

A structural equation model of preschool teacher candidates' self-efficacy beliefs for music teaching: The role of academic and preschool teaching self-efficacy

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Abstract

This study sought to explore the interrelationships between preschool teacher candidates' self-efficacy in music teaching, their academic self-efficacy and their self-efficacy in preschool teaching. A review of the relevant literature was conducted, and Structural Equation Modeling was used to examine the relationships between variables. The study sample comprised 425 preschool teacher candidates. The findings indicated that academic self-efficacy significantly and positively predicted both preschool teaching self-efficacy and music teaching self-efficacy. Additionally, preschool teaching self-efficacy emerged as a significant positive predictor of music teaching self-efficacy. Notably, preschool teaching self-efficacy was identified as the strongest predictor of music teaching self-efficacy. Furthermore, preschool teaching self-efficacy was found to mediate the relationship between academic self-efficacy and music teaching self-efficacy. Theoretical implications suggest that the music teaching self-efficacy beliefs of preschool teacher candidates, who are also responsible for providing music education, are positively related to their academic self-efficacy and preschool teaching self-efficacy. However, further research is needed that addresses other variables with the potential to predict music teaching self-efficacy.

Keywords

Academic self-efficacy, music teaching self-efficacy, preschool teacher candidate, preschool teaching self-efficacy

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Introduction

Preschool teacher candidates may possess sufficient skills and abilities to teach music, yet doubts about their own capabilities can hinder the implementation of music education practices in the classroom. This is because cognitive, motivational and emotional factors, which facilitate the translation of knowledge and skills into competent actions, may play a influential role in this process. This situation, highlighting the concept of self-efficacy, reveals that sometimes the belief in what can be achieved with existing resources under different conditions is more important than the abundance of available skills or abilities (Bandura, 1997).

Pajares (2002) asserts that the sources of self-efficacy beliefs do not directly translate into efficacy beliefs. In the formation of self-efficacy, individuals' interpretations of their experiences provide the foundation for their beliefs. As self-efficacy is not a static construct, it is shaped within the social environment, influenced by various factors such as past experiences (mastery experiences), observing others perform similar tasks (vicarious experiences) and feedback received from the social context (social persuasions), somatic and emotional states (physiological and affective states). Therefore, people who are similar in terms of their abilities and skills or the same person under different conditions may perform at different levels depending on fluctuations in self-efficacy (Bandura, 1997). In other words, regardless of the individual's skills and abilities in any subject, the perceived sense of self-efficacy can have a significant impact on the outcome during the implementation phase.

Across the globe, music education in preschool and primary school is predominantly delivered by teachers who are not specialists in music (Şen, 2024). In this context, it can be argued that, particularly for general education teachers, music teaching self-efficacy is a multifaceted variable influenced by various classroom factors and potentially related to numerous other variables. Jeanneret (1997) posits that the development of music teaching competencies among general education teachers is far more complex than is generally acknowledged in the literature. In this regard, a perspective, which views music teaching self-efficacy as shaped by an interplay of personal, social and cognitive factors (Biasutti & Concina, 2017), reinforces the notion that music teaching, especially for general education teachers, is a complex task that involves a range of professional and personal characteristics beyond mere individual abilities (Biasutti et al., 2020).

This study examines the relationship between the self-efficacy beliefs regarding music teaching of preschool teacher candidates, who are not subject to a musical aptitude test upon entering school but are responsible for providing music education, and certain identified variables.

Academic self-efficacy

Academic self-efficacy encompasses students' beliefs in their competence in academic subjects (Bandura, 1997). Research on academic self-efficacy frequently highlights its cognitive nature, with self-efficacy items often designed to emphasise the cognitive aspects of individuals' self-perceptions (Ferla et al., 2009). According to scholars, academic self-efficacy is positively associated with a variety of factors, including task selection, persistence, effective classroom activities, classroom management skills and academic achievement (Karakose et al., 2023). Furthermore, it plays a critical role in shaping students' academic trajectories (Yeşilyurt, 2013) and field-specific attitudes (Yeşilyurt et al., 2016). Students with a high level of academic self-efficacy tend to be more eager in their learning experiences, exert greater effort in school activities and develop more effective strategies for coping with challenges (Tabancalı & Çelik, 2013).

Teacher self-efficacy

Teacher self-efficacy, regarded as a crucial component of teacher effectiveness, is conceptualised (Skaalvik & Skaalvik, 2007, p. 612) as a teacher's personal belief in their own capabilities in areas such as planning, organising and executing the activities necessary to achieve specific educational objectives, consistent with Bandura's (1997, p. 3) definition of self-efficacy. Teachers' beliefs in their competencies affect not only their general orientation towards classroom management during the education process but also all their teaching-oriented activities (Bandura, 1997). According to researchers, teacher self-efficacy positively impacts the quality of classroom processes by providing a psychological foundation for the teacher (Chang et al., 2022; Hu et al., 2021; Künting et al., 2016; Zee & Koomen, 2016), making it one of the most important determinants of successful educational outcomes (Holzberger et al., 2013).

The literature contains numerous studies examining the self-efficacy perceptions of teachers across different disciplines as well as pre-service teachers (Inan Kaya, 2017; McLennan et al., 2017). For example, the findings in Garvis and Pendergast's (2011) study suggest that early childhood teachers have higher self-efficacy in teaching Mathematics and English compared to any art branch, with some teachers even not incorporating certain art branches in their classrooms. These results emerge as issues that need to be addressed by the relevant parties. On the other hand, research highlighting the significant relationships between teacher self-efficacy and various variables such as domain-specific teaching self-efficacy in a particular subject area (Akay & Boz, 2011; Yeşilyurt et al., 2016), professional attitudes (Karakose et al., 2023) and various teaching strategies (Hu et al., 2021) is also evident.

Music teaching self-efficacy

The literature on beliefs regarding the teaching of music, a key educational tool across all levels of formal education, is extensive. This body of research encompasses beliefs about the ability and skills required for music teaching (Jeanneret, 1997; Mills, 1989; Seddon & Biasutti, 2008), as well as beliefs concerning the teacher characteristics necessary for effective music instruction (Burak, 2014; Teachout, 1997). Additionally, some studies have explored the relationships between self-efficacy in music teaching and variables such as personality traits (Biasutti et al., 2020), gender and grade level (Koca, 2016).

The relationship between self-efficacy in music teaching and other variables has been investigated among both music educators and general education teachers, as well as pre-service teachers. For instance, significant relationships were found between pre-service music teachers' self-efficacy in music teaching and their attitudes towards the teaching profession (Kaleli, 2020). Moreover, it has been observed that self-efficacy levels for music teaching among preschool and classroom teacher candidates can vary depending on factors such as grade, musical experience (Burak, 2019) and even gender in favor of females (Çevik, 2011; Koca, 2016). Furthermore, research highlights that classroom teachers' self-efficacy for music teaching may differ from their self-efficacy for teaching lessons like mathematics and English (Garvis, 2013). There is also evidence suggesting that self-efficacy for music teaching can be predicted through a multidimensional model that includes personal and professional characteristics, such as music teachers' social skills, beliefs about musical ability, teaching experience and gender (Biasutti & Concina, 2017).

Studies show varying results regarding the self-efficacy levels of teachers/teacher candidates in music teaching. For instance, some studies (Gölbaşı, 2013; Koca, 2016) report that preschool teachers and teacher candidates demonstrate high self-efficacy in music teaching. Another study (Hallam et al., 2009) found that while nearly all primary school teachers are confident in their

teaching abilities, only half demonstrate high self-efficacy in teaching music. Gifford (1993) states that one of the most frequently reported issues is the low self-efficacy of pre-service elementary school teachers in music teaching. Taş and Atılğan (2022) indicate that, despite expectations of low results due to limited training and experience, classroom teachers encountered moderate outcomes regarding their self-efficacy in music teaching. These varying results underscore that self-efficacy possesses a dynamic structure shaped by the complex interplay of multidimensional factors (Pajares, 2002).

Moreover, several studies have examined the factors affecting music teaching self-efficacy. For example, the frequency of music listening and the level of interest in music among classroom teacher candidates (Gülle & Akay, 2019), as well as their being able to play a musical instrument (Hallam et al., 2009; Köksoy, 2017), have been found to influence their perceptions of self-efficacy in music teaching. Eren and Engür (2019) discovered a positive correlation between the music backgrounds of special education teacher candidates and their self-efficacy in music instruction. These examples demonstrate that the interactions teacher candidates have with music can enhance their perceptions of competence in music teaching.

Conceptual relationship between variables. Prospective beliefs about classroom practices are significantly shaped during the pre-service teacher education process. Although there is significant evidence (Richardson, 2003) that teacher candidates enter teacher education programmes with certain ingrained beliefs that strongly influence their teaching approaches in the classroom, it can be argued that these programmes contribute to transforming these implicit beliefs into more objectively reasonable and outcome-focused ones.

Studies (Inan Kaya, 2017; Tabanlı & Çelik, 2013; Yağcı & Aksoy, 2015; Yeşilyurt et al., 2016; Yılmaz et al., 2016), have demonstrated a linear relationship between pre-service teachers' academic self-efficacy and teacher self-efficacy. Academic self-efficacy impacts learning and success (Yeşilyurt, 2013), as academic self-efficacy increases, teacher self-efficacy will also increase as knowledge base of the candidate teacher will expand. It remains unclear whether academic self-efficacy predicts self-efficacy for teaching music. However, the research findings that identify previously unknown variables (e.g. social skills) as predictors of self-efficacy in music teaching (Biasutti & Concina, 2017) reveals the need for further studies to explore its relationship with different variables. On the other hand, Burak's (2019) study emphasises the important role that the music education received by preschool and classroom teacher candidates within the scope of their undergraduate education plays in the development of their self-efficacy in music teaching. This sheds light on the formative effect of academic education on music teaching self-efficacy. In the current research, it is deemed important to examine the interaction between academic self-efficacy and teacher self-efficacy, with the understanding that self-efficacy in music teaching is a specific sub-dimension of teacher self-efficacy, in order to understand the relationship between academic self-efficacy and self-efficacy in music teaching. Based on the above explanations, it can be suggested that academic self-efficacy shapes learning experiences and outcomes, and that the teaching practices, strategies and performance beliefs that teacher candidates acquire as a result of their learning will also influence their self-efficacy for music teaching. Indeed, there are studies (Akay & Boz, 2011; Yeşilyurt et al., 2016) employing Structural Equation Modelling (SEM) to examine how academic self-efficacy and teacher self-efficacy predict competence in specific fields. In this context, since academic self-efficacy, teacher self-efficacy and music teaching self-efficacy collectively determine the overall learning experiences of prospective teachers, each of these factors can be considered a vital component of the preschool teacher education process.

A few studies have investigated the intricate dynamics of music teaching self-efficacy within preschool environments. Pan and Luen (2024), emphasise that the intersection of teacher

self-efficacy and music teaching self-efficacy forms a framework that influences the foundational experiences and skills necessary for effective music education in preschool settings. Battersby and Cave (2014), highlight the importance of pre-service teachers learning to create musical environments that can be seamlessly and confidently integrated into the general curriculum during their training. In this light, music teaching self-efficacy for preschool teachers can be seen as dynamically and multifacetedly interacting with teacher self-efficacy, which encompasses a broader confidence and belief in their teaching abilities across various subjects.

Bouffard-Bouchard et al. (1991) found that students with high self-efficacy, regardless of talent and skill levels, employ more effective self-regulation strategies to maintain task persistence. The teacher efficacy model (Tschannen-Moran et al., 1998), which is based on a cyclical process where efficacy beliefs are formed, assessed, applied and subsequently lead to new beliefs, suggests that teachers' efficacy beliefs are interpreted and evaluated through cognitive processing. From this perspective, it can be argued that as general education teacher candidates' perceptions of their academic and professional beliefs are shaped during pre-service education, they may begin to set aside any preconceived notions about the necessity of innate talents and skills in the specific subjects, such as music, they will teach. Instead, they can develop field-specific beliefs that will enhance their motivation (Asbury et al., 2023). Indeed, it is well-established that preschool teachers' self-efficacy beliefs for teaching specific subjects are strong predictors of their classroom practices in those subjects (Oppermann et al., 2019).

The literature contains studies examining the relationships between field-specific teaching competence, teacher self-efficacy and other variables. For example, Akay and Boz (2011) explored the relationships between primary school teacher candidates' academic achievement, teacher self-efficacy beliefs, mathematics self-efficacy and attitudes towards mathematics. The study found significant relationships between pre-service teachers' self-efficacy, mathematics self-efficacy and attitudes towards mathematics. However, since the study observed no significant relationship between academic success and both teacher self-efficacy and mathematics self-efficacy, it was noted that this result did not align with findings from similar studies. Yeşilyurt et al. (2016) used SEM to investigate the relationships between teacher candidates' academic self-efficacy, teacher self-efficacy, computer self-efficacy and attitudes towards computer-assisted education, finding significant relationships among the variables.

Rationale and purpose of the current study

Garvis and Pendergast (2011) argue that a preschool teacher's high self-efficacy in music teaching significantly increases the likelihood of incorporating music into classroom activities. However, a teacher's innate musical talent may also influence this likelihood. Burak's (2019) study found a strong correlation between preschool and primary school teacher candidates' self-efficacy for music teaching and their musical talent. Conversely, Vannatta-Hall (2010) emphasises that while musical talent is important for effective music teaching in preschool, personal beliefs about lesson planning and delivery are also crucial and decisive factors.

Pre-service early childhood educators enter teacher education programmes with pre-existing beliefs, abilities and skills. Their perceived self-efficacy in specific areas like music education is often seen as domain-specific competence (Asbury et al., 2023). Notably, since pre-service early childhood teacher candidates are not assessed for musical aptitude and do not undergo vocational music education, their innate musical talent remains an uncontrollable variable. However, throughout their training, teacher candidates may develop self-awareness and efficacy beliefs regarding the role of music education in their future practice (Garvis & Pendergast, 2011) may harness their existing potential. Studies (Burak, 2014; Teachout, 1997) support this, showing that both candidate and experienced

teachers value personal characteristics and teaching skills over musical knowledge and skills. Jeanneret (1997) also found that the competence of primary school teacher candidates in music teaching is linked not only to their musical knowledge but also to their self-efficacy and positive attitude.

Given these considerations, it is unsurprising that early childhood educators can successfully implement music teaching by providing pedagogical diversity and effectiveness, driven by their multifaceted and strong self-efficacy beliefs, independent of their innate musical talent. Indeed, the author of this study has frequently observed such situations during the music activities conducted by teacher candidates as part of their internship practices in schools while advising preschool teacher candidates.

In this context, the sources of preschool teacher candidates' self-efficacy perceptions towards music teaching – excluding their specialised skills such as singing, playing a musical instrument, reading musical notation and their innate musical talents – have become a subject of interest. It has been proposed to examine the relationship between these perceptions and certain variables identified based on the above discussions. Although the perceived self-efficacy in music teaching among preschool teacher candidates, which is addressed through the dimensions of planning music activities, preparing musical materials and organising music learning-teaching environments, may be predicted by other potential variables not covered in this study, it is considered worthwhile to investigate the extent to which academic self-efficacy and self-efficacy beliefs in preschool teaching predict this perceived self-efficacy using SEM.

Some studies draw attention to issues related to the beliefs, attitudes and classroom practices of preschool teachers/teacher candidates regarding music teaching (Burak, 2014; Garvis & Pendergast, 2011; Gölbaşı, 2013; Vannatta-Hall, 2010). However, it appears that the studies in the literature focus on the level of teachers/teacher candidates' ability to use musical knowledge and skills or only on music teaching self-efficacy itself. In this context, no existing research has been found that addresses self-efficacy in music teaching by simultaneously comparing multiple parameters within a holistic model framework. From this point of view, it is aimed to expand the field of previous research by evaluating the self-efficacy of preschool teacher candidates and therefore teachers towards music teaching in a broad perspective by examining the effects of the determined variables.

The hypotheses to be tested in this study are as follows:

H1: Pre-service early childhood educators' academic self-efficacy (ASE) beliefs significantly predict their self-efficacy beliefs regarding preschool teaching (TSEPT).

H2: Pre-service early childhood educators' ASE beliefs significantly predict their self-efficacy beliefs in music teaching (TSEMT).

H3: Pre-service early childhood educators' TSEPT beliefs significantly predict their TSEMT beliefs.

H4: The TSEPT variable mediates the relationship between ASE and TSEMT.

For each hypothesis proposed above, null hypotheses have also been defined. The study aims to provide evidence for rejecting these null hypotheses.

Method

Research design

In this study, Structural Equation Modeling (SEM) was used. SEM, which is a combination of regression, factor and variance analysis, is seen as a comprehensive and powerful statistical method

Table 1. Demographic characteristics of the participants.

Demographic variable	N=425	% of sample
Gender		
Female	378	88.9
Male	47	11.1
Grade		
Fourth	181	42.6
Third	142	33.4
Second	102	24

in that it allows statistical analysis of all variables simultaneously in order to determine to what extent the tested structural model fits the data (Byrne, 2016).

Participants

To recruit participants, an online survey link was distributed to all universities in Türkiye, accompanied by an official permission letter. A total of 425 pre-service early childhood educators from 18 different universities voluntarily completed the survey. As all questions in the online survey (refer Supplemental Material) were mandatory, no data was lost. All participants provided informed consent before completing the survey.

As in many countries, preschool music education in Türkiye is delivered by teachers who are not music specialists (Burak, 2014; Şen, 2024). Teacher candidates undertake their training in faculties of education at universities, following a standardised curriculum and content determined by the central state authority. The teacher training programme spans eight semesters, each lasting 14 weeks. Over 4 years, teacher candidates complete a total of 141 credits, with three credits allocated to ‘Early Childhood Music Education’, taken in the second year. Admission to these programmes is based on candidates’ scores from central, nationwide general academic knowledge entrance exam, with no additional talent test in music.

Based on Pajares’ (2002) explanations, participants who had previously taken the ‘Music Education in Early Childhood’ course were included in the study, as this course is considered an important factor influencing the development of self-efficacy beliefs in music teaching. According to official reports at the time of the research, approximately 14,000 students were enrolled in the second, third and fourth grades across 67 state universities offering preschool teaching education, making the sample represent about 3% of the population. Table 1 shows demographic details of the participants.

Procedures

Data collection occurred at the end of the spring semester of 2023. The research was approved by the ethics committee of a public university in Türkiye (decision number 2022/172). The survey link, accompanied by the university’s official permission letter, was sent to other universities across Türkiye. The link was distributed through educators in early childhood education departments, specifically targeting second, third and fourth-year preschool teacher candidates who had taken the relevant course. Therefore, to verify whether they had taken the relevant course, the survey included questions regarding their year of study and the grades they had received in the course.

Table 2. Goodness of fit values.

Fit indices	Good fit	Acceptable
CMIN/DF	$0 \leq \chi^2/df \leq 3$	$3 < \chi^2/df < 5$
RMSEA	$0 \leq RMSEA \leq .05$	$.05 < RMSEA \leq .08$
SRMR	$0 \leq SRMR \leq .05$	$.05 < SRMR \leq .08$
CFI	$.95 \leq CFI < 1.00$	$.90 \leq CFI < .95$
TLI	$.95 \leq TLI < 1.00$	$.90 \leq TLI < .95$
IFI	$.95 \leq IFI < 1.00$	$.90 \leq IFI < .95$
NFI	$.95 \leq NFI < 1.00$	$.90 \leq NFI < .95$

After the earthquakes in Turkey in 2023, a distance education process was implemented in all universities. Despite various difficulties in reaching students and collecting data, surveys were returned from a total of 18 universities. Additionally, written permission was obtained from the rights holders of all scales used in the study.

Data collection instruments

The data collection instrument consists of the personal information form and the following three scales.

Academic self-efficacy (ASE). The scale, originally developed in German by Jerusalem and Schwarzer (1981) to assess the academic self-efficacy beliefs of university students, was adapted into Turkish by Yılmaz et al. (2007). This Likert-type scale, with responses ranging from ‘Does not apply to me at all’ (1) to ‘Applies to me completely’ (4), comprises seven items, six of which are positively worded (e.g. When I prepare sufficiently, I always achieve high success in exams) and one negatively worded item that is reverse-coded (e.g. When preparing for exams, I usually do not know how to deal with the topics I need to learn).

In this study, the reliability and validity analyses of the ASE scale were based on the answers of preschool teacher candidates. Cronbach’s alpha reliability coefficient of the scale was found to be .86. This result shows that the measurement tool has a high level of reliability. A confirmatory factor analysis (CFA) was conducted to assess the fit of the scale’s single-factor structure to the current data. The standardised factor loadings of the items ranged from .57 to .80. The goodness of fit values obtained are as follows: $CMIN/DF(\chi^2/SD) = 2.87$;

RMSEA=.07; SRMR=.03; CFI=0.98; TLI=0.97; IFI=0.98; NFI=0.97. According to these results, the theoretical structure of the scale is confirmed and the model is compatible with the data (Byrne, 2016; Kline, 2016; Schumacker & Lomax, 2004). Table 2 shows the reference ranges of goodness of fit values.

Teacher self-efficacy for preschool teaching (TSEPT). The scale developed by Tepe and Demir (2012) is designed to measure the self-efficacy beliefs of preschool teachers regarding their teaching. It is a Likert-type scale, with responses rated from ‘Not at all’ (1) to ‘Completely’ (5). The scale comprises 37 items across six sub-dimensions: Learning-Teaching Process (LTP-9 items, e.g. I can ensure the active participation of my students in the learning process), Communication Skills (CS-7 items, e.g. I can adjust the tone of my voice and necessary emphasis appropriately), Family Participation (FP-5 items, e.g. I can encourage families to participate in school and classroom activities), Planning (PL-6 items, e.g. I can plan the learning process effectively), Organising

Learning Environments (OLE-5 items, e.g. I use the learning environment to increase the creativity of my students) and Class Management (CM-5 items, e.g. I can motivate all my students to participate in activities).

In this study, reliability and validity analyses of the TSEPT scale were based on the answers of preschool teacher candidates. Cronbach's alpha reliability coefficient for the entire scale was found to be .98. The reliability coefficients of the sub-dimensions were determined as .94, .91, .91, .94, .92 and .92, respectively. These results show that the measurement tool has a high level of reliability. A first-level CFA was conducted to evaluate the fit of the scale's six-dimensional structure with the current data. The standardised factor loadings of the items ranged from .71 to .89. The goodness of fit values obtained are as follows: $CMIN/DF(\chi^2/SD)=2.29$; $RMSEA=0.06$; $SRMR=0.04$; $CFI=0.94$; $TLI=0.94$; $IFI=0.94$; $NFI=0.90$. According to these results, the theoretical structure of the scale is confirmed and the model is compatible with the data (Byrne, 2016; Kline, 2016; Schumacker & Lomax, 2004).

Preschool teacher candidates' teacher self-efficacy for music teaching (TSEMT). The scale developed by Koca (2016) aims to determine the self-efficacy perceptions of preschool teacher candidates towards music activities. The Likert-type scale, which consists of 20 items, includes five options for each response, ranging from 'Strongly disagree' (1) to 'Strongly agree' (5). The three sub-dimensions of the scale are as follows: Planning of Music Activities (PMA-8 items, e.g. I can design activities suitable for the purpose of musical events), Preparation of Musical Materials (PMM-6 items, e.g. I can prepare useful and economical materials for musical activities), Preparation of Musical Environments. (PME-6 items, e.g. I can organise learning environments according to the type of musical activity).

In this study, reliability and validity analyses of the TSEMT scale were based on the answers of preschool teacher candidates. Cronbach's alpha reliability coefficient for the entire scale was found to be .96. The reliability coefficients of the sub-dimensions were determined as .93, .89 and .93, respectively. These results show that the measurement tool has a high level of reliability. A first-level CFA was performed to test the compatibility of the scale's three-dimensional structure with the existing data. The standardised factor loadings for the items ranged between .70 and .86. The goodness of fit values obtained are as follows: $CMIN/DF(\chi^2/SD)=2.77$; $RMSEA=0.07$; $SRMR=0.04$; $CFI=0.96$; $TLI=0.95$; $IFI=0.96$; $NFI=0.93$. According to these results, the theoretical structure of the scale is confirmed and the model is compatible with the data (Byrne, 2016; Kline, 2016; Schumacker & Lomax, 2004).

Data analysis

In this study, SPSS 27 was used to calculate descriptive statistics, and AMOS 22 was employed for structural equation analysis. Initially, it was confirmed that there was no missing data. Reliability analysis was conducted for each scale, calculating *Cronbach's alpha* reliability coefficient (Tolmie et al., 2011). Then, by applying CFA, the factor structures of each scale were examined and their validity was determined (Tabachnick & Fidell, 2013). Before proceeding with the SEM analysis, the prerequisites were checked. When the sample size was deemed sufficient (Kline, 2016), the normality distribution in the data, which is another condition for SEM, was checked. First, the skewness and kurtosis values of each variable were calculated for univariate normality, followed by an examination of the multivariate normality assumption. Values of ± 1 for skewness and kurtosis were determined as acceptable limits (Schumacker & Lomax, 2004) in ensuring univariate normality distribution. *Mahalanobis distance* was used to identify multivariate outliers. Mahalanobis distance, which is used to find outliers by measuring each observation relative to the

Table 3. Descriptive statistics for variables.

Variables	Min–max	Median	Mean	SD	Skewness	Kurtosis
Total ASE score	11–28	21	21.5	3.4	–.23	–.19
Total TSEPT score	107–185	155	156.3	18.2	–.14	–.56
LTP	25–45	37	38.2	4.7	–.09	–.61
CS	21–35	31	30.7	3.7	–.46	–.69
FP	7–25	20	20.3	3.1	–.19	–.09
PL	17–30	25	25.3	3.6	–.24	–.81
OLE	14–25	21	21.4	2.8	–.19	–.72
CM	14–25	20	20.5	3.0	–.03	–.77
Total TSEMT score	53–100	81	83.9	9.2	.04	.06
PMA	16–40	32	33.1	4.1	–.12	.38
PMM	16–30	24	25.0	2.9	.16	–.35
PME	16–30	25	25.8	3.0	–.10	–.46

Note. ASE = academic self-efficacy; LTP = learning-teaching process; CS = communication skills; FP = family participation; PL = planning; OLE = organising learning environments; CM = class management; PMA = planning of music activities; PMM = preparation of musical materials; PME = preparation of musical environments.

mean centre of all observations, especially in a data set with more than two variables, is seen as one of the most appropriate methods as it weights all variables equally by adjusting the correlations (Hair et al., 2019). In the Mahalanobis distance, a value of $p < .001$ (Tabachnick & Fidell, 2013), which is a very conservative level for the χ^2 value, was considered. *Mardia's coefficient* was examined to test multivariate normality, calculating the critical value using the $p(p + 2)$ formula (Bollen, 1989; Raykov & Marcoulides, 2008). Here p is the number of observed variables.

After all prerequisites of the SEM analysis were met, the compatibility of the structural model with the data set was examined. Since the data showed a normal distribution, the *maximum likelihood* calculation method was used for parameter estimation (Kaplan, 2009). Additionally, the *bootstrap* method was applied to test indirect effects between variables in the structural model. In the bootstrap method, new data samples are created randomly from the data set. This method creates new data samples randomly from the dataset, and calculations are based on the distribution formed by thousands of random samples (Schumacker & Lomax, 2004), providing more reliable results than traditional methods (Hayes, 2022). In this study, 5,000 resampling options (Hayes, 2022) were used for the mediation effect analysis. Results were considered statistically significant if they showed non-zero values within the 95% confidence interval (CI; MacKinnon, 2008).

As a result of the analyses, commonly reported $CMIN/DF(\chi^2/sd)$, $RMSEA$, $SRMR$, CFI , TLI , IFI and NFI goodness of fit values were calculated in evaluations regarding the fit of the model. The fit levels of goodness of fit values to the model were evaluated according to the threshold levels (Byrne, 2016; Kline, 2016; Schumacker & Lomax, 2004) in Table 2.

Results

Descriptive statistics for the variables included in the model

Table 3 presents the descriptive statistics for the variables included in the model. The arithmetic means of all variables are generally quite close to the median or above the median. This situation indicates that the data have a normal distribution. Additionally, it can be said that the participants' self-efficacy beliefs are also strong. Specifically, for TSEMT, the scores in the PMA sub-dimension

Table 4. Correlations of variables.

Variables	1	2	3	4	5	6	7	8	9	10
1. ASE	–									
2. LTP	.45**	–								
3. CS	.43**	.75**	–							
4. FP	.39**	.67**	.62**	–						
5. PL	.44**	.73**	.70**	.70**	–					
6. OLE	.42**	.74**	.70**	.68**	.82**	–				
7. CM	.41**	.71**	.67**	.67**	.75**	.78**	–			
8. PMA	.47**	.55**	.48**	.44**	.56**	.51**	.48**	–		
9. PMM	.47**	.59**	.51**	.43**	.55**	.53**	.48**	.81**	–	
10. PME	.45**	.59**	.56**	.46**	.58**	.61**	.52**	.71**	.78**	–

** $p < .01$.

are higher, while the scores for the other two sub-dimensions are similar. Regarding TSEPT, the highest scores were observed in the LTP sub-dimension, while the lowest scores were in the FP sub-dimension. The average scores on the ASE scale are also near the upper score limit.

Skewness coefficients for all variables vary between $-.46$ and $.16$, and kurtosis coefficients vary between $-.81$ and $.38$. In this case, it can be said that the univariate normality assumption regarding the data is met (Schumacker & Lomax, 2004).

Mahalanobis distance was examined to identify multivariate outliers. Accordingly, 15 responses (3.5%) that were found to be outside the acceptable distance at the $p < .001$ significance level and violated the multivariate normality distribution were removed from the analysis. Afterward, Mardia's multivariate kurtosis coefficient was calculated to determine whether the multivariate normality distribution was achieved and was found to be 678.393. With 64 observed variables, the critical value for multivariate normality, calculated using the $p(p + 2)$ formula, was 4,224. Since Mardia's coefficient (678.393) is smaller than the critical value (4,224), multivariate normality is considered achieved (Bollen, 1989; Raykov & Marcoulides, 2008). Thus, the assumption of homogeneity in the sample of 410 respondents was met prior to the SEM analysis, which is sensitive to multivariate kurtosis and can affect results (Byrne, 2016).

Table 4 shows the results of the Pearson correlation analysis performed to determine the relationships between variables. According to the results, there are positive and significant relationships between all variables.

Results regarding the structural model

To test the research hypotheses, a SEM was developed to assess the interactions among the latent variables: Academic Self-Efficacy (ASE), Teacher Self-Efficacy for Preschool Teaching (TSEPT) and Teacher Self-Efficacy for Music Teaching (TSEMT). The results for the hypothesised model are depicted in Figure 1. The goodness-of-fit indices for the model are as follows: $CMIN/DF(\chi^2/SD) = 1.84$; $RMSEA = 0.05$; $SRMR = 0.05$; $CFI = 0.93$; $TLI = 0.92$; $IFI = 0.93$; $NFI = 0.85$. According to these results, the model fits the data well and confirms its validity (Byrne, 2016; Kline, 2016; Schumacker & Lomax, 2004).

Once the model was validated, the hypotheses were tested within the latent variable structural model. The analysis revealed that ASE predicted TSEPT positively and significantly ($\beta = .55$; $p < .001$), accounting for 30% of the variance in TSEPT. Thus, Hypothesis 1 (H1) was accepted.

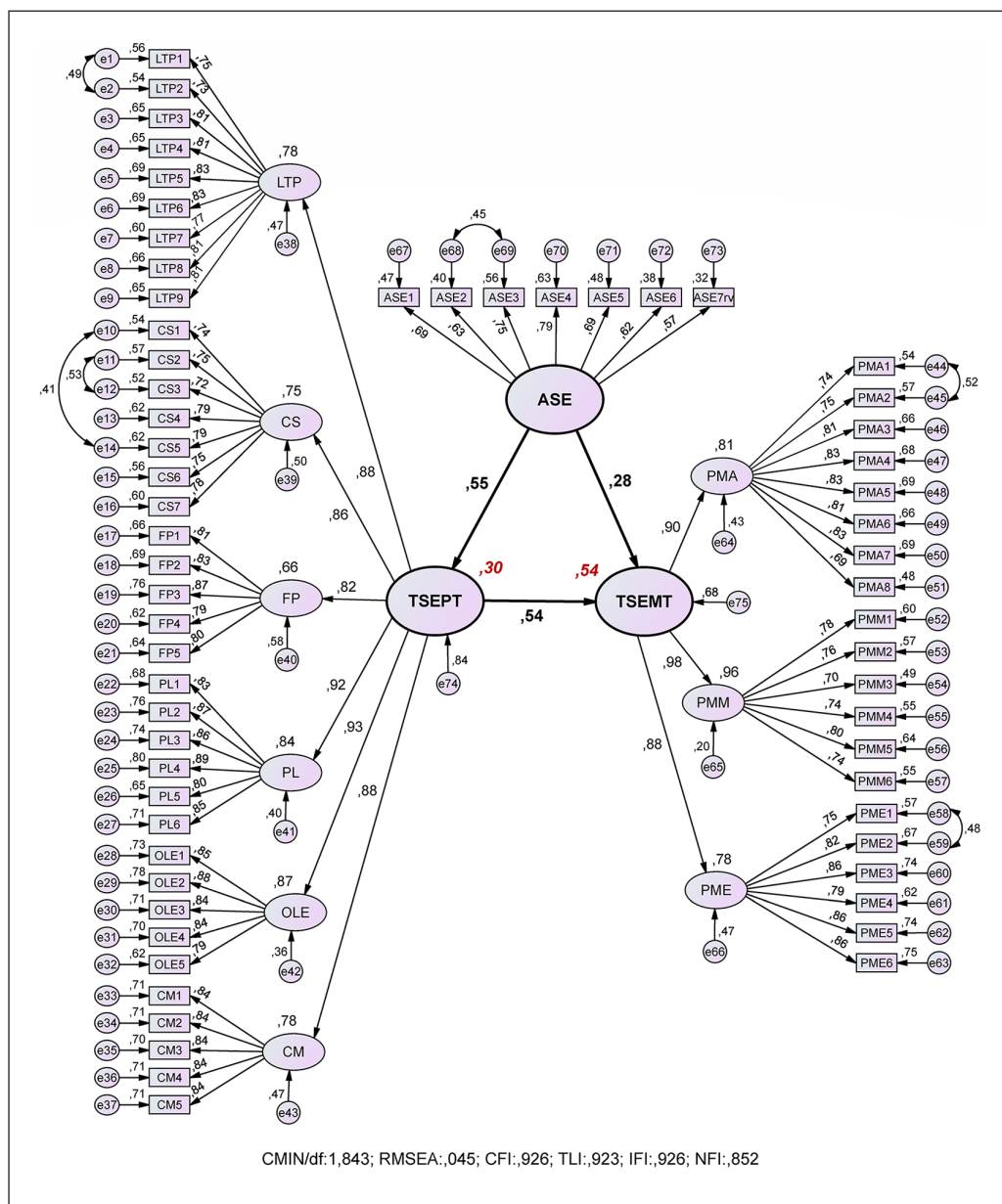


Figure 1. Structural model.

Additionally, ASE had a significant direct effect on TSEMT ($\beta = .28$; $p < .001$), leading to the acceptance of Hypothesis 2 (H2). Furthermore, the direct effect of TSEPT on TSEMT was also significant ($\beta = .54$; $p < .001$), which confirmed Hypothesis 3 (H3).

To examine the mediating role of TSEPT in the relationship between ASE and TSEMT, a bootstrap analysis was conducted with 5,000 resamples and a 95% confidence interval (CI). The bootstrap results indicated that the indirect effect of ASE on TSEMT through TSEPT was significant

Table 5. Structural model analysis results.

Predictive variables		Predicted variables	R ²	Direct effect (β)	Indirect effect (β)	Total effect (β)
ASE	→	TSEPT	.30	.55***	–	.55***
ASE	→	TSEMT	.54	.28***	.29 [0.223–0.372]	.57***
TSEPT	→	TSEMT		.54***	–	.54***

Note. The values in parentheses are the lower and upper confidence interval values obtained by the bootstrap method.

($\beta = .29$; 95% CI [0.22, 0.37]), as the confidence interval did not include zero. Additionally, the total effect of ASE and TSEPT on TSEMT was significant ($\beta = .57$; $p < .001$), with ASE and TSEPT explaining 54% of the variance in TSEMT. Consequently, Hypothesis 4 (H4) was accepted. The standardised analysis results for the model are shown in Table 5.

Discussion, conclusion and recommendations

This study explored the direct and mediating relationships between preschool teacher candidates' ASE, TSEPT and TSEMT beliefs through the lens of self-efficacy theory. Using a SEM approach, the study aimed to determine the effect levels of these variables on one another.

Findings from this study indicated that preschool teacher candidates' ASE beliefs significantly and positively predicted their beliefs in TSEPT (H1). This finding aligns with previous research (Inan Kaya, 2017; Tabancalı & Çelik, 2013; Yağcı & Aksoy, 2015; Yeşilyurt et al., 2016; Yılmaz et al., 2016), indicating a positive relationships between academic self-efficacy and teacher self-efficacy.

According to the second hypothesis of the current study, preschool teacher candidates' ASE beliefs significantly and positively predicted their beliefs in TSEMT (H2). This result aligns with findings from other studies (Akay & Boz, 2011; Yeşilyurt et al., 2016).

As stated by Yeşilyurt (2013), ASE will also influence teacher self-efficacy as it affects learning and success by determining the level of knowledge acquisition of teacher candidates. In this context, it can be stated that ASE is essential for teacher candidates in developing specific teaching competencies and confidence in their instructional abilities. ASE significantly predicts teaching competence and confidence in teaching abilities. This necessitates referencing the teacher efficacy model by Tschannen-Moran et al. (1998) and Schunk's (1991) emphasis on the relationships between cognitive processing and self-efficacy. This perspective explains that ASE, influenced by cognitive processing mechanisms, affects both TSEPT and TSEMT, shaping performance beliefs related to teaching. Additionally, meta-analyses on self-efficacy research indicate a low rate of negative self-efficacy findings (Bandura, 2012). Therefore, significant relationships between ASE and other variables are likely due to the inherent nature of self-efficacy.

According to the third hypothesis of the current study, pre-service preschool teachers' beliefs about their TSEPT positively and significantly predicted their beliefs about TSEMT (H3). Furthermore, TSEPT emerged as the strongest predictor of TSEMT. These findings are consistent with other research (Akay & Boz, 2011; Garvis, 2013; Garvis & Pendergast, 2011; Oppermann et al., 2019; Seddon & Biasutti, 2008; Yeşilyurt et al., 2016) indicating relationships between pre-service teachers' teacher self-efficacy and their teaching competencies in a specific domain. Additionally, previous studies (Chang et al., 2022; Holzberger et al., 2013; Hu et al., 2021; Küsting et al., 2016; Zee & Koomen, 2016) have confirmed that teacher self-efficacy serves as a crucial psychological foundation for effective classroom processes, which supports the current study's

results. Indeed, based on the researcher's own observations, the notion that the ability of teacher candidates to conduct effective and successful music activities in the classroom is grounded in a psychological foundation, irrespective of their level of musical ability, has been the starting point of this study. This also supports the validity of high self-efficacy in the context of effective classroom processes, consistent with findings from Bouffard-Bouchard et al. (1991).

According to the fourth hypothesis of the current study, the TSEPT variable mediates the relationship between ASE and TSEMT (H4). Previous studies (Chang et al., 2022; Hu et al., 2021; McLennan et al., 2017) have also examined the mediating effect of teacher/pre-service teacher self-efficacy beliefs, and the findings regarding the mediating role of pre-service teachers' teaching self-efficacy align with the current results. The direct effect of ASE on TSEMT ($\beta = .28$), is lower than the direct effect of TSEPT on TSEMT ($\beta = .54$), indicating that TSEPT is the strongest predictor of TSEMT. When considering ASE strongly predicts teacher self-efficacy both in the current study ($\beta = .55$) and in other research (Inan Kaya, 2017; Tabancalı & Çelik, 2013; Yağcı & Aksoy, 2015; Yılmaz et al., 2016), the indirect effect of ASE on TSEMT through TSEPT ($\beta = .29$) is understandable. In the current study, the total effect of ASE and TSEPT together on TSEMT was $\beta = .57$. ASE and TSEPT together accounted for a significant portion of the variance in TSEMT, with an R^2 (Squared Multiple Correlations) value of .54. R^2 values, indicating the strength of structural relationships, range from 0 to 1 (Schumacker & Lomax, 2004). According to Keith (2019), R^2 values in social science research are often below .50, and R^2 values as low as .10 are not uncommon. Accordingly, in this educational research, which is part of social science research, the finding explaining the change in TSEMT (54%) can be accepted higher than the average findings in the field. However, there remains an unexplained portion of 46%, highlighting the complexity of factors contributing to preschool teacher candidates' TSEMT beliefs. This substantial proportion supports the view that self-efficacy for music teaching is a multifaceted phenomenon with many latent variables that are difficult to assess (Biasutti et al., 2020).

As a result, this study found that the pre-service teachers in the preschool teacher training programmes within the sample group hold positive beliefs regarding TSEMT. The findings offer insight into the sources of these self-reported self-efficacy beliefs, independent of uncontrolled variables such as musical ability. Statistical analyses reveal that ASE and TSEPT significantly impact TSEMT beliefs indicating that, despite having different musical abilities and skills, a strong sense of academic and teaching self-efficacy significantly contributes to the music teaching self-efficacy of teacher candidates.

In the present study, the unexplained variance in TSEMT suggests that future research should investigate additional variables influencing self-efficacy beliefs in music teaching. In this regard, new studies could be conducted by incorporating different variables, or alternative models could be developed. Conducted within the cultural context of Türkiye, the findings may provide insights into the self-efficacy beliefs of teacher candidates in other countries, as preschool teachers worldwide are typically not music specialists. More research is needed to better understand the sources of self-efficacy.

Limitations

There are certain limitations to consider when interpreting the findings of this study. Firstly, the data are based on the participants' self-reports. Indeed, some findings (Gölbasi, 2013) indicate that, despite reporting high self-efficacy, many preschool teachers are actually inadequate in implementing music activities in the classroom. Additionally, McMullen (1999) highlights occasional inconsistencies between teachers' beliefs and actions, although her own study showed consistency.

In the current study, 57.4% of the teacher candidates are in their second and third years and will continue their pre-service education. All participants shaped their self-efficacy beliefs based on knowledge gained from their current experiences, likely in accordance with Pajares' (2002) explanations. Upon entering the professional field, they will be able to readjust their self-efficacy, which possesses a dynamic structure, in relation to their development in the new context. It is important to note that the cross-sectional design of the study limits causal inferences; longitudinal research could provide deeper insights into the relationships between variables. Finally, although a sufficient number of participants were obtained for SEM analysis, data could not be collected from all universities.

Implications

Based on the findings of this study, both theoretical and practical implications can be drawn. Theoretically, the TSEMT beliefs of preschool teacher candidates are directly influenced by their ASE and TSEPT beliefs. The hypothesised model, grounded in these beliefs, aids in understanding the sources of TSEMT perceptions among preschool teacher candidates who are not subject to a musical aptitude test and have varying musical abilities. This validates the relationships among the examined variables. From a practical perspective, even in fields requiring specialised skills like music, perceived self-efficacy seems to be more significant during implementation than the teacher's actual skill and ability level.

Research on teacher self-efficacy, including this study, can guide the enhancement of teacher candidates' professional profiles by identifying strengths and addressing weaknesses. Therefore, teacher training programmes should focus on holistically strengthening preschool teacher candidates' academic and teacher self-efficacy, as well as their self-efficacy for teaching specific subjects. Focusing solely on developing a foundation of music knowledge and skills is a rather simplistic approach to fostering teaching ability in music (Jeanneret, 1997). Given that there is no music aptitude test upon entering the school, it should be remembered that, teacher candidates need both musical and pedagogical competence to provide suitable music education for preschool children (Pan & Luen, 2024). Additionally, reinforcing TSEMT beliefs alongside ASE and TSEPT beliefs during pre-service training will significantly prepare teacher candidates for their profession.

Author contribution(s)

Çağrı Şen: Conceptualisation; Data curation; Formal analysis; Methodology; Resources; Software; Supervision; Validation; Visualisation; Writing – original draft and Writing – review & editing.

Data availability

Data will be made available on request.

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Supplemental material

Supplemental material for this article is available online.

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