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The mediating role of self-efficacy in the impact of sensory teaching resources on psychological stress among educators of children with hearing loss

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Abstract

Despite the increasing availability of sensory teaching resources for children with hearing impairments, educators (parents and special education teachers) commonly report low teaching efficacy and high psychological stress. Merely possessing resources may not alleviate stress; instead, its effects are mediated by individual cognition and moderated by contextual supports. This study is based on social cognitive theory and resource conservation theory and constructs a moderated mediation model to explore how sensory resource ownership affects psychological stress through resource use self-efficacy and overall teaching efficacy, and to examine the moderating effects of perceived ease of use, training experience, and social support. Data were collected from 331 Chinese parents and special education teachers of children with hearing impairments. Structural equation modeling (SEM) was used to test direct and mediation paths. Bootstrap methods were applied for mediation and moderation analyses, and fuzzy-set qualitative comparative analysis (fsQCA) was employed to identify configurational pathways. Research has shown that sensory teaching resources cannot directly alleviate psychological stress; On the contrary, they exert influence through a chain mediated pathway of 'resources', which is further regulated by technological availability, system training, and social support. Educational practice should shift from a “resource-provision” approach to an “empowerment-oriented” strategy that integrates capability building with supportive systems to enhance educators’ psychological well-being and teaching confidence.

1. Introduction

The global prevalence of hearing loss in children is high, with the World Health Organization estimating that over 34 million children worldwide suffer from disabling hearing loss, with the majority residing in low - and middle-income countries (WHO, 2021). In China, recent epidemiological studies suggest a prevalence of childhood hearing impairment ranging from 0.1% to 0.3%, translating to a substantial population requiring specialized educational support (Zheng et al., 2021). Correspondingly, the field of special education has witnessed a remarkable expansion in the development and availability of sensory-based teaching resources designed to support the language, cognitive, and social development of children with hearing impairments (Bayat, 2023). These resources, encompassing tactile books, visual cue systems, auditory training software, and multimedia applications, are grounded in the principles of multisensory integration, which posits that learning is enhanced when information is processed through multiple sensory channels (Shams & Seitz, 2008). Government and educational institutions have invested heavily in providing such resources to special education schools and rehabilitation centres, aiming to bridge the development gap and improve educational outcomes (Joyce, 2021).

Despite an increase in resource availability, educators (including specialized teachers and parents who serve as primary interveners in the home environment) have consistently reported high levels of psychological distress and a decrease in their perception of teaching effectiveness.

A national survey of special education teachers in China revealed that over 58% experience moderate to high levels of occupational stress, with those working with sensory-impaired children reporting particularly acute feelings of incompetence and burnout (Wang et al., 2020).

Similarly, qualitative research involving parents of children with hearing loss highlights chronic stress, anxiety, and self-doubt related to their role in facilitating their child's development, often described as a "constant struggle" despite access to various tools and programs (Jackson et al., 2020). Why does the possession of sensory teaching resources frequently fail to translate into enhanced educator confidence and psychological well-being, and under what conditions can these resources become effective assets rather than sources of pressure?

Complementing this perspective, Bandura's Social Cognitive Theory (1997) places self-efficacy as the core mediator between knowledge, skills, and action. In the field of education, teacher self-efficacy is a powerful predictor of teaching quality, persistence, and resilience (Zee&Koomen, 2016). For parents of disabled children, parenting self-efficacy is also associated with lower stress and more adaptive caregiving behaviours (Hastings&Brown, 2002). It is crucial that self-efficacy is not an inherent trait, but is established through experience acquisition, alternative learning, social persuasion, and physiological states (Ofalt, 2021). The process of effectively using complex sensory tools provides a mastery experience that may enhance self-efficacy. On the contrary, fighting against tools may undermine them. Therefore, the relationship between resource possession and outcomes like teaching efficacy and stress is likely not direct but filtered through the critical cognitive lens of self-efficacy in resource use. This intermediary role of self-efficacy has been supported in general educational technology research (Scherer et al., 2019), but its specific function in the high stakes, emotionally charged context of hearing impairment education remains underexplored.

Existing research on education for children with hearing impairments has made substantial contributions but exhibits distinct limitations that this study aims to address. First, the literature has traditionally been segmented, with one stream focusing on resource development and efficacy (e.g., evaluating the impact of a specific cochlear implant training software; Dettman et al., 2016), and another focusing on educator well-being and burnout (e.g., stress levels among teachers of the deaf; Antia et al., 2020). Few studies have empirically connected these two streams to model how the former influences the latter through explicit psychological pathways. For instance, while Schmulian (2022) discusses the challenges of technology integration in deaf education, the study does not quantify the stress outcomes or test mediating variables. To address these interrelated gaps, this study proposes and tests a comprehensive mediation model based on COR theory and social cognitive theory. To investigate the moderating roles of three key contextual factors: perceived ease of use, training experience, and social support on the relationship between resource possession and self-efficacy, and between self-efficacy and teaching efficacy. Using fsQCA as a supplementary method to reveal complex, configurational conditions (involving resources, support, and training) that can lead to high or low levels of psychological stress, beyond net effects analysis.

This research offers significant contributions. From the practical point of view, it advances the field by integrating major psychological theories into a unified model specific to special education, clarifying the mechanism (self-efficacy) and boundary conditions (ease of use, training, support) that govern the impact of resources on educator psychology. Methodologically, it demonstrates the value of a mixed-methods approach combining advanced statistical mediation/moderation analysis with set-theoretic configurational analysis (fsQCA) to provide a more holistic and nuanced understanding. From the theoretical perspective, the findings will shift the focus of support programs from merely distributing resources to building educators' capacity and supportive ecosystems. By identifying which combinations of factors most effectively buffer stress, the study will inform the design of targeted, multifaceted interventions aimed at truly empowering both special education teachers and parents of children with hearing impairments, ultimately contributing to more sustainable and effective educational support systems.

2. Literature Review and Hypothesis Development

2.1 Theoretical Foundations: Social Cognitive Theory and Conservation of Resources Theory

This study is based on two complementary theoretical frameworks: Bandura's Social Cognitive Theory (1997) and Hobfoll's Conservation of Resources Theory (COR; 1989, 2001). Social cognitive theory holds that human functioning is a dynamic and interactive product of individual factors (cognition, emotion), behavior, and environmental influences. Its core structure, self-efficacy, is defined as an individual's belief in their ability to organize and execute the action processes required to manage future situations (Benight & Bandura, 2004). Self-efficacy is not a global characteristic, but rather specific to functional domains, such as a person's effectiveness in using specific teaching resources (Stajkovic & Luthans, 1998). These beliefs are powerful determinants of how people think, feel, motivate themselves, and act. The theory of conservation of resources provides a complementary perspective for understanding pressure. It assumes that individuals strive to acquire, preserve, cultivate, and protect what they cherish, namely their resources (Mensah et al., 2023). Stress occurs when these resources are threatened with loss, are lost, or when individuals fail to gain sufficient resources after significant investment.

Resources can be objects (e.g., teaching tools), conditions (e.g., social support), personal characteristics (e.g., self-efficacy), or energies (e.g., time, knowledge) (Wang et al., 2022). COR theory further proposes the concept of "resource caravans," where resources tend to aggregate, and "caravan passageways," which are environmental conditions that support or hinder resource accumulation (Liao et al., 2025). Integrating these theories, this study conceptualizes sensory teaching resources as potential environmental resources. Their impact on an educator's psychological stress and overall teaching efficacy is not direct but is fundamentally channelled and shaped by the educator's cognitive appraisal, specifically, their self-efficacy in using those resources. Furthermore, the theory suggests that the process of converting a possessed resource into a meaningful psychological gain (e.g., reduced stress, increased efficacy) is not automatic but is facilitated or constrained by other contextual resources, such

as perceived ease of use, training experience, and social support. This integrated theoretical lens informs all subsequent hypotheses. The conceptual model is shown as Fig. 1:

2.2 Direct Effects of Sensory Resource Possession

2.2.1 Sensory Resource Possession and Overall Teaching Efficacy

The relationship between resource availability and teaching efficacy is foundational yet complex. Overall teaching efficacy refers to a teacher's or parent's belief in their ability to positively affect student learning and development (Tschannen-Moran & Hoy, 2001). Drawing from Social Cognitive Theory, environmental facilitators, such as appropriate tools and materials, can enable successful performance, which serves as a powerful source of efficacy information. Research in general education suggests that access to instructional materials correlates with higher teacher efficacy (Goddard et al., 2000). In special education, specifically for hearing impairment, possessing specialized sensory resources (e.g., visual phonics cards, assistive listening device simulators) provides the tangible means to implement effective strategies, thereby potentially bolstering educators' global sense of competence (Catalano et al., 2022; Hashemi, 2024). Hence, the following hypotheses are proposed.

H1: Sensory resource possession has a positive effect on overall teaching efficacy.

2.2.2 Sensory Resource Possession and Self-Efficacy in Resource Use

This hypothesis focuses on a more specific, domain-linked belief. Self-efficacy in resource use is the confidence an educator has in their ability to effectively select, operate, and integrate specific sensory tools into their teaching or caregiving practice (Vîrlan & Ratnaweera, 2025). According to Bandura (1997), mastery experience is the most potent source of self-efficacy. The act of possessing resources itself provides opportunities for participation and experimentation. Even before mastery is achieved, the availability of tools can create a sense of preparedness and potential, which can positively influence domain-specific confidence. Studies on technology integration in education support this link, showing that access to technology is a precursor to developing technology-related self-efficacy (Scherer et al., 2019). Hence, the hypothesis is formulated as follows.

H2: Sensory resource possession has a positive effect on self-efficacy in resource use.

2.2.3 Sensory Resource Possession and Psychological Stress

The direct link between resources and stress is central to COR theory. Resources are theorized to have a direct stress-buffering capacity because they can be used to counter threats or meet demands (Hobfoll, 2001). In the challenging context of educating a child with hearing loss, sensory resources can be seen as tools to manage specific pedagogical and communicative challenges (Zhao et al., 2023). Possessing

these tools may directly reduce the uncertainty and helplessness that contribute to stress. For example, having a clear visual schedule (a sensory resource) may reduce a parent's anxiety about daily transitions. While the primary pathway may be indirect (via efficacy), COR theory allows for a direct protective effect of resource possession itself. Hence, the following hypothesis is constructed.

H3: Sensory resource possession has a positive effect on psychological stress.

2.3 Direct Effects Among Mediating and Outcome Variables

2.3.1 Self-Efficacy in Resource Use and Overall Teaching Efficacy

Bandura's theory suggests that efficacy beliefs are not isolated; efficacy in one domain can generalize and contribute to a broader sense of personal agency. Successfully mastering a specific tool (high self-efficacy in resource utilization) provides concrete mastery experience, which can enhance an individual's more comprehensive belief in their teaching ability (Jia & Tu, 24). In teacher research, specific forms of self-efficacy (such as classroom management and teaching strategies) are consistently correlated with general teaching efficacy (Zee&Koomen, 2016). Parents who feel confident using specific communication applications may feel more capable in their overall parenting/teaching role. Hence, the hypothesis is formulated as follows.

H4: Self-efficacy in resource use has a positive effect on overall teaching efficacy.

2.3.2 Psychological Stress and Overall Teaching Efficacy

The relationship between stress and efficacy is dynamic and often reciprocal. High levels of psychological pressure are characterized by being overwhelmed, emotionally drained, and unable to meet needs, which can deplete cognitive and emotional resources (Gilar-Corb et al., 2024). This kind of consumption will damage an individual's performance, and more importantly, it will damage their interpretation of this performance (Bardach er al., 2022). According to Social Cognitive Theory, emotional and physiological states are a source of efficacy information; high stress (a negative physiological/emotional state) can lower self-appraisals of capability (Bandura, 1997). Empirical evidence consistently shows a negative correlation between teacher stress and teacher efficacy (Klassen & Chiu, 2010). Stress consumes the very psychological resources needed to sustain a sense of efficacy. Thus, the following hypothesis is constructed.

H5: Psychological stress has a negative effect on overall teaching efficacy.

2.4 Mediating Mechanisms

Self-efficacy in resource use is considered as the critical psychological bridge that translates material resource possession into enhanced overall teaching efficacy (Yang & Du, 2024). The possession of appropriate sensory resources provides the opportunity for mastery experiences. When an educator successfully uses a tactile book to engage a child or effectively operates an auditory training device, they

accumulate direct mastery experiences (Martin et al., 2019). According to Social Cognitive Theory, these mastery experiences are the most potent source of self-efficacy information. As confidence in using specific resources grows (increased self-efficacy in resource use), it fosters a more generalized belief in one's teaching capabilities. Research on technology integration consistently indicates that acquiring technology primarily influences teaching practice through its impact on teachers' technology related self-efficacy (Scherer et al., 2019). In the field of special education, a study by Alqraini and Paul (2020) on the use of assistive technology found that teachers' self-efficacy is an important mediator between technology acquisition and reported teaching outcomes. This approach emphasizes that the value of resources is not inherent but is realized through the perceived ability of users to use them.

Moreover, in the demanding context of educating children with hearing loss, chronic stressors such as communication barriers, behavioral challenges (Eriks-Brophy & Whittingham, 2013), and slow progress can deplete emotional energy and cognitive bandwidth, which are critical personal resources (Alkhawaldeh & Khasawneh, 2021). Sensory teaching resources can serve as tools to directly address these sources of stress. For instance, a well-designed visual schedule can reduce transition-related tantrums, thereby lowering parental stress (Mckee & Hauser, 2017; Bardach er al., 2022). A functioning FM system can ease the strain of constant vocal projection for a teacher. By effectively mitigating specific daily challenges, these resources help conserve the educator's emotional and psychological resources (Hobfoll, 1989). Stress impairs cognitive function, reduces patience, and fosters negative attributions about one's performance, all of which erode self-efficacy (Klassen & Chiu, 2010). When stress is lowered, educators are more emotionally available, can reflect more positively on their interactions, and have greater resilience in the face of setbacks. This improved affective state provides a more fertile ground for a strong sense of teaching efficacy to develop and persist.

H6: Self-efficacy in resource use mediates the relationship between sensory resource possession and overall teaching efficacy.

H7: Psychological stress mediates the relationship between sensory resource possession and overall teaching efficacy.

2.5 The Moderating Role

2.5.1 Perceived Ease of Use

The Technology Acceptance Model (TAM) identifies perceived ease of use as a critical antecedent to technology adoption and use (Davis, 1989). This study extends this logic to sensory teaching resources. Assuming usability is a key accidental factor. When a resource is perceived as intuitive and easy to use (with high usability), owning it is more likely to lead to quick mastery and positive experiences, greatly enhancing its self-efficacy in use. On the contrary, if a resource is considered complex and difficult (with low usability), possessing it may lead to frustration or even failure, which may weaken or negate the positive impact on self-efficacy (Scherer et al., 2019). Thus, the strength of the path from possession to self-efficacy depends on usability.

H8: Perceived ease of use positively moderates the relationship between sensory resource possession and self-efficacy in resource use.

2.5.2 Training Experience

Training experience represents a deliberate investment in human capital, a key “condition” resource in COR theory. For one, systematic training unlocks the potential of possessed resources. Training provides the knowledge and skills needed to use resources effectively, making the possession of resources a more reliable pathway to building self-efficacy. Without training, educators may not know how to use their tools, so possession alone has a weak effect on self-efficacy (Hastings & Brown, 2002). For another, training can also amplify the value of self-efficacy. Training typically includes teaching integration strategies, not only on how to use tools, but also on when and why to use them (Klassen et al, 2010) Therefore, educators with high self-efficacy in resource utilization and extensive training will be better equipped to translate this technological confidence into effective and comprehensive teaching practices, thereby establishing a closer connection with overall teaching effectiveness (Joyce, 2021). Hence, the following hypotheses are constructed.

H9: Training experience positively moderates the relationship between sensory resource possession and self-efficacy in resource use.

H10: Training experience positively moderates the relationship between self-efficacy in resource use and overall teaching efficacy.

2.5.3 Social Support

Social support from colleagues, other parents, experts, and family members is a fundamental 'conditional' resource that can create a supportive caravan passage (Hobfoll, 2011). A supportive environment encourages experimentation and provides a safety net. When an educator tries a new resource, encouragement from peers and access to advice reduce the perceived risk of failure. This supportive context makes it more likely that resource possession will lead to positive, efficacy-building experiences (Zee & Koomen, 2016). Moreover, social support facilitates the translation of specific skills into broader effectiveness (Mensah, 2023). Through collaboration, feedback, and shared problem-solving within a supportive network, an educator’s confidence in using a specific tool (self-efficacy) can be more readily connected to and reinforced by improvements in overall teaching outcomes, thus strengthening its relationship with overall teaching efficacy. Hence, the hypotheses formulated as follows.

H11: Social support positively moderates the relationship between sensory resource possession and self-efficacy in resource use.

H12: Social support positively moderates the relationship self-efficacy in resource use and overall teaching efficacy.

3. Research Methods

3.1 Sample and Data Collection Procedure

This study employed a cross-sectional survey design to investigate the relationships between sensory resource possession, psychological constructs, and contextual factors among educators of children with hearing impairments. Data collection occurred from September 2025 to November 2025 at multiple special education schools and rehabilitation centers in Anhui Province, China, targeting parents and special education teachers as key participants.

A total of 350 questionnaires were distributed through a combination of online survey platforms (Wenjuanxing) and on-site distribution at participating institutions. To ensure data quality, several measures were implemented: (1) the questionnaire included attention-check items; (2) completion time was monitored, with responses taking less than two minutes excluded; and (3) logical consistency checks were performed. Of the distributed questionnaires, 339 were returned, yielding 331 valid responses after data cleaning, resulting in a valid response rate of 94.6% of returned surveys and 94.6% of the original distribution.

This study was conducted in accordance with the Declaration of Helsinki and was approved by the Human Research Ethics Committee of Sultan Idris Education University (Reference Number: 2025-0813-01; Date of Approval: 29 August 2025). Informed consent was obtained from all participants prior to their involvement in the study.

3.2 Participants

The final sample consisted of 331 participants, including 173 parents (52.3%) and 158 special education teachers (47.7%), representing a balanced proportion between the two educator groups (see in Fig. 2). This dual-perspective approach enriches the study by capturing both formal educational and home-based teaching contexts. Regarding daily specialized teaching or interaction time with the child, participants reported: less than 1 hour (n = 100, 30.2%), 1–2 hours (n = 132, 39.9%), 2–4 hours (n = 62, 18.7%), and over 4 hours (n = 37, 11.2%). This distribution indicates that over 70% of respondents spent 2 hours or less per day in dedicated educational interaction. The children's degree of hearing loss was predominantly moderate: mild (n = 98, 29.6%), moderate (n = 130, 39.3%), severe (n = 69, 20.8%), and profound (n = 34, 10.3%). Additional demographic information collected included respondent role, educational background, years of experience, and child's age, ensuring a comprehensive characterization of the sample.

3.3 Measurement Instruments

This study investigates how sensory teaching resource allocation and usage in educational settings for children with hearing impairments influence educators' psychological stress. It considers both individual psychological mechanisms and support systems. Questionnaire items were developed from an integration of social cognitive theory and conservation of resources theory. Existing validated instruments were referenced, and items were contextualized to match participant characteristics. All constructs were measured using multi-item scales adapted from established instruments in the

literature. Responses were recorded on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), unless otherwise specified. Table 1 presents the research variables, their adaptation bases, and key measurement notes.

Table 1
Research Variables, Dimensions, and References

Variable Name	Adaptation Basis (Key References)	Notes
Sensory Resource Possession	Davis (1989); Self-developed checklist	Comprehensive measurement via checklist and frequency items
Perceived Ease of Use Resources	Davis (1989) Perceived Ease of Use Scale	Directly adapted from the classic TAM scale
Self-Efficacy in Resource Use	Bandura (2006) Guide for Constructing Self-Efficacy Scales	Self-developed based on Bandura's guidelines, tailored to the context
Psychological Stress	Berry & Jones (1995) Parental Stress Scale; Common dimensions of teacher stress scales	Items are generalized to suit both parents and teachers
Social Support	Zimet et al. (1988) Multidimensional Scale of Perceived Social Support	The "Other Support" dimension is specified as "Professional Support"
Training Experience	Self-developed	Measured as a background variable
Overall Teaching Efficacy	Tschannen-Moran & Hoy (2001) Teacher Efficacy Scale; Johnston & Mash (1989) Parenting Sense of Competence Scale	Items are designed to be universal for both parents and teachers

The questionnaire development followed a rigorous process: (1) comprehensive literature review to identify appropriate scales; (2) adaptation of items to the specific context of hearing impairment education; (3) expert review by three special education professors for content validity; (4) pilot testing with 30 respondents (15 parents and 15 teachers) to assess clarity and reliability; and (5) refinement based on pilot feedback. The final instrument contained 21 core scale items measuring the seven latent constructs, plus demographic and background questions. The overall Cronbach's Alpha for the scale was 0.793, approaching the recommended threshold of 0.80, indicating acceptable internal consistency.

The measurement of Sensory Resource Possession was based on Davis' (1989) Perceived Usefulness Scale, and a self-designed list of 8 items was developed in conjunction with hearing-impaired education scenarios, covering common resource types such as visual cue systems, tactile teaching materials, auditory training software, and multimedia applications. This scale uses a 5-point frequency scale and exploratory factor analysis shows a clear single factor structure with factor loadings ranging from 0.68 to 0.86, and a cumulative explained variance of 62.4%.

3.4 Data Analysis

The data analysis employed a sequential mixed-methods approach combining quantitative techniques to test the hypothesized relationships and qualitative comparative analysis to explore configurational patterns. To examine potential differences between parents and special education teachers in the structural model, a multi-group analysis (MGA) was conducted. This analysis tested whether the path coefficients were invariant across the two groups. The procedure involved: Estimating an unconstrained model in which all structural paths were freely estimated separately for parents (n = 173) and teachers (n = 158). Estimating a constrained model in which the structural paths were set to be equal across groups. Comparing the chi-square values of the constrained and unconstrained models using a chi-square difference test ($\Delta\chi^2$). A non-significant $\Delta\chi^2$ would indicate that the paths are invariant across groups, suggesting a consistent psychological mechanism.

4. Results

4.1 Reliability, Validity and Model Fit Indices Analysis

Prior to structural model evaluation and hypothesis testing, the study assessed the questionnaire's reliability, validity, and overall model fit. This step ensured that the data quality met the requirements for subsequent factor analysis. Table 2 presents 21 scale items. The overall Cronbach's Alpha was 0.793, near the recommended threshold of 0.80. This indicates good internal consistency among items. The KMO measure of sampling adequacy was 0.855, exceeding 0.80. This suggests the sample data had a solid factor structure, making it suitable for factor analysis. Model fit was assessed using confirmatory factor analysis. The CMIN/DF value was 1.200, well below the standard threshold of 3, suggesting a good balance between model complexity and explanatory power. Incremental fit indices—CFI, TLI, and IFI—exceeded 0.98, while NFI and RFI were above 0.93. The absolute fit index GFI was 0.945, and RMSEA was 0.025, demonstrating excellent model fit and very low approximation error. Overall, reliability, validity, and fit indices indicate that the measurement instrument demonstrates sound structural validity, strong internal consistency, and excellent model fit. It can reliably and effectively measure the latent variables.

Table 2
Reliability, Validity and Model Fit Indices

Category		**Items**		**Alpha α**				**KMO**		
Reliability & Validity		21		.793				.855		
Model Fit	**CMIN**	**DF**	**CMIN/DF**	**NFI**	**RFI**	**IFI**	**TLI**	**CFI**	**GFI**	**RMSEA**
Fit Results	201.596	168	1.200	.948	.935	.991	.989	.991	.945	.025
Judgment Std.	–	–	< 3	> 0.9	> 0.9	> 0.9	> 0.9	> 0.9	> 0.9	< 0.08

4.2 Convergent Validity Analysis:

After assessing the overall fit of the measurement model, the study further evaluated the convergent and discriminant validity of the latent variables (see Table 3). This step confirmed the measurement quality of

the scale at the structural level. Convergent validity was evaluated using composite reliability (CR) and average variance extracted (AVE). The seven latent variables had CR values ranging from 0.82 to 0.90, all above the recommended threshold of 0.70, indicating strong internal consistency. All AVE values exceeded 0.50. Training Experience and Sensory Resource Possession achieved 0.81 and 0.78, respectively, while the remaining variables ranged from 0.54 to 0.71. These results indicate that the latent variables explain over half of the variance in their indicators, with minimal measurement error. Discriminant validity was examined by comparing the square root of each latent variable's AVE with its correlations with other latent variables. The square roots exceeded the inter-construct correlations, indicating good discriminant validity. Overall, the measurement model satisfied SEM requirements for both convergent and discriminant validity, based on CR, AVE, and Fornell–Larcker results. The scale can effectively distinguish and accurately measure each theoretical construct.

Table 3
Convergent validity Composite reliability and discriminant validity(Fornell–Larcker Criterion

Construct	CR	AVE	SERU	PS	OTE	SRP	PEUR	TE	SS
Self-Efficacy in Resource Use	**0.82**	**0.54**	**0.735**						
Psychological Stress	**0.88**	**0.71**	-0.348	**0.842**					
Overall Teaching Efficacy	**0.88**	**0.65**	0.347	-0.509	**0.806**				
Sensory Resource Possession	**0.88**	**0.78**	0.256	-0.106	0.242	**0.883**			
Perceived Ease of Use Resources	**0.82**	**0.60**	0.623	-0.301	0.244	0.172	**0.775**		
Training Experience	**0.90**	**0.81**	0.457	-0.256	0.072	0.039	0.446	**0.90**	
Social Support	**0.88**	**0.71**	0.67	-0.286	0.359	0.092	0.614	0.443	**0.842**

4.3 Structural Equation Model Path Analysis:

This study employed structural equation modeling (SEM) to test the hypotheses. It systematically examined the structural relationships among sensory resource possession, self-efficacy in resource use, overall teaching efficacy, and psychological stress. As presented in Table 4, sensory resource possession had a significant positive effect on self-efficacy in resource use (Estimate = 0.245, $p < 0.001$). This indicates that adequate resources enhance parents' and special education teachers' confidence and sense of control in using teaching resources. In contrast, sensory resource possession did not have a significant direct effect on psychological stress (Estimate = 0.083, $p = 0.313$). This suggests that resources alone do not directly determine an individual's level of psychological stress. Further analysis revealed that self-efficacy in resource use significantly positively influenced overall teaching efficacy (Estimate = 0.399, $p < 0.001$). This indicates that ability beliefs developed in specific resource use contexts can transfer to overall teaching performance. Meanwhile, overall teaching efficacy had a

significant negative effect on psychological stress (Estimate = − 0.502, p < 0.001). This indicates that teaching efficacy plays a critical role in reducing psychological stress. Structural path analysis revealed that psychological stress is not directly triggered or alleviated by sensory resources. Instead, it is indirectly influenced through a sequential psychological mechanism: self-efficacy in resource use leading to overall teaching efficacy.

Table 4
Structural equation model path coefficient test

hyp	Path			Estimate	S.E.	C.R.	P	Conclusion
H1	Self-Efficacy in Resource Use	<--	Sensory Resource Possession	.245	.062	3.945	***	Supported
H2	Psychological Stress	<--	Sensory Resource Possession	.083	.082	1.009	.313	Not Supported
H3	Overall Teaching Efficacy	<--	Self-Efficacy in Resource Use	.399	.091	4.381	***	Supported
H4	Psychological Stress	<--	Overall Teaching Efficacy	− .502	.074	-6.822	***	Supported
* p < 0.05; ** p < 0.001； *** p < 0.001.								

4.4 Multi-group Analysis: Parent vs. Teacher Comparison

To examine whether the structural model holds consistently across different educator roles, a multi-group analysis was conducted comparing parents and special education teachers. First, the structural model was fitted separately for each group. Both models demonstrated excellent fit: Parent group (n = 173): $\chi^2/df = 1.221$, CFI = 0.983, TLI = 0.976, RMSEA = 0.029. Teacher group (n = 158): $\chi^2/df = 1.265$, CFI = 0.979, TLI = 0.972, RMSEA = 0.031. Second, a constrained model was tested in which all structural path coefficients were set to be equal across groups. The chi-square difference test between the unconstrained and constrained models was non-significant: $\Delta\chi^2(4) = 6.32$, p = 0.176, indicating that the path coefficients did not differ significantly between parents and teachers. This finding suggests that the core psychological mechanism, specifically, the sequential pathway from sensory resource possession → self-efficacy in resource use → overall teaching efficacy → psychological stress—operates consistently across both parents and special education teachers. Therefore, the integrated model is applicable to both groups, supporting the rationale for analyzing them within a unified framework.

4.5 Mediation Analysis

Building on the structural path analysis, the study further examined the indirect effects among latent variables using mediation analysis. As presented in Table 5, self-efficacy in resource use significantly mediated the relationship between sensory resource possession and overall teaching efficacy (indirect effect = 0.098, 95% CI [0.038, 0.185], p = 0.001). The total effect was also significant (0.322, 95% CI

[0.151, 0.487], p = 0.003). This indicates that sensory resources indirectly enhance overall teaching efficacy by strengthening individuals' confidence in using resources. This finding supports the applicability of self-efficacy theory in the study context. In contrast, psychological stress showed significant negative mediation in certain paths (indirect effects = − 0.074, − 0.113, − 0.049, all $p < 0.05$). However, its overall mediation effects were non-significant ($p > 0.6$). This suggests that the role of psychological stress is diffuse and context-dependent, making it insufficient to independently explain the relationship between resources and teaching efficacy. Self-efficacy in resource use serves as the central psychological bridge linking external resource conditions with internal teaching efficacy. Psychological stress plays a supplementary role. These findings emphasize that in educational practice, the impact of resources on teaching outcomes must be mediated through positive ability beliefs.

Table 5
Mediation Analysis Results

Parameter		Estimate	Lower	Upper	P
H5: Self-efficacy in resource use mediates the relationship between sensory resource possession and overall teaching efficacy.	**INT**	.098	.038	.185	.001
	TOTAL	.322	.151	.487	.003
H6: Psychological stress mediates the relationship between sensory resource possession and overall teaching efficacy.	**INT1**	− .074	− .170	− .018	.008
	INT2	− .113	− .212	− .027	.011
	INT3	− .049	− .104	− .019	.001
	TOTAL1	.009	− .152	.174	.910
	TOTAL2	− .030	− .207	.159	.740
	TOTAL3	.033	− .129	.206	.666

4.6 Moderation Analysis

After examining the direct and mediating effects, the study further investigated how key contextual variables moderate structural relationships using moderation analysis. As presented in Table 6, the effect of sensory resource possession on self-efficacy in resource use was significantly moderated by perceived ease of use (coefficient = 0.0872, p = 0.0147, 95% CI [0.0172, 0.1571]). When perceived ease of use was high, the positive impact of resources on self-efficacy was strengthened. When ease of use was low, the effect was attenuated even with ample resources. Similarly, training experience significantly positively moderated the same path (coefficient = 0.1327, p = 0.0003, 95% CI [0.0619, 0.2034]). This indicates that systematic training enhances the translation of resources into self-efficacy. Social support also influenced the resource–self-efficacy relationship (coefficient = 0.0782, p = 0.0192, 95% CI [0.0129, 0.1435]). Providing additional emotional or instrumental support enhances the effect of resources on self-efficacy. It also positively moderates the pathway from self-efficacy to overall teaching efficacy (coefficient = 0.2258, p = 0.0003, 95% CI [0.1056, 0.3460]). Perceived ease of use, training experience, and social support significantly moderated the resource–psychological–efficacy relationships across various

paths. This indicates that these relationships are nonlinear and strongly contingent on technological and social contexts. These findings not only enhance the explanatory power of the model but also suggest that educational practice should simultaneously improve resource usability, reinforce training mechanisms, and establish stable social support networks. This approach maximizes the positive effects of resources on educators' psychological states and teaching outcomes.

Table 6
Moderation effect results

hyp	Model	coeff	se	t	p	LLCI	ULCI
H7	Y: SERU; X: SRP; W: PEUR	.0872	.0356	2.4518	.0147	.0172	.1571
H8	Y: SERU; X: SRP; W: TE	.1327	.0360	3.6899	.0003	.0619	.2034
H9	Y: SERU; X: SRP; W: SS	.0782	.0332	2.3542	.0192	.0129	.1435
H10	Y: OTE; X: SERU; W: SS	.2258	.0611	3.6954	.0003	.1056	.3460
* p < 0.05; ** p < 0.001 *** p < 0.001.							

4.7 fsQCA Analysis

After conducting SEM path, mediation, and moderation analyses, the study further employed fuzzy-set qualitative comparative analysis (fsQCA) to examine the mechanisms underlying the formation and alleviation of psychological stress from a configurational perspective. Unlike SEM, which emphasizes single-path effects, fsQCA highlights the simultaneous influence of multiple conditions and their equifinality. This method captures the complex structure of "multiple causes leading to one outcome." Psychological stress and its negation were used as outcome variables. The study examined the configurational effects of sensory resource possession, perceived ease of resource use, self-efficacy, social support, training experience, and overall teaching efficacy. Table 7 presents the necessary condition analysis. It shows that for both high and low psychological stress, the consistency of any single condition did not exceed 0.90. This indicates that no individual factor is a necessary condition. This finding aligns with SEM results, where resources did not exhibit a significant direct effect on psychological stress. Additionally, training experience and overall teaching efficacy exhibited higher consistency in cases of low psychological stress. This suggests that they provide foundational support in buffering stress.

Table 7
Analysis of Necessary Conditions for Psychological Stress and ~ Psychological Stress

Condition	Psychological Stress Consistency	Psychological Stress Coverage	~Psychological Stress Consistency	~Psychological Stress Coverage
Sensory Resource Possession	0.614103	0.656982	0.683599	0.649719
~Sensory Resource Possession	0.672581	0.705254	0.639096	0.595359
Perceived Ease of Use Resources	0.650958	0.64365	0.757128	0.665086
~Perceived Ease of Use Resources	0.661285	0.753985	0.594336	0.60203
Self-Efficacy in Resource Use	0.637438	0.646623	0.757001	0.682215
~Self-Efficacy in Resource Use	0.68673	0.760825	0.607886	0.59832
Social Support	0.648048	0.65941	0.750835	0.678741
~Social Support	0.684277	0.755575	0.623234	0.611377
Training Experience	0.700936	0.666811	0.792063	0.669416
~Training Experience	0.652499	0.779353	0.605767	0.642794
Overall Teaching Efficacy	0.590483	0.646713	0.753146	0.732817
~Overall Teaching Efficacy	0.756048	0.775152	0.636913	0.580136

In the sufficient condition analysis, Table 8's complex solution identified 19 equivalent paths leading to high or low psychological stress. The overall solution coverage was 0.891, and overall consistency was 0.754, both exceeding the recommended thresholds for fsQCA empirical research. Paths leading to high psychological stress typically involve missing resources, abilities, and support conditions, with several key factors absent simultaneously and accompanied by low teaching efficacy. In contrast, low psychological stress paths show compensatory and synergistic mechanisms. Here, overall teaching efficacy exists along with either social support or training experience. Even when other conditions are

moderate, psychological stress can remain low. Additionally, combinations of self-efficacy with social support or training experience repeatedly appear across multiple paths. These findings reveal the asymmetrical and configurational nature of psychological stress formation. They indicate that reducing educators' psychological stress cannot rely on a single factor. Instead, it requires multidimensional and context-specific configurations of resource conditions, capability beliefs, and support systems. This approach supplements and validates the findings from SEM, mediation, and moderation analyses.

Table 8
Sufficient configurations for high and low levels of Psychological Stress (fsQCA complex solutions)

Recipe/Factor	SRP	PER	SERU	SS	TE	OTE	Raw Coverage	Unique Coverage	Consistency
1	⊗		●			⊗	0.378594	0.00918537	0.856147
2	⊗				●	⊗	0.433649	0.0114673	0.844555
3	⊗	●	●	⊗			0.294899	0.00188267	0.870349
4	●		⊗		●	●	0.272821	0.00165445	0.837331
5	●		●	●		●	0.372261	0.0119236	0.786239
6	⊗	⊗	⊗	⊗	●	●	0.230773	0.00673205	0.89412
7		●			⊗	⊗	0.358512	0.00205374	0.846444
8		●	●			⊗	0.4195	0.00644678	0.832352
9		●		●		⊗	0.434847	0.00627559	0.84868
10			⊗	⊗	⊗	⊗	0.36028	0.0015974	0.884825
11		⊗	⊗	⊗		⊗	0.378023	0.00136918	0.879479
12		⊗	⊗	⊗	⊗		0.368496	0.00701731	0.866747
13	●	⊗	⊗	⊗			0.302544	0	0.864384
14		⊗		⊗	●	⊗	0.31133	0	0.863996
15			●	⊗	●	⊗	0.332211	0.00096982	0.856827
16		●	⊗	●	●		0.352065	0	0.85082
17		●		⊗	●	●	0.323882	0.00062757	0.82192
18		●	⊗		●	●	0.313726	0	0.829788
19	●	●	●		●		0.401586	0.00353718	0.812067
Overall solution coverage							0.890803		
Overall solution consistency							0.753644		
● = Condition exists ⊗ = Condition is missing Blank = Condition is irrelevant									

5. Research discussion

The combined results from structural equation modeling (SEM), mediation and moderation analyses, and fsQCA (see Fig. 3) **largely support** the proposed theoretical framework in the context of hearing impairment education. The findings suggest a pattern wherein sensory teaching resources are

associated with reduced educators' psychological stress not directly, but indirectly through individual cognitive mechanisms, specifically self-efficacy in resource use and overall teaching efficacy. This model is consistent with the core principles of social cognitive theory, which holds that external resources influence psychological outcomes through cognitive assessment rather than direct environmental determinism (Bandura, 1997). Furthermore, conservation of resources theory is supported in that resources buffer stress only when they are perceived as usable and controllable by the individual (Hobfoll, 2001).

The identified effect chain—sensory resource possession → self-efficacy in resource use → overall teaching efficacy → psychological stress—demonstrates the practical application of this theoretical logic in special education settings. Within this pathway, self-efficacy in resource use serves as a critical psychological hub, connecting external resource conditions to broader teaching efficacy assessments and indirectly influencing stress levels. This suggests that educators perceived capability to use resources carries greater explanatory power than mere resource availability, consistent with technology acceptance literature where subjective perceptions outweigh objective conditions (Davis, 1989).

It is worth noting that the direct effect of sensory resources on psychological stress was not significant (H2 not supported). This finding was not consistent with the hypothesis derived from COR theory, which posits a direct stress-buffering effect of resources. The possible reason is that the psychological benefits of resources need to be transformed through cognitive assessment (such as self-efficacy). If resources are not effectively used or perceived as a burden, it may not be possible to directly alleviate stress. This finding echoes Scherer et al.'s (2019) study on technology acceptance, which suggests that the tool itself is not as important as the user's sense of control over it.

Moderation analyses further revealed that the relationship between resource possession and self-efficacy is significantly strengthened by perceived ease of use, training experience, and social support. These contextual factors act as “caravan passageways” (Hobfoll, 2011) that facilitate the conversion of resources into psychological gains. Specifically, high perceived ease of use reduces cognitive barriers, systematic training enhances both skill mastery and pedagogical integration, and social support provides emotional and instrumental scaffolding that encourages experimentation and resilience.

The fsQCA results complement these findings by revealing the configurational and equifinal nature of psychological stress outcomes. No single condition was necessary for high or low stress; instead, multiple combinations of resource, efficacy, and support factors led to similar outcomes. For instance, low stress could emerge from high teaching efficacy combined with strong social support or substantial training, even when sensory resources were moderate. This underscores the compensatory potential of supportive ecosystems in resource-constrained settings and highlights the nonlinear, systemic nature of stress formation.

In the structural model, the overall teaching effectiveness has the strongest and most significant negative impact on psychological stress, while the direct impact of sensory resources on stress is not significant. This model supports the theoretical proposition that external conditions mainly affect

psychological results through cognitive processes (Bandura, 1997). When self-efficacy, training, or social support are included in the model, the impact of resources is significantly amplified through indirect pathways, consistent with the concept of the "resource gain spiral" in resource conservation theory (Hobfoll, 2001).

An important contribution of this study is the empirical demonstration that the core psychological mechanism operates consistently across both parents and special education teachers. This finding is noteworthy given the different contexts in which these two groups operate: teachers within structured educational institutions with (theoretically) systematic support, and parents within home environments with more varied and often limited support. Given the different backgrounds in which these two groups operate, this finding is worth noting: teachers in structured educational institutions (theoretically) receive systematic support, while parents in family environments receive more diverse and often limited support.

The results of this study can be combined with the teacher burnout model (Maslach&Leiter, 2016). Self-efficacy is the core resource for alleviating emotional exhaustion, while social support corresponds to the dimension of professional community. At the same time, the applicability to the parent group also echoes the key role of 'parental efficacy' in the Family Stress Model (Masarik&Conger, 2017). This indicates that both professional teachers and family caregivers have cross role commonalities in psychological empowerment mechanisms.

This cross-role consistency within our sample suggests that the resource transformation and stress coping processes may be driven by common cognitive-affective principles across these educator roles, rather than being entirely role-specific. It reinforces the applicability of Social Cognitive Theory and Conservation of Resources Theory to both professional and familial caregiving contexts. Practically, this implies that interventions designed to enhance resource usability, build self-efficacy, and provide social support could be beneficial for both parents and teachers, though the specific delivery mechanisms may need adaptation. The result also validates the methodological approach of integrating both groups into a single analytical framework, enriching the sample and enhancing the generalizability of the findings to the broader ecosystem of educators supporting children with hearing impairments.

These findings have significant implications for both theory and practice. Theoretically, this study extends social cognition and resource conservation theory to special education contexts, particularly in the context of hearing impairment, by demonstrating the importance of cognitive assessment and situational support in the relationship between resource pressure. Practically, the achievement advocates a shift from a "resource provision" approach to an "empowerment oriented" model, combining capacity development with supportive ecosystems. Suggested measures include designing sensory tools with a focus on usability, implementing ongoing contextualized training programs, establishing collaborative support networks between teachers and parents, and developing policy frameworks that prioritize the well-being of educators through systematic support rather than one-time resource allocation.

6. Conclusions

This study elucidates the nuanced mechanisms through which sensory teaching resources affect educators' psychological stress in the context of hearing impairment education. The empirical analysis leads to several key conclusions:

First, sensory resource possession does not directly alleviate psychological stress but influences it indirectly through a sequential cognitive pathway involving self-efficacy in resource use and overall teaching efficacy. This finding calls into question the assumption that merely increasing resource availability will improve educator well-being and instead highlights the critical role of perceived capability in resource utilization.

Second, self-efficacy in resource utilization is the core psychological mechanism that transforms external resources into internal ability beliefs. When educators have confidence in using sensory tools, the effectiveness of this specific field will be extended to a wider range of teaching outcomes, significantly reducing psychological stress. This emphasizes the importance of focusing on the subjective experience and ability development of educators, rather than just resource allocation.

Third, the effectiveness of sensory resources is highly contingent on contextual supports. Perceived ease of use, systematic training experience, and social support significantly moderate the relationships between resources, efficacy, and stress. These factors create enabling environments that facilitate resource utilization and amplify its positive effects on educator psychology. Our fsQCA results (with an overall solution consistency of 0.754) suggest that psychological stress formation may exhibit configurational and equifinal properties. Multiple combinations of resource, efficacy, and support conditions can lead to similar stress outcomes, suggesting that interventions should be tailored to specific contextual configurations rather than following a one-size-fits-all approach.

These conclusions have significant implications for educational practices and policies. Based on these findings, we suggest that support plans might benefit from moving beyond a primary focus on resource provision toward a more comprehensive approach that combines usability enhancement tools with capacity building training and collaborative support networks. This empowerment-oriented strategy is more likely to improve the mental health and teaching confidence of educators, ultimately benefiting children with hearing impairments through a more sustainable and effective educational support system.

Future research should address several limitations of this study, including its cross-sectional design, geographic focus on a province in China, and reliance on self-reported data. Longitudinal studies, cross-cultural comparisons, and surveys of specific moderating factors in children will further enrich our understanding of these complex relationships. In addition, exploring emerging technologies and digital tools in the context of special education is a promising direction for future research.

7. Research significance

7.1 Theoretical significance

This study makes several important theoretical contributions to the fields of educational psychology and special education. First, it extends the application of social cognitive theory and conservation of resources theory to the specific context of hearing impairment education, demonstrating how these frameworks can explain the complex relationships between resource availability, cognitive processes, and psychological outcomes (Xu et al., 2023). By validating a moderated mediation model that incorporates both individual and environmental factors, this research provides a more nuanced understanding of how resources affect educator well-being.

Second, this study elucidates the mediating role of self-efficacy in resource utilization, emphasizing that resource value can only be realized when educators feel capable of effectively utilizing tools. This insight advances our theoretical understanding of how external resources can be transformed into psychological assets through cognitive assessment processes.

Finally, the integration of fsQCA with traditional SEM methods represents a methodological advancement that captures the configurational nature of psychological stress. By revealing multiple equivalent pathways of stress outcomes, this study contributes to a more systematic understanding of educators' well-being, rather than just linear causal relationships.

7.2 Practical Significance

From a practical standpoint, this study provides valuable insights for special education administrators, policymakers, and support service providers. The findings emphasize that merely providing sensory resources is insufficient for improving educator well-being; instead, comprehensive support systems must be developed that address usability, training, and social support simultaneously.

Educational institutions should implement usability testing and design improvements for sensory teaching tools to reduce cognitive impairments. To develop a systematic and context sensitive training plan, with a focus on technical skills and teaching integration. Moreover, to establish a peer support network and counseling system between special education teachers and parents and develop institutional policies that prioritize continuous professional development and cross departmental cooperation (Zhu et al., 2025).

Furthermore, the configurational insights from fsQCA suggest that interventions should be tailored to specific contextual needs rather than following standardized approaches. In resource-constrained settings, enhanced training and social support can compensate for material limitations, while in resource-rich contexts, attention should focus on usability and integration to prevent cognitive overload.

By adopting these evidence-based strategies, educational systems can move toward more sustainable and effective support for both educators and children with hearing impairments, ultimately contributing to improved educational outcomes and enhanced quality of life for all stakeholders.

8. Limitations and future research

Although this study provides meaningful insights into short-video content marketing, some limitations provide directions for further exploration in future research. First, the cross-sectional design of the study precludes causal inference regarding the relationships between sensory resources, self-efficacy, teaching efficacy, and psychological stress. While the proposed theoretical model is grounded in established frameworks, longitudinal or experimental designs are needed to trace the dynamic evolution of these constructs over time and to establish directional causality (Martin et al., 2024).

Second, the sample was geographically limited to special education schools and rehabilitation canters in Anhui Province, China. This restricts the generalizability of the findings to other cultural, administrative, or educational contexts. Cross-regional and cross-cultural studies are needed to examine whether the identified mechanisms operate consistently across diverse educational systems and cultural value orientations.

Third, the study focused primarily on sensory teaching resources without distinguishing between different types of tools (e.g., tactile vs. auditory vs. visual). The effectiveness of these resources may vary depending on the child's degree of hearing loss, age, and learning style. Future studies should examine how resource characteristics interact with child-specific factors to influence educator outcomes.

Fourth, while the study examined both parents and special education teachers, it did not fully explore the potential differences in needs and experiences between these two groups. Future research could employ dyadic or multi-level designs to investigate how educator role moderates the relationships identified in this study, and how school-family collaboration influences outcomes for children with hearing impairments.

Addressing these research gaps will advance both theoretical understanding and practical applications in the field of special education, ultimately contributing to more effective, equitable, and humane educational systems for all learners.

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Author Contribution

J.X. conceived and designed the experiments, performed data analysis, and wrote the initial draft of the manuscript. N.M. secured funding, supervised the research project, and critically reviewed and revised the manuscript. All authors have read and approved the final version of the manuscript.

Data Availability

The data presented in this study can be made available upon request from the corresponding author.

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Figures

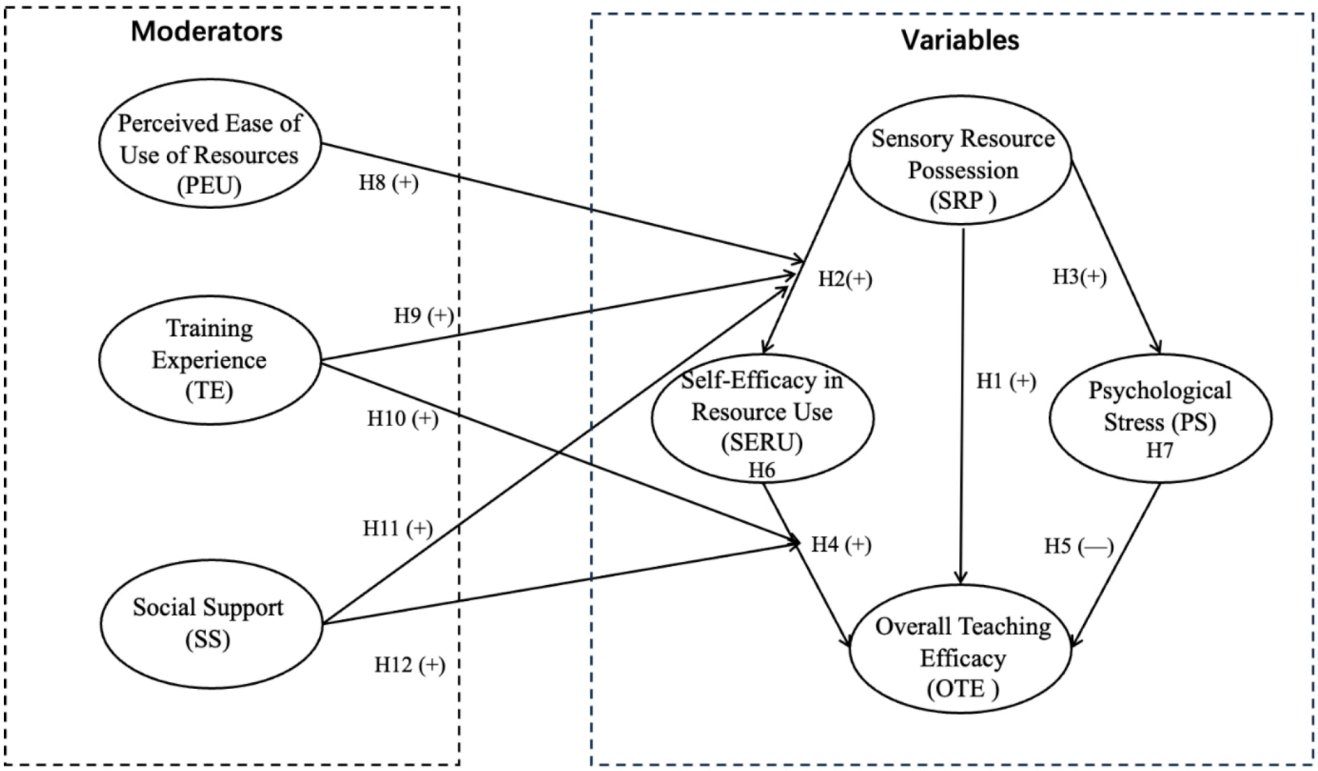

Figure 1

Research model.

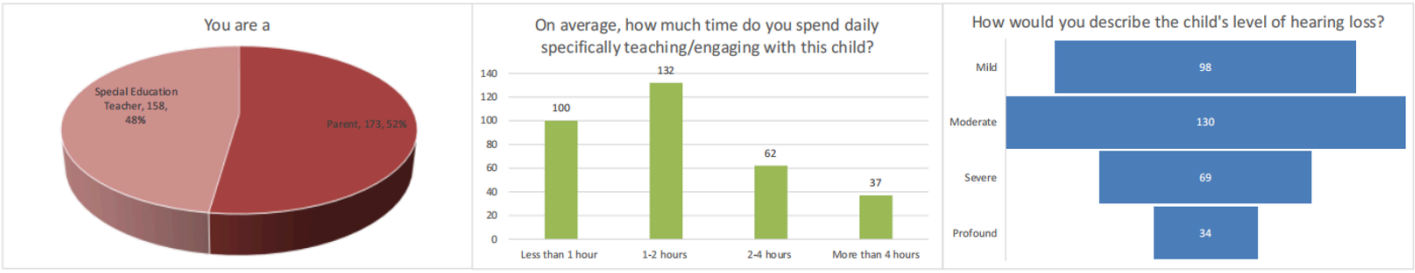

Figure 2

Distribution of Basic Information

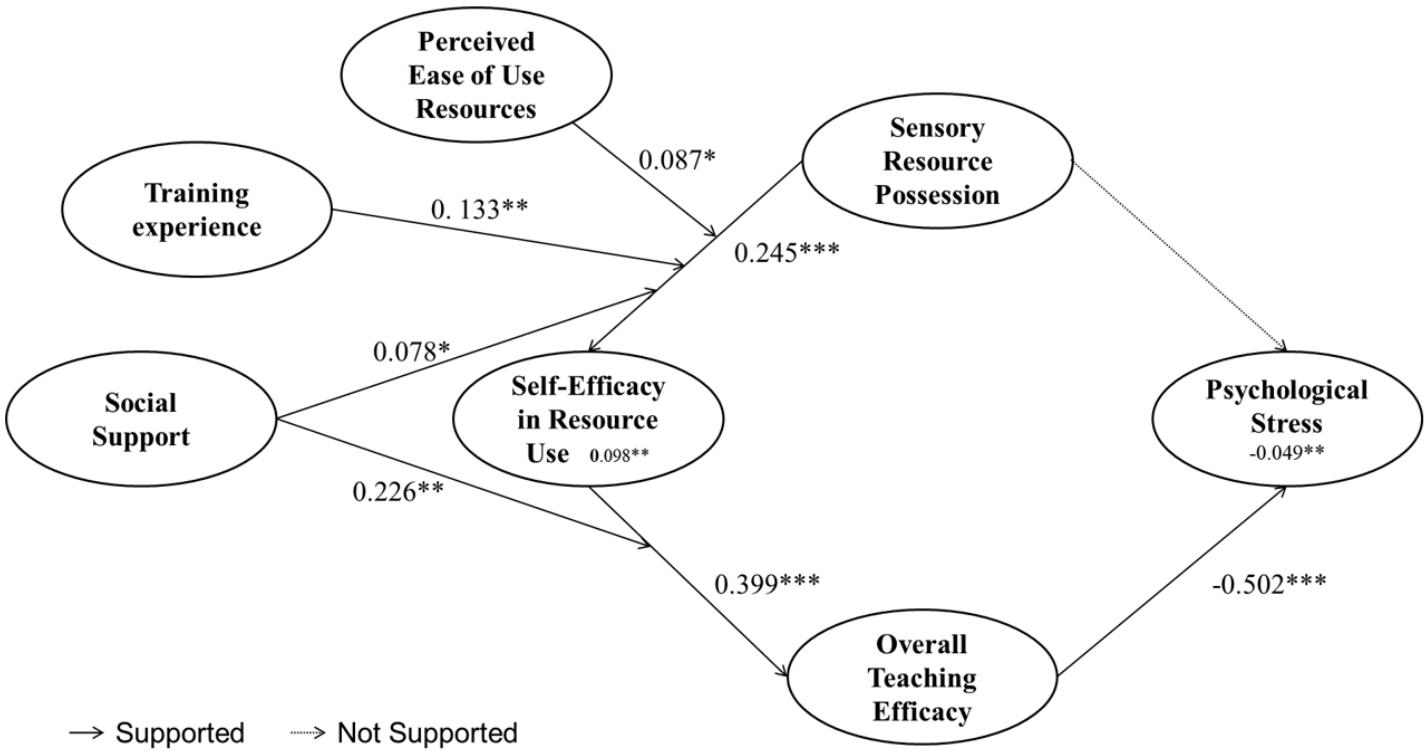

Figure 3

Hypothesized Path Coefficients