham, 1987; Nicholls, 1978), and that children who believe that effort and ability are inversely related find effort praise to be less motivational (Lam, Yim, & Ng, 2008). However, the grade × perceived parent process praise interaction was not a significant predictor of learning goals ($p = .381$) or theories of intelligence ($p = .392$), indicating that the relation of process praise to each motivational construct did not significantly differ between 5th- and 8th-graders.

of these nuanced combinations of beliefs. For example, researchers could compare the relative impact of learning goals versus theories of intelligence on overall academic performance across a range of ages. In addition, researchers could examine whether theories of intelligence are most predictive of academic success in the context of low learning goals; this could help to explain the fact that most research showing the impact of theories of intelligence has focused on children in middle school or above (e.g., Aronson et al., 2002; Blackwell et al., 2007; Yeager et al., 2016), when learning goals are lower than in early elementary school.

The divergent relations of theories of intelligence and learning goals to child age appear surprising; however, these age-related differences are consistent with some previous research. For example, lower learning goals among older versus younger students is consistent with research showing a decline in academic self-concept and intrinsic motivation as environments become increasingly performance-oriented (and parent praise is lower, as we show here) (Wigfield et al., 2015). Older children's higher level of incremental theories is consistent with empirical work on age differences in beliefs about ability (Gunderson, Hamdan, et al., 2017; Haimovitz et al., 2011; Stipek & Gralinski, 1996). Both social and cognitive theories have been proposed to explain this age-related difference. Pomerantz and Saxon (2001) theorized that as most children transition through elementary school, they learn through personal experience and/or observation of peers that their ability is controllable and contingent on their own actions. For example, the increase in performance-oriented school environments might provide opportunities for children to observe and evaluate their own and peers' academic outcomes and associated efforts, indirectly teaching them an incremental theory of intelligence, while, at the same time, reducing learning goals and intrinsic motivation through the greater emphasis on performance outcomes and external rewards (thus, accounting for the seemingly counterintuitive finding of divergent trajectories of theories of intelligence and learning goals).

We also suggest an alternative theory: the overall age-related increase in incremental theories may be related to a more global shift from viewing traits as unchangeable to a more flexible view of human attributes, consistent with decreasing rates of essentialism and categorical rigidity among older children (Heyman & Gelman, 2000). This cognitive shift may allow children to think more flexibly about the nature of intelligence and to reject the idea that people can never change how smart they are. Of course, this cognitive shift may be the result of environmental input, but the specific inputs are beyond the scope of this investigation. Based on this theory, we would expect that individual differences in categorical flexibility would correlate with individual differences in theories of intelligence.

Role of Perceived Parent Praise

This is the first study to show a positive relation between the overall amount of perceived parent praise and children's learning goals across such a broad age range (1st to 8th grades). Further, we found that children who reported receiving more process praise - a type of praise that gives children the message that effort is valued and important for success - had higher learning goals than those who received less process praise, even among children who reported equal amounts of parental person praise.

Some studies have suggested that children in late elementary school begin to believe that effort and ability are inversely related (Barker & Graham, 1987; Nicholls, 1978), and that children who endorse this inverse relation interpret process praise as an indicator of low ability, making it less motivating (Lam et al., 2008). However, we found that parents' effort praise was positively related to children's learning goals in both 5th and 8th grades. One possible explanation is that receiving process praise from parents at an early age makes children more likely to endorse a positive relation between effort and ability; this could in turn lead them to view subsequent parent process praise as an indicator of high ability as well. Future research on parent praise could include direct assessments of children's beliefs about the relationship between effort and ability in order to test these possibilities.

In contrast, neither overall praise, nor process or person praise, was significantly related to children's theories of intelligence. This result was unexpected given previous studies finding this relation (Gunderson et al., 2013). However, the present study included older children and measured praise using child report rather than naturalistic observations. Further research using a variety of methods within a single sample could help to determine whether these methodological differences explain the different results.

Another potential explanation is that the relation between amount of parent praise and child motivation may be non-linear and depend on the appropriateness of the praise (Lee, Kim, Kesebir, & Han, 2016). Specifically, when praise is aligned with child's level of success, children have better academic and well-being outcomes, whereas when parents either over- or under-praise their children, children's outcomes are less adaptive (Brummelman et al., 2014). This complexity may help to explain the lack of relation between praise and theories of intelligence in the present study, because the appropriateness of praise was not examined. Understanding these potentially complex interactions among types of praise, appropriateness, frequency, as well as how these differ based on children's own developmental level, may have important theoretical and practical implications.

Role of Perceived Parent Criticism

A key, novel aspect of the present studies was our investigation of the relations between perceived parent criticism and children's motivation. In our path analyses, we found that overall amount of perceived parent criticism was negatively related to incremental theories of intelligence in both studies, and was not significantly related to learning goals in either study. When examining specific aspects of criticism, perceived parent person criticism was a consistently negative correlate of incremental theories of intelligence. In other words, children who reported that their parents criticized their academic abilities more frequently were more likely to believe that intelligence is fixed and unchangeable, compared to children who received less frequent criticism of their abilities. This was true even after accounting for frequency of process criticism, person and process praise, and children's grade level. This result stands in contrast to the lack of relation between parents' praise and theories of intelligence, discussed previously. Our results suggest that parents' person criticism may have a substantially greater impact than parents' praise on this critical aspect of children's academic motivation.

This finding sets the stage for further research to explore important questions about the nature and impact of parents' academic criticism on children's learning and motivation. For example: What kinds of utterances do parents typically use to criticize their child's academic achievement? Do direct (e.g., "That wasn't a very good way to do that") and indirect (e.g., "Maybe you can think of another way to do it"; Kamins & Dweck, 1999) forms of criticism have different effects? Is there any amount of "appropriate" criticism that is beneficial to children, similar to appropriate amounts of praise (Lee et al., 2016)? More research is needed to develop a coherent theory of parents' academic praise and criticism, and to provide practical guidance to parents on how to respond to children's failures in a way that encourages them to develop an adaptive motivational system.

Praise and Criticism as Mediators of Age-Related Differences in Motivation

Finally, the present study was unique in examining whether age-related differences in learning goals or theories of intelligence could be explained (mediated) by age-related differences in parent praise or criticism. We found support for this in Study 2. Older children reported less perceived parent praise than younger children, and this lower level of parent praise in turn was related to lower learning goals among older children (a significant indirect effect). Further analyses isolated this effect to parents' process praise, showing that lower learning goals among older versus younger students could be at least partially attributed to less process praise from parents.

Surprisingly, in Study 2, we also found that older children reported more perceived parent criticism, which in turn was related to lower incremental theories of intelligence (a significant indirect effect). This indirect effect was primarily driven by perceived parent person criticism. This was surprising because the overall age difference, after controlling for parent praise and criticism, indicated that older students had higher incremental theories of intelligence than younger ones; therefore, higher levels of parent criticism among older versus younger students were working against this overall age difference (sometimes called inconsistent mediation or a suppressor effect). This suggests that, if not for the countervailing effect of higher parental criticism, middle-school students might show even stronger incremental theories of intelligence. A fruitful area for future research could be to examine multiple potential mediators of the age-related difference in theories of intelligence simultaneously. This may reveal that cognitive factors such as categorical flexibility mediate the relation between age and stronger incremental theories, whereas environmental factors such as parents' person criticism serve as suppressors.

Unexpectedly, in Study 1, older children did not report significantly higher levels of praise or lower levels of criticism than younger children. One potential reason is methodological. Study 1 used only one item each to assess parent praise and criticism and used potentially-ambiguous terms to assess frequency ("often" and "sometimes"). Study 2 included multiple items and more specific response choices. This may have led to more precise responses in Study 2 that allowed us to detect the predicted age-related differences. Future research, using strong measurements of perceived parent praise and criticism across ages, would be helpful to determine whether these age-related trends in perceived parent praise and criticism are replicable.

Limitations

One limitation of the present studies is that the data are cross-sectional. It is possible that age-related differences reflect cohort differences rather than developmental change. Although a longitudinal study would help to confirm these results, we believe that the consistency of these age-related differences across a broad age range – 1st to 8th grades in Study 1 – supports the idea that they represent true developmental changes.

The data are correlational, and we therefore cannot determine the direction of causality. Our theory suggests that parents' behaviors (praise and criticism) impact children's motivation; prior experimental and longitudinal studies support this causal direction (e.g., Gunderson et al., 2013; Mueller & Dweck, 1998; Zentall & Morris, 2010). However, it is possible that children's academic motivation impacts their parents' praise and criticism. For example, children with low learning goals might avoid academic challenges and elicit criticism of their effort from their parents. It is also possible that the effects may be bidirectional. Future research using longitudinal methods (e.g., cross-lagged analyses) or experimental methods (e.g., interventions to change parents' use of praise and/or criticism) are needed to disentangle these effects.

The data were collected during the 1997–1998 and 1998–1999 school years. Although replicating these findings in a more recent cohort would improve generalizability, our use of data collected before growth mindsets received wide publicity likely reduced any influence of parents' awareness of growth mindset research on the results.

Another limitation is that our use of child report to assess parents' praise and criticism leaves open the possibility that children's own theories of intelligence and goal orientations biased their perception of their parents' feedback. However, children's report of parents' behaviors tends to more strongly relate to children's outcomes than parents' report, perhaps because children's reports incorporate aspects of objective reality, the child's perception, and the child's attributional style, all of which may influence children's beliefs and behaviors (e.g., Barry et al., 2008; Haines et al., 2008). In addition, our measures of parent praise and criticism included only one or two items, potentially reducing reliability of the measures. The reliability of the incremental theories and learning goals scales was also relatively low. Although our latent variable approach accounts for measurement error, non-significant relations involving these measures should be interpreted with caution. Future studies using more reliable scales and combining children's and parents' reports would lend additional validity to these findings.

Finally, our study focused on parents' praise and criticism, and did not assess other potentially-important environmental factors, such as socialization and feedback by teachers. As we have noted, age-related difference in the school environment contribute to age-related differences in children's learning goals (Eccles et al., 1984). The role of teachers versus parents may change with child age; for example, in one study, compared to parents' perceptions, teachers' perceptions of students' academic competence become increasingly related to students' self-concepts over the elementary school years (Spinath & Spinath, 2005). Future research that includes feedback from both parents and teachers could provide a more complete picture of the environmental processes impacting students' motivation.

Conclusion

Learning goals and incremental theories are both related to adaptive responses to challenge and greater academic achievement (e.g., Blackwell et al., 2007; Elliott & Dweck, 1988; Grant & Dweck, 2003), and are positively related to each other, at least in older students and adults (Burnette et al., 2013). Here, we show that despite their similarities, they show divergent relations to child age and to parents' praise and criticism in elementary and middle school. We conclude that the early development of these critical motivational constructs is more complex than previously recognized. It may be fruitful for research on motivational interventions in early elementary and middle school to specifically target learning goals, which are more proximally related to children's academic outcomes than theories of intelligence (Gunderson, Park, Maloney, Beilock, & Levine, 2018), rather than assuming that influencing children's theories of intelligence will lead to stronger learning goals.

These results have practical implications for parents and other caregivers who seek to encourage their young children's adaptive motivation. Making parents aware of the potentially positive effects of process praise and the potentially debilitating effects of person criticism might provide parents with more specific ideas about how to help encourage their children to adopt goals and behaviors that sustain academic motivation.

Appendix A: Measures

Study 1: Theories of intelligence [Original scale: 1= Not at all true, 5=Very true; Reverse-coded so that 1=Very true, 5=Not at all true]

1. You can't really change how smart you are.
2. How smart you are is something about you that you can't change very much.
3. You have a certain amount of smartness, and you can't really do much to change it.

Study 1: Learning goals [1= Not true at all, 5=Very true]

1. I enjoy working on challenging tasks.
2. I will usually keep working on homework until it is completed.
3. I generally seek out challenging tasks.

Study 1: Parent praise [1= Not true at all, 5=Very true]

1. My parents often give me praise for doing well.

Study 1: Parent criticism [1= Not true at all, 5=Very true]

1. My parents sometimes criticize me for not doing well.

Study 2: Theories of intelligence [Original scale: 1=Strongly disagree, 5=Strongly agree; Reverse-coded so that 1=Strongly agree, 5=Strongly disagree]

1. You can't really change how smart you are.
2. How smart you are is something about you that you can't change very much.

3. I have a certain amount of smartness, and I can't really do much to change it.

Study 2: Learning goals [1=Strongly disagree, 5=Strongly agree]

1. I like schoolwork that I'll learn from even if I make a lot of mistakes.
2. I feel most successful in school when I learn something I didn't know before.
3. I like schoolwork the best when it really makes me think.
4. The main reason I do my work in school is because I like to learn.

Study 2: Perceived parent praise [1=Never, 4=About half the time, 7=Always]

DURING THE PAST MONTH, when you and your parent(s) have spent time talking or doing things together, how often did they…

1. Praise you for your academic abilities
2. Praise you for your effort in school.

Study 2: Perceived parent criticism [1=Never, 4=About half the time, 7=Always]

DURING THE PAST MONTH, when you and your parent(s) have spent time talking or doing things together, how often did they…

1. Criticize you for your academic abilities.
2. Criticize you for your lack of effort in school.

Appendix B: Supplementary Tables

Table B.1

Study 1: Sample Size, Gender, and Age by Grade Level

Grade level	*n*	Child gender Percent female	Child age (years) Mean (*SD*)
First	34	41.2	6.72 (0.61)
Second	26	61.5	7.72 (0.64)
Third	46	54.3	8.70 (0.66)
Fourth	14	50.0	9.45 (0.65)
Fifth	35	71.4	10.44 (0.56)
Sixth	51	45.1	11.69 (0.66)
Seventh	62	62.9	12.73 (0.57)
Eighth	49	57.1	13.82 (0.54)
Total	317	55.8	10.66 (2.44)

Notes. Age data was available for $n = 297$ participants. Although demographic data were not available for individual participants, the overall school population was 22.7% African American, 5.7% Asian American, 49.4% European American, 12.8% Hispanic, and 9.4% "other". Twenty percent of the students in the school were of low socioeconomic status (on Aid to Families with Dependent Children (AFDC) or free/reduced lunch). There were between 2 and 6 participating classrooms per grade level, with an average of 10.2 participating students per classroom ($SD = 5.9$, range = 1 to 21).

Table B.2

Study 1: Correlations Among All Variables, Overall and Within Grade-Level Pairs

	1.	2.	3.
All participants (*N* = 317)			
1. Incremental theory of intelligence	–		
2. Learning goal	−0.09	–	
3. Perceived parent praise	0.07	0.24**	–
4. Perceived parent criticism	−0.16*	−0.15*	−0.09
1st and 2nd-graders (*N* = 60)			
1. Incremental theory of intelligence	–		
2. Learning goal	−0.22	–	
3. Perceived parent praise	−0.02	0.27	–
4. Perceived parent criticism	−0.25	−0.20	0.08
3rd- and 4th-graders (*N* = 60)			
1. Incremental theory of intelligence	–		
2. Learning goal	−0.07	–	
3. Perceived parent praise	−0.00	0.46**	–
4. Perceived parent criticism	−0.10	0.01	−0.12
5th- and 6th-graders (*N* = 86)			
1. Incremental theory of intelligence	–		
2. Learning goal	0.13	–	
3. Perceived parent praise	0.14	0.22	–
4. Perceived parent criticism	−0.25	−0.21	0.01
7th and 8th-graders (*N* = 111)			
1. Incremental theory of intelligence	–		
2. Learning goal	0.02	–	
3. Perceived parent praise	0.12	0.11	–
4. Perceived parent criticism	−0.11	−0.16	−0.28*

Notes:
* $p < .01$,
** $p < .001$

Table B.3

Study 2: Sample Size, Gender, and Age by Grade Level

Grade level	*n*	Child gender Percent female	Child age (years) *M* (*SD*)
Fifth	177	56.8	11.00 (0.47)
Eighth	105	51.4	14.00 (0.37)
Total	282	55.8	12.53 (1.56)

Notes: Participants were 62.1% White, 12.3% Hispanic, 10.3% Black, 9.6% Filipino, 5.0% Asian American, and 0.8% Native American ($n = 261$). Child age was calculated by subtracting the child's date of birth from the estimated average date of participation, April 1, 1999, and was available for $n = 156$ participants. Child gender was available for $n = 281$

participants. An additional 9 students provided consent but were ineligible for the present study because they did not complete any of the relevant tasks.

Table B.4

Study 2: Correlations Between Measures (N = 282)

	2.	3.	4.	5.	6.	7.	8.	9.
1. Incremental theory of intelligence	–							
2. Learning goal	−0.11	–						
3. Overall perceived parent praise	−0.00	0.41**	–					
4. Perceived parent process praise	−0.04	0.41**	0.93**	–				
5. Perceived parent person praise	0.04	0.36**	0.91**	0.69**	–	/		
6. Overall perceived parent criticism	−0.19*	−0.23**	−0.37**	−0.37**	−0.31**	–		
7. Perceived parent process criticism	−0.13	−0.27**	−0.36**	−0.37**	−0.30**	0.92**	–	
8. Perceived parent person criticism	−0.22**	−0.17*	−0.31**	−0.32**	−0.26**	0.91**	0.67**	–

Notes.
* $p < .01$,
** $p < .001$

Table B.5

Study 2 Path Analysis Model 3 Coefficients

	β	SE	p
Path Coefficients			
Incremental theories of intelligence			
Perceived person criticism	−0.26	0.10	.007
Perceived process criticism	−0.06	0.09	.536
Perceived person praise	0.17	0.10	.074
Perceived process praise	−0.22	0.10	.026
Grade level	0.15	0.05	.002
Learning goals			
Perceived person criticism	0.07	0.08	.381
Perceived process criticism	−0.16	0.09	.071
Perceived person praise	0.17	0.09	.052
Perceived process praise	0.28	0.09	.002
Grade level	−0.16	0.04	< .001
Perceived person criticism			
Grade level	0.12	0.04	.002
Perceived process criticism			
Grade level	0.17	0.04	< .001
Perceived person praise			
Grade level	−0.12	0.04	.004
Perceived process praise			
Grade level	−0.16	0.04	< .001
Covariances			
Incremental theories of intelligence with learning goals	−0.16	0.09	.079
Perceived person criticism with perceived process criticism	0.65	0.04	< .001

	β	SE	p
Perceived person criticism with perceived person praise	−0.23	0.06	< .001
Perceived person criticism with perceived process praise	−0.28	0.06	< .001
Perceived process criticism with perceived person praise	−0.26	0.06	< .001
Perceived process criticism with perceived process praise	−0.32	0.06	< .001
Perceived person praise with perceived process praise	0.68	0.03	< .001

Notes. Coefficients are standardized on y-variable only, so that relations involving grade level can be interpreted as the effect of a one-grade-level increase (all other relations are the same as in a fully standardized model).

Appendix C: Supplementary Analyses of Scales

For each study, we conducted preliminary analyses to eliminate poorly-fitting items on each scale and establish scalar invariance across grade levels.

Study 1

In Study 1, we created four groups of paired adjacent grade levels (1st & 2nd, 3rd & 4th, 5th & 6th, and 7th & 8th) to ensure adequate sample size to assess item functioning and model fit within each group.

Item fit and item exclusions

The theories of intelligence scale originally included 4 items. One item (“Kids who are smart in school were born that way”) was excluded due to poor fit for that item in Study 2 (see below). In addition, this item has not typically been included in more recent measures of theories of intelligence.

The learning goals scale originally included 7 items. Preliminary analyses examined the item-total correlations within pairs of grade levels. One item (“I am often more concerned about learning than about getting the right answer”) had a low corrected item-total correlation (less than 0.31) among all grade pairs, and the two reverse-coded items had low item-total correlations within the youngest grade pairs (1st to 4th graders, corrected item-total correlations less than 0.25) (“When given difficult homework, I often get frustrated and give up” and “I get angry and upset when I cannot figure out how to do something right away”). One item (“I have fun working on problems, even if I don’t always know the answer”) had an intercept that was non-invariant across grade levels. Eliminating these 4 items increased the reliability among 1st and 2nd-graders from Cronbach’s $\alpha = 0.28$ (7-item scale) to $\alpha = 0.32$ (3-item scale), and among 3rd and 4th-graders from $\alpha = 0.52$ to $\alpha = 0.61$ (we report Cronbach’s α because ω could not be calculated for 1st & 2nd-graders due to a non-positive-definite error matrix on the 7-item scale).

Invariance

We assessed scalar invariance of the final scales by comparing configural, metric, and scalar models using chi-square difference tests (implemented via the command “MODEL=Configural Metric Scalar” in MPlus). We tested for invariance across the four

groups of paired grade levels. We fixed the variance of the latent variable to 1 in the first group (1st & 2nd-graders) in order to avoid just-identification in the configural model. All models had good model fit (see Table C.1 for fit statistics). The chi-square difference test revealed no significant difference between the metric and configural models for theories of intelligence, $\chi^2(6) = 8.48$, $p = 0.205$, supporting weak factorial invariance (i.e., equivalent factor loadings) across grade pairs. Further, the chi-square difference test comparing scalar and metric invariance models was also not significant, $\chi^2(6) = 6.16$, $p = 0.406$, supporting scalar invariance across grade pairs.

For learning goals, the chi-square difference test again showed no significant difference between the configural and metric models, $\chi^2(6) = 7.38$, $p = 0.287$, supporting weak factorial invariance across grade pairs, and no significant difference between metric and scalar invariance models, $\chi^2(6) = 10.11$, $p = .120$, supporting scalar invariance across grade pairs.

Study 2

In Study 2, we examined the latent variables within and across the two grade levels (5th and 8th grades).

Item fit and item exclusions

The original theories of intelligence scale included 4 items. One item (“Kids who are smart in school were born that way”) had a low corrected item-total correlation of 0.21. Removing this item increased scale reliability from $\alpha = 0.61$ to $\alpha = 0.66$.

The original learning goals scale included 5 items. One item (“Understanding the work in school is more important to me than the grades I get”) had a low corrected item-total correlation of 0.18, and removing this item increased scale reliability from $\alpha = 0.63$ to $\alpha = 0.68$.

The original parent praise and criticism scales included three items. On each scale, one item assessed perceived parent praise (or criticism) for children’s ideas. However, because we had no a priori hypotheses about praise and criticism for children’s ideas, we did not include these items in our analyses.

Invariance

We assessed scalar invariance across the two grade levels. For theories of intelligence we fixed the variance of the latent variable to 1 for 5th-graders to avoid just-identification in the configural model. Model fit statistics for configural, metric, and scalar invariance models are shown in Table C.1. For theories of intelligence, the chi-square difference test comparing the metric and configural models was not significant, $\chi^2(2) = 1.89$, $p = 0.389$, supporting weak factorial invariance, and the scalar invariance and metric invariance models did not significantly differ, $\chi^2(2) = 1.54$, $p = 0.463$, supporting scalar invariance.

For learning goals, the chi-square difference test comparing the metric and configural models was not significant, $\chi^2(3) = 5.92$, $p = 0.116$, supporting weak factorial invariance.

Scalar invariance was also supported, based on a non-significant difference in model fit between the scalar and metric models, $\chi^2(3) = 5.10$, $p = 0.164$.

For parent praise and criticism, we tested invariance in a correlated factors model, where perceived praise and criticism were modeled as separate latent factors with two indicators each. The configural and metric models did not significantly differ, $\chi^2(2) = 0.01$, $p = 0.993$, supporting weak factorial invariance. Scalar invariance was supported based on a non-significant difference between the scalar invariance and metric invariance models, $\chi^2(2) = 0.59$, $p = 0.744$.

Table C.1

Model Fit Statistics for All Invariance Testing Models

Model	RMSEA [90% CI]	CFI	TLI	SRMR	χ^2 stat.	χ^2 *df*
Study 1						
Theories of intelligence, configural invariance	.000 [.000, .2101	1.000	1.081	.007	0.12	1
Theories of intelligence, metric invariance	.054 [.000, .155]	.988	.979	.072	8.59	7
Theories of intelligence, scalar invariance	.041 [.000, .123]	.987	.988	.083	1475	13
Learning goals, configural invariance	.068 [.000, .316]	.995	.945	021	1 .36	1
Learning goals, metric invariance	.056 [.000, .156]	.978	.962	075	8.75	7
Learning goals, scalar invariance	.075 [.000, .145]	.926	.932	.084	18.86	13
Study 2						
Theories of intelligence, configural invariance	.111 [.000, .279]	.986	914	.053	2.73	1
Theories of intelligence, metric invariance	.062 [.000, .167]	.987	973	.078	4.62	3
Theories of intelligence, scalar invariance	.041 [.000, .130]	.990	.989	.074	6.16	5
Learning goals, configural invariance	.029 [.000, .133]	.997	.991	.027	4.47	4
Learning goals, metric invariance	.059 [.000, .128]	.978	.962	.059	10.39	7
Learning goals, scalar invariance	.062 [.000, .120]	.964	.957	.077	15.49	10
Perceived parent praise and criticism, configural invariance	.000 [.000, .162]	1.000	1.005	.008	1.71	2
Perceived parent praise and criticism, metric invariance	.000 [.000, .084]	1.000	1.021	.008	1.73	4
Perceived parent praise and criticism, scalar invariance	.000 [.000, .052]	1.000	1.022	.013	2.32	6

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Highlights

- Two studies of learning goals & theories of intelligence (TOIs) in 1st-8th-graders.
- Older children had more incremental TOIs & lower learning goals than younger ones.
- Children's TOIs and learning goals were not strongly related.
- Parent praise (especially process-focused) positively related to learning goals.
- Parent criticism (especially person-focused) negatively related to incremental TOIs.

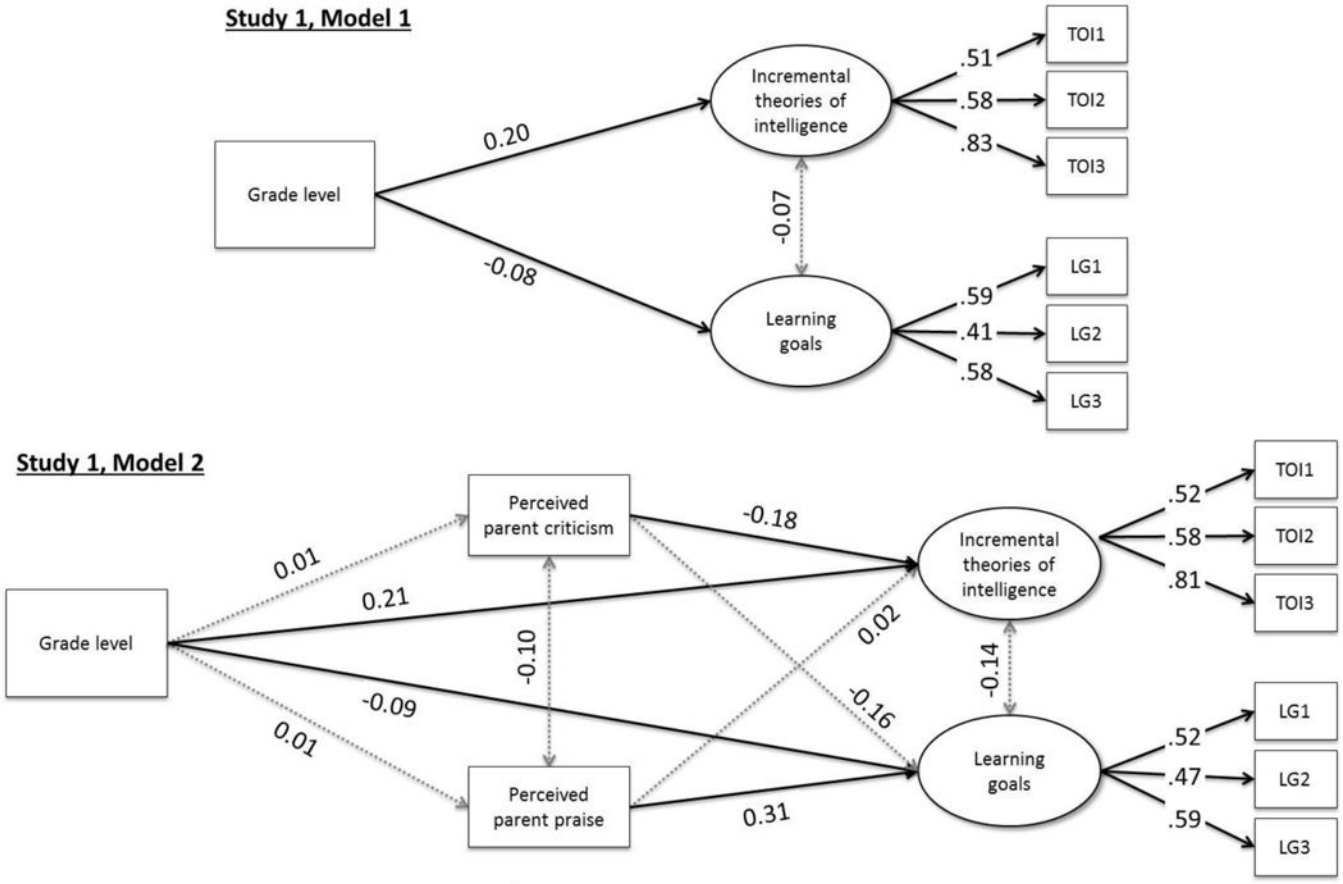

Figure 1.

Study 1 path analyses. Estimates are standardized on the y-variable. Significant relations ($p < .01$) are indicated by solid black lines. Non-significant relations are indicated by dashed gray lines.

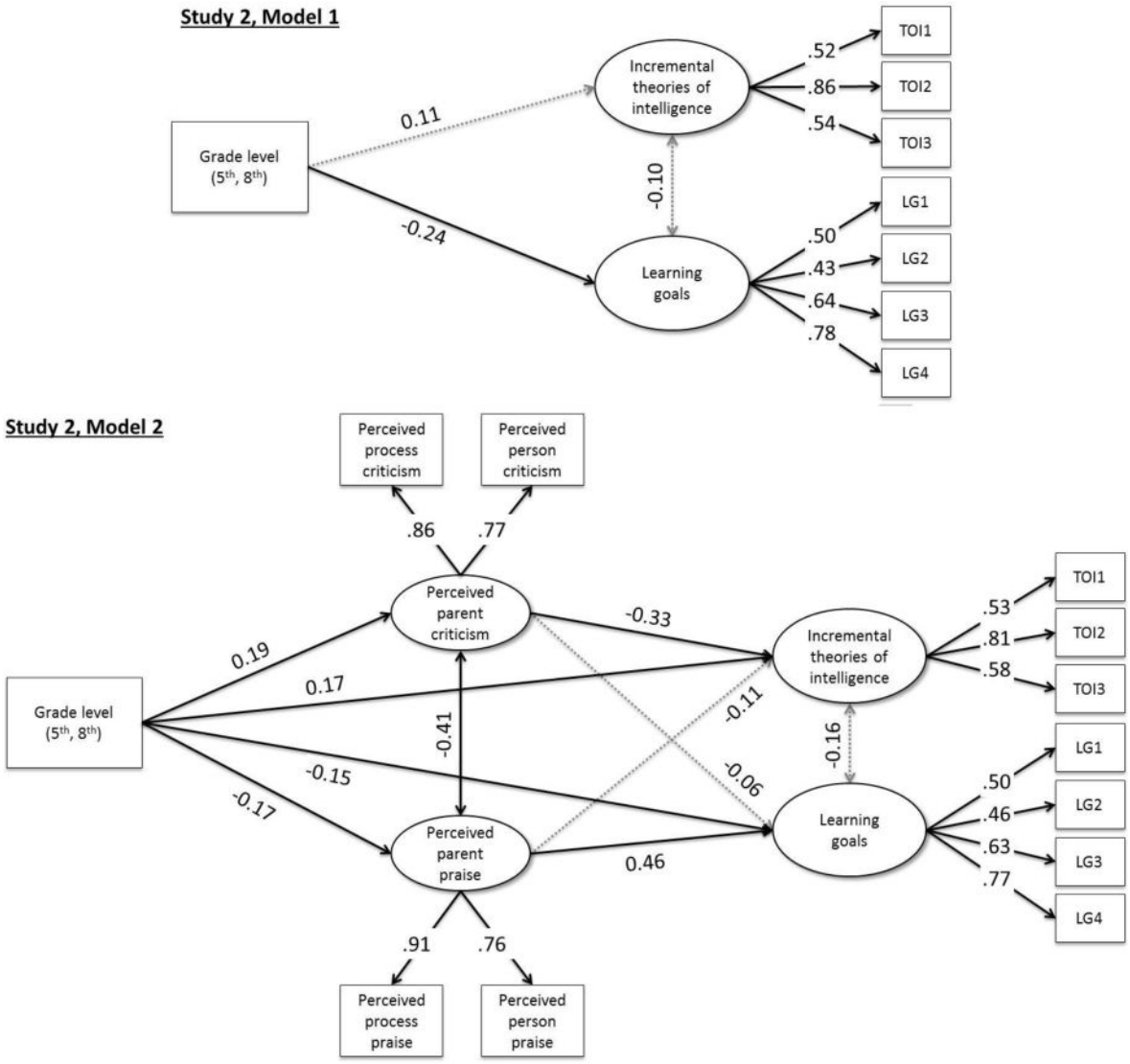

Figure 2.

Study 2 Models 1 and 2. Coefficients are standardized on y-variables. Significant relations ($p < .01$) are indicated by solid black lines. Non-significant relations are indicated by dashed gray lines.

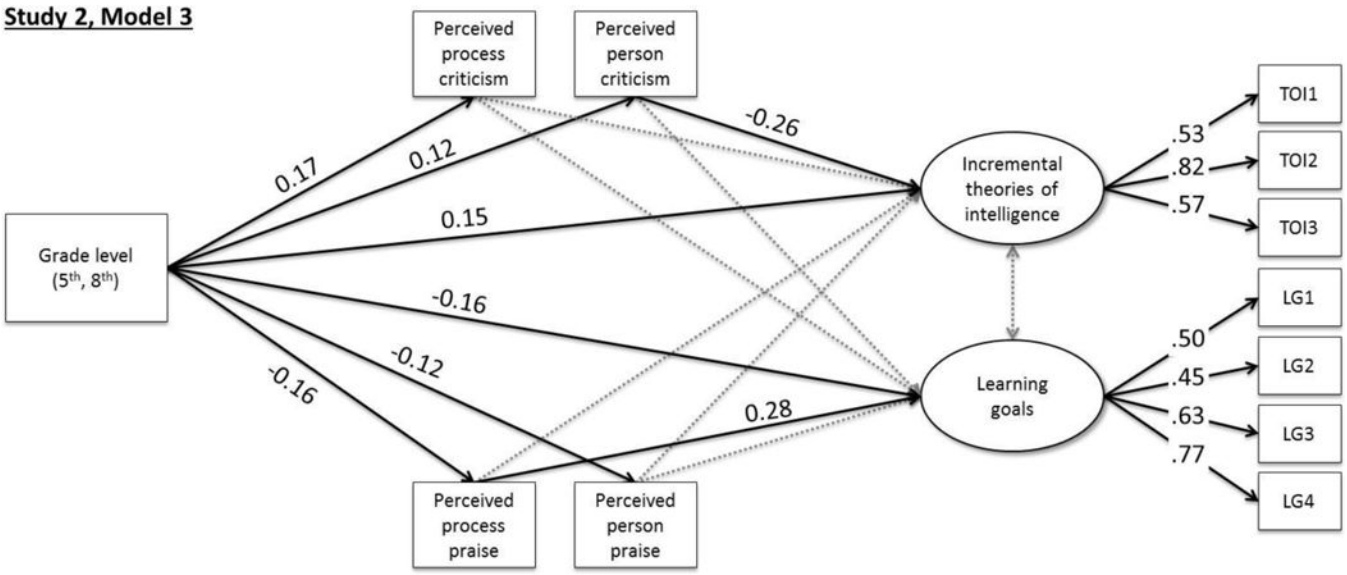

Figure 3.

Study 2 Model 3. Coefficients are standardized on y-variables. Significant relations ($p < .01$) are indicated by solid black lines. Non-significant relations are indicated by dashed gray lines. For simplicity, non-significant path coefficients are not shown, and significant covariances between perceived parent praise and criticism items are not shown (see Appendix Table B.5 for these values).

Table 1

Model Fit Statistics for All Models

Model	RMSEA [90% CI]	CFI	TLI	SRMR
Study 1, Model 1: Grade, theories of intelligence, and learning goals	.000 [.000, .056]	1.00	1.001	.031
Study 1, Model 2: Overall parent praise and criticism	.037 [.000, .065]	.972	.949	.034
Study 2, Model 1: Grade, theories of intelligence, and learning goals	.046 [.000, .076]	.968	.950	.036
Study 2, Model 2: Overall parent praise and criticism	.040 [.014, .060]	.974	.962	.037
Study 2, Model 3: Specific types of parent praise and criticism	.039 [.009, .061]	.979	.963	.033

Table 2

Study 1: Means and Correlations with Grade for all Variables (N = 317 Students)

Measure	*N*	*M* (*SD*)	Correlation with grade (*r*)
1. Grade level	317	5.01 (2.33)	–
2. Incremental theory of intelligence	317	3.72 (1.10)	0.39**
3. Learning goal	317	3.94 (0.83)	−0.16*
4. Perceived parent praise	317	4.26 (1.08)	0.02
5. Perceived parent criticism	313	2.21 (1.43)	0.02

Note.

* $p < .01$,

** $p < .001$

Table 3

Study 2: Means (SDs) on All Measures, by Grade

	Full sample		5th graders	8th graders	Effect size of grade difference
	N	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*d*
Incremental theory of intelligence	279	3.47 (1.12)	3.33 (1.15)	3.71 (1.03)	0.35
Learning goal	282	3.70 (0.82)	3.87 (0.76)	3.40 (0.82)	−0.61
Overall perceived parent praise	267	5.04 (1.80)	5.36 (1.62)	4.54 (1.94)	−0.46
Perceived parent process praise	264	5.05 (2.01)	5.43 (1.84)	4.43 (2.13)	−0.50
Perceived parent person praise	265	5.05 (1.89)	5.31 (1.74)	4.63 (2.04)	−0.36
Overall perceived parent criticism	273	2.57 (1.81)	2.24 (1.52)	3.11 (2.09)	0.48
Perceived parent process criticism	269	2.56 (1.98)	2.16 (1.67)	3.20 (2.26)	0.52
Perceived parent person criticism	266	2.59 (1.98)	2.30 (1.78)	3.06 (2.20)	0.38

Note. Positive effect sizes indicate that 8th graders had higher scores than 5th graders; negative effect sizes indicate that 8th graders had lower scores than 5th graders. Independent-samples t-tests indicated significant differences between grade levels ($p < .01$) for all variables. Because of significant differences in variance between grades for some measures, we calculated effect sizes using the square root of the unweighted average of the group variances (rather than the pooled variance), as recommended by Bonett (2008).