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RECEIVED 28 November 2025

REVISED 23 January 2026

ACCEPTED 23 January 2026

PUBLISHED 13 February 2026

## CITATION

Ding Y, Bakar KA, Ismail NK and Sun G (2026)  
Pre-service teachers' attitudes toward early  
childhood sexuality education as a mediator  
between knowledge and teaching  
self-efficacy: gender as a moderator.  
*Front. Educ.* 11:1756244.  
doi: 10.3389/educ.2026.1756244

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# Pre-service teachers' attitudes toward early childhood sexuality education as a mediator between knowledge and teaching self-efficacy: gender as a moderator

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**Introduction:** With the global advancement of sexuality education, educators' professional preparedness has become essential to improving its quality and sustainability. In early childhood education, teachers' knowledge, attitudes, and self-efficacy significantly influence children's developing concepts of sexuality. However, while much research focuses on in-service teachers, limited attention has been given to pre-service teachers, who are future implementers of sexuality education. To address this gap, the present study developed and validated a mediation model based on Bandura's Social Cognitive Theory, focusing on examining how attitudes mediate the relationship between pre-service teachers' knowledge of sexuality education and their teaching self-efficacy, and how gender moderates this pathway.

**Methods:** A quantitative approach was adopted using a cluster sampling method, data were collected from 458 Chinese pre-service teachers majoring in early childhood education. Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed to test the model.

**Result:** Findings revealed that attitudes significantly mediated the knowledge-self-efficacy relationship, and gender moderated this mediation effect, with effect among females is higher than that of males.

**Discussion:** These results contribute to the theoretical understanding of pre-service teacher development in sexuality education and offer practical implications for designing gender-sensitive teacher training programs. The study supports the development of targeted policies and instructional support systems aimed at enhancing professional competencies in delivering early childhood sexuality education.

## KEYWORDS

attitude, gender, knowledge, pre-service teacher, self-efficacy

## 1 Introduction

Early childhood is a vital period for children's development and identity formation, laying the groundwork for future sexual wellbeing and social adaptation (Li, 2022). Without proper guidance, children undergoing early physical, emotional, and sexual development may face risks such as sexual abuse, gender stereotyping, and inequality, which can hinder their overall wellbeing and potential [Raising Children Network, 2025; UNESCO, 2018]. In response, comprehensive sexuality

education (CSE) has been recognized globally as a key strategy to support children's holistic growth [UNFPA, 2021; Global Education Monitoring Report Team, 2019; UNESCO et al., 2018].

According to the international guidance, CSE should offer evidence-based, age-appropriate, and culturally sensitive education that helps individuals understand their bodies, enhance self-protection, foster healthy relationships, and promote gender equality and respect for diversity (UNESCO et al., 2018). Through CSE, children can develop informed sexuality values, improve decision-making skills, and achieve healthy, well-rounded development (UNESCO et al., 2018).

Individuals' understanding of sexuality and the formation of values are not accomplished in isolation but are gradually constructed under the interplay of multiple factors involving family, schooling, peer interactions, and social culture (Gouvernement du Québec, 2025; Maasoumi et al., 2024; UNESCO et al., 2018). As a major source of formal knowledge about sexuality, schools shoulder the important responsibility of guiding children to form healthy sexual concepts, value judgments, and behavioral patterns (Gouvernement du Québec, 2025; Noh and Bakar, 2023; Kurtuncu et al., 2015). Numerous studies showed the significant positive impact of school-based sexuality education in fostering childhood wellbeing and sexuality development (Mehroliya et al., 2023; UNESCO et al., 2018; UNESCO and UNFPA, 2018; Goldfarb and Lieberman, 2021). Sciencebased and well-organized sexuality education not only raises the awareness of physical development and gender identity but also plays an irreplaceable value in nurturing their consciousness of gender equality, self-protection and tolerance of others' differences growth (UNFPA, 2021; UNESCO et al., 2018).

As the primary responsibility of school-based sexuality education, teachers' function in educational practice is much more than knowledge transmitters but also value-oriented leaders and shapers of the school climate (Maasoumi et al., 2024; Xiong et al., 2019). Teachers' knowledge, attitudinal stance and teaching confidence directly influence the quality of education and the effectiveness of childhood development (Binu et al., 2018; Fisher and Cummings, 2015). Given this context, the professional preparedness of pre-service teachers, as the future implementers of sexuality education, is linked directly to the sustainability and high quality of sexuality education in schools. As such, it is important to ensure that pre-service teachers are equipped with systematic and solid knowledge, open and respectful attitudinal stance, and teaching confidence at the teacher education stage to facilitate the sound development of children's sexuality and the successful implementation of school sexuality education in the future (Bourke et al., 2024; Hendriks et al., 2024; Barr et al., 2014).

Knowledge of sexuality education among teachers, which typically encompasses multiple dimensions including reproductive health, gender equality, sexual identity, the prevention of child sexual abuse, etc., whose sufficiency is the foundation of teaching readiness and confidence (Bourke et al., 2024; Cheung et al., 2021; Kapella and Brockschmidt, 2017). Deficiencies in specialized knowledge may cause misinformation, avoidance of students' questions, and/or even persistence of stereotypes and gender bias in schools. International studies indicate a more professional delivery of sexuality education programs among teachers who

have received systematic education to proactively introduce interactive, critical and contextualized instructional strategies (Maasoumi et al., 2024; Szucs et al., 2020). For example, studies in countries like the Netherlands and Ireland, where training for teachers in sexuality education at preschool and primary levels has been institutionalized, found generally high knowledge levels among teachers (Bourke et al., 2024; de Looze et al., 2024).

Teachers' attitudes are key predictors of their willingness and behavior to provide instruction (Zhuravleva and Helmer, 2024; Mkumbo, 2012). As interpreted based on Bandura's Social Cognitive Theory (SCT; Bandura, 1986, 1997), the attitudes and values that teachers possess toward sexuality education—including their recognition of the importance of sexuality education, their determinations of social acceptability, and their understanding of pupils' needs—would directly influence their willingness to participation and selection of pedagogy. With an open and tolerant attitude, teachers are more likely to introduce an interactive and value-oriented mode of teaching, whereas they may display evasive, restrictive, or negative teaching behaviors (Mike and Hartal, 2025; Ding et al., 2025; Kahveci, 2023). Research has indicated there are differences in teachers' attitudes toward sexuality education in various areas owing to the socio-cultural context. In countries where sexuality education has been systematically promoted, such as Netherlands and Ireland, the attitudes of educators are more positive (Bourke et al., 2024; de Looze et al., 2024); while in culturally conservative societies, such as China and India, teachers are constrained by societal expectations and traditional concepts which make them express more negative or avoidant attitudes (Bibina et al., 2023; Smith and Harrison, 2013).

Bandura's concept of self-efficacy highlights that individuals' beliefs in their ability to perform specific tasks influence their motivation, emotional regulation, and persistence (Bandura, 1997). In education, this translates to teachers' confidence in addressing sensitive topics, managing student inquiries, and maintaining classroom dynamics (Castillo Nuñez et al., 2019). Higher self-efficacy is linked to sustained engagement and effective performance, while lower self-efficacy may lead to avoidance or anxiety (Fisher and Cummings, 2015). Under Bandura's Social Cognitive Theory (SCT), behavior results from the interaction between cognitive processes, emotional factors, and social environments (Bandura, 1986, 1997). The theory underscores observational learning and the role of external factors—such as social norms, role models, and cultural expectations—in shaping knowledge and attitudes (Bandura, 1977). Drawing on SCT, this study proposed a mediation model where knowledge of sexuality education influences teaching self-efficacy through attitudes, forming a cognitive–attitudinal–behavioral pathway. Gender, as a socially constructed identity, may moderate this process through societal expectations, educational interactions, and role identification, justifying its inclusion in the model and offering valuable insight for research on gendered dimensions in sexuality education preparation.

In China, there are obvious political shortcomings and cultural resistance to the promotion of sexuality education (Qin and Zhang, 2023). Though national policy has specifically stated in law the necessity of bringing sexuality education into the pre-school

and elementary education phases, the absence of supporting enforcement guidelines, mandatory requirements and monitoring systems makes it generally unsatisfactory to encourage school-based programs (Cai, 2023; Chen et al., 2022; The Central People's Government of the People's Republic of China, 2020; UNESCO, 2019). Meanwhile, owing to the far-reaching impact of traditional Chinese culture, the subject of sexuality has long been regarded as taboo, making it quite challenging to discuss it openly and guide it scientifically under the conditions (Qin and Zhang, 2023; Jiang, 2023; Huang, 2021; Leung et al., 2019). Such cultural patterns have not only undermined the accountability and responsibility of introducing sexuality education to young children but also limited the breadth and depth of the educational content. Some educators have realized the significance of childhood sexuality education in contributing to the individual's health and social adaptability, yet the teaching and learning activities remain limited for children and mainly concentrated on basic knowledge such as biological structure and personal safety protection, with rare coverage of critical topics concerning gender equality, relationships, sexual identity, and personal rights (Zhang and Yuan, 2023; UNFPA, 2021; UNESCO, 2019; Xiong et al., 2019). Moreover, Chinese education programs generally fail to provide a systematic curriculum framework and a sustainable supporting strategy for pedagogy, with teachers missing the necessary professional training on teaching skills and knowledge development, rendering it hard for them to respond to young children's actual needs (Hu et al., 2023; Qin and Zhang, 2023; UNESCO and UNFPA, 2018). The absence of standardized curricula and associated resources may cause individuals to form misconceptions, prejudices and stereotypes about sexuality, which in turn may affect their future perspectives in sexuality education as educators (Shibuya et al., 2023). Overall, Chinese school-based sex education remains at the preliminary stage of development, with the urgent need to improve the systematic development of policy and to localize curricula and professionalize teachers in practice.

With the continuous promotion of sexuality education globally, numerous studies have focused on the components and effectiveness of sexuality education in schools. Yet, since the relevant studies are mostly based on Western sociocultural contexts, its applicability in diverse cultural settings requires further validation. Moreover, due to the unique culture and concepts of sexuality in China, sexuality education has long been constrained by conservative notions, inadequate policy support, and practical barriers in its development locally, particularly at the early childhood stage where such education tends to be marginalized. While attention to sexuality education has gradually grown over the past decades, compared to the extensive concern for in-service teachers, the existing literature lacks sufficient research on pre-service teachers, who are the backbone of the teaching force, causing a certain gap in the teacher education program regarding sexuality education. Hence, it is necessary to thoroughly explore the perspectives and competencies of pre-service teachers on early childhood sexuality education starting from the roots of teacher education development.

According to the social cognitive theory posits that knowledge could shape one's attitudes by influencing individuals' expectations of behavioral outcomes, while attitudes, as motivational cognitive

factors, exert a certain influence on self-efficacy, this study proposes an extended model based on the theory, suggesting that knowledge influences self-efficacy through the mediating pathway of attitude. Also considering the marked differences exist between males and females in knowledge processing, attitude formation mechanisms, and the psychological processes involved in establishing self-efficacy suggested by gender socialization and gender role orientation research, this study, therefore, seeks to construct a mediation model that includes moderating effects to investigate the mediating role of pre-service teachers' attitudes toward early childhood sexuality education between their knowledge and teaching self-efficacy, and to further analyze the moderating effects of pre-service teachers' gender in this mediating mechanism. To be specific, the hypothesis of this study are: (1) H<sub>1</sub>: pre-service teachers' attitudes mediate the relationship between their knowledge of sexuality education and teaching self-efficacy; (2) H<sub>2</sub>: gender moderates the mediation pathway between knowledge of sexuality education and teaching self-efficacy via attitudes.

## 2 Methodology

### 2.1 Research design

This study adopted a quantitative research design and employed a cross-sectional questionnaire to conduct data collection and analysis with the aim of investigating the mediating mechanism of preservice teachers' attitudes toward sexuality education for young children in the relationship between their knowledge of sexuality education and their teaching self-efficacy, as well as the moderating role of gender in that mediating pathway. Due to the cross-sectional design of this study, the mediation analysis is used solely to explore the relationships among the variables. Data were collected from students who are majoring in pre-school education with accredited diploma and undergraduate education in public institutions of higher education in two cities of Dandong and Ganzhou, China, using the PLS-SEM technique for data analysis to achieve statistical validation of the relationships among the variables.

### 2.2 Participants

Since classes in Chinese universities are normally assigned to freshmen at the time of enrolment based on defined criteria which remain constant throughout the university years, it was reasonable and feasible to apply the cluster sampling method in this study. The computational results based on Cochran's Formula suggested a minimum sample size of 385 for the research (Cochran, 1977).

Considering that the return rate of the online questionnaire should be higher than 80% (Wu et al., 2022), the researcher had set a target sample size of 462 to avoid ending up with less than the minimum sample size of valid data that could be analyzed.

Targeting the pre-service teacher's cohort, the study carried out the questionnaire through an online questionnaire platform with a

voluntary and anonymized manner of participation, ensuring no personally identifiable information was involved. The researcher sent a survey link to all students in the selected classes and invited for participation. Access to the link was open for a 14-day period. A separate informed consent page was placed prior to the answering of the questionnaire to safeguard the participants' rights and interests, detailing the background of the study, the principles of data processing, the freedom of participation, and the mechanism for keeping the information confidential. Only after participants have fully read the relevant instructions and clearly stated their consent could they enter the formal questionnaire page. Participants were allowed to withdraw at any time if they decided to terminate their participation during the process, and their data would not be recorded.

## 2.3 Measurement

The questionnaire used in this study was developed based on previously validated scales and relevant literature, comprising four key sections. The first section gathered demographic and background information, including participants' gender (Gender is measured through self-reported biological sex, with options including male and female.), age, current institution, year of study, ethnicity, and prior exposure to school-based sexuality education. This information aimed to contextualize participants' perspectives and experiences related to early childhood sexuality education.

The second to fourth sections focused on measuring constructs relevant to the study's objectives (Table 1). The Sexuality Knowledge Scale, adapted from UNESCO guidelines and related works (UNESCO et al., 2018; Koch and Brick, 2011), included 24 items scored to reflect factual knowledge ( $\alpha = 0.932$ ). The Attitude Toward Sexuality Education Scale, adapted from Perez et al.'s TACS (2004), comprised 18 items rated on a five-point Likert scale to assess openness and acceptance of teaching sexuality education to young children ( $\alpha = 0.964$ ). Lastly, the Sexuality Teaching Self-Efficacy Scale, adapted from Bandura (2006), contained 16 items evaluating confidence in delivering sexuality education ( $\alpha = 0.933$ ). Higher scores in each scale reflected stronger knowledge, more positive attitudes, and greater self-efficacy.

## 2.4 Data analysis

Three software, Microsoft Excel, IBM SPSS Statistics 29.0, and SmartPLS 4.1.0, were used to analyse the data in this study. The demographic characteristics and the responses to

the questionnaire items were firstly analyzed using descriptive statistics in Excel and SPSS to reveal the sample composition and data distribution characteristics. Subsequently, a moderated mediation model was built based on Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS, followed by path analysis and statistical testing of the hypotheses proposed in the study.

## 3 Results

In the present study, there were 497 pre-service teachers who successfully completed the questionnaire. Of these, 39 were dropped due to poor response (e.g., choosing the same option for all questions on the same scale). Eventually, a valid sample of 458 was accepted for statistical analysis. The mean age of the participants enrolled was 19.5 years old, of which 426 were female. Participants were from two cities, with 177 data from Ganzhou City and 281 data from Dandong City. Regarding the distribution of years of study, the majority of the respondents were sophomores representing 58.95%, followed by freshmen and juniors with 23.58% and 13.97%, respectively, while senior students occupied a minimal percentage of 3.49%. Nine different ethnic groups were covered in this study, with Han Chinese comprising the majority at 385, followed by Zang (28) and Zhuang (24).

The details are presented in Table 2.

Adopting a PLS-SEM approach, the study sought to explore the structural relationships among pre-service teachers' knowledge of sexuality education, their attitudes toward it, and their teaching self-efficacy, with a specific attention to analyzing the mediating role attitudes in the relationship between knowledge and self-efficacy, as well as the moderating effect of gender on this mediating pathway. Before testing the structural model, the reliability and validity of the measurement model was first assessed. Results indicated that the Cronbach's alpha coefficients and the composite reliability (CR) of each variable exceeded 0.70, and the average variance extracted (AVE) were all above 0.50, suggesting that the instrument possessed satisfactory internal consistency and convergent validity (Hair et al., 2021; Fornell and Larcker, 1981). Moreover, discriminant validity was confirmed through the Fornell-Larcker criterion and the heterotrait-monotrait ratio (HTMT) of correlations, ensuring the adequacy of the measurement model for subsequent structural analysis (Fornell and Larcker, 1981; Henseler et al., 2015).

Regarding model fit, the coefficients of determination ( $R^2$ ) for the key endogenous variables showed  $R^2$  values of all dimensions within the range of 0.5–0.8, demonstrating a moderate to strong

TABLE 1 Information of the instrument.

Variable	Scale	Number of items	Response format	Scoring
Knowledge	Sexuality knowledge scale	24	Yes/not sure/no (0 = no, 2 = yes)	Higher scores indicate greater knowledge
Attitude	Attitude toward sexuality education scale	18	5-point Likert (1 = strongly disagree, 5 = strongly agree)	Higher scores indicate more positive attitudes
Self-efficacy	Sexuality teaching self-efficacy scale	16	5-point Likert (1 = strongly disagree, 5 = strongly agree)	Higher scores indicate higher teaching self-efficacy

TABLE 2 Participants characteristics.

Category	Items	Frequency	Percentage (%)
Location	Ganzhou	177	38.65
	Dandong	281	61.35
Gender	Male	32	6.99
	Female	426	93.01
Age	18–19	232	50.65
	20–21	208	45.41
	22+	18	3.93
Year of study	Year 1	108	23.58
	Year 2	270	58.95
	Year 3	64	13.97
	Year 4	16	3.49
Ethnicity	Zang	28	6.11
	Zhuang	24	5.24
	Han	385	84.06
	Others	21	4.69

explanatory power of the model for each variable (Hair et al., 2019). Additionally, the predictive relevance indicator,  $Q^2$ , also indicated that the model had good predictive relevance, with the  $Q^2$  values for knowledge, attitude and self-efficacy being greater than 0, which is consistent with the criterion (Hair et al., 2019). Collectively, these indicators revealed the adequacy of the model's fit and predictive performance, thereby validating the interpretation of the hypothesized structural relationships and moderated mediation effects.

This study used bootstrap approach to test the mediating effect, the results showed that the mediating effect of attitude was significant. Specifically, the results of the paths were illustrated as follows: (1) Knowledge → Attitude → Self-efficacy: the total effect coefficient of this pathway was 0.383, the 95% confidence interval was [0.299, 0.465], and the  $T$ -value was 9.027, which indicated that the total effect of pre-service teachers' sexuality knowledge on their self-efficacy teaching of it was significant; (2) Knowledge → Self-efficacy: it had a direct effect coefficient of 0.217, a 95% confidence interval of [0.140, 0.298], and a  $T$ -value of 5.401, suggesting that sexuality knowledge of the respondents has a significant positive direct effect on their teaching self-efficacy; (3) Knowledge → Attitude → Self-efficacy: the indirect effect coefficient of pre-service teacher's sexuality knowledge on their teaching self-efficacy was 0.166, with a 95% confidence interval of [0.120, 0.214], and a  $T$ -value of 6.916, which showed that their attitude toward sexuality education had a significant mediating effect on the relationship between knowledge and self-efficacy (Table 3). It is therefore evident that attitude as a mediating variable not only directly affects individual self-efficacy, but also indirectly affects the role of one's knowledge on one's personal self-efficacy. This suggests that attitude plays a partly mediating role in this mechanism, that is, individuals with greater knowledge tend to hold more positive

attitudes toward sexuality education, and these attitudes in turn enhance their confidence in teaching sexuality education.

Prior to conducting multiple group analyses, preliminary path estimates were examined to clarify the fundamental relationships among the key variables. The results revealed that knowledge was positively associated with both attitudes ( $O = 0.358$ ,  $p < 0.001$ ) and self-efficacy ( $O = 0.217$ ,  $p < 0.001$ ), and attitude was positively correlated with self-efficacy ( $O = 0.462$ ,  $p < 0.001$ ). To further examine the moderating role of gender in mediating pathways, multiple group analysis was applied to analyse the structural pathway coefficients comparing male and female pre-service teachers. Results showed that the indirect effect of pre-service teachers' knowledge of sexuality education affecting their sense of teaching self-efficacy through their own attitudes was more significant among female counterparts (Difference =  $-0.169$ ,  $p = 0.002$ ). The MGA test for path differences yielded a  $p$  value of  $<0.05$ , indicating a statistically significant difference between the two groups for the effect. That is, gender markedly moderated the strength of the mediation path, showing a moderated mediation effect in the model, of which the mediation effect of female teachers in the knowledge → attitude → self-efficacy path was significantly more powerful than that of the males, thus confirming the research hypothesis. The finding highlights the importance of gender as a factor contributing to the development of positive attitudes and self-confidence in taking actions during the process of raising the professional competence of pre-service teachers in sexuality education, which deserves more attention in the relevant training programs and intervention strategies.

## 4 Discussion

### 4.1 Attitudes mediate the relationship between knowledge and self-efficacy

The study validated the mediating role played by pre-service teachers' attitudes toward young children's sexuality education between their level of knowledge and teaching self-efficacy and further examined the moderating effect of gender in this pathway, with the results supporting the pre-defined research hypotheses.

Firstly, pre-service teachers' attitudes toward sexuality education exerted a significant mediating role in the process of transforming knowledge into self-confidence in teaching, showing that when pre-service teachers are more knowledgeable about sexuality, they are more willing to properly value sexuality education, to disseminate and share scientific knowledge, and that such positive attitudes can increase their self-efficacy in making decisions about sexuality education with greater self-confidence and initiative. This is to imply an indirect contribution of knowledge base to the development of teachers' teaching self-efficacy through attitudes, underscoring that knowledge alone may not be sufficient to enhance teaching confidence. The finding confirms hypothesis, also echoing the concept in SCT, which states that an individual's behavior is neither only produced directly by the input of knowledge but is rather jointly constructed by cognitive factors, affective attitudes, and the social environment (Bandura, 1977, 1997). Viewed from the

TABLE 3 Mediator analysis results.

Pathway	Effect type	Original sample (O)	2.50%	97.5%	T statistics	P values
Knowledge → Attitude → Self-efficacy	Direct	0.217	0.140	0.298	5.401	<0.001
	Indirect	0.166	0.120	0.214	6.916	<0.001
	Total	0.383	0.299	0.465	9.027	<0.001

standpoint of the theory, one's attitude performs a bridging and transforming role between individual knowledge input and self-efficacy construction, acting as a key internalizing process of cognition into behaviors.

Educators' attitudes, as a form of psychological and emotional engagement, shape how they utilize their expertise in teaching practice, especially in sensitive and controversial domains (Alemu, 2024; Kapella and Brockschmidt, 2017; Mkumbo, 2012). Not only does the positive attitude boost their willingness to spread scientific knowledge about sexuality, but it also strengthens their sense of confidence and initiative in decision-making and practice of sexuality education (Maasoumi et al., 2024; Mseti and Daudi, 2020; UNESCO et al., 2018). As a result, teachers' favorable attitudes could help them build trusting relationships with students, parents and colleagues, so that the knowledge they possessed could be more smoothly disseminated in the delivery of sexuality education curricula, and could efficiently raise their coping ability and decision-making power when facing the challenges and complex contexts of sexuality education, thereby achieving the goal of bettering the effectiveness of the educational process.

It is noteworthy that the idea of pre-service teachers' attitudes as a mediating variable in the influence of knowledge on teaching self-efficacy is fairly recent in the context of sexuality education research. However, studies have been undertaken in other educational domains that bring out rich perspectives on the relationship between knowledge, attitudes, and self-efficacy. For example, Çavaş et al. (2024) revealed a significant mediating effect of teachers' attitudes on the relationship between their professional knowledge and teaching self-efficacy in STEM education, as well as a study by Lu et al. (2020) on special education context in China indicated that improved knowledge alone is insufficient to strongly boost teachers' confidence, and attitudes may play both mediating and moderating roles. These interdisciplinary studies lend support to the underlying logic of this study and underscore the critical role of educators' attitudes in the process of transforming knowledge into a sense of teaching self-efficacy.

Therefore, it is stressed that while knowledge positively affect self-efficacy, its impact is partly mediated by attitude. Simply upgrading the knowledge base of pre-service teachers is not a sufficient guarantee of their sense of self-efficacy and performance in teaching sexuality education. As attitudes activate positive thinking and motivation between knowledge and confidence of practicing, whether or not pre-service teachers acknowledge the value of sexuality education and believe in its necessity and reasonableness in early education would largely determine the degree to which they feel confident enough to actively shoulder the responsibility of teaching in early childhood, positively respond to young children's sexual curiosity and behaviors,

and properly cope with the complexity of the teaching and learning situation.

## 4.2 Gender moderates the mediation pathway

The present study furthermore discovered that pre-service teachers' gender performed a significant moderating role in the above mediating pathway. To be specific, female teachers exhibited more powerful effects in this mediating pathway, which not only confirms hypothesis 2 but also theoretically echoes the emphasis of SCT on gender as a constructed variable of socialization (Bandura, 1977, 1997). It argues that gender is more than just a biological attribute but also a social role constructed through long-term cultural, educational, personal experience and social interactions. The internalization of gender roles, the embedding of social expectations, and the construction of identity could affect both the depth of an individual's knowledge internalization process and the role attitudes play in the transition to self-efficacy (Durand et al., 2022; Canevello, 2020).

Although fewer studies in sexuality education directly examine gender as a moderator in the attitude-mediated pathway from knowledge to self-efficacy, evidence from educational psychology and health behavior research supports the general moderating role of gender in cognitive behavioral pathways. For example, some studies have indicated that gender were found to moderate the mediating process between multiple psychological variables in multi-directional investigations such as educational identity and career development, critical thinking disposition, mental health and academic stress, and so forth (Liu and Pásztor, 2023; Wang and Yu, 2023; Yikeranmu et al., 2023; Ye et al., 2018). These studies, while not directly focused on the field of sexuality education, have supplied strong theoretical and methodological references that collectively suggest a generalization of the effect of gender as a moderating variable in pathways.

Contextualized in this study, gender differences may stem from gender role expectations, cultural norms, and patterns of interaction in educational contexts (Jin and Han, 2025; Wang et al., 2024). Like some previous findings stating that females' attitudes tend to be more constrained by the gender expectations on the sensitivity topics (Ouahid et al., 2025; Gewirtz-Meydan et al., 2024; Maas et al., 2015), pre-service teachers of different genders are subject to varying influences of socialization process on the gender role expectations in the attitude formation process, which thus exhibit different response mechanisms on the path of

knowledge transformation to teaching self-efficacy. Such findings imply that it is advisable to strengthen the awareness of gender issues in preservice teacher preparation by focusing on the different patterns of knowledge absorption, attitude construction, and self-efficacy development among pre-service teachers of different genders.

### 4.3 Implication, limitation, and recommendation

This study provides valuable contributions from methodological, theoretical, and practical perspectives. Methodologically, the use of PLS-SEM to examine mediating and moderating effects addresses a gap in the existing literature and offers a technical reference for future research, particularly in areas where such statistical techniques are underutilized. Theoretically, the study applies Bandura's Social Cognitive Theory (SCT) to the context of pre-service teacher development in early childhood sexuality education by developing and empirically validating a three-dimensional model of knowledge, attitude, and self-efficacy. This contributes to a deeper understanding of the cognitive-psychological mechanisms that underpin teachers' preparedness. On a practical level, the findings suggest that professional development programs should go beyond knowledge delivery to also nurture positive attitudes and self-efficacy through multidimensional approaches such as scenario-based learning and case study analysis.

Despite these contributions, the study has several limitations. The cross-sectional design limits the ability to infer causal relationships between variables, meaning the mediating effect of attitudes and the moderating role of gender can only reflect associations at a single point in time. Additionally, the sample was drawn from pre-service teachers in only two regions, reducing the generalizability of the findings across diverse educational and cultural contexts. The self-report nature of the questionnaire, especially given the culturally sensitive topic of sexuality, may also introduce social desirability bias, with participants potentially overstating their attitudes or confidence. The overrepresentation of female participants—although reflective of the gender imbalance in early childhood education—may further skew gender-related findings.

Future studies are encouraged to employ longitudinal or experimental designs to better capture the dynamic relationships among knowledge, attitudes, and self-efficacy over time. Expanding the sample to include more geographically and culturally diverse groups of pre-service teachers would enhance the robustness of the model. Incorporating multiple data sources such as interviews and classroom observations can improve the depth and accuracy of findings. It is also recommended that future research balance gender representation and consider other influencing factors such as age, ethnicity, and academic background, to provide a more comprehensive understanding of how various social and personal variables shape pre-service teachers' readiness to teach sexuality education in early childhood settings.

## 5 Conclusion

This study, through the lens of pre-service teachers, examined how their attitudes toward early childhood sexuality education mediate the relationship between their knowledge and teaching self-efficacy, while also validating the moderating role of gender. Results indicated that attitudes play a crucial mediating role, with stronger effects observed among female participants. These findings reinforce the theoretical relevance of the knowledge–attitude–self-efficacy model in teacher education and contribute to a deeper understanding of pre-service teacher development in sexuality education. The study highlights the importance of structured training that not only enhances knowledge but also cultivates positive attitudes and confidence, particularly by addressing gender based differences and fostering supportive learning environments. While limitations such as the cross-sectional design, reliance on self-reported data, and limited regional scope may affect the generalizability of findings, the study still provides valuable insights for educators and policymakers. To strengthen future research, it is recommended to expand the sample size, diversify the variables, and apply longitudinal or mixed-method approaches. Such efforts can help refine strategies for equipping pre-service teachers with the professional competence needed to deliver effective, value driven sexuality education in early childhood settings.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

Ethical considerations were addressed in accordance with the institutional requirements because the questionnaire introduction provided participants with information on the study objectives, the scope of data collection, and strict confidentiality measures. Participants were required to read the introduction carefully and provide informed consent before completing the questionnaire. All participants were adults aged 18 years or older. Given these measures, the study posed minimal ethical risk. As part of a doctoral dissertation, the study was approved by Universiti Kebangsaan Malaysia, and no further ethical review was deemed necessary. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

## Author contributions

YD: Conceptualization, Data curation, Formal analysis, Methodology, Resources, Software, Writing – original draft. KA: Supervision, Writing – review & editing. NI: Supervision, Writing – review & editing.

## Funding

The author(s) declared that financial support was not received for this work and/or its publication.

## Acknowledgments

As part of the work in Doctoral Program, we would like to express our sincere gratitude to Universiti Kebangsaan Malaysia and the Faculty of Education for their generous support with technology and resources. Our heartfelt thanks also go to all the participants whose time, effort, and valuable input made this study possible.

## Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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