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MODESTUM

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Validation of a theoretical model for school climate-trust and assessment of its effect on mathematics teaching efficacy in preschool education

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ABSTRACT

This study aimed to validate the Greek version of the school climate-trust (SC-T) omnibus scale and examine its effect on mathematics teaching efficacy among preschool teachers in both typical and special education settings. The sample included 621 early childhood Greek teachers. For this purpose, we implemented exploratory and confirmatory factor analyses and built evidence for the acceptance of the three-factor model, assessing trust in principals, colleagues, and clients (parents and students). Measurement invariance across typical and special education teachers was also supported. Structural equation modeling revealed that a trustful school climate significantly predicts teachers' efficacy beliefs regarding mathematics instruction. Results were consistent across both educational contexts, with slightly stronger effects observed in special education. The findings underscore the central role of relational trust in enhancing teacher confidence, particularly in inclusive mathematics education. The study contributes to the field by validating a culturally adapted SC-T scale and highlighting trust as a foundational element of effective teaching practices. Implications suggest that cultivating trust within educational communities can enhance both teaching efficacy and early numeracy outcomes, especially for learners at-risk or with disabilities. The results advocate for embedding trust-building strategies in teacher training and school leadership policies to foster inclusive, high-quality early mathematics education.

Keywords: mathematics education, school climate, trust, teachers, special education

INTRODUCTION

School climate is frequently linked to school culture, which includes the values, attitudes, and expectations unique to a specific school district. Elements of a school's climate can influence student learning. A positive climate promotes learning and student success by creating a caring, safe, and supportive atmosphere, while a negative climate can hinder student achievement (Moran et al., 2012). Researchers acknowledge that a school's climate is made up of a complex array of interconnected factors. The *essential supports for school improvement* framework from the University of Chicago's consortium on school research identifies several key organizational elements within schools that are most likely to foster improvements in student learning (Rochester et al., 2019). The first element focuses on how principals involve teachers and staff in decision-making processes (leadership component), the second element focuses on effective collaboration among teachers and how attitudes can greatly influence the learning environment and student success (professional capacity), the third element focuses on teachers effort to understand local culture and engage parents (parent-community), the forth element focuses on school safety as well as student support and engagement (student/child-centered learning environment) and the fifth focuses on curricular guidelines and teaching approaches (instructional guidance).

Schools that prioritize input from parents and the wider community can strengthen parent-teacher trust, which in turn can improve student-teacher relationships in the classroom. This positive dynamic can directly impact student outcomes, as parents establish routines at home that support their children's learning at school (Wang & Degol, 2016). In addition, student-teacher trust makes the former feel secure in school, experience fewer distractions and are able to concentrate better on adjusting to classroom routines, such as moving from one activity to another and interacting with teachers and classmates (Rochester et al., 2019).

The concept of *trust* typically refers to the willingness to be vulnerable when depending on others (Niedlic et al., 2021). Trust, according to Markson and Luo (2020) is the confidence in someone's reliability, truthfulness, or ability to carry out a promised or

anticipated action, is fundamental to human social interactions and personal relationships. Research indicates that trust is undermined by ongoing social matters such as social inequality, perceived poor performance, and the lack of responsiveness from public institutions. With trust declining, experts suggest that social cohesion is at risk (Dragolov et al., 2017). Recent studies have examined trust among teachers toward principals, colleagues, students, and parents, as well as parental trust in schools and its significance for school improvement. Findings suggest that trust has a positive impact on academic performance, enhances the everyday operations of schools, and is a crucial resource for reform. Specifically, trust has been shown to foster collective decision-making, increase teacher commitment, improve the likelihood of schools' improvement efforts, spread across schools, and lead to better students' achievements (Babaoglan, 2016; Yin et al., 2013).

Focusing on teachers specifically, experienced and well-educated teachers possess stronger communication skills and are more effective at managing classrooms. They are more attuned to the various aspects of children's development and utilize a wide range of teaching methods (Reynolds & Shlafer, 2010). Trust among teachers plays a vital role in creating an organizational environment that promotes cooperation, empowerment, and motivation to achieve tasks. In well-functioning schools, teacher-teacher relationships are highly interdependent. Since teachers have varying teaching models and concepts, reaching an academic consensus can sometimes be challenging. Trust is built on shared goals and ideas. As a result, teachers should regularly exchange resources, collaborate on learning, and discuss teaching plans and decisions. In their daily activities, teachers should trust their colleagues' judgment and abilities (Day, 2011; Fang, 2020). Research has demonstrated that cooperation is strengthened through closely connected relationships and fostered by trust-driven professional discussions among participants of the school community (Liou & Daly, 2014). Teachers in high-trust schools are more engaged in exploring innovative teaching methods and are more motivated to impart new knowledge to their students. Researchers found also a positive link between trust in educational staff and perceptions of organizational justice, transparency, goal commitment, and the management of information through reliable sources (Gibbs & Dean, 2015; Parris et al., 2015).

Trust between teachers and students generally enhances well-being. Studies show that teachers who lack trust in their students are more likely to experience exhaustion. Perceptions play a crucial role and are influenced by both personal and professional attitudes. Moreover, trusting relationships between home and school lead to greater parental involvement, which relies on parents' confidence in the teacher's competence and child-focused approach (Berčnik & Devjak, 2017). Trust from teachers in parents is positively associated with the teacher's level of professional experience. On the other hand, differences in social backgrounds between teachers and parents can hinder the development of mutual trust. Additionally, factors such as the school's socio-economic constitution, the proportion of girls, and the socio-economic status of students' families seem to have an effect (Kikas et al., 2011; Niedlich et al., 2021; Santiago et al., 2016).

In Hummel et al.'s (2022) study, data showed that although parents gave high ratings to the perceived quality of informal communication and their satisfaction with parent-school communication, assessments of the interaction quality between parents and professionals suggest that communication is limited and of low quality. Researchers explained these controversial findings in the light of parents' subjective views such as educational background or personal affinity for the professionals. In general, parents-teachers trust is considered to be particularly high (Petrogiannis & Penderi, 2013).

Teachers create a nurturing social atmosphere by being emotionally responsive to their students, paying attention to their individual cues and needs. The interactions between teachers and children involve frequent physical contact and affection. These relationships are founded on trust, respect, and empathy. Communication is open and affectionate, with teachers often using a soothing voice and a moderate tone, offering praise and compliments (Guo et al., 2021). Teachers work to establish emotionally supportive environments, offering comfort, reassurance, and encouragement. The classroom climate is positive, as demonstrated by the enthusiasm, enjoyment, and mutual respect present in interactions between the teacher and students (Rossbach et al., 2024). Teachers are highly sensitive and responsive, providing consistent, timely, and appropriate reactions during interactions. Such teachers create an atmosphere of trust and security and help children view adults as supportive resources, fostering environments where children feel safe, welcomed, and encouraged to explore and learn.

In relationships characterized by trust, both parents and teachers perceive their respective expertise and contributions as being acknowledged and respected. From a parental perspective, various factors–such as differing school practices and values, language barriers, and cultural beliefs regarding the teacher's role–can hinder the development of trustful relationships with educators (Neuenschwander, 2020). Nonetheless, the effectiveness of a teacher in establishing a collaborative partnership with parents is largely contingent upon the degree of alignment between the teacher's concerns and those of the parents (Rautamies et al., 2019).

Parent-teacher relationships yield the most positive outcomes when they reflect a genuine partnership, marked by bidirectional communication, mutual respect, and trust, as well as shared values and aligned expectations regarding the child's support and development. Research has indicated that parental trust in teachers is also influenced by the parents' level of education. While it is often assumed that lower educational attainment corresponds with reduced levels of trust in teachers, empirical findings on this association remain inconclusive (Hummel et al., 2022). Parental beliefs and involvement are often influenced by various factors, including socio-economic status, cultural background, parents' own educational experiences, as well as their perceptions of their role in their child's education and their confidence in fulfilling that role. Additionally, disparities in parenting practices, communication styles, and educational beliefs between parents and teachers can lead to a reduced sense of relatedness between the two parties. When there is a lack of shared values, it becomes more challenging to establish mutual understanding and foster trust (Lerkkanen & Pakarinen, 2021).

Furthermore, previous studies suggest that the quality of the parent-teacher relationship may also be shaped by the child's gender, specifically, teachers tend to hold lower regard for the parents of boys compared to the parents of girls (Silver et al., 2005). However, empirical findings regarding the influence of a child's gender on parental trust in teachers remain inconclusive.

Figure 1. Trustful school effects on learning success for all students (Source: Authors' own elaboration)

Additionally, there is a noticeable gap in literature concerning potential differences in the levels of trust that mothers and fathers place in educators.

Moreover, school leadership must be capable and responsible. School leaders should possess the ability to work effectively with teachers from diverse cultures and demonstrate the courage needed to navigate the inevitable challenges in teaching and school management. They must be intelligent, capable of taking risks, and show a deep commitment to the personal development of their staff. Additionally, leaders must operate in accordance with democratic principles, wisely handle complex situations within school environments, and embody values related to teaching (Day, 2011).

As presented in **Figure 1**, organizational/school trust is determined by leadership, structure, and pedagogy/didactics. These components are interrelated and when they develop conjointly they can formulate the desired culture in every school. The only way that we can promote learning success for all students is by caring, collaboration, and respect. Leadership including administrative, staff, parents, students, and community fosters shared responsibility and builds capacity for change, creating a strong foundation of mutual respect and commitment. Organizational structure supports this leadership by implementing clear, equitable systems for change, resource allocation, personnel development, and student policies, ensuring transparency and reliability. Pedagogy/didactics, grounded in developmental appropriateness and a deep understanding of learners, reflects the organization's commitment to students' academic, social, emotional, and physical growth. When these elements align, they reinforce one another, cultivating a culture of trust that empowers every stakeholder and promotes holistic student achievement (Hoy & Tschannen-Moran, 2003).

Consequently, trust is extremely important for all schools and especially for kindergartens. Considering the above-mentioned researchers' findings there are many factors that influence trust in schools and kindergartens, and these factors can impact children's growth, development, and future social standing. Kindergartens can operate as inclusive communities to foster a culture of trust within the school. This perspective ensures that all members collaborate, share common goals and expectations, and work together towards progress (Fang, 2020).

Connections Between Trust and Mathematics Teaching in Preschool Typical and Special Education

Mathematical skills in preschool classrooms

Mathematics education plays a vital role in the curriculum for students globally. Following Linder et al. (2011) study there are some key reasons for purposefully teaching mathematics to preschoolers:

(a) young children have an inherent curiosity and informal mathematical skills that should be fostered,

(b) children from low-income backgrounds often face challenges with math in later education, and early success in math can help reduce this gap, and

(c) preschoolers' brains undergo significant developmental changes and respond better to engaging and complex learning activities rather than repetitive counting or drills.

Young children can learn mathematics because many of these concepts and relationships can be observed directly in their natural learning environment.

Before entering formal schooling, children naturally develop a wide range of informal, everyday math skills that are often more advanced than expected. This early development usually includes foundational concepts such as number sense, basic operations, and geometric thinking, including ideas related to size, shape, location, and patterns (Kinzie et al., 2014). To help young children make meaningful connections to mathematical concepts, the early childhood classroom should incorporate learning experiences into the daily routine that engage children in real-life activities. These activities include *relational skills*, such as synthesizing, areas like classification, seriation, comparison, and correspondence. The ability to create and identify homogeneous groups of items based on one or more perceptual features is assessed through classification tasks. Comparison tasks focus on recognizing non-equivalent items (e.g., identifying the shorter girl), while seriation tasks involve comparing items repeatedly to create a sequence and operations, which involve composing and decomposing sets of objects. Lastly, correspondence tasks assess the ability to

match items from set A to set B on a one-to-one basis (Charitaki et al., 2022, 2025a). Additionally, *counting skills*, which involve the child's ability to recognize quantities and understand the rules and processes of counting (Aunio & Räsänen, 2016). Mathematical reasoning processes receive less focus, despite children also developing these skills (Mulligan et al., 2018). Teachers should be aware that mathematical skills in early childhood education are interconnected and develop simultaneously and be encouraged to embrace a holistic approach in their teaching (Parviainen, 2019).

Trust in preschool typical and special education

The early childhood education and care organization highlights that the key factors for preschool classroom quality are teacher-child relationships, which are defined by responsiveness, sensitivity, trust and emotional support. These relationships are linked to a broad range of developmental outcomes across various domains, including social, emotional, and cognitive development, both in the early years and later (Nguyen et al., 2020).

According to attachment theory (Bowlby, 1969), teacher-child interactions foster children's engagement, at least indirectly. Warm and positive interactions with teachers create a sense of security for children–providing trust, comfort, and a sense of balance that allows them to explore the classroom environment. The consistency and stability of sensitive and responsive interactions help tranquilize children that their teacher is available, thereby enhancing their feelings of security (Hatfield et al., 2013). Since cognitive and social challenges arise in early childhood classrooms that may cause stress for children, preschool teachers play a crucial role in supporting stress regulation and helping children reengage with classroom tasks and activities. This emotional support is particularly vital for children with disabilities (Sanches-Ferreira et al., 2022).

Teacher-child relationships serve as vital resources for children with disabilities, low academic achievement, or externalizing behavior issues, as they may find the classroom setting socially or academically challenging (Cash et al., 2019). For children with disabilities or those from disadvantaged backgrounds, high-quality, inclusive environments can act as a protective buffer, helping to counteract negative life experiences and risk factors. Such environments promote greater child engagement and resilience. Emotionally supportive interactions create a sense of trust between teacher-children and have positive effects for at-risk children, particularly for those who struggle to form close, non-conflictual relationships with teachers due to internalizing or externalizing behaviors (Goble & Pianta, 2017). Additionally, children from low-income families appear to improve their social skills and adjust behavior when they experience trust and emotional support.

In the educational context, trust is conceptualized as an interpersonal dynamic characterized by confident anticipation of favorable outcomes. The parent-teacher relationship is grounded in trust when the individuals involved engage in behaviors that uphold or enhance the relationship, align with its intended objectives, or contribute positively to the child's development (Kikas et al., 2011). Parents trust toward teachers in relation to *teaching practices* in kindergarten seems to play an important role. Specifically, teachers who adopt child-centered approaches tend to create structured learning environments that support exploration and discovery. These teachers also provide experiences that build children's self-esteem and foster a positive attitude toward learning. This sense of confidence in the child may also enhance parents, especially mother's trust in the teacher (Lerkkanen et al., 2013). In relation to children with behavioral disorders, Santiago et al. (2016) study shows that increased parental trust was linked to fewer issues within peer groups and lower emotional symptoms in children with behavioral disorders.

The development of trust within the parent-teacher partnership can be impeded by a range of complex factors. One notable influence is the presence of challenging behavior in children, which can contribute to strained or conflictual relationships between teachers and students (Bromer et al., 2011). Behaviors commonly associated with attention deficit hyperactivity disorder–such as oppositionality or aggression–have been linked to elevated levels of teacher stress and the adoption of maladaptive instructional strategies (Rautamies et al., 2019). Consequently, the ethical conduct and attitudes of educators toward both the child and their parents, along with the educators' professional competence and expertise, are considered critical in fostering effective collaboration with the families of children exhibiting challenging behaviors.

Students experiencing learning difficulties are at increased risk for a range of adverse outcomes, including diminished academic motivation and challenges in their relationships with teachers, peers, and parents. In such contexts, the presence of trust between parents and teachers becomes especially critical for supporting the child's educational success. Parents must have confidence that the teacher both understands their child's specific needs and is committed to providing effective instruction tailored to those needs (Deng et al., 2022). It is possible that a child's learning difficulties may lead to lowered expectations regarding their academic achievement, which in turn could diminish parental trust in the teacher's capacity to provide adequate support. Nevertheless, there remains a significant gap in the research regarding how a child's risk for learning difficulties may influence parental trust in educators (Lerkkanen & Pakarinen, 2021).

Trust in mathematics preschool typical and special education

It is widely recognized that positive parent-teacher relationships and active parental involvement in a child's education foster mutual trust, which subsequently contributes to enhanced academic performance and increased motivation in the child (Penttinen, 2020). The Bakken et al. (2017) study examined the long-term outcomes of children from economically disadvantaged backgrounds who participated in a high-quality early education program (the opportunity project) from kindergarten through fourth grade. The program was built around three core components: child development and learning, individual differences among children, and the social and cultural context surrounding each child. Its goals focus on supporting emotional, social, cognitive, and physical development by offering opportunities and experiences that promote growth across all these areas. At the posy program phase children in third and fourth grades demonstrated improved performance on standardized state assessments in math and reading. Beyond academic gains, the researchers found that the children developed appropriate behavior, a strong sense of trust in their environment, confidence in their abilities, an emerging self-identity, personal initiative, and autonomy. The

data also indicated that participants in the program showed significantly strong social skills when interacting with their classmates and adults compared to their peers.

In Lerkkanen and Pakarinen (2021) study investigated cross-lagged associations between parental trust in a child's teacher and at-risk children's academic interest in reading and math across grade 1-grade 4 in primary school. Their findings revealed distinct patterns in the association between maternal and paternal trust in teachers and the development of children's interest in reading and mathematics. Specifically, during the first two years of primary education, parental trust to teachers was positively linked to the child's later interest in mathematics. Specifically, the results indicated that parental trust in the child's teacher during the first two years of primary school was a predictor of the child's subsequent interest in mathematics. Researchers suggested that these findings are based on the distinct nature of mathematics compared to other subjects. They argued that mathematical skills are hierarchical, building upon previous knowledge, and typically require greater effort and motivation from students.

In the same study fathers' trust in teachers in grade 3 was found to be a predictor of the subsequent interest in mathematics among at-risk children. Specifically, for at-risk children, higher paternal trust in teachers at Grade 3 was associated with greater interest in mathematics throughout grade 1 to grade 4. This connects to broader discussions on social inequalities in education, emphasizing that, particularly for families facing risk factors, fostering trusting relationships between parents and educators is essential.

The study by Zhang et al. (2011) highlighted key characteristics of early childhood educational settings that effectively support inclusion and provide essential services for young children with special needs through trusting relationships between interested parties. To ensure successful teaching in mathematics and other subjects, the study identified ten crucial components:

(1) collegial support among educators,

(2) attention to nutrition and health needs,

(3) effective classroom environment management,

(4) curriculum adaptations to meet diverse needs,

(5) the establishment of inclusive classrooms,

(6) team teaching approaches,

(7) the implementation of individualized education program-IEPs and individualized family service plan-IFSPs,

(8) preparation for transitions between educational stages,

(9) ongoing professional development for educators, and

(10) active family involvement.

In conclusion, both teachers and parents should recognize that low levels of parental trust in educators may be reflected in children's school engagement, particularly in the form of diminished interest in mathematics over time. Therefore, it is crucial to foster and maintain trusting relationships between teachers and parents, particularly during the early years of schooling. This is important for all students, but especially for those at risk of learning difficulties. The foregoing analysis highlights the limited nature of trust-based relationships between teacher and child, as well as between teacher and parent, within the context of mathematics instruction in early childhood education (Aunio & Räsänen, 2016; Charitaki et al., 2025a; Kinzie et al., 2014; Linder et al., 2011; Mulligan et al., 2018; Parviainen, 2019). Despite the acknowledged importance of such relationships, the extent to which trust among the primary stakeholders of the educational community (i.e., teacher, child, and parent) influences the teaching of mathematics to children at heightened risk of developing learning difficulties, remains underexplored, if not entirely absent from the existing literature (Bakken et al., 2017; Lerkkanen & Pakarinen, 2021). The present study seeks to address this gap as its principal aim.

Purpose of Study

By taking into consideration the number of factors derived from the different analyses conducted in the studies where the school climate-trust (SC-T) in mathematics classrooms was used, the limitations that exist in typical and special mathematics education, and its strengths mentioned above, we formulated the following hypotheses:

RQ1. Is the measurement model with the best fit of the Greek version of the SC-T omnibus scale the three-factor model?

RQ2. Does the SC-T omnibus scale demonstrate adequate reliability operationalized as an average inter-item correlation above .5?

RQ3. Is measurement invariance reported across different groups of teachers (typical and special education teachers)?

RQ4. Are there any potential effects of SC-T on mathematics teaching efficacy?

METHOD

The sample of the study consisted of *621* early childhood teachers. Early childhood teachers in Greece are mostly females. Consequently, 92.3% of the sample were females. Almost all teachers' age groups had adequate representatives apart from the age group of those older than 62 (≥ 62). The teachers of the sample were employed either in typical or in special education (parallel support or resource classes). The specific characteristics of the sample are presented in detail in **Table 1**.

Table 1. Demographic characteristics of the sample (n = 621)

Teachers		Descriptive statistics: n (%)	SC-T (overall): Statistical criterion
Gender	Male	48 (7.7%)	t(619) = -.825, p = .410 > .05
	Female	573 (92.3%)	
Teacher's age	22-31	105 (16.9%)	F(3, 617) = 8.399 & p = .000 < .050
	32-41	193 (31.1%)	
	42-51	142 (22.9%)	
	52-61	177 (28.5%)	
	≥ 62	4 (.6%)	
Current role in education	Substitute teacher (typical education)	115 (18.5%)	F(1, 619) = 10.478 & p = .001 < .050
	Certified teacher (typical education)	281 (45.3%)	
	Substitute teacher (special education)	74 (11.9%)	
	Certified teacher (special education)	151 (24.3%)	
Highest degree	Degree	373 (60.1%)	F(4, 616) = .724 & p = .576 > .050
	Master's in special education	233 (37.5%)	
	PhD	12 (1.9%)	
	PhD in special education	3 (.5%)	
Educational experience	0-4	137 (22.1%)	F(4, 616) = 8.310 & p = .000 < .05
	5-9	84 (13.5%)	
	10-14	78 (12.6%)	
	15-19	129 (20.8%)	
	≥ 20	133 (31.1%)	
Number of modules related to special education (attended)	None	141 (22.7%)	F(2, 618) = .239 & p = .788 > .05
	1-3	287 (46.2%)	
	≥ 4	193 (31.1%)	
Intention to work as a teacher (earss	1-5	54 (8.7%)	F(4, 615) = 1.717 & p = .146 > .05
	6-10	69 (11.1%)	
	11-15	92 (14.8%)	
	16-20	85 (13.7%)	
	≥ 21	321 (51.7%)	
Income (monthly)	Poor (income/education in the lowest 20%)	65 (10.5%)	F(2, 618) = 3.905 & p = .021 < .05
	Moderate (income/education in the middle 60%)	492 (79.2%)	
	Affluent (income/education in the highest 20%)	64 (10.3%)	
Experience in special education	Minimal (1 hour or less per month)	149 (24.0%)	F(2, 618) = 3.905 & p = .021 < .05
	Some (2-10 hours per month)	167 (26.9%)	
	Considerable (11-80 hours per month)	173 (27.9%)	
	Extensive (more than 80 hours per month)	132 (21.3%)	
Residence	Urban	296 (47.7%)	t(619) = -2.371 & p = .018 < .05
	Sub-Urban	207 (33.3%)	
	Rural	118 (19.0%)	
Seminar on special education	No	311 (50.1%)	
	Yes	310 (49.9%)	

Measures

Demographics

A total number of 10 demographic questions were used to assess each teacher's gender, age, current role in education, highest degree, educational experience (in special education and typical), intention to work as a teacher (in years), monthly income, number of modules related to special education and seminars in special education (that teachers attended).

The omnibus T-scale-teacher form

The SC-T consists of 26 items (Hoy & Tschannen-Moran, 2002), rated on a 6-point Likert-type scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). The SC-T measures SC-T in mathematics classrooms. It assesses aspects of school climate, such as benevolence, reliability, competence, honesty, and openness in mathematics classrooms. It consists of three sub-scales assessing trust in principal, colleagues, and clients.

Mathematics teaching efficacy scale

The mathematics teaching efficacy scale is an adaptation (Charitaki et al., 2025b) of the science teaching efficacy belief instrument (Riggs & Knochs, 1990). It is a self-rating questionnaire, adapted appropriately to assess mathematics teaching outcome expectancy and personal mathematics teaching efficacy belief. It consists of 25 close-ended statements, being rated on a 5-point Likert-type scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

Procedure

Firstly, we obtained written permission for the translation and adaptation of the SC-T omnibus scale. Afterward, the English version of the SC-T omnibus scale was translated and adapted into the Greek language and then back-translated to English. A

professional translator, in collaboration with the research team, implemented the translation (English to Greek). The back-translation of the Greek version of the SC-T was implemented by another professional translator. A comparison of the two versions was made for the identification of potential differences and discrepancies. Three experts (university professors with expertise in the field of special and inclusive education) reviewed the Greek adaptations and provided the research team with specific comments for corrections. The research team revised the Greek adaptations with the guidance of the specific comments that the experts provided. Written approval was taken by the Scientific and Ethics Committee of the Department of Early Childhood Education of the University of Crete. The research tools were shared (SC-T) conjointly with an information letter and a consent form.

All participants were informed regarding the purpose of the research and ethical issues such as anonymity and confidentiality of the data collected from the participants. Each teacher answered the close-ended questions and returned them to the research team. The SC-T was given by the researchers to the teachers. The research team, as well as 69 trained undergraduate students participated in the data collection. More specifically, each researcher created a team of 23 students to train and follow the administration process. There were 4 sessions with the undergraduate students and additional meetings when needed to support the administration of the questionnaire. The educational regions of Greece were distributed to each one of the trained students, who was responsible for sending to all schools of his/her region an invitation so as to recruit randomly the sample of participants. The introduction of the questionnaire informed participants about the aim of the study, encouraged them to provide true and unbiased answers, and ensured participants' consent, confidentiality, and anonymity. They were also informed that their participation in the survey was voluntary and that they could stop completing the questionnaire if they wished at any time. In addition, they were informed about the research team and were given contact details for any questions. It was also stressed that at no point would information about their identity be disclosed and that the data be used exclusively for research purposes. The distribution of the questionnaire took approximately 20-25 minutes. All data were collected during the spring semester of the 2023-24.

Data Analysis

Data analysis was implemented using SPSS, SPSS Syntax, and SPSS Amos. Firstly, we reported in detail the measures of central location and dispersion. Moreover, we estimated statistical tests such as Kolmogorov-Smirnov, Shapiro-Wilk, Shapiro-Francia, and Anderson Darling to assess univariate normality for SC-T omnibus scale. We evaluated the adequacy of the size sample with the use of the Kaiser-Meyer-Olkin test, and afterward, we performed an exploratory factor analysis (EFA) with the extraction method of maximum likelihood (promax rotation with Kaiser normalization). A confirmatory factor analysis (CFA) by SPSS Amos was also performed. A variety of goodness of fit indexes were estimated, including adjusted goodness of fit index (AGFI ≥ .90), confirmatory fix index (CFI ≥ .90), Tucker-Lewis index (TLI ≥ .95), root mean square error of approximation (RMSEA < .08), and (standardized) root mean square residual (SRMR < .08) (Hooper et al., 2008; Kline, 2015). We assessed measurement equivalence across teachers' current roles in education. We estimated measures of internal consistency, such as Pearson's, Cronbach's alpha, and McDonald's omega coefficients (Revelle & Condon, 2019). At last, we employed structural equation modelling to add the latent variable of mathematical teaching efficacy and unearth any potential effects.

RESULTS

Preliminary Analysis

There were no data missing for the responses of the data set. Descriptive measures (mean, standard deviation, skewness, and kurtosis) and tests of univariate normality (Kolmogorov-Smirnov, Shapiro-Wilk, Shapiro-Francia, and Anderson-Darling) are presented in detail in **Table 2**. Analysis suggested that there were no floor and ceiling effects.

Table 2. Descriptive statistics and univariate normality for SC-T omnibus scale

	Descriptive statistics				Tests of normality			
	Mean	Standard deviation	Skewness	Kurtosis	Kolmogorov-Smirnov	Shapiro-Wilk	Shapiro-Francia	Anderson- Darling
Trust in principal								
SC-T.1	5.04	1.031	-1.338	2.338	.238	.802	.802	69.54
SC-T.4	2.13	1.415	1.276	.700	.259	.774	.774	65.22
SC-T.7	5.06	1.062	-1.326	1.589	.267	.790	.790	73.54
SC-T.9	5.10	1.153	-1.678	2.865	.267	.745	.745	58.13
SC-T.11	1.98	1.488	1.487	1.023	.321	.695	.695	56.16
SC-T.15	5.17	1.026	-1.632	3.200	.251	.757	.757	62.14
SC-T.18	5.17	1.022	-1.748	3.630	.276	.741	.741	63.56
SC-T.23	2.18	1.537	1.243	.328	.281	.752	.752	53.28
Trust in colleagues								
SC-T.2	4.95	1.053	-1.194	1.981	.223	.821	.821	54.31
SC-T.5	5.17	1.008	-1.595	3.181	.250	.762	.762	68.54
SC-T.8	2.01	1.261	1.080	.030	.281	.775	.775	65.22
SC-T.12	5.18	1.040	-1.563	2.541	.264	.753	.753	54.19
SC-T.13	5.10	.969	-1.561	3.551	.269	.777	.777	56.17
SC-T.16	5.06	1.032	-1.380	2.176	.264	.794	.794	53.22
SC-T.19	5.10	1.006	-1.726	4.204	.272	.759	.759	52.11
SC-T.21	5.02	.978	-1.332	2.633	.271	.807	.807	68.13

Table 2 (Continued). Descriptive statistics and univariate normality for SC-T omnibus scale

	Descriptive statistics				Tests of normality			
	Mean	Standard deviation	Skewness	Kurtosis	Kolmogorov-Smirnov	Shapiro-Wilk	Shapiro-Francia	Anderson- Darling
Trust in clients (parents and students)								
SC-T.3	4.78	.983	-1.088	2.479	.242	.837	.837	54.12
SC-T.6	4.22	1.080	-.672	.426	.210	.894	.894	62.87
SC-T.10	4.73	1.037	-.901	1.153	.244	.865	.865	58.12
SC-T.14	4.56	1.089	-.827	.612	.256	.878	.878	53.62
SC-T.17	4.55	1.046	-.787	.741	.241	.878	.878	51.13
SC-T.20	4.43	1.119	-.756	.737	.200	.887	.887	68.24
SC-T.22	4.49	1.154	-.951	.697	.271	.865	.865	64.22
SC-T.24	4.07	1.196	-.540	-.158	.199	.911	.911	59.08
SC-T.25	4.02	1.084	-.832	.634	.258	.873	.873	61.22
SC-T.26	2.07	1.169	1.152	.828	.252	.816	.816	71.07
SC-T total								

Note. Tests of normality are significant at the 0.001 level

Table 3. Multivariate normality for SC-T omnibus scale

	Multivariate normality tests					
	Mardia's skew	Mardia's kurtosis	Henze-Zirkler's	Doornik-Hansen	E-statistic	Royston
Typical education (n = 396)	4.508,09	28.11	1.37	1.561,17	9.777	6.512,12
Special education (n = 225)	4.764,08	23.17	1.45	1.624,28	8.894	6.642,08
Total (n = 621)	4.126,22	32.13	1.72	1.918,05	8.951	6.864,12

Note. Tests of normality are significant at the .001 level (p = .000)

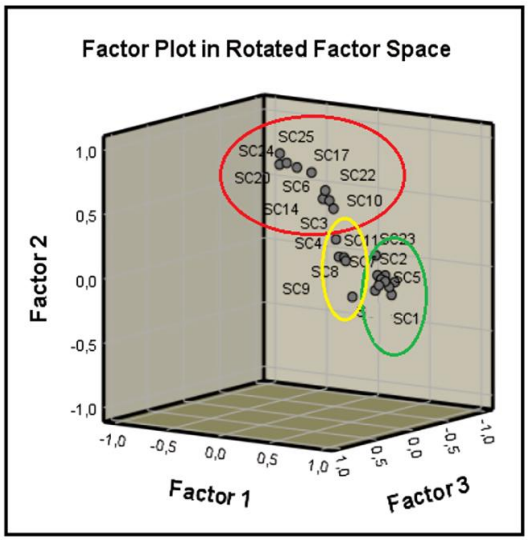

Figure 2. Factor plot in rotated factor space (Source: Authors' own elaboration)

Univariate and Multivariate Normality

Below we present in detail the criteria we employ for the assessment of univariate and multivariate normality. More specifically, we used the Kolmogorov-Smirnov, Shapiro-Wilk, Shapiro-Francia, and Anderson-Darling tests so as to draw conclusions for univariate normality (**Table 1**), and Mardia's skew, Mardia's kurtosis, Henze-Zirkler's, Doornik-Hansen, E-statistic, and Royston's tests for multivariate normality. The estimated multivariate normality tests were estimated for the entire sample, special and typical education teachers separately (**Table 3**). Analysis suggested that the data follow the normal distribution.

Exploratory Factor Analysis (n = 207)

A prerequisite for the implementation of EFA and CFA is to create independent samples. Consequently, we randomly split the entire sample into two subsamples ($S_1 = \frac{1}{3}n$ = 207 participants, and $S_2 = \frac{2}{3}n$ = 414 participants). S_1 sub-sample was used to implement EFA. The initial SC-T was comprised of a 26-item scale. EFA supported the 26-items version. No item was discarded. The Kaiser-Meyer-Olkin formed at KMO = .953 > .700, suggesting factorability for the dataset. Bartlett's test of sphericity was formed at $\chi^2(325)$ = 7,892.528, p = .000 < .005, suggesting that the reduced number of factors could summarize the redundancy. The EFA explained 65.664% of the total variance and provided sufficient support to the three-factor solution (**Figure 2**). A presentation of the specific items that load on the factors, the initial eigenvalues, and the total variance of the contribution of each factor (**Table 4**).

Table 4. Rotated component matrix (EFA factor loadings) and communalities for the SC-T omnibus scale

Measured variables (N = 207)	F1	F2	F3	C
SC-T.1. Teachers in this school trust the principal.	.886			.810
SC-T.2. Teachers in this school trust each other.		.768		.714
SC-T.3. Teachers in this school trust their students.			.521	.593
SC-T.4. The teachers in this school are suspicious of most of the principal's actions.	-.742			.648
SC-T.5. Teachers in this school typically look out for each other.		.903		.765
SC-T.6. Teachers in this school trust the parents.			.820	.687
SC-T.7. The teachers in this school have faith in the integrity of the principal.	.830			.799
SC-T.8. Teachers in this school are suspicious of each other.		-.758		.643
SC-T.9. The principal in this school typically acts in the best interests of teachers.	.818			.752
SC-T.10. Students in this school care about each other.			.577	.638
SC-T.11. The principal of this school does not show concern for the teachers.	-.611			.398
SC-T.12. Even in difficult situations, teachers in this school can depend on each other.		.846		.840
SC-T.13. Teachers in this school do their jobs well.		.732		.783
SC-T.14. Parents in this school are reliable in their commitments.			.589	.591
SC-T.15. Teachers in this school can rely on the principal.	.910			.855
SC-T.16. Teachers in this school have faith in the integrity of their colleagues.		.881		.889
SC-T.17. Students in this school can be counted on to do their work.			.781	.740
SC-T.18. The principal in this school is competent in doing his or her job.	.800			.770
SC-T.19. The teachers in this school are open with each other.		.847		.817
SC-T.20. Teachers can count on parental support.			.866	.752
SC-T.21. When teachers in this school tell you something, you can believe it.		.795		.691
SC-T.22. Teachers here believe students are competent learners.			.656	.661
SC-T.23. The principal doesn't tell teachers what is really going on.	-.647			.473
SC-T.24. Teachers think that most of the parents do a good job.			.832	.624
SC-T.25. Teachers can believe what parents tell them.			.916	.707
SC-T.26. Students here are secretive.			-.558	.452
Total variance explained-initial eigenvalue per factor	51.538%-9.845	9.845%-2.560	4.281%-1.113	

Note. F1: Factor 1: Trust in principal (TP): Cronbach's alpha = .971 & McDonald's omega = .986; & F2: Factor 2: Trust in colleagues (TCol); Cronbach's alpha = .933 & McDonald's omega = .942; F3: Factor 3: Trust in clients (TCl): Cronbach's alpha = .812 & McDonald's omega = .835; & C: Communalities

Table 5. Fit indices for the models of the structure of SC-T omnibus scale

Model	χ^2	df	p	CFI	TLI	AIC_c	BIC	RMSEA	SRMR
Model A 1-factor (TP & TCol & TCl)	322.28	164	.000	.863	.845	1,813.04	1,952.07	.215	.326
Model B 2-factor (TP & TCol-TCl)	408.04	175	.000	.852	.851	1,864.22	1,904.03	.415	.398
Model B 2-factor (TP & TCl-TCol)	438.21	176	.000	.849	.857	1,765.14	1,822.13	.321	.219
Model B 2-factor (TP & TCol-TCl)	478.91	189	.000	.864	.849	1,798.12	1,754.11	.346	.346
Model D 3-factor (TP-TCol-TCl)	418.25	289	.425	.987	.985	1,213.27	1,389.09	.027	.052

Note. N = 414; CFI: Comparative fit index; TLI: Tucker-Lewis index; AICc: Corrected Akaike information criterion; BIC: Bayesian information criterion; RMSEA: Root mean square error of approximation; & SRMR: Standardized root mean square residual

Confirmatory Factor Analysis (n = 414)

A comparative evaluation of all models from the unidimensional to the 3-factor model (TP-TCol-TCl) was implemented to identify the model with the best fit (**Table 5**). Results confirmed the hypothesized two-factor structure of the SC-T omnibus teacher version. All statistical tests for goodness of fit (χ^2/df = 1.416 < 2 and p = .425, TLI = .985 ≥ .950, RMSEA = .027 < .080, CFI = .987 ≥ .90 and SRMR = .052 < .080) of the three-factor model provided sufficient evidence, enabling us to accept it as the model with the best fit.

Measurement Invariance Across Typical and Special Education Teachers

Assessment of measurement invariance suggested a good fit across different groups of teachers [for typical education (*n=396*) and special education (n=225)] (**Table 6**). The nested models were compared using the cutoffs of ΔCFI ≤ .01 and ΔRMSEA ≤ 0.015. All nested invariance models suggested a good fit of the data. ΔCFIs and ΔRMSEAs for weak to configural model comparison and strong to weak model comparison yielded below the cutoffs of non-invariance. Invariance was not supported by the strict to strong model comparison.

Internal Consistency

Reliability statistics suggested excellent internal consistency (overall: α =.897). More specifically, Cronbach's alpha coefficients were formed at α = .971 for trust in principal, α = .933 for trust in colleagues, and α = .812 for trust in clients (parents and students). While McDonald's omega coefficient for the first factor was formed at ω = .986, the second one at ω = .942, and the third one at ω = .835. Moreover, we assessed inter-correlations within the scale's items with the use of Pearson's correlation. Results suggested moderate to strong inter-correlations. More specifically, Pearson's coefficient ranged from .566 to .820.

Table 6. Goodness of fit measures

Models	χ^2	df	χ^2/df	CFI	TLI	RMSEA	RMSEA Lower CI	RMSEA Higher CI	SRMR
Goodness of fit measures for testing measurement invariance across different groups of teachers (special and typical education) for the 2-factor of SC-T omnibus model									
Model 1: Special education (n = 225)	418.21	253	1.65	.972	.988	.029	.021	.037	.032
Model 2: Typical education (n = 396)	427.08	258	1.66	.972	.986	.027	.019	.035	.035
Goodness-of-fit measures for the nested SC-T omnibus models to validate full measurement invariance across different groups of teachers (special and typical education)									
Models	χ^2	**df**		**CFI**	**RMSEA**	**Model comparison**	**ΔCFI**	**ΔRMSEA**	
(1) Configural invariance	423.15	262		.974	.032	-	-	-	
(2) Weak factorial invariance	439.22	265		.976	.025	Model 2 vs. 1	.002	-.007	
(3) Strong factorial invariance	442.08	271		.981	.023	Model 3 vs. 2	.005	-.002	
(4) Strict factorial invariance	456.97	279		.922	.052	Model 4 vs. 3	-.059	.029	

Note. N = 621; CFI: Comparative fit index; TLI: Tucker-Lewis index; RMSEA: Root mean square error of approximation; & SRMR: Standardized root mean square residual

Structural Equation Modelling

To assess whether the "SC-T" predicts "mathematics teaching outcome expectancy" better than "personal mathematics teaching efficacy belief" and "mathematics teaching efficacy", we used structural equation modelling. SC-T entered the construct as a latent variable. The hypothesized model was assessed separately in special and typical education teachers to reveal potential differences.

The goodness of fit indexes supported the hypothesized model in both samples (special and typical education teachers). More specifically, for special education teachers, the results of direct paths suggested that mathematics teaching outcome expectancy ($\beta = .39$, $p < .001$), personal mathematics teaching efficacy beliefs ($\beta = .62$, $p < 0.001$), and mathematics teaching efficacy ($\beta = .68$, $p < 0.001$) predict directly and positively SC-T ($\beta = .71$, $p < 0.001$). The goodness of fit indexes provided evidence for satisfactory of the suggested model (TLI = .964, RMSEA = .041, CFI = .958, and SRMR = .029). When it comes to the typical education teachers, the results of direct paths suggest that mathematics teaching outcome expectancy ($\beta = .31$, $p < .001$), personal mathematics teaching efficacy beliefs ($\beta = .63$, $p < 0.001$), and mathematics teaching efficacy ($\beta = .59$, $p < 0.001$) predict directly and positively SC-T ($\beta = .68$, $p < 0.001$). The goodness of fit indexes provided evidence for satisfactory of the suggested model (TLI = .972, RMSEA = .027, CFI = .952, and SRMR = .035).

The evaluation of measurement invariance resulted in "a good fit" for the suggested model across special and typical education teachers. Both metric-to-configural model and scalar-to-metric model comparisons yielded ΔCFIs and ΔRMSEAs below the cut-offs of non-invariance. The comparison of the strict-to-scalar model was not supported by ΔCFI and ΔRMSEA cut-off.

DISCUSSION

This study was focused on the one hand on providing a reliable and valid Greek version of the SC-T omnibus scale and on the other hand on exploring potential effects of school climate/trust on mathematics teaching efficacy in cases of typical and special education preschool teachers. Regarding the first research question, the application of the CFA, as presented below, provided enough evidence supporting the claim that the model of the SC-T omnibus scale with the best fit is the three-factor one. Accordingly, existing literature in the field success for each student (with and without special educational needs or/and disabilities) is affected by organizational leadership, organizational structure and organizational pedagogy (**Figure 1**).

The finding suggests that the theoretical structure doesn't differentiate from the initial theoretical structure (trust in colleagues, trust in principals, and trust in clients (parents and students)) when translated and culturally adapted to the Greek educational context. Tschannen-Moran (2004) conceptualized and introduced this multidimensional nature of school climate/trust. According to all the fit indices that we employed (CFI, TLI, and RMSEA) the finding is in line with existing literature and supports potential cross-cultural application of the SC-T omnibus scale and comparisons among different educational systems. This validation of the suggested format is coming to support the generalizability of the scale and promote the ongoing scientific dialogue of the effect of school climate on mathematics education in the Greek context.

Regarding the second research question, findings from reliability analyses supported that the SC-T omnibus scale demonstrates excellent internal consistency. According to this result all separate items that assess school climate/trust are closely interconnected and measure in a reliable manner the suggested theoretical construct. The importance of internal consistency is constituted to the fact that the measurement of school climate/trust can be invariant across different contexts and populations. Moreover, results emphasize the fact that the Greek SC-T omnibus scale the suggested theoretical scheme for trust offers a concrete base to gain insights into educational systems and promote school improvement initiatives focused on trust empowerment.

Regarding the third research question, the configural and metric measurement remained invariant across typical and special education teachers. The interpretation of this finding indicates that the proposed theoretical model of school climate/trust is appropriate for measurement for both groups of participants (Lerkkanen & Pakarinen, 2021). We can assume that there is equivalence in the measurement which supports our aim to draw valid and reliable comparative conclusions. Moreover, there is

also evidence that the scale can be applied for research and educational purposes to promote inclusive education. Moreover, it is important to mention that the variability in the professional challenges that both typical and special education cope with to facilitate inclusive mathematics education doesn't have a significant effect on the way they conceptualize school climate / trust.

Finally, regarding the fourth research question, results indicated a statistically significant positive effect of perceived school climate/trust on mathematics teaching efficacy. The finding aligns with literature in the field (Babaoglan, 2016; Yin et al., 2013) suggesting that teachers with higher trust in their principal and colleagues, also tend to believe in their efficacy to implement mathematics instruction (Bandura, 1997). A potential interpretation of the phenomenon may be attributed to the fact that the schools who make efforts to create trustful schools promote in this way the psychological safety for the entire community of the school. Teachers tend to feel free to share instructional strategies, seek support, and take educational risks all of which can enhance teaching efficacy, particularly in a subject like mathematics that often provokes anxiety or insecurity. For special education teachers, in particular, trust appeared to support confidence in adapting instruction to diverse learner needs. These results suggest that interventions aimed at strengthening relational trust within schools could have secondary benefits for instructional quality in mathematics. Moreover, this finding is of major importance for inclusive mathematics education, where collaboration between general and special education staff is essential. Strengthening trust among these groups can facilitate joint planning, differentiated instruction, and the consistent application of individualized support strategies in mathematics classrooms (Zhang et al., 2011).

Together, these findings validate the Greek version of the SC-T omnibus scale and demonstrate the centrality of trust in shaping teachers' professional beliefs. They underscore the importance of cultivating trust-rich environments to support teaching efficacy, with particular relevance to mathematics instruction and inclusive education. Overall, this study contributes to a growing body of evidence that trust is not merely a background condition but a central, dynamic driver of early mathematics learning. It operates across multiple ecological levels–from the individual child to the school organization–and plays a critical role in both typical and special educational contexts. These findings suggest that efforts to improve early numeracy outcomes must also prioritize the relational infrastructure of schooling, particularly through ethically grounded**,** emotionally supportive**,** and culturally responsive practices.

Implications for Mathematics Education

Findings from this study supported the hypothesis that trust should be considered as a pedagogical/didactical resource that promotes conceptual learning and engagement not only in teaching but also in learning mathematics (Day, 2011; Fang, 2020). When teacher-student relationships are built on trust and respect, then it works as a psychosocial precondition for mathematical engagement leaving free space for mathematical inquiry and risk-taking has higher possibility to emerge (Rautamies et al., 2019). Especially in early years education, preschoolers need to feel emotionally safe before they are willing to take intellectual risks, such as proposing problem-solving strategies, exploring patterns, or confronting mathematical errors (Boaler, 2016; Lerkkanen & Pakarinen, 2021). In environments where trust is low, children are more likely to engage in performance-avoidant behaviors or remain passive during numeracy tasks. Mathematics teacher education should include explicit training in relational pedagogy and emotional attune to help educators create the conditions for mathematical exploration. Consequently, undergraduate, postgraduate, and training programs for preschool education teachers should reform their curriculums to enroll relational pedagogy/didactics and attachment-informed practices as essential competencies (Hatfield et al., 2013; Lerkkanen & Pakarinen, 2021).

The findings also reveal that children are more likely to engage in mathematical dialogue and meaning-making when they trust their teacher. Relational trust contributes to the development of children's mathematical self-concept and identity. When children are consistently encouraged, listened to, and taken seriously by trusted adults, they are more likely to see themselves as "math-capable" and persist through challenges (Black et al., 2010; Cobb et al., 2009). Early interventions in mathematics education should focus not only on cognitive skills but also on affective and identity-building dimensions, particularly through consistent, trusting adult-child interactions (Gibbs & Dean, 2015; Liou & Daly, 2014). This claim is in line with previous research indicating that dialogic, inquiry-based pedagogy, effective in developing conceptual mathematical understanding, is only successful in relationally secure environments (Mercer & Howe, 2012). Teachers must learn how to facilitate open-ended mathematical discussions and position themselves as trustworthy co-learners rather than authoritative judges, especially in early learning settings (Parris et al., 2015).

Moreover, it is of major importance for school's well-being and promotion of inclusive mathematics education to cultivate trust through shared values, open communication, and inclusive decision-making by the school's organizational structures. Particularly, in settings characterized by culturally, socioeconomically, and developmentally diversity it is important to empower teachers and build strong relationships not only with families, but only with the entire school community (Bryk & Schneider, 2002; Wang & Degol, 2016). Consequently, professional development in early childhood education should be focused on culturally responsive relationships and trust-building strategies with both teachers, parents, and children.

Parents who trust teachers are more likely to support mathematics learning at home, communicate openly about their child's needs, and reinforce school-based learning through shared language and practices (Civil, 2007; Sheldon & Epstein, 2005). This study found that when parents–particularly fathers–felt respected and heard, they became more engaged in children's mathematical learning. Schools should develop structured, math-focused parent engagement initiatives that begin with building relational trust, especially with fathers and marginalized families.

Moreover, when the school's climate isn't trust-oriented there are significant difficulties that children with special educational needs or/and disabilities should cope with. As we already know, the feeling of acceptance is of major importance for children with special educational needs or/and disabilities and the only way for schools to achieve it is by integrating trust-building explicitly

through inclusive education practices. Mathematics education should be embedded within culturally sustaining pedagogies that affirm diverse home numeracy practices and use trust to bridge gaps between school mathematics and children's lived experiences. Teachers should be supported to recognize how emotional safety influences cognitive access, particularly in mathematical learning, which often triggers anxiety or avoidance in vulnerable learners (Goble & Pianta, 2017). Trust can act as a cognitive enabler, especially in the context of abstract reasoning required in early numeracy.

Finally, neuroscientific research suggests that executive function development, which is foundational for math learning, is enhanced by emotionally secure environments (Blair & Raver, 2015). Trusting relationships reduce stress and support attention regulation, working memory, and problem-solving, which are cognitive processes that are closely related to early numeracy development. Mathematics curricula should be designed with attention to emotional safety and cognitive load, especially for children with additional needs or from trauma-affected backgrounds.

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REFERENCES

Aunio, P., & Räsänen, P. (2016). Core numerical skills for learning mathematics in children aged five to eight years–A working model for educators. *European Early Childhood Education Research Journal, 24*(5), 684-704. https://doi.org/10.1080/1350293X.2014.996424

Babaoglan, E. (2016). The predictive power of leadership to the perception of school trust. *Universal Journal of Educational Research, 4*, 125-132. https://doi.org/10.13189/ujer.2016.041316

Bakken, L., Brown, N., & Downing, B. (2017). Early childhood education: The long-term benefits. *Journal of Research in Childhood Education, 31*(2), 255-269. https://doi.org/10.1080/02568543.2016.1273285

Bandura, A. (1997). *Bandura* (Vol. 2). FrancoAngeli.

Berčnik, S., & Devjak, T. (2017). Cooperation between parents and preschool institutions through different concepts of preschool education. *Center for Educational Policy Studies Journal, 7*(4), 207-226. https://doi.org/10.26529/cepsj.372

Black, L., Mendick, H., & Solomon, Y. (2010). *Mathematical relationships in education: Identities and participation*. Routledge. https://doi.org/10.4324/9780203876114

Blair, C., & Raver, C. C. (2015). School readiness and self-regulation: A developmental psychobiological approach. *Annual Review of Psychology, 66*, 711-731. https://doi.org/10.1146/annurev-psych-010814-015221

Boaler, J. (2016). *Mathematical mindsets: Unleashing students' potential through creative math, inspiring messages and innovative teaching*. Jossey-Bass.

Bowlby, J. (1969). *Attachment and loss: Volume I: Attachment*. The Hogarth Press and the Institute of Psycho-Analysis.

Bromer, J., Paulsell, D., Porter, T., Henly, J., Ramsburg, D., & Weber. R. (2011). Family-sensitive caregiving. A key component of quality in early-care education arrangements. In M. Zaslow, I. Martinez-Beck, K. Tout, & T. Halle (Eds), *Quality measurement in early childhood settings* (pp. 161-190). Paul H. Brookes Publications.

Bryk, A., & Schneider, B. (2002). *Trust in schools: A core resource for improvement*. Russell Sage Foundation.

Cash, A. H., Ansari, A., Grimm, K., & Pianta, R. C. (2019). Power of two: The impact of 2 years of high-quality teacher child interactions. *Early Education and Development, 30*, 60-81. https://doi.org/10.1080/10409289.2018.1535153

Charitaki, G., Alevriadou, A., & Soulis, S.-G. (2022). Early numeracy profiles in young children with intellectual disabilities: The role of cognitive functions. *Journal of Intellectual Disabilities, 28*(1), 48-66. https://doi.org/10.1177/17446295221117021

Charitaki, G., Vretudaki, H., & Kypriotaki, M. (2025a). Assessing mathematics teaching efficacy profiles in kindergarten: The impact of special educational needs, school climate, responsibility for students' achievement, self-efficacy and locus of control. *Asian Journal for Mathematics Education*. https://doi.org/10.1177/27527263251329953

Charitaki, G., Vretudaki, H., & Kypriotaki, M. (2025b). Revisiting the factor structure of the mathematics teaching efficacy through a bifactor approach in a Greek sample of special and typical preschool education teachers. *Mathematics Education Research Journal*, 1-26.

Civil, M. (2007). Building on community knowledge: An avenue to equity in mathematics education. In N. S. Nasir, P. Cobb, & J. A. banks (Eds.), *Improving access to mathematics: Diversity and equity in the classroom* (pp. 105-117). Teachers College Press.

Cobb, P., Gresalfi, M., & Hodge, L. L. (2009). An interpretive scheme for analyzing the identities that students develop in mathematics classrooms. *Journal for Research in Mathematics Education, 40*(1), 40-68. https://doi.org/10.5951/jresematheduc.40.1.0040

Day, C. (2011). Organizational democracy, trust and the progressive distribution of leadership. In C. Day, P. Sammons, K. Leithwood, D. Hopkins, A. Gun, & E.Pataridou (Eds.), *Successful school leadership: Linking with learning and achievement* (pp. 193-222). Open University Press.

Deng, Y., Cherian, J., Khan, N., Kumari, K., Sial, MS., Comite, U., Gavurova, B., & Popp, J. (2022). Family and academic stress and their impact on students' depression level and academic performance. *Frontiers in Psychiatry, 13*. https://doi.org/10.3389/fpsyt.2022.869337

Dragolov, G., Ignacz, Z., Lorenz, J., Delhey, J., & Boehnke, K. (2017). Social cohesion radar: Measuring common ground. *Bertelsmann Stiftung*. https://www.bertelsmann-stiftung.de/fileadmin/files/BSt/Publikationen/GrauePublikationen/Codebook_LW_SCRInternational_en_2013.pdf

Fang, X. (2020). What research tells us about how trust is built in kindergarten and why it is important for children's education. *Review of Educational Theory, 3*(4), 88-98. https://doi.org/10.30564/ret.v3i4.2459

Gibbs, P., & Dean, A. (2015). Do higher education institutes communicate trust well? *Journal of Marketing for Higher Education, 25*(2), 155-170. https://doi.org/10.1080/08841241.2015.1059918

Goble, P., & Pianta, R. (2017). Teacher-child interactions in free choice and teacher-directed activity settings: Prediction to school readiness. *Early Education and Development, 28*, 1035-1051. https://doi.org/10.1080/10409289.2017.1322449

Guo, S., Guan, S., & Yan, X. (2021). Effects of early learning environment on early childhood development in rural areas in China. *Children and Youth Services Review, 124*, Article 105978. https://doi.org/10.1016/j.childyouth.2021.105978

Hatfield, B., Hestenes, L., Kintner-Duffy, V., & O'Brien, M. (2013). Classroom emotional support predicts differences in preschool children's cortisol and alpha-amylase levels. *Early Childhood Research Quarterly, 28*, 347-356. https://doi.org/10.1016/j.ecresq.2012.08.001

Hooper, D., Coughlan, J., & Mullen, M. (2008, September). Evaluating model fit: a synthesis of the structural equation modelling literature. In *7th European Conference on research methodology for business and management studies* (Vol. 2008, No. 2, pp. 195-200).

Hoy, W., & Tschannen-Moran, M. (2002). The conceptualization and measurement of faculty trust in schools: The omnibus T-scale. In C. Miskel, & W. K. Hoy, (Eds.), *Studies in leading and organizing schools* (pp. 181-208). University of South Florida. https://doi.org/10.1037/t65808-000

Hummel, T., Cohen, F., & Anders, Y. (2022). Parents' trust in their child's preschool: Associations with child and family characteristics and aspects of parent-preschool communication. *Early Education and Development, 34*(5), 1057-1074. https://doi.org/10.1080/10409289.2022.2101344

Kikas, E., Peets, K., & Niilo, A. (2011). Assessing Estonian mothers' involvement in their children's education and trust in teachers. *Early Child Development and Care, 181*(8), 1079-1094. https://doi.org/10.1080/03004430.2010.513435

Kinzie, M., Vick Whittaker, J., Williford, A., DeCoster, J., McGuire, P., Lee, Y., & Kilday, C. (2014). *MyTeachingPartner-Math/Science* pre-kindergarten curricula and teacher supports: Associations with children's mathematics and science learning. *Early Childhood Research Quarterly, 29*(4), 586-599. https://doi.org/10.1016/j.ecresq.2014.06.007

Kline, P. (2015). *A handbook of test construction (psychology revivals): Introduction to psychometric design*. Routledge. https://doi.org/10.4324/9781315695990

Lerkkanen, M.-K., & Pakarinen, E. (2021). Parental trust in teachers and children's interest in reading and math: A longitudinal study. *European Education, 53*(3-4), 152-167. https://doi.org/10.1080/10564934.2022.2080562

Lerkkanen, M.-K., Kikas, E., Pakarinen, E., Poikonen, P., & Nurmi, J. E. (2013). Mothers' trust toward teachers in relation to teaching practices. *Early Childhood Research Quarterly, 28*(1), 153-165. https://doi.org/10.1016/j.ecresq.2012.04.005

Linder, S., Powers-Costello, B., & Stegelin, D. (2011). Mathematics in early childhood: Research-based rationale and practical strategies. *Early Childhood Education Journal, 39*, 29-37. https://doi.org/10.1007/s10643-010-0437-6

Liou, Y.-H., & Daly, A. (2014). Closer to learning: Social networks, trust, and professional communities. *Journal of School Leadership, 24*(4), 753-795. https://doi.org/10.1177/105268461402400407

Markson, L., & Luo, Y. (2020). Trust in early childhood. *Advances in Child Development and Behavior, 58*, 137-162. https://doi.org/10.1016/bs.acdb.2020.01.005

Mercer, N., & Howe, C. (2012). Explaining the dialogic processes of teaching and learning: The value and potential of sociocultural theory. *Learning, Culture and Social Interaction, 1*(1), 12-21. https://doi.org/10.1016/j.lcsi.2012.03.001

Moran, E., Tableman, B., & Carlson, J. (2012). School climate and learning. In N. M. Seel (Ed.), *Encyclopedia of the sciences of learning* (pp. 2962-2966). Springer. https://doi.org/10.1007/978-1-4419-1428-6_396

Mulligan, J., Woolcott, G., Mitchelmore, M., & Davis, B. (2018). Connecting mathematics learning through spatial reasoning. *Mathematics Education Research Journal, 30*, 77-87. https://doi.org/10.1007/s13394-017-0210-x

Neuenschwander, M. (2020). Information and trust in parent-teacher-cooperation: Connections with educational inequality. *Central European Journal of Educational Research, 2*(3), 19-28. https://doi.org/10.37441/CEJER/2020/2/3/8526

Nguyen, T., Ansari, A., Pianta, R., Whittaker, J., Vitiello, V., & Ruzek, E. (2020). The classroom relational environment and children's early development in preschool. *Social Development, 29*, 1071-1091. https://doi.org/10.1111/sode.12447

Niedlich, S., Kallfaß, A., Pohle, S., & Bormann, I. (2021). A comprehensive view of trust in education: Conclusions from a systematic literature review. *Review of Education, 9*(1), 124-158. https://doi.org/10.1002/rev3.3239

Parris, S., Dozier, M., Purvis, K., Whitney, C., Grisham, A., & Cross, D. (2015) Implementing trust-based Relational Intervention_ in a charter school at a residential facility for at risk youth. *Contemporary School Psychology, 19*(3), 157-164. https://doi.org/10.1007/s40688-014-0033-7

Parviainen, P. (2019). The development of early mathematical skills–A theoretical framework for a holistic model. *Journal of Early Childhood Education Research, 8*(1), 162-191.

Penttinen, V., Pakarinen, E., & Lerkkanen, M.-K. (2020). Exploring parent-teacher trust and school involvement: Finnish perspective. In N. Toren, & G. van Schalkwyk (Eds.), *Parental involvement. Practices, improvement strategies and challenges* (pp. 65-89). Nova Science Publisher.

Petrogiannis, K., & Penderi, E. (2013). The quality of parent-teacher relationship scale in the kindergarten: A Greek study. *International Research in Education, 2*(1), 1-21. https://doi.org/10.5296/ire.v2i1.4343

Rautamies, E., Vähäsantanen, K., Poikonen, P.-L., & Laakso, M.-L. (2019). Trust in the educational partnership narrated by parents of a child with challenging behaviour. *Early Years, 41*(2), 1-14. https://doi.org/10.1080/09575146.2019.1582475

Revelle, W., & Condon, D. M. (2019). Reliability from α to ω: A tutorial. *Psychological assessment*, *31*(12), 1395-1412. https://doi.org/10.1037/pas0000754

Reynolds, A., & Shlafer, R. (2010). Parent involvement in early education. In S. Christenson, & A. Reschly (Eds.), *Handbook of school-family partnerships* (pp. 158-174). Routledge.

Riggs, I., & Knochs, L. (1990). Towards the development of an elementary teacher's science teaching efficacy belief instrument. *Science Education, 74*, 625-637. https://doi.org/10.1002/sce.3730740605

Rochester, S., Weiland, C., Unterman, R., McCormickc, M., & Moffett, L. (2019). The little kids down the hall: Associations between school climate, pre-K classroom quality, and pre-K children's gains in receptive vocabulary and executive function. *Early Childhood Research Quarterly, 48*, 84-97. https://doi.org/10.1016/j.ecresq.2019.02.008

Rossbach, H.-G., Blaurock, S., Grosse, C., Kluczniok, K., Kuger, S., Lehrl, S., & Smidt, W. (2024). Quality of learning environments in early childhood. In S. Weinert, H. G. Rossbach, J. von Maurice, H. P. Blossfeld, & C. Artelt (Eds.), *Educational processes, decisions, and the development of competencies from early preschool age to adolescence. Edition ZfE, vol 16* (pp. 55-90). Springer. https://doi.org/10.1007/978-3-658-43414-4_3

Sanches-Ferreira, M., Gonçalves, J. L., Araújo, S. B., Alves S., & Barros, S. (2022). Building inclusive preschool classrooms: How desirable and feasible is a set of strategies that facilitate teacher-child relationships? *Frontiers in Education, 7*. https://doi.org/10.3389/feduc.2022.944822

Santiago, R., Garbacz, S., Beattie, T., & Moore, C. (2016). Parent-teacher-relationships in elementary school: An examination of parent-teacher-trust. *Psychology in Schools, 53*(10), 1003-1017. https://doi.org/10.1002/pits.21971

Sheldon, S. B., & Epstein, J. L. (2005). Involvement counts: Family and community partnerships and mathematics achievement. *The Journal of Educational Research, 98*(4), 196-207. https://doi.org/10.3200/JOER.98.4.196-207

Silver, R., Measelle, J., Armstrong, J., & Essex, M. (2005). Trajectories of classroom externalizing behavior: Contributions of child characteristics, family characteristics, and the teacher-child relationship during the school transition. *Journal of School Psychology, 43*(1), 39-60. https://doi.org/10.1016/j.jsp.2004.11.003

Tschannen-Moran, M. (2004, November). What's trust got to do with it? The role of faculty and principal trust in fostering student achievement. In *UCEA Conference Proceedings for Convention*.

Wang, M., & Degol, J. (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

Yin, H.-B., Lee, J.- C.-K., Jin, Y.-L., & Zhang, Z.-H. (2013). The effect of trust on teacher empowerment: The mediation of teacher efficacy. *Educational Studies, 39*(1), 13-28. https://doi.org/10.1080/03055698.2012.666339

Zhang, K. (2011). Early childhood education and special education: How well do they mix? An examination of inclusive practices in early childhood educational settings in Hong Kong. *International Journal of Inclusive Education, 15*(6), 683-697. https://doi.org/10.1080/13603110903317676