þÿStudents growth mindset : Relation to teacher beliefs þÿteaching practices, and school climate /

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2022-08

þÿYu , J , Kreijkes , P & Salmela-Aro , K 2022 , ' Students growth mindset þÿteacher beliefs, teaching practices, and school climate / ' , Learning and , 101616 . https://doi.org/10.1016/j.learninstruc.2022.101616

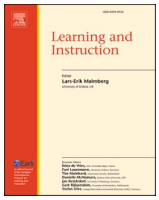
http://hdl.handle.net/10138/342511
https://doi.org/10.1016/j.learninstruc.2022.101616

Learning and Instruction 80 (2022) 101616

Contents lists available at ScienceDirect

Learning and Instruction

journal homepage: www.elsevier.com/locate/learninstruc



Students' growth mindset: Relation to teacher beliefs, teaching practices, and school climate

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ARTICLE INFO

Keywords:
Implicit theories
Growth mindset
Teacher beliefs
Instructional practices
School culture

ABSTRACT

To effectively cultivate students' growth mindset, it is important to identify contextual factors that may communicate mindset messages to students. The present study examined the association of students' growth mindset with various dimensions of teacher beliefs (mindset, self-efficacy), teaching practices (guided inquiry, group work, task differentiation, in-class ability grouping, mastery and normative evaluations), and school climate (holistic development, in-school ability grouping). Participants were 2200 ten-year-old students, 358 teachers, and 65 principals from Finnish elementary schools that participated in the OECD Survey on Social and Emotional Skills. Multilevel analyses show that students endorsed more of a growth mindset in classrooms where teachers used guided inquiry and in schools that emphasized students' social-emotional development. In contrast, students endorsed more of a fixed mindset when teachers assigned different tasks to different students based on ability. Implications for how to combine teaching practices to support students' growth mindset are discussed.

1. Introduction

Students with a growth mindset view ability as malleable and within their control, whereas students with a fixed mindset view ability as stable and beyond their control (Dweck & Leggett, 1988). These mindsets not only shape students' beliefs, goals, and behavior, but may also influence their long-term academic trajectories (Blackwell et al., 2007). Given the divergent consequences of holding a growth versus a fixed mindset for student learning and motivation (Burnette et al., 2013), understanding how to foster a growth mindset among students is of high priority. Although it is possible to change students' mindsets in brief interventions (Yeager et al., 2019), much remains to be learned about how students develop a growth mindset in naturalistic settings as well as what teachers and schools can do to cultivate students' growth mindset (Park et al., 2016). The current study examined the association of elementary school students' growth mindset with various dimensions of teacher beliefs, teaching practices, and school climate. By identifying teacher and school factors that are linked to a growth mindset among elementary school students, this study has the potential to enrich our understanding of how seeds of growth mindset can be sowed early in students' educational journey (Walton & Yeager, 2020).

1.1. Teacher beliefs

Teachers are important socializers of students' beliefs about ability (Rubie-Davies, 2006). Therefore, it seems plausible that teachers may transmit their mindset beliefs to students because teacher beliefs guide their practices, which in turn may shape students' mindset. However, prior studies show that teachers' mindsets are not systematically linked to students' mindsets (for a review, see Haimovitz & Dweck, 2017). One possible reason for this elusive link is that there may be some incongruence between teachers' mindsets and practices.

Teachers' self-efficacy, or beliefs about their capability to influence student learning (Tschannen-Moran & Woolfolk Hoy, 2001), may be a more proximal guide for instructional practices than teachers' mindsets. For example, in studies of high school teachers in the US and Italy, researchers simultaneously assessed teachers' self-efficacy and mindset beliefs, and consistently showed that teachers' self-efficacy predicted mastery-oriented practices aimed at supporting students' growth, but teachers' mindsets did not (Deemer, 2004; Matteucci et al., 2017). This suggests that even when teachers believe that abilities are malleable, they may not act accordingly if they do not feel confident about their capability to help students learn. In contrast, self-efficacious teachers

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https://doi.org/10.1016/j.learninstruc.2022.101616
Received 8 September 2021; Received in revised form 20 January 2022; Accepted 17 March 2022
Available online 30 March 2022

may be more proactive in using a variety of strategies to support student learning, and thereby convey to students that they can improve. In the current study, we investigated the role of both teachers' self-efficacy and mindset beliefs for student mindset and expected a positive association only between teacher efficacy and student mindset.

1.2. Teaching practices

Studies have demonstrated that teachers' verbal statements can influence students' growth mindset development (Barger, 2019). In addition to what teachers say, their instructional practices (i.e., what they do) may further convey mindset messages to students. The present study focused on teachers' practices in four areas, namely autonomy, task, grouping, and evaluation (see Table 1 for an overview). These practices have long been considered key channels through which teachers communicate their expectations and shape students' ability conceptions (Marshall & Weinstein, 1984; Rosenholtz & Simpson, 1984). In addition, these dimensions have been studied extensively by goal theorists to outline the conditions under which students seek to develop their ability (Ames, 1992; Epstein, 1988). In the following sections, we review the available evidence linking these practices to students' mindsets. Given that students with fixed and growth mindsets differ in their beliefs about the *stability* and *controllability* of intelligence (Dweck, 2017), our general prediction is that practices that focus on learning and promote student agency are likely to cultivate a growth mindset. Conversely, practices that focus on ability and discourage student agency are likely to foster a fixed mindset.

1.2.1. Support for autonomy

Teachers who support student autonomy in learning tend to adopt a student-centered rather than teacher-centered instructional approach (Reeve & Cheon, 2021). In particular, researchers have underscored the importance of supporting cognitive autonomy or student ownership of learning (Stefanou et al., 2004). Two instructional strategies that foster student ownership of learning are guided inquiry and group work. Guided inquiry represents a middle ground between teacher-directed instruction and student-led discovery (Furtak et al., 2012). In guided inquiry, students explore their own ideas, develop explanations through discussion, and articulate their thinking. Meanwhile, teachers facilitate the learning process, guide student discussion, and respond to students' questions (Furtak et al., 2012). In group work, students work together in small groups to complete learning tasks. Compared to traditional teacher-directed knowledge transmission, guided inquiry and group work represent active learning strategies that foster students' agency by allowing them to solve problems independently and think for themselves (Lombardi & Shipley, 2021).

In previous correlational studies, students in middle school and university reported a stronger growth mindset when they perceived greater autonomy support from teachers (Ommundsen, 2001; Zarrinabadi et al., 2021). One possible reason is that when students are given opportunities to think and solve problems independently, they may experience a sense of effectiveness and view learning within their control. In contrast, if adults try to monitor every step of the learning process, provide excessive direction, and offer unnecessary help, students may view these controlling practices as meaning that they have fixed and low abilities (Pomerantz & Eaton, 2000; Schiffrin et al., 2019). Based on prior studies, we hypothesized that elementary school students would also hold a stronger growth mindset when teachers used more autonomy-supportive practices such as guided inquiry and group work.

Table 1
Typology of teaching practices according to potential mindset messages.

	Ability is stable and beyond one's control (Fixed mindset)	Ability is changeable and within one's control (Growth mindset)
Autonomy	Learning directed by teachers, few opportunities for students to exercise control	Learning constructed through guided inquiry, opportunities for self-direction
Task	Differentiate the amount and difficulty level of assigned tasks based on students' ability	Offer multiple difficulty levels and the choice to attempt challenging tasks with teacher support
Grouping	Homogenous and hierarchical ability groups that remain stable over time	Students work in varying groups not defined by ability
Evaluation	Focus on social comparison and how smart a student is	Focus on individual improvement and how able a student is becoming

1.2.2. Ability differentiation in task and grouping

To educate learners with diverse abilities in elementary school classrooms, teachers may adapt instruction based on students' achievement levels. One common way to organize differentiated instruction is to place students in small groups based on prior achievement (Steenbergen-Hu et al., 2016). Another common practice is to assign different tasks to different students on the basis of ability.

When conducted well, in-class ability grouping and task differentiation have the potential to enhance students' learning through addressing individual needs (Prast et al., 2018). However, these practices may also have unintended consequences by communicating negative beliefs about students' potential. A meta-analysis on ability grouping in elementary school reveals a negative effect of in-class ability grouping on the performance of low-achieving students (Deunk et al., 2018). Children assigned to low-achieving groups in class tend to express feelings of shame (McGillicuddy & Devine, 2020)—an emotional response tied to a fixed mindset about ability (King et al., 2012). Furthermore, students may use the tasks to infer teachers' expectations and their own potential for growth. In one experimental study, undergraduate students were told that they would receive either easier or more challenging math tasks from their instructors. Students who heard that they would receive easier work perceived lower expectations as well as a stronger fixed mindset from their instructors and expected little change in their performance (Rattan et al., 2012). Based on previous findings, we hypothesized that elementary school students would hold a stronger fixed mindset when teachers engaged in more ability-differentiated practices such as in-class ability grouping and task differentiation.

1.2.3. Evaluation standards

Teachers can adopt different standards when evaluating students' performance. Most studies contrast two types of evaluation standards: one focused on individual improvement and learning, and the other focused on social comparison between students. These standards have been variously labeled temporal versus social comparison (Butler, 2000), individual versus social reference norm (Retelsdorf & Günther, 2011), and mastery versus normative evaluation (Ames, 1992; Greene et al., 2004). Given the conceptual similarities, we adopt the labels mastery and normative evaluations hereafter.

Students may come to view ability as malleable when progress is made salient by the evaluation standard. In contrast, students may view ability as fixed when stable performance differences between students are made salient. In a two-year longitudinal study, fifth and sixth graders who perceived more normative evaluation practices from teachers showed a steeper decline in growth mindset about math ability (Dickhäuser et al., 2017). In another experimental study, seventh and eighth graders were asked to solve some reasoning problems. Students in the normative condition were told that they would receive information on how well they performed compared to others, whereas students in the mastery condition were told that they would receive information on how their performance changed over time. Students who anticipated normative evaluation endorsed a stronger fixed mindset compared to those in the mastery condition (Butler, 2006). Based on these findings, we hypothesized that elementary school students' growth mindset would be positively associated with mastery evaluation but negatively

associated with normative evaluation.

1.3. School climate

Students' mindset may be influenced not only by teachers' practices but also by the larger school climate. School climate is an umbrella term that encompasses various structural and social-emotional features of the school environment (Wang & Degol, 2016). School climate typically changes as students progress to higher grades, with a decreasing emphasis on students' social-emotional needs and an increasing emphasis on ability and performance (Eccles & Roeser, 2011; Roeser et al., 2002). This gradual change from a caring school climate to a more ability-focused one may play a role in shaping students' mindset. Previous experiments have shown that a heavy emphasis on grades and achievement can lead university students to perceive a fixed mindset culture and adopt goals focused on demonstrating ability (Murphy & Dweck, 2010). In contrast, when schools value students' holistic development by prioritizing not only students' academic learning but also social-emotional functioning, students may become less concerned about ability.

The school-level focus on ability is intensified by the use of in-school ability grouping. It involves grouping students by achievement into different classes for certain subjects or for all subjects (Steenbergen-Hu et al., 2016). Forming separate classes may draw students' attention to differences in ability and lead them to internalize ability labels (McGillicuddy & Devine, 2020). Experimental studies show that using ability labels to describe performance predisposes elementary school children to view ability as a fixed trait rather than something that can be developed (Heyman, 2008; Mueller & Dweck, 1998). One case study compared two middle schools that were matched on academic performance and sociodemographic factors but differed in grouping practices (Francome & Hewitt, 2020). Compared to students in the mixed-ability school, students in the ability-grouped school reported a stronger fixed mindset. However, students also perceived more traditional, teacher-directed instruction in the ability-grouped school. Therefore, it is unclear whether in-school ability grouping may affect students' mindset directly or indirectly by shaping teachers' instructional style. In the current study, we hypothesized that students' growth mindset would be positively associated with a school focus on holistic development but negatively associated with in-school ability grouping.

1.4. The present study

To effectively cultivate students' growth mindset, it is important to identify contextual factors that may convey mindset messages to students. Thus far, only a limited number of studies have examined teacher and school factors that predict students' mindset, and many of them focused on students in high school or university. The present study examined the association of elementary school students' growth mindset with various dimensions of teacher beliefs, teaching practices, and school climate. Fig. 1 depicts the conceptual model and the hypothesized relationships among variables. Although prior studies tend to rely on students' perceived teaching practices or school climate to predict student reports of mindsets, the present study used reports from multiple

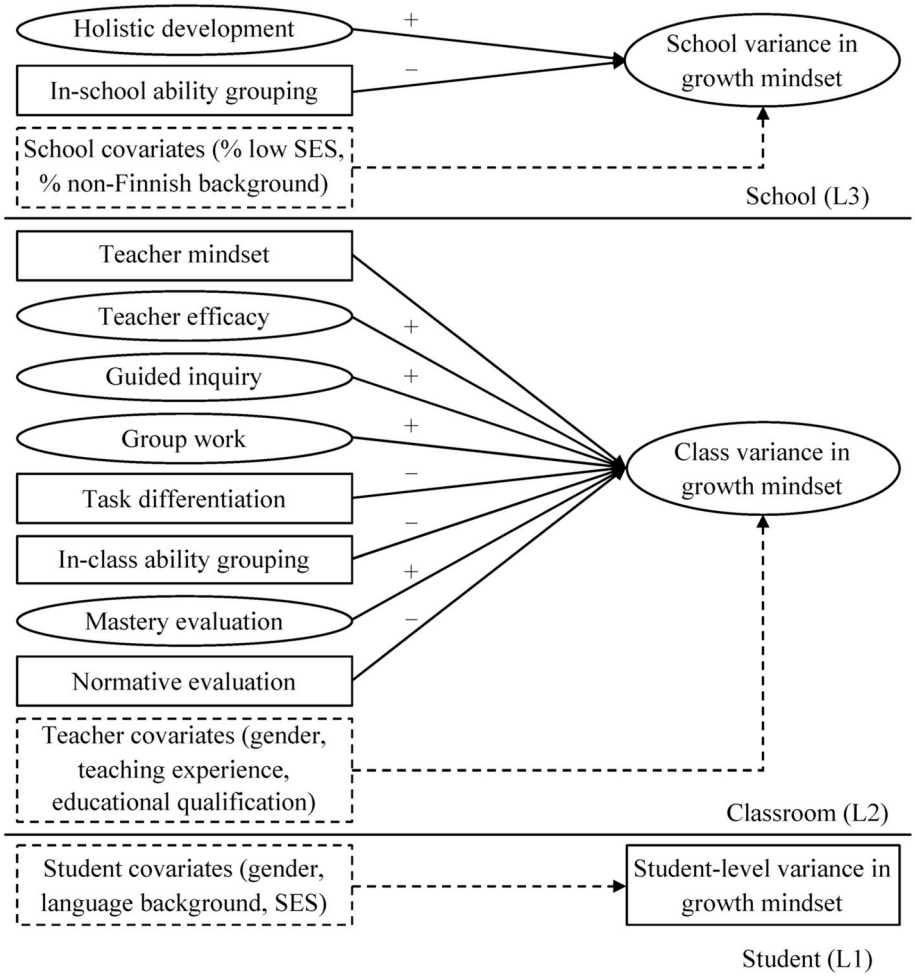

Fig. 1. Conceptual model and hypothesized relationships among variables. *Note.* Solid lines indicate paths of central interest and dashed lines indicate covariate paths. Ovals represent factors and rectangles represent single-item variables.

informants so that any significant association cannot be explained by shared method variance from a single source. Furthermore, teacher beliefs, teaching practices, and school climate are interdependent. By simultaneously examining various dimensions of these factors, the present study can reveal their relative importance in explaining differences in students' mindsets.

2. Method

2.1. Sample

Data for the study came from the OECD Survey on Social and Emotional Skills (SSES), an international survey that offers a snapshot of 10- and 15-year-old students' social-emotional skills. SSES also collects contextual information from students' parents, teachers, and school principals. Ten cities from nine countries participated in the first round (2018–2020). In this study, we used the Finnish sample from the city of Helsinki and focused on the 10-year-olds because elementary school students are taught all subjects by a single teacher, making it straightforward to link students' mindset to teachers' beliefs and practices.

To select a representative sample, SSES employs a two-stage stratified sampling design: schools are first randomly selected with probability proportional to size, followed by a random selection of students within sampled schools. Of the 3071 ten-year-old students surveyed, we limited consideration to students with matching data from their teachers and principals ($N = 2200$). In terms of growth mindset, students who had matching data from teachers and principals ($M = 2.70$, $SD = 1.01$) did not differ systematically from those who did not have matching data ($M = 2.64$, $SD = 1.09$), $p = .22$. The final sample consisted of 2200 students, 358 teachers, and 65 principals. The average cluster size was 6.15 students per class ($SD = 3.74$, range = 1–23) and 5.51 classes per school ($SD = 2.34$, range = 1–12). Simulation studies show that a low number of observations per cluster does not bias estimates provided that the number of clusters is large (Clarke, 2008; Maas & Hox, 2005), which is the case in the present study.

The student sample was 49% female, and 18% spoke a language other than Finnish at home. The majority of teachers were female (69%). On average, teachers were 41.2 years old ($SD = 10.1$) and had 12.7 years of teaching experience ($SD = 9.3$). Most teachers had completed a master's degree or above (92%). Based on principal reports, the participating schools were diverse in their socioeconomic profile. Half of the schools (57%) had fewer than 10% students from low socioeconomic status (SES) backgrounds. A third of the schools (35%) had between 11 and 50% low SES students, and 5% of the schools had over 50% of the students from low SES backgrounds.

2.2. Measures

The study capitalized on reports from multiple sources: students reported their intelligence mindset; teachers reported their beliefs and teaching practices; and principals reported the school climate. Similar to other large-scale surveys conducted by the OECD (e.g., Programme for International Student Assessment [PISA], Teaching and Learning International Survey [TALIS]), SSES measured key constructs with only a few items or sometimes a single item to reduce respondent burden. Because most items had five or fewer response categories, reliability was estimated using ordinal omega from the *psych* package in R to account for their categorical nature (Flora, 2020). All items are provided in Appendix A.

2.2.1. Student mindset

The outcome variable was students' self-reported intelligence mindset, assessed via one negatively-worded item from Dweck's scale (1999). The item was rated on a 5-point scale (1 = *Strongly disagree*, 5 = *Strongly agree*). The answer was reverse coded such that a higher score corresponded to a stronger growth mindset.

2.2.2. Teacher mindset

Teachers responded to the same intelligence mindset item as students. The answer was reverse coded to reflect the endorsement of a growth mindset.

2.2.3. Teacher efficacy

Teachers rated their capabilities to engage students in learning on three items from the Teachers' Sense of Self-Efficacy Scale (Tschannen-Moran & Woolfolk Hoy, 2001). The items were rated on a 4-point scale (1 = *Not at all*, 4 = *A Lot*) and showed good internal consistency ($\omega = 0.84$).

2.2.4. Guided inquiry

Teachers indicated the frequency of their guided inquiry practices on three items. These items assessed how often teachers provided opportunities for students to debate ideas and articulate their thinking while teachers guided discussion and responded to students' questions. These items had been included in PISA 2015 and were rated on a 4-point scale (1 = *Never or almost never*, 4 = *Every lesson or almost every lesson*). The items had a satisfactory level of reliability in the present study ($\omega = 0.77$).

2.2.5. Group work

Teachers rated how often they provided opportunities for students to work collaboratively in groups. Teachers responded to three items on a 6-point scale (1 = *Never or almost never*, 6 = *Once a week or more*). These items had been used in PISA 2015 and were internally consistent for this study sample ($\omega = 0.77$).

2.2.6. Ability differentiation

Two aspects of ability-differentiated practices were assessed, each with one item. Task differentiation concerned how often teachers assigned different tasks to different students based on ability. In-class ability grouping concerned the frequency with which teachers organized students into working groups based on ability. Both items had been used in TALIS 2008 and were rated by teachers on a 5-point scale (1 = *Never or hardly ever*, 5 = *In almost every lesson*).

2.2.7. Evaluation standards

Teachers indicated how often they used mastery and normative standards to evaluate students. Three items assessed mastery evaluation—a focus on individual improvement, effort, and learning ($\omega = 0.78$). One item assessed normative evaluation—a focus on comparing student performance to those of others. These items had been used in PISA 2015 and were rated by teachers on a 4-point scale in the present study (1 = *Never or almost never*, 4 = *Every lesson or almost every lesson*).

2.2.8. Holistic development

Principals rated the extent to which schools valued students' social-emotional functioning on three items. The items were rated on a 5-point scale (1 = *Strongly disagree*, 5 = *Strongly agree*) and had a high degree of reliability ($\omega = 0.97$).

2.2.9. In-school ability grouping

Principals indicated whether and how students were grouped by ability into different classes. The response options were *Not for any subjects* (1), *For some subjects* (2), and *For all subjects* (3).

2.2.10. Covariates

A number of student, teacher, and school characteristics were included as covariates because they might be correlated with the outcome or predictors of interest. At the student level, we controlled for students' gender (0 = female, 1 = male), SES (a composite of parental education, parental occupation, and home possessions), and language background (0 = Finnish, 1 = non-Finnish). Results from PISA 2018 reveal a stronger growth mindset among girls and students from

socioeconomically advantaged backgrounds (OECD, 2021). In addition, students who speak another language at home than the one used at school are less likely to report a growth mindset (Tarbetsky et al., 2016). At the classroom level, we controlled for teachers' gender (0 = female, 1 = male), educational qualification (1 = below upper secondary education, 7 = doctoral or equivalent), and years of teaching experience. Studies have reported that students with female teachers show a greater increase in growth mindset over time (Mesler et al., 2021), and that older and more experienced teachers tend to espouse stronger fixed mindset beliefs (Jonsson et al., 2012). At the school level, the percentages of students coming from low SES and non-Finnish language backgrounds were controlled for. Results from PISA 2018 indicate a positive association between schools' socioeconomic profile and students' endorsement of growth mindset (OECD, 2021).

2.3. Analysis

Multilevel path analysis was used to identify teacher and school factors that were linked to students' growth mindset. A multilevel approach was adopted to accommodate the three-level structure of the dataset (i.e., students nested in classrooms, and classrooms nested in schools). The outcome variable was modeled as ordinal as opposed to continuous because students' growth mindset was assessed by a single item on a 5-point scale. The model was estimated using the Bayes estimator, default priors, and the probit link. Similar to maximum likelihood estimation, Bayes is a full-information estimator that handles missing values within the analysis model. Multilevel analyses were performed in Mplus Version 8.7 (Muthén & Muthén, 1998–2017).

Four models were estimated: a null model, a covariates-only model, a random intercept model, and a random slope model. In the null model, variance in students' growth mindset was partitioned into three parts: variance between students within classes (Level 1), variance between classes within schools (Level 2), and variance between schools (Level 3). This determined the intraclass correlation coefficients or the proportion of variance in student mindset that could be attributed to classroom and school contexts. In the second step, the model included only covariates to serve as the baseline for comparison. In the third step, a random intercept model was estimated by incorporating all predictors of interest. Standardized coefficients were used to compare the relative importance of different factors, and the proportion of variance explained above and beyond the covariates-only model was computed as a global effect size measure. Lastly, as a robustness check, a random slope model was estimated to test whether significant associations between teacher factors and student mindset held when allowed to vary across schools. In all models, continuous variables were grand mean centered, and binary variables were centered using effect coding (e.g., −0.5 = female, 0.5 = male). Fit of a Bayesian model is evaluated by the posterior predictive p-value (PPP). An extreme PPP value near 0 or 1 indicates poor fit, whereas a PPP value near .50 indicates excellent fit (Gelman et al., 2013).

Given the large number of predictors and covariates at the classroom level (see Fig. 1), a two-step approach was used to improve model convergence. In the first step, confirmatory factor analysis was conducted to verify the factor structure of latent variables. Model fit was assessed using the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and the standardized root mean-square residual (SRMR). Good model fit is indicated by a CFI value close to 0.95 or above, RMSEA close to 0.06 or below, and SRMR close to 0.08 or below (Hu & Bentler, 1999). Factor scores corrected for measurement errors were saved from the measurement model. In the second step, factor scores for the latent variables, along with raw scores for single-item variables, were used as input to estimate the structural part of the model. Significant paths were indicated by a 95% credibility interval (CI) excluding 0.

3. Results

3.1. Missing data and descriptive statistics

Missing data were minimal for teacher and principal questionnaires (<2%). However, 429 students had missing values on self-reported mindset presumably because this item was located at the end of a lengthy questionnaire. We inspected missing data patterns at the class level and found that even in classes with a moderate to high missing rate (i.e., ≥50%), the distribution of mindset scores was relatively even and similar to classes with little missing values. Given that no systematic patterns of missing data were identified, we retained all cases in the analysis. Robustness checks show that omitting students with missing values on growth mindset did not change the results.

Descriptive statistics and bivariate correlations at the classroom and school levels are presented in Table 2. Inspection of means suggests that during elementary school years, most schools emphasized students' social-emotional functioning (M = 4.78, SD = 0.59). Although task differentiation, in-class ability grouping, and normative evaluation were hypothesized to be less adaptive practices, only normative evaluation was negatively associated with other adaptive beliefs and practices. In contrast, task differentiation was positively correlated with mastery evaluation (r = 0.36), suggesting that teachers who evaluated students by individual progress were also more likely to differentiate tasks according to students' ability. Nevertheless, students' growth mindset was negatively associated with task differentiation (r = −0.16), and positively associated with teachers' autonomy-supportive practices (guided inquiry: r = 14; group work: r = 13) and schools' valuing of social-emotional development (r = 0.29).

3.2. Multilevel analyses

The null model indicates that classroom and school memberships accounted for 4.7% and 5.5% of the variance in students' growth mindset, respectively. Confirmatory factor analysis supported the factor structure of latent variables indicated by multiple items, as evidenced by good model fit indices (CFI = 0.99, RMSEA = 0.03, SRMR = 0.04) and strong loadings on the target factors (see Appendix A). Factor scores for latent variables, along with raw scores for single-item variables, were used to estimate the random intercept model. The hypothesized model (Fig. 1) incorporating only random intercepts fitted the data very well (PPP = .49). When significant associations between teacher factors and student mindset were allowed to vary across schools, the results were identical to those in the random intercept model, thus providing some evidence of robustness of the findings. Key results from the random intercept model are graphically presented in Fig. 2, and all estimates are reported in Appendix B.

In terms of teacher beliefs, neither teachers' self-efficacy nor mindset beliefs were directly associated with students' growth mindset. Regarding autonomy-supportive practices, group work was unrelated to students' growth mindset, but there was a positive effect of guided inquiry such that students reported a stronger growth mindset when teachers engaged more frequently in guided inquiry, β = 0.41, 95% CI [0.11, 0.68], p < .01. Concerning ability-differentiated practices, grouping students by ability in class was not related to students' growth mindset, but there was a negative effect of task differentiation such that students reported a stronger fixed mindset when teachers assigned different tasks to different students based on ability, β = −0.56, 95% CI [–0.79, −0.22], p < .01. Regarding teachers' evaluation standards, neither mastery evaluation nor normative evaluation was associated with students' growth mindset. Compared to the covariates-only model, teacher-level factors explained a substantial proportion of the between-class variations in student mindset (R^2 = 0.56).

At the school level, students reported a stronger growth mindset in schools that valued students' social-emotional functioning, β = 0.43, 95% CI [0.01, 0.73], p = .04. Grouping students into different classes

Table 2
Descriptive statistics and bivariate correlations at the classroom and school levels.

	1	2	3	4	5	6	7	8	9
Classroom level (n = 358)									
1 Student mindset									
2 Teacher mindset	−.01								
3 Teacher efficacy	.08	.04							
4 Guided inquiry	**.14**	.01	**.27**						
5 Group work	**.13**	**.13**	**.27**	**.31**					
6 Task differentiation	**−.16**	.06	**.29**	**.18**	.05				
7 In-class ability grouping	−.05	.09	**.21**	**.11**	**.15**	**.35**			
8 Mastery evaluation	−.04	.09	**.28**	**.20**	.10	**.36**	**.20**		
9 Normative evaluation	−.02	**−.13**	−.07	−.06	**−.12**	**−.14**	−.02	.01	
Mean	3.69	3.75	3.28	3.32	4.10	3.34	2.62	3.43	2.08
SD	0.64	0.97	0.51	0.50	0.85	1.23	1.33	0.45	0.78
Possible range	1–5	1–5	1–4	1–4	1–6	1–5	1–5	1–4	1–4
Observed range	1–5	1–5	2–4	2–4	1–6	1–5	1–5	2–4	1–4
School level (n = 65)									
1 Student mindset									
2 Holistic development	**.29**								
3 In-school ability grouping	−.05	.18							
Mean	3.65	4.78	1.45						
SD	0.31	0.59	0.50						
Possible range	1–5	1–5	1–3						
Observed range	3–4.3	1–5	1–2						

Note. Student mindset at classroom and school levels are based on aggregated scores. Significant correlations at $p < .05$ are shown in bold. SD = standard deviation.

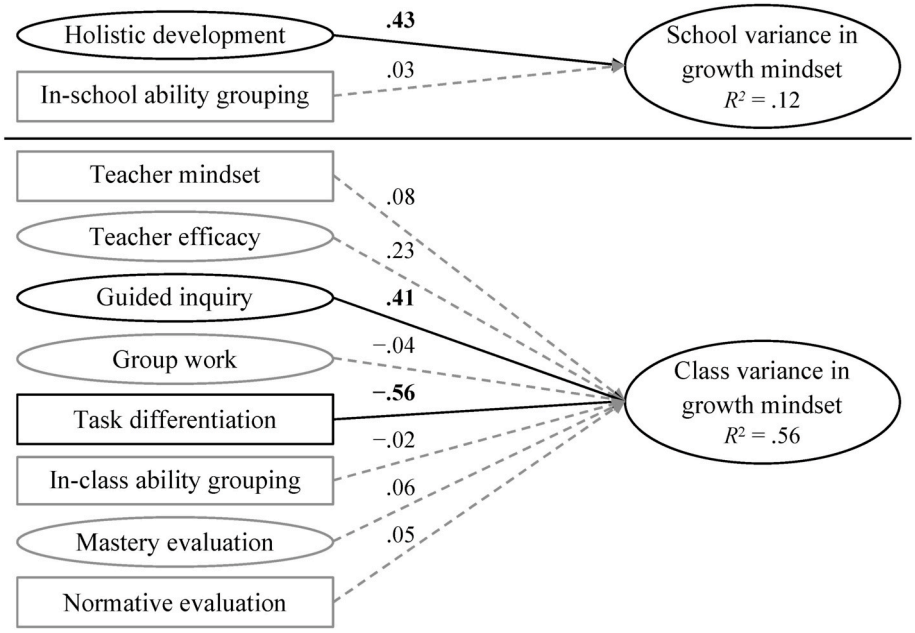

Fig. 2. Standardized coefficients from the random intercept model predicting students' growth mindset. *Note.* Solid lines are significant at $p < .05$, dashed lines are not significant.

according to ability was not associated with students' growth mindset. Compared to the covariates-only model, school-level factors accounted for 12% of the between-school variations in student mindset.

3.3. Exploratory analyses

As teachers' mindset and self-efficacy were not directly associated with students' growth mindset, two exploratory analyses were conducted to better understand the interplay between teacher beliefs, teaching practices, and student mindset. First, we examined whether teacher mindset moderated the associations between teaching practices and student mindset by adding interaction terms to the model. None of the interactions between teacher mindset and teaching practices were significant.

Second, we specified a mediation model at the classroom level where teacher beliefs were indirectly associated with students' growth mindset through teaching practices. An indirect effect was considered significant when the non-symmetric 95% CIs excluded 0. The multilevel mediation model fitted the data very well (PPP = .48), and key results at the classroom level are depicted in Fig. 3. Compared to teachers' self-efficacy, teacher mindset was only weakly associated with teaching practices. Although teachers with a stronger growth mindset were more likely to provide students with opportunities to work collaboratively and refrain from normative evaluations, these practices were not associated with students' growth mindset. Teachers with higher levels of self-efficacy, on the other hand, tended to use a variety of teaching practices more frequently, and two of the practices were in turn related to students' growth mindset. Teacher efficacy was positively associated

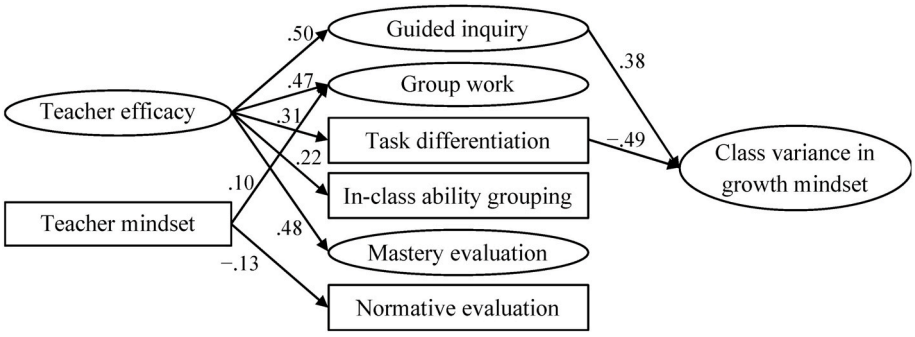

Fig. 3. Standardized coefficients from the mediation model at the classroom level. *Note*. Results at the school level are identical to those in Fig. 2 and are omitted.

with students' growth mindset via increased use of guided inquiry, $\beta = 0.26$, 95% CI [0.06, 0.54], $p = .01$. However, teacher efficacy was negatively associated with students' growth mindset via increased use of task differentiation, $\beta = -0.19$, 95% CI [–0.42, −0.08], $p < .01$. These opposing processes canceled each other out and accounted for the non-significant direct association between teacher efficacy and student mindset.

4. Discussion

Although brief interventions have been developed to change students' mindset, there is much to be learned about what teachers and schools can do to cultivate and sustain students' growth mindset. To guide teachers' and schools' efforts, a crucial first step involves identifying contextual factors that can communicate growth and fixed mindset messages to students. The results indicate that teachers' guided inquiry and task differentiation were closely linked to students' mindset and explained a considerable portion of variance between classes. In addition, schools' emphasis on students' social-emotional functioning was positively associated with students' growth mindset. The findings point to these contextual factors as potentially salient cues that elementary school students use to interpret the nature of their ability.

Classroom and school contexts each accounted for approximately 5% of the variance in students' growth mindset. This is comparable to findings from previous studies. Using a representative sample of ninth-grade students in the US, the National Study of Learning Mindsets reported that 4.5% of the variance in students' growth mindset existed between schools (Yeager et al., 2019). Other studies based on large samples reported that 5–8.7% of the variance in students' mindsets existed between classrooms (Luo et al., 2019; Mesler et al., 2021). Although these numbers may seem small, they are typical in multilevel studies of student motivation. For instance, studies guided by achievement goal theory often report that classroom and school contexts account for 10% or less of the variability in mastery and performance goals (Lam et al., 2015; Theis & Fischer, 2017). This suggests that students' mindsets are as susceptible to contextual influences as other motivational constructs.

The findings indicate that autonomy-supportive practices may represent an important context for students' growth mindset development. Elementary school students reported a stronger growth mindset when teachers engaged more frequently in guided inquiry—an instructional strategy where students debate ideas and articulate their thinking while teachers guide the discussion and respond to students' questions. This finding aligns with previous studies that found a positive association between perceived teachers' autonomy support and students' growth mindset in middle school and university (Ommundsen, 2001; Zarrinabadi et al., 2021). Of the two autonomy-supportive practices, only guided inquiry was associated with students' growth mindset in the full model and group work was not. Given that the items assessing group work did not capture the level of scaffolding provided by teachers, the positive effect of guided inquiry might suggest that teachers' autonomy support needs to be accompanied by teachers' guidance to effectively promote students' growth mindset. When students are asked to construct and develop their understanding without sufficient guidance, some students may feel lost, overwhelmed, and even helpless, which may be associated with a tendency to give up and blame their ability. Systematic reviews and meta-analyses consistently show that inquiry-based instruction and collaborative learning are most effective when accompanied by high levels of teacher guidance (Alfieri et al., 2011; van Leeuwen & Janssen, 2019). Research on self-determination theory similarly indicates that a guiding instructional approach (i.e., high in autonomy support and structure) correlates most strongly with positive student outcomes (Aelterman et al., 2019). Our finding suggests that when teachers give students the opportunity to solve problems independently as well as the scaffolding needed for students to achieve their goals, students may experience a sense of effectiveness as well as greater control over the learning process. This, in turn, may facilitate the view that ability is malleable and controllable.

Of the two ability-differentiated practices, task differentiation was negatively associated with students' growth mindset and in-class ability grouping was not. This suggests that how teachers instruct after grouping students may be more important than the grouping itself, and that assigning easier work to weaker students and more challenging work to stronger students convey that only some students can learn at high levels. This result is in line with a previous experimental study, where university students perceived lower teacher expectations and expected little improvement in their performance when they heard that they would be given easier work (Rattan et al., 2012). Teachers may assign easier work to struggling students with the intention of helping them avoid failure and maintain positive self-esteem. Yet, adults' views of failure as something to be avoided has been linked to stronger fixed mindset beliefs among elementary school students (Haimovitz & Dweck, 2016). Although task differentiation has the potential to ensure that students working at different levels are appropriately challenged, our result suggests that implementing task differentiation is not straightforward, and its effect may depend on how it is conducted. Simply setting different work for different students does not offer equal access to learning materials. It may also publicly communicate students' ability levels and teachers' differential expectations. Instead of deciding for students what level of work is appropriate for them, an alternative strategy might be to embed different levels of difficulty within the same task. This approach provides students with equal access as well as choice. Stronger students can progress more quickly to the challenging questions, while weaker students can focus on the essential questions while being able to attempt the challenging questions with support from teachers. Additional research is needed to understand the differences between effective and ineffective differentiation practices as well as their impact on students' mindset.

Teacher-reported evaluation standards were not associated with elementary school students' growth mindset. This differs from the results of a previous study that relied on fourth and fifth graders' self-reports and found associations between students' perceived evaluation

standards and their mindsets (Dickhäuser et al., 2017). Differences in results could be due to the use of different raters. Teacher-reported evaluation standards may not influence students' mindset if these standards do not translate into observable differences in teachers' behaviors. This is because students tend to rely on teachers' behaviors to infer their evaluation standards. A normative evaluation standard becomes visible when teachers announce the class rank and praise the high-performing students. A mastery evaluation standard becomes visible when teachers recognize 'personal best' and provide feedback that emphasizes individual improvement. Public recognition practices such as praise can communicate teachers' evaluation standards and have been shown to influence elementary school students' mindsets (Mueller & Dweck, 1998). This suggests that teachers' behaviors signaling their evaluation standards may be more strongly linked to students' mindsets than the standards themselves. Future research may want to directly investigate the impact of teachers' public recognition practices on students' growth mindset.

Neither teachers' mindset nor self-efficacy was related to students' mindset. A direct association rests on the assumptions that teacher beliefs guide their practices, which in turn are effective in cultivating students' growth mindset. The mediation model provides mixed support for these assumptions. In line with previous studies (Deemer, 2004; Matteucci et al., 2017), teachers' self-efficacy had a stronger association with self-reported instructional practices than teachers' mindsets. This suggests that teachers' level of confidence in implementing a practice may be a more proximal guide for teachers' behaviors. Additionally, teachers' actions may be more immediately influenced by their beliefs about the effectiveness of teaching practices than by mindsets (Wilkins, 2008). Efficacious teachers in the present study reported greater use of task differentiation, presumably because differentiation is often viewed as a component of effective teaching (Kyriakides et al., 2009). Nevertheless, giving different work to different students on the basis of ability was associated with a stronger fixed mindset among students. Overall, as other teacher beliefs (e.g., What works? Can I successfully implement it?) may play a more central role in guiding actions than mindsets, teachers may not consistently engage in practices that support students' growth mindset even when they view ability as malleable.

At the school level, we found a positive association between schools' valuing of social-emotional development and students' growth mindset. Given that most elementary schools in this study emphasized students' social-emotional development, the finding suggests that students had a stronger fixed mindset in schools that deviated from this norm. Although academic success is highly valued in school, a sole focus on grades and achievement can engender a performance goal structure, which has been linked to a fixed mindset among elementary school students (Park et al., 2016). In contrast, schools that support students' social-emotional functioning alongside academic learning may signal an emphasis on holistic development and thus divert students' concerns away from the adequacy of their ability (Roeser & Midgley, 1997). In addition, no association was found between in-school ability grouping and students' growth mindset. Prior studies show that teachers shift toward a more traditional, teacher-directed approach when teaching ability-grouped classes compared to mixed-ability classes (Boaler et al., 2000; Francome & Hewitt, 2020). The present study indicates that in-school ability grouping was not associated with students' mindset when differences in teaching practices were accounted for. This suggests that grouping practices, as an organizational tool, might be less important than teachers' instructional strategies in shaping students' mindsets.

4.1. Implications for practice

Among various teacher factors, guided inquiry and task differentiation were most closely related to students' mindset. Although it is too early to make practice recommendations given the correlational nature of the study, the results underscore these instructional practices as potential areas of focus in teacher training, professional development, and teacher-focused mindset interventions. Our findings, together with prior studies showing a positive link between teachers' autonomy support and students' growth mindset (Ommundsen, 2001; Zarrinabadi et al., 2021), indicate the potential role of guided inquiry in supporting students' growth mindset. The findings further point to the nuanced nature of differentiated practices, as ineffective task differentiation might unwittingly communicate fixed mindset messages to students (see also Rattan et al., 2012).

Furthermore, changes in the broader context might be needed to support teaching practices that are conducive to students' growth mindset. Teachers are less likely to support student autonomy when they are under pressure to follow a prescribed curriculum or to produce good student outcomes (Soenens et al., 2012). In addition, teachers may be encouraged to assign different tasks to students of different abilities by school or government policies. Therefore, it is important to recognize the external constraints on teachers' practices.

Although practices such as evaluation standards were unrelated to students' mindset, our results do not necessarily mean that these practices are unimportant. If teachers engage in guided inquiry but then evaluate students using a normative standard, it might communicate mixed mindset messages to students. It is likely that different aspects of teaching practices need to work in concert to support students' growth mindset. Teaching practices investigated in this study largely map onto the TARGET model of classroom structure (i.e., task, autonomy, recognition, grouping, evaluation, and time; Epstein, 1988). Research on the TARGET framework shows that students endorse more of a growth mindset when different dimensions of teaching practices jointly direct the focus of students toward learning and mastery (Lüftenegger et al., 2017). Therefore, research on classroom goal structure may offer useful guidance on how to combine different teaching practices to support students' growth mindset.

4.2. Limitations and future directions

This study capitalized on a stratified random sample and reports from multiple sources to pinpoint teacher and school factors that were linked to students' growth mindset. However, the study has several limitations. First, the data are cross-sectional in nature. Longitudinal and intervention studies are needed to verify the direction of relations between teaching practices and student mindset. Second, to measure a large number of constructs while minimizing respondent burden, SSES assessed some focal constructs in this study with only a single item, including growth mindset. Given the increased risk of false positives associated with measurement error (Shear & Zumbo, 2013), future studies could use more comprehensive measures to improve reliability and validity. Third, this study assessed teachers' and students' beliefs about the malleability of intelligence in general. However, teachers' mindsets can vary across subject areas (Jonsson et al., 2012) and their domain-specific mindsets might be more predictive of students' domain-specific outcomes (Heyder et al., 2020). Fourth, scales in the teacher questionnaire focused solely on the frequency of teaching practices, and it is unclear to what extent teachers' self-reports converged with their actual practices. Future research can capture both the quality and frequency of teaching practices as well as incorporate student reports or observations to gain a fuller picture of teachers' practices. Lastly, additional research is needed to determine whether our results can generalize to students of other ages or in other contexts. For example, normative evaluation and in-school ability grouping, although unrelated to students' mindset in the current study, may become more salient in middle school and start to play a role in shaping students' mindset.

5. Conclusion

Given the benefits of holding a growth mindset for student learning and motivation, understanding how to embed a growth mindset culture

in classrooms and schools is of high priority. An evidence-based approach depends on an accurate understanding of which contextual factors communicate growth and fixed mindset beliefs to students. The current study considered factors at multiple levels of the school environment and include various dimensions of teacher beliefs, teaching practices, and school climate. The findings reveal that elementary school students had more of a growth mindset when teachers used guided inquiry and when schools emphasized students' social-emotional development. In contrast, students reported more of a fixed mindset when teachers assigned different tasks to students of different abilities. These findings provide insights into how to effectively cultivate students' growth mindset at an early stage of education, which can help them thrive as they progress through school.

Author statement

Junlin Yu: Conceptualization, Methodology, Formal Analysis, Writing – Original Draft, Writing – Review & Editing. **Pia Kreijkes:** Conceptualization, Methodology, Writing – Review & Editing. **Katariina Salmela-Aro:** Funding Acquisition, Writing – Review & Editing.

Declaration of competing interest

None.

Acknowledgements

The work was supported by funding from the Academy of Finland [308351, 345117, 336138] to KSA. We thank Ros McLellan and the anonymous reviewers for their helpful comments on earlier versions of this paper.

Appendix A. Summary of key constructs and their measures

Construct	Factor Loading	Item
Student mindset		Your intelligence is something about yourself that you cannot change very much. (reverse)
Teacher mindset		(Same as above)
Teacher efficacy		*In your teaching, to what extent can you do the following?*
	.78	Get students to believe they can do well in school work.
	.87	Help my students to value learning.
	.72	Motivate students who show low interest in school work.
Guided inquiry	.68	Students are given opportunities to explain their ideas.
	.69	A whole class discussion takes place in which I participate.
	.77	I discuss questions that students ask.
Group work		*How often do you assign the following activities to your students?*
	.64	Doing some short task (10 min–2 h) in teams such as exercises or problems.
	.81	Conducting a longer project (over several weeks) in teams such as writing a document, inventing something, etc.
	.70	Preparing and giving a talk/presentation together.
Task differentiation		I give different work to the students that have difficulties learning and/or to those who can advance faster.
In-class ability grouping		Students work in groups based upon their abilities.
Mastery evaluation	.70	I consider students' individual improvement in performance since the beginning of the semester/term.
	.70	I recognize students' effort even if performance does not improve.
	.80	I consider the degree to which the students participate in the course.
Normative evaluation		I compare students' performance to that of other students in the course.
Holistic development		*To what extent do you agree that your school has the following aims?*
	.80	Students' functioning as good citizens
	.91	Students' personal well-being
	.93	Students' social and emotional skills
In-school ability grouping		*How are students grouped in your school?*
		By their performance (Not for any subjects, For some subjects, For all subjects)

Appendix B. Results from multilevel models predicting students' growth mindset

Variable	Covariates only			Random intercept		
	Standardized coefficient	95% CI		Standardized coefficient	95% CI	
		Lower	Upper		Lower	Upper
Student level (L1)						
Gender (M)	−.01	−.06	.04	−.01	−.06	.04
Language (Non-Finnish)	**−.15**	−.21	−.10	**−.13**	−.19	−.08
SES	**.10**	.04	.15	**.10**	.05	.15
Classroom level (L2)						
Teacher gender (M)	.12	−.19	.39	.21	−.02	.41
Teaching experience	.13	−.15	.43	.14	−.08	.35
Teacher qualification	.23	−.07	.75	.19	−.04	.41
Teacher mindset				.08	−.16	.29
Teacher efficacy				.23	−.08	.53
Guided inquiry				**.41**	.11	.68
Group work				−.04	−.29	.21
Task differentiation				**−.56**	−.79	−.22
In-class ability grouping				−.02	−.26	.26
Mastery evaluation				.06	−.24	.37

(*continued on next page*)

(*continued*)

Variable	Covariates only			Random intercept		
	Standardized coefficient	95% CI		Standardized coefficient	95% CI	
		Lower	Upper		Lower	Upper
Normative evaluation				.05	−.19	.28
R^2	.12	.02	.62	.68	.26	.90
School level (L3)						
% Non-Finnish	−.22	−.80	.34	−.14	−.67	.42
% Low SES	−.22	−.75	.41	−.21	−.78	.35
Holistic development				**.43**	.01	.73
In-school ability grouping				.03	−.28	.37
R^2	.21	.02	.55	.33	.07	.67

Note. Coefficients in bold are significant at $p < .05$ (i.e., 95% CI does not contain 0).

References

Aelterman, N., Vansteenkiste, M., Haerens, L., Soenens, B., Fontaine, J. R. J., & Reeve, J. (2019). Toward an integrative and fine-grained insight in motivating and demotivating teaching styles: The merits of a circumplex approach. *Journal of Educational Psychology, 111*(3), 497–521. https://doi.org/10.1037/edu0000293

Alfieri, L., Brooks, P. J., Aldrich, N. J., & Tenenbaum, H. R. (2011). Does discovery-based instruction enhance learning? *Journal of Educational Psychology, 103*(1), 1–18. https://doi.org/10.1037/a0021017

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology, 84*(3), 261–271. https://doi.org/10.1037/0022-0663.84.3.261

Barger, M. M. (2019). Connections between instructor messages and undergraduate students' changing personal theories about education. *The Journal of Experimental Education, 87*(2), 314–331. https://doi.org/10.1080/00220973.2018.1469111

Blackwell, L. S., Trzesniewski, K. H., & Dweck, C. S. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child Development, 78*(1), 246–263. https://doi.org/10.1111/j.1467-8624.2007.00995.x

Boaler, J., Wiliam, D., & Brown, M. (2000). Students' experiences of ability grouping—disaffection, polarisation and the construction of failure. *British Educational Research Journal, 26*(5), 631–648. https://doi.org/10.1080/713651583

Burnette, J. L., O'Boyle, E. H., VanEpps, E. M., Pollack, J. M., & Finkel, E. J. (2013). Mind-sets matter: A meta-analytic review of implicit theories and self-regulation. *Psychological Bulletin, 139*(3), 655–701. https://doi.org/10.1037/a0029531

Butler, R. (2000). Making judgments about ability: The role of implicit theories of ability in moderating inferences from temporal and social comparison information. *Journal of Personality and Social Psychology, 78*(5), 965–978. https://doi.org/10.1037/0022-3514.78.5.965

Butler, R. (2006). Are mastery and ability goals both adaptive? Evaluation, initial goal construction and the quality of task engagement. *British Journal of Educational Psychology, 76*(3), 595–611. https://doi.org/10.1348/000709905X52319

Clarke, P. (2008). When can group level clustering be ignored? Multilevel models versus single-level models with sparse data. *Journal of Epidemiology & Community Health, 62*(8), 752–758. https://doi.org/10.1136/jech.2007.060798

Deemer, S. (2004). Classroom goal orientation in high school classrooms: Revealing links between teacher beliefs and classroom environments. *Educational Research, 46*(1), 73–90. https://doi.org/10.1080/0013188042000178836

Deunk, M. I., Smale-Jacobse, A. E., de Boer, H., Doolaard, S., & Bosker, R. J. (2018). Effective differentiation practices: A systematic review and meta-analysis of studies on the cognitive effects of differentiation practices in primary education. *Educational Research Review, 24*, 31–54. https://doi.org/10.1016/j.edurev.2018.02.002

Dickhäuser, O., Janke, S., Praetorius, A.-K., & Dresel, M. (2017). The effects of teachers' reference norm orientations on students' implicit theories and academic self-concepts. *Zeitschrift Für Pädagogische Psychologie, 31*(3–4), 205–219. https://doi.org/10.1024/1010-0652/a000208

Dweck, C. S. (1999). *Self-theories: Their role in motivation, personality, and development*. Psychology Press.

Dweck, C. S. (2017). From needs to goals and representations: Foundations for a unified theory of motivation, personality, and development. *Psychological Review, 124*, 689–719. https://doi.org/10.1037/rev0000082

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review, 95*(2), 256–273. https://doi.org/10.1037/0033-295X.95.2.256

Eccles, J. S., & Roeser, R. W. (2011). Schools as developmental contexts during adolescence. *Journal of Research on Adolescence, 21*, 225–241. https://doi.org/10.1111/j.1532-7795.2010.00725.x

Epstein, J. L. (1988). Effective schools or effective students: Dealing with diversity. In R. Haskins, & D. MacRae (Eds.), *Policies for America's public schools: Teachers, equity, and indicators* (pp. 89–126). Ablex Publishing.

Flora, D. B. (2020). Your coefficient alpha is probably wrong, but which coefficient omega is right? A tutorial on using R to obtain better reliability estimates. *Advances in Methods and Practices in Psychological Science, 3*(4), 484–501. https://doi.org/10.1177/2515245920951747

Francome, T., & Hewitt, D. (2020). My math lessons are all about learning from your mistakes": How mixed-attainment mathematics grouping affects the way students experience mathematics. *Educational Review, 72*(4), 475–494. https://doi.org/10.1080/00131911.2018.1513908

Furtak, E. M., Seidel, T., Iverson, H., & Briggs, D. C. (2012). Experimental and quasi-experimental studies of inquiry-based science teaching: A meta-analysis. *Review of Educational Research, 82*(3), 300–329. https://doi.org/10.3102/0034654312457206

Gelman, A., Carlin, J. B., Stern, H. S., Dunson, D. B., Vehtari, A., & Rubin, D. B. (2013). *Bayesian data analysis* (3rd ed.). Chapman and Hall/CRC.

Greene, B. A., Miller, R. B., Crowson, H. M., Duke, B. L., & Akey, K. L. (2004). Predicting high school students' cognitive engagement and achievement: Contributions of classroom perceptions and motivation. *Contemporary Educational Psychology, 29*(4), 462–482. https://doi.org/10.1016/j.cedpsych.2004.01.006

Haimovitz, K., & Dweck, C. S. (2016). Parents' views of failure predict children's fixed and growth intelligence mind-sets. *Psychological Science, 27*(6), 859–869. https://doi.org/10.1177/0956797616639727

Haimovitz, K., & Dweck, C. S. (2017). The origins of children's growth and fixed mindsets: New research and a new proposal. *Child Development, 88*(6), 1849–1859. https://doi.org/10.1111/cdev.12955

Heyder, A., Weidinger, A. F., Cimpian, A., & Steinmayr, R. (2020). Teachers' belief that math requires innate ability predicts lower intrinsic motivation among low-achieving students. *Learning and Instruction, 65*, 101220. https://doi.org/10.1016/j.learninstruc.2019.101220

Heyman, G. D. (2008). Talking about success: Implications for achievement motivation. *Journal of Applied Developmental Psychology, 29*(5), 361–370. https://doi.org/10.1016/j.appdev.2008.06.003

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Jonsson, A.-C., Beach, D., Korp, H., & Erlandson, P. (2012). Teachers' implicit theories of intelligence: Influences from different disciplines and scientific theories. *European Journal of Teacher Education, 35*(4), 387–400. https://doi.org/10.1080/02619768.2012.662636

King, R. B., McInerney, D. M., & Watkins, D. A. (2012). How you think about your intelligence determines how you feel in school: The role of theories of intelligence on academic emotions. *Learning and Individual Differences, 22*(6), 814–819. https://doi.org/10.1016/j.lindif.2012.04.005

Kyriakides, L., Creemers, B. P. M., & Antoniou, P. (2009). Teacher behaviour and student outcomes: Suggestions for research on teacher training and professional development. *Teaching and Teacher Education, 25*(1), 12–23. https://doi.org/10.1016/j.tate.2008.06.001

Lam, A. C., Ruzek, E. A., Schenke, K., Conley, A. M., & Karabenick, S. A. (2015). Student perceptions of classroom achievement goal structure: Is it appropriate to aggregate? *Journal of Educational Psychology, 107*(4), 1102–1115. https://doi.org/10.1037/edu0000028

van Leeuwen, A., & Janssen, J. (2019). A systematic review of teacher guidance during collaborative learning in primary and secondary education. *Educational Research Review, 27*, 71–89. https://doi.org/10.1016/j.edurev.2019.02.001

Lombardi, D., & Shipley, T. F. (2021). The curious construct of active learning. *Psychological Science in the Public Interest, 22*(1), 8–43. https://doi.org/10.1177/1529100620973974

Lüftenegger, M., Tran, U. S., Bardach, L., Schober, B., & Spiel, C. (2017). Measuring a mastery goal structure using the TARGET framework: Development and validation of a classroom Goal Structure Questionnaire. *Zeitschrift Für Psychologie, 225*(1), 64–75. https://doi.org/10.1027/2151-2604/a000277

Luo, W., Liem, G. A. D., & Lee, K. (2019). Implicit beliefs of ability and maladaptive learning: Does self-efficacy matter? *Educational Psychology, 39*(2), 153–168. https://doi.org/10.1080/01443410.2018.1510115

Maas, C. J. M., & Hox, J. J. (2005). Sufficient sample sizes for multilevel modeling. *Methodology, 1*(3), 86–92. https://doi.org/10.1027/1614-2241.1.3.86

Marshall, H. H., & Weinstein, R. S. (1984). Classroom factors affecting students' self-evaluations: An interactional model. *Review of Educational Research, 54*(3), 301–325. https://doi.org/10.3102/00346543054003301

Matteucci, M. C., Guglielmi, D., & Lauermann, F. (2017). Teachers' sense of responsibility for educational outcomes and its associations with teachers' instructional approaches and professional wellbeing. *Social Psychology of Education, 20*(2), 275–298. https://doi.org/10.1007/s11218-017-9369-y

McGillicuddy, D., & Devine, D. (2020). 'You feel ashamed that you are not in the higher group'—children's psychosocial response to ability grouping in primary school. *British Educational Research Journal, 46*(3), 553–573. https://doi.org/10.1002/berj.3595

Mesler, R. M., Corbin, C. M., & Martin, B. H. (2021). Teacher mindset is associated with development of students' growth mindset. *Journal of Applied Developmental Psychology, 76*, 101299. https://doi.org/10.1016/j.appdev.2021.101299

Mueller, C. M., & Dweck, C. S. (1998). Praise for intelligence can undermine children's motivation and performance. *Journal of Personality and Social Psychology, 75*(1), 33–52.

Murphy, M. C., & Dweck, C. S. (2010). A culture of genius: How an organization's lay theory shapes people's cognition, affect, and behavior. *Personality and Social Psychology Bulletin, 36*(3), 283–296. https://doi.org/10.1177/0146167209347380

Muthén, L. K., & Muthén, B. O. (1998-2017). *Mplus user's guide* (8th ed.). Muthén & Muthén.

OECD. (2021). *Sky's the limit: Growth mindset, students, and schools in PISA*. OECD Publishing.

Ommundsen, Y. (2001). Students' implicit theories of ability in physical education classes: The influence of motivational aspects of the learning environment. *Learning Environments Research, 4*, 139–158. https://doi.org/10.1023/A:1012495615828

Park, D., Gunderson, E. A., Tsukayama, E., Levine, S. C., & Beilock, S. L. (2016). Young children's motivational frameworks and math achievement: Relation to teacher-reported instructional practices, but not teacher theory of intelligence. *Journal of Educational Psychology, 108*(3), 300–313. https://doi.org/10.1037/edu0000064

Pomerantz, E. M., & Eaton, M. M. (2000). Developmental differences in children's conceptions of parental control: "They love me, but they make me feel incompetent. *Merrill-Palmer Quarterly, 46*(1), 140–167.

Prast, E. J., Van de Weijer-Bergsma, E., Kroesbergen, E. H., & Van Luit, J. E. H. (2018). Differentiated instruction in primary mathematics: Effects of teacher professional development on student achievement. *Learning and Instruction, 54*, 22–34. https://doi.org/10.1016/j.learninstruc.2018.01.009

Rattan, A., Good, C., & Dweck, C. S. (2012). It's ok — not everyone can be good at math": Instructors with an entity theory comfort (and demotivate) students. *Journal of Experimental Social Psychology, 48*(3), 731–737. https://doi.org/10.1016/j.jesp.2011.12.012

Reeve, J., & Cheon, S. H. (2021). Autonomy-supportive teaching: Its malleability, benefits, and potential to improve educational practice. *Educational Psychologist, 56*(1), 54–77. https://doi.org/10.1080/00461520.2020.1862657

Retelsdorf, J., & Günther, C. (2011). Achievement goals for teaching and teachers' reference norms: Relations with instructional practices. *Teaching and Teacher Education, 27*(7), 1111–1119. https://doi.org/10.1016/j.tate.2011.05.007

Roeser, R. W., Marachi, R., & Gehlbach, H. (2002). A goal theory perspective on teachers' professional identities and the contexts of teaching. In C. Midgley (Ed.), *Goals, goal structures, and patterns of adaptive learning* (0 ed., pp. 223–260). Routledge. https://doi.org/10.4324/9781410602152-15.

Roeser, R. W., & Midgley, C. (1997). Teachers' views of issues involving students' mental health. *The Elementary School Journal, 98*(2), 115–133.

Rosenholtz, S. J., & Simpson, C. (1984). The formation of ability conceptions: Developmental trend or social construction? *Review of Educational Research, 54*(1), 31–63. https://doi.org/10.3102/00346543054001031

Rubie-Davies, C. M. (2006). Teacher expectations and student self-perceptions: Exploring relationships. *Psychology in the Schools, 43*(5), 537–552. https://doi.org/10.1002/pits.20169

Schiffrin, H. H., Yost, J. C., Power, V., Saldanha, E. R., & Sendrick, E. (2019). Examining the relationship between helicopter parenting and emerging adults' mindsets using the consolidated helicopter parenting scale. *Journal of Child and Family Studies, 28*(5), 1207–1219. https://doi.org/10.1007/s10826-019-01360-5

Shear, B. R., & Zumbo, B. D. (2013). False positives in multiple regression: Unanticipated consequences of measurement error in the predictor variables. *Educational and Psychological Measurement, 73*(5), 733–756. https://doi.org/10.1177/0013164413487738

Soenens, B., Sierens, E., Vansteenkiste, M., Dochy, F., & Goossens, L. (2012). Psychologically controlling teaching: Examining outcomes, antecedents, and mediators. *Journal of Educational Psychology, 104*(1), 108–120. https://doi.org/10.1037/a0025742

Steenbergen-Hu, S., Makel, M. C., & Olszewski-Kubilius, P. (2016). What one hundred years of research says about the effects of ability grouping and acceleration on K–12 students' academic achievement: Findings of two second-order meta-analyses. *Review of Educational Research, 86*(4), 849–899. https://doi.org/10.3102/0034654316675417

Stefanou, C. R., Perencevich, K. C., DiCintio, M., & Turner, J. C. (2004). Supporting autonomy in the classroom: Ways teachers encourage student decision making and ownership. *Educational Psychologist, 39*(2), 97–110. https://doi.org/10.1207/s15326985ep3902_2

Tarbetsky, A. L., Collie, R. J., & Martin, A. J. (2016). The role of implicit theories of intelligence and ability in predicting achievement for Indigenous (Aboriginal) Australian students. *Contemporary Educational Psychology, 47*, 61–71. https://doi.org/10.1016/j.cedpsych.2016.01.002

Theis, D., & Fischer, N. (2017). Sex differences in the development of achievement goals in middle school. *Learning and Individual Differences, 57*, 170–177. https://doi.org/10.1016/j.lindif.2017.05.006

Tschannen-Moran, M., & Woolfolk Hoy, A. (2001). Teacher efficacy: Capturing an elusive construct. *Teaching and Teacher Education, 17*(7), 783–805. https://doi.org/10.1016/S0742-051X(01)00036-1

Walton, G. M., & Yeager, D. S. (2020). Seed and soil: Psychological affordances in contexts help to explain where wise interventions succeed or fail. *Current Directions in Psychological Science, 29*(3), 219–226. https://doi.org/10.1177/0963721420904453

Wang, M.-T., & Degol, J. L. (2016). School climate: A review of the construct, measurement, and impact on student outcomes. *Educational Psychology Review, 28*(2), 315–352. https://doi.org/10.1007/s10648-015-9319-1

Wilkins, J. L. M. (2008). The relationship among elementary teachers' content knowledge, attitudes, beliefs, and practices. *Journal of Mathematics Teacher Education, 11*(2), 139–164. https://doi.org/10.1007/s10857-007-9068-2

Yeager, D. S., Hanselman, P., Walton, G. M., Murray, J. S., Crosnoe, R., Muller, C., Tipton, E., Schneider, B., Hulleman, C. S., Hinojosa, C. P., Paunesku, D., Romero, C., Flint, K., Roberts, A., Trott, J., Iachan, R., Buontempo, J., Yang, S. M., Carvalho, C. M., & Dweck, C. S. (2019). A national experiment reveals where a growth mindset improves achievement. *Nature, 573*(7774), 364–369. https://doi.org/10.1038/s41586-019-1466-y

Zarrinabadi, N., Lou, N. M., & Shirzad, M. (2021). Autonomy support predicts language mindsets: Implications for developing communicative competence and willingness to communicate in EFL classrooms. *Learning and Individual Differences, 86*, 101981. https://doi.org/10.1016/j.lindif.2021.101981