



# Spatial-temporal evolution pattern and optimization path of family education policy: An LDA thematic model approach

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## ARTICLE INFO

### Keywords:

Family education policy  
LDA topic model  
Temporal features  
Spatial features

## ABSTRACT

Family education policy plays a crucial role in modernizing family education. By examining the temporal and spatial evolution of this policy, its inherent logic, constructs, and optimal pathways can be better understood. The study analyzed local family education policy documents, extracting six major themes using the Latent Dirichlet Allocation (LDA) model, and presented them according to the calculated mean theme probability. The themes include parental ability, school security, institutional environment, government support, social coordination, and high-quality development. Parental ability and government support were found to be particularly prominent, suggesting that many local policies focus on enhancing parents' skills for delivering family education and bolstering the government's role in public affairs. This combines the dual responsibilities of being an educational entity and accountable subject in the joint development of family education. Understanding the characteristics and variations in temporal and spatial distribution can enrich family education policy design, fostering the high-quality development of family education initiatives. Based on the findings, the study proposes three optimization paths for policy design: promotion and empowerment (building a multi-cooperative system), regional interconnection (understanding the current state of local policies and leveraging their strengths), and breaking barriers (simultaneously promoting the inclusiveness of family education and brand development). This study emphasizes the needs of customizing family education policy based on the temporal and spatial features and local requirements for maximum outputs.

## 1. Introduction

Family education serves as a foundation of the national education system and a key element in the educational ecosystem [1]. The challenges posed by an aging population have led to the "three-child" policy. Concurrently, significant efforts to reduce burdens at the compulsory education stage have been recognized as a major public project [2]. In this context, many parents face parenting complications, and the anxiety of the new generation of mothers needs urgent attention [3]. So, promoting high-quality and balanced development of family education guidance services has become a significant concern [4]. In addition, the implementation of the "Family Education Promotion Law of the People's Republic of China" shows that family education has received the legislature's attention and is integral to modernizing the education governance system [5].

Family education policy serves as an important tool for the government to regulate and guide family education development [6]. This policy holds significant value in promoting the in-depth development of the family education practices and enhancing families'

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<https://doi.org/10.1016/j.heliyon.2023.e17460>

Received 12 December 2022; Received in revised form 10 June 2023; Accepted 19 June 2023

Available online 21 June 2023

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academic ability [7]. The trajectories of family education practice are also reflected in the policy texts due to the differences in the historical culture, social development, and economic level of different regions [2]. Therefore, an in-depth analysis of family education policy and exploration of their temporal and spatial evolutionary differences can help grasp the policy intention and direction. Analyzing regional differences and their underlying causes can reveal the inherent logic of existing policies, providing a reference for the high-quality development of family education and the formulation of future policies.

Current research on family education mainly focuses on three aspects: different subjects [8,9], strategic concepts [6,10], and policy analysis [1,11,12]. First, family education involves responsible entities, such as children. Relevant studies explore issues like parental burnout [13], loss of mothers' income [7], family education of left-behind children [14–16] and the family education environment of migrant children [17,18]. Moreover, the cultivation of different educational subjects also affects children's abilities [19]. Second, strategies and concepts of family education show obvious disparities across different social backgrounds. Chinese scholars mainly focus on traditional culture, analyzing the influence of classical educational ideas, such as Yan's Family Instructions [20] and Han and Wei Dynasty Family Instructions [21] on modern family education concepts. Tendo and Takahashi [22] conducted a discourse analysis of Japanese parenting magazines, focusing on the transfer of knowledge in family education, and revealing parenting strategies in late modern Japan. Third, the exploration of family education policy mainly employs comparative analysis, including the comparison between China and Japan [12], the comparison between two sides of the Taiwan Strait [23], etc., or analyses of policy historical evolution to explore its temporal context [24].

Previous studies have yielded substantial insights on the relevant subjects [8,9], and strategic concepts of family education [6,10], and have also investigated the historical development of national level policies [1,25]. However, there is still room for expansion in several ways. Firstly, concerning research objects, national-level policies usually signify the direction, while provincial and municipal policies are more related to successful implementation of the relevant programs [25]. Therefore, examining family education policy issued by the local government can offer a more nuanced and specific perspective on the optimization direction and path of family education development. Secondly, in terms of research methods, existing literature mainly focuses on the temporal logic of family education policies, ignoring the spatial differences between regions. Provincial level policy content can be adapted to explore the spatial distribution pattern. In addition, with the continuous expansion of the application of statistics and measurement methods in public policy research, the importance of quantitative analysis of public policy is undeniable [26]. Policy text analysis relies on policy tools [27] and co-word analysis [28]. Compared to traditional manual coding, automated analysis methods based on big data offer significant advantages in dealing with extensive and lengthy texts [29]. The Latent Dirichlet Allocation (LDA) topic model is particularly dominant in this context [30]. Machine learning-based text analysis method have been widely used in policy research, such as the studies of digital government construction [31], and the interactive analysis of network public opinion and government response [32].

The importance of the issue deserves an in-depth investigation to understand how the family education policy can be more effective in various social settings. Therefore, this study aims to analyze the spatial pattern and optimization path of family education policies in China. Local government-issued family education policy is the focus of this research. The LDA topic model, suitable for analyzing massive irregular text data [33], is used to deeply assess the topics and their probability ratios embedded in policy texts. Then the time series and the probability ratio of each topic are also explored. Simultaneously, a spatial autocorrelation test is used to determine whether there is a spatial correlation in the probability mean of each case, thereby informing policy suggestions for the high-quality development of family education.

This study contributes to the family education policy literature in several ways. For example, existing research often ignores the impact of regional variations and generally concentrates on national-level initiatives, despite the crucial role of family education as a foundation of the national education system. These studies, however, only provide a limited suggestions on how to successfully implement family education at the regional level. To provide a comprehensive understanding of family education policy, this study concentrates on local governments' policies for family education. It does so by using cutting-edge analytical techniques like the LDA topic model and spatial autocorrelation test. This strategy will not only add to the body of current knowledge but also provide insightful information for developing quality family education policies in the future.

## 2. Theoretical framework

The theoretical basis of this study is Natural Language Processing (NLP) and Information Retrieval, along with Public Opinion Theory. This study introduces an innovative, multidimensional approach to the study of policy development by fusing NLP and information retrieval with public opinion theory, laying the groundwork for future studies in policy analysis and public opinion research.

We used Latent Dirichlet Allocation (LDA), a key NLP tool, to extract latent themes from our corpus, a large collection of texts pertaining to family education policy [34]. LDA is necessary for comprehensive understanding, interpreting, and producing of human language. Contrarily, information retrieval deals with organizing and obtaining data from large document collections. Our work makes use of these interdisciplinary ideas to extract pertinent issues from a large text corpus via the use of an LDA-based technique, allowing for a more complex understanding of the underlying themes in family education policy across time.

Additionally, Public Opinion Theory is a key component of this study. To fully comprehend the development and optimization of these policies, it is suitable for analyzing public opinion about family education policy [35]. The public opinion theory sheds light on the processes by which public opinion develops, changes through time, and maybe even affects how policies are formulated [36]. LDA also serves as a technique for extracting public opinion from the text corpus and provides an unbiased, data-driven prism through which to assess the public's opinion. The thematic model, which gives policymakers an evidence-based framework for evaluating and optimizing policies, shows changes in public opinion and developing trends.

### 2.1. Information retrieval and policy sources

The magic weapon of Peking University, renowned for its normative and authoritative collection and arrangement of policy texts, was used to retrieve policy documents [37]. Keywords including, family education, home-school cooperation, home-school co-education, and home-school co-education were employed in the search, yielding over 300 records. To refine the scope of the research and provide more accurate direction, only normative documents such as regulations, opinions, notices, and decisions were retained from the search results. Consequently, a total of 201 policy documents were included in the research scope. The period covered spans from 1999 to February 1, 2022, and encompasses 26 provinces. Detailed information is shown in Table 1.

### 2.2. Analysis of LDA topic model of family education policy

Unsupervised machine learning techniques such as Latent Dirichlet Allocation (LDA) was used to discover hidden thematic information in massive document collections, or corpora, developed by American academic Blei [34]. In recent years, LDA has been extensively employed by scholars for researching public opinion. For instance, in the field of topic discovery, Chen et al. [38] utilized LDA for topic extraction and evolution of public opinion regarding hot social events.

The LDA topic model is not limited by the size of the text, effectively minimizing human intervention and yielding a document-topic matrix and topic-vocabulary matrix [39]. The probability of each topic appearing in the document can reflect the degree of importance a policy document assigns to a topic, thereby indicating the relative importance of the topic [30].

During the operation process, locally sourced family education policy documents are processed by regular expressions, filtering out noise data. Symbols, URLs, and the like are deleted, and entries-related family education are obtained. Subsequently, the Jieba word segmentation tool [38], is used to break down entries into independent words, removing stop words such as “and”, “only” and “those” are removed. The bag-of-words model is then used to extract and encodes unique words, vectorizing the text. Finally, the LDA model in the Gensim toolkit [40] is used to extract topics and generate “topic-vocabulary” and “document-topic” matrices [41]. Topic perplexity and consistency are used to identify the optimal number of topics. Lower perplexity suggests better model clustering [33], and a higher the consistency score indicates a better the model effect [42]. The detailed process is shown in Fig. 1.

### 2.3. Subject identification

The analysis jointly identifies joint identification of topic perplexity and topic consistency. Concurrently, case-related keywords are recorded. Each case is named according to the semantic characteristics of the keywords. The detailed results are shown in Table 2.

Further, six policy documents are randomly selected to create a “document-topic” distribution map, as shown in Fig. 2(a–f). The probability of the policy document belonging to a certain topic is represented by the height of the vertical line. As seen in the figure,

**Table 1**  
Family education policy text statistics table (part).

Serial number	Policy title	Potency level	Issuing department	Release date
1	Notice of the Office of the Guangdong Provincial Department of Education on Studying and Implementing the “Family Education Promotion Law of the People’s Republic of China”	Local working papers	Guangdong Provincial Department of Education	2022.01.29
2	Notice of the Office of the Fujian Provincial Department of Education on Studying, Propagating, and Implementing the “Family Education Promotion Law of the People’s Republic of China”	Local working papers	Fujian Provincial Department of Education	2021.12.31
3	Reply to Shenyang Education Bureau’s Suggestion on Strengthening Family Education Guidance (No. 0728)	Local working papers	Shenyang Education Bureau	2020.04.23
4	Hubei Province Family Education Promotion Regulations	Provincial and local regulations	Hubei Provincial People’s Congress (including the Standing Committee)	2021.01.22
5	Hunan Province Family Education Promotion Regulations	Provincial and local regulations	Hunan Provincial People’s Congress (including the Standing Committee)	2021.01.19
6	Fujian Province Family Education Promotion Regulations	Provincial and local regulations	Fujian Provincial People’s Congress (including the Standing Committee)	2020.07.24
7	Notice of the Sanya Education Bureau on Printing and Distributing the Implementation Plan for Further Strengthening the Contact between Primary and Secondary Schools in Sanya	Local normative documents	Sanya Education Bureau	2016.11.05
8	Notice of the Shaanxi Provincial Department of Education on Further Strengthening the Work of Home-School Co-education in Primary and Secondary Schools	Local normative documents	Shaanxi Provincial Department of Education	2021.12.29
...	...	...	...	...
201	Jiangsu Provincial People’s Procuratorate and Jiangsu Provincial Women’s Federation released six typical cases of family education guidance for minors involved	Local judicial documents	Jiangsu Women’s Federation	2021.11

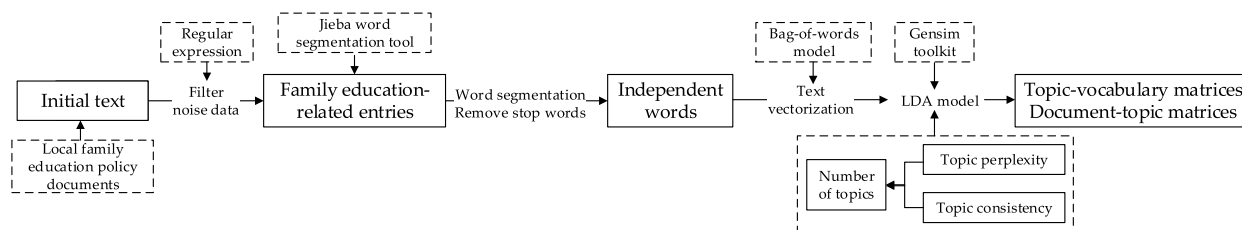


Fig. 1. Data acquisition process.

each policy document is more likely to belong to a certain topic, suggesting that the document has a main topic. This observation indicates the effective performance of the LDA topic model. Fig. 2(a), (b), 2(c), 2(d), 2(e), and 2(f) show the “document-topic” distribution of policy documents related to parent ability, school safeguards, institutional environment, government support, social synergy, and quality development, respectively.

In addition, once processed by the LDA topic model, each document contains time information (published year), spatial information (published province), subject, and probability. Therefore, the variation characteristics of each theme can be summarized at the time level (year) and space level (province).

### 3. Temporal dynamics of family education policy

#### 3.1. Changes in the number of policies

The “Notice of the General Office of Changsha Municipal People’s Government Forwarding the Municipal Women’s and Children’s Working Committee’s Opinions on Further Strengthening the Work of Parents’ Schools” was released in April 1999, marking the beginning of the local family education policy. The release of national-level policies such as the “Five-Year Plan” for the National Family Education Work and the “National Family Education Guiding Outline” has enabled the family education work to receive scientific and objective guidance [41]. Local policies have also been enriched and expanded [25], showing a steady upward trend.

In 2015, the Ministry of Education issued the “Guiding Opinions on Strengthening Family Education”, as a landmark document, which received positive responses from the local government. The number of local policies reached 16 in 2015, and 2016 saw a peak with 31 policies. As shown in Fig. 3, the number of local family education policies is consistently rising. The enactment of the “Law of the People’s Republic of China on the Promotion of Family Education” also provides opportunities for further development of local policies.

#### 3.2. Changes in policy themes

Upon obtaining the “document-topic” probability distribution through the LDA topic model, all policy documents are classified and sorted on their of publication year. The topics and their probabilities in the policy documents under each year are obtained. The mean value of topic probability is calculated year by year. Upon computing the proportion of topics, it is found that the topic strengths of topic 1, Parent ability, and topic 4, Government Support, are significantly higher than other topics. This underlines the emphasis placed on the role and influence of parents as the primary educators, and the government as the main responsible entity in local family education policy (Fig. 4).

Further, we plotted the temporal trend of the probability mean value of each topic in Fig. 5(a–f), highlighting diachronic changes in the relative importance of each topic. Theme 1 (Parent Ability), has consistently surfaced in the local family education policy texts over the years. Its mean probability has been rising continuously since 2003, peaking in 2006. The Education Law of the People’s Republic of China, passed in 1995, clearly states that parents should cooperate with schools to educate their minor children, and schools and teachers can guide parents. The “Decision of the State Council on the Reform and Development of Basic Education” issued in 2001, calls for enhanced guidance on family education and assistance for parents in establishing a contemporary educational concept. Under the guidance of national laws and policies, local governments direct parents to carry out family education, enhancing their educational ability as the policy direction, and using parents schools as their work base. From 2003 to 2006, the relevant policies were mostly

Table 2  
Subject heading distribution.

Themes	Theme name	Keywords
Theme 1	Parent ability	Parent, education, family, parent school, parent, training, ability
Theme 2	School security	Primary school, kindergarten, teacher, training, junior high school, central primary school, senior high school
Theme 3	Environment system	Services, Notices, Opinions, Laws, Implementations, Publications, Standards
Theme 4	Governmental support	Education bureaus, departments, units, women’s federations, institutions, people’s governments, administrative departments
Theme 5	Social synergy	Activity, society, building, committee, organization, community, demonstration
Theme 6	Quality development	Develop, research, improve, feature, evaluate, scientific, excellent

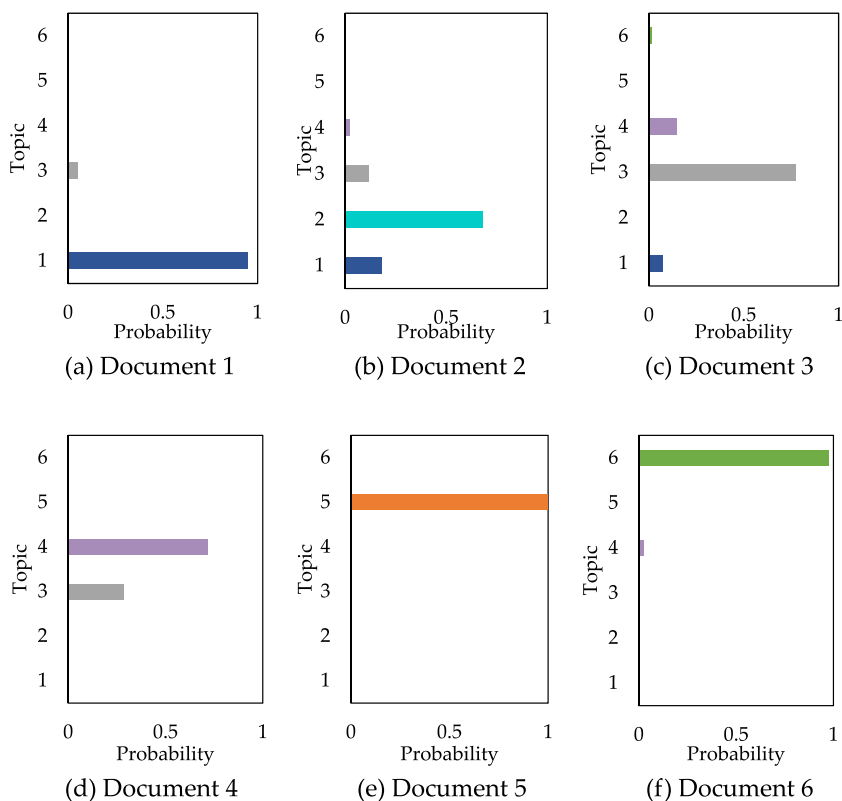


Fig. 2. Document-topic distribution.

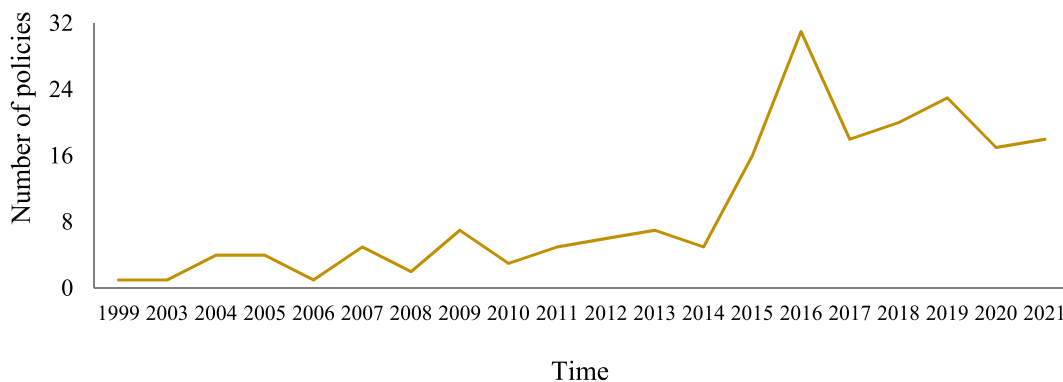


Fig. 3. Changes in the number of policies.

under titled “popularizing and strengthening the work of parents’ schools”. The content of the policies includes holding family education lectures, printing and distributing parent school management measures, establishing a family education steering committee, and establishing a leading group for publicity and practice activities, etc. Parent ability has become a key theme in this stage, with high relative importance. After 2006, the probability mean of Theme 1 has declined and stabilized, indicating that local policy content has begun to consider other themes while emphasizing the cultivation of parents’ abilities.

The probability mean of Theme 2 (School Security), and theme 3 (Institutional Environment) follow similar temporal trends and maintain a relatively stable evolution at a lower level. In family education, schools serve as supporters, undertaking auxiliary work, offering parents with the knowledge and resources needed to carry out family education and facilitating home-school co-education [25]. Concerning the “institutional environment” laws such as the Education Law, the Compulsory Education Law, and the Minor Protection Law all highlight the significant responsibilities of parents, schools, the government, and society in family education. The “Law of the People’s Republic of China on the Promotion of Family Education”, which will come into effect in 2022, will elevate the legalization of family education and provide robust institutional support for family education work.

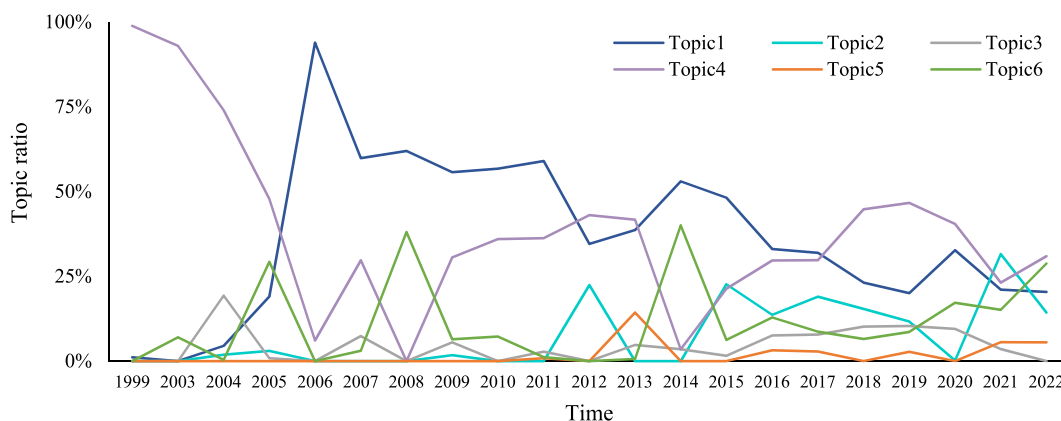


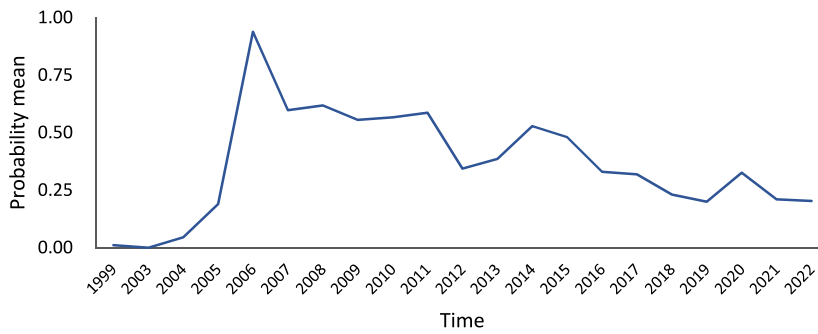
Fig. 4. Topic intensity evolution trend.

The probability means of Theme 4 (Government Support) showed great fluctuations, exceeded 90% in 1999 and 2003. The practical support behind it is that since the 1990s, the number of juvenile delinquencies has accounted for 0.3% of the total number of juveniles, which is ten times higher than before, and the survey results show that juvenile delinquency is related to the lack of family education [43]. In response to this situation, the government needed to sustain and promote family education, supporting local family education policies and actions as the main body responsible for providing public services. Consequently, government support emerged as a main theme in local policy texts [44]. However, the probability mean for Theme 4 continued to decline between 2003 and 2006. The reason is that when governments at all levels put the promotion of family education work on the agenda. The focus of their work has shifted from “need to advance” to “how to advance”, and more discussions focused on methods and methods and began to emphasize the role of parents in family education. Consequently, the themes within policy texts shifted. In the Tenth Five-Year Plan for National Family Education Work released in 2002, the implementation measures include extensive publicity, popularization of knowledge, improvement of the quality of schools for parents, promotion of community guidance and community guidance, and strengthening of workforce construction. Therefore, under the direction of national-level policies, the local government’s emphasis on parental competence began to crowd out other topics [12]. After 2006, the probability mean of Theme 4 remained stable with small fluctuations.

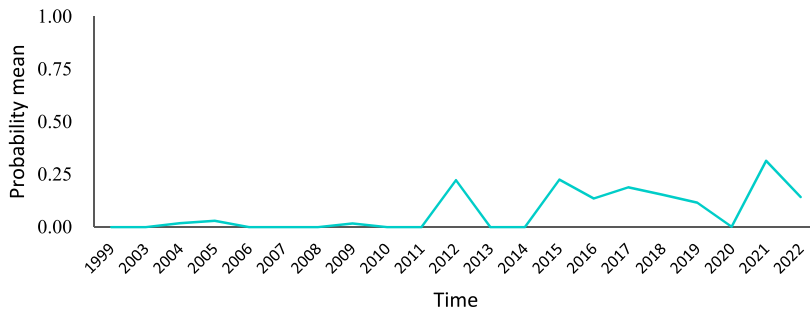
As for Theme 5 (Social Synergy), it has always maintained a low level, only appearing since 2013. This trend reflects local policies’ increasing focus on mobilizing social forces to participate in family education work. Regarding the content of local policies, only the Hefei Municipal Education Bureau mentioned establishing an educational network combining school, home, and community in the “Guiding opinions on further establishing and improving the school-school contact system for primary and secondary schools” in 2013. It was not until 2016 that special sections were dedicated to describe the content of social participation and collaboration in family education in the regulations issued by ten provinces, including Chongqing, Guizhou, and Jiangxi. Public cultural facility management units, neighborhood (village) committees, and social work service agencies actively carry out family education activities.

Probability mean of Theme 6 (Quality Development), showed three probable peaks distributed in 2005, 2008, and 2014. The central focus of the local family education policy was the concept of parent school in 2005. However, analysis of documents issued by the Zhuhai Women’s Federation, the Hefei Education Bureau, and Nanchang Education Bureau reveals that the focus had expanded beyond merely establishing parent schools. These organizations now called for the enhancement of teaching management within parent schools, assurance of quality education, and increased parent training. They also advocated for the equal promotion of parent schools in both urban and rural areas, aiming to achieve high-quality development of these institutions [45]. In 2008, the Jiangxi Provincial Department of Education proposed several opinions in its local policy to strengthen family education. It indicates that the standardized management of family education work should be strengthened, the evaluation system should be improved, and development should be accelerated. Improve the health and sustainability of family education and realize the high-quality development of family education [15].

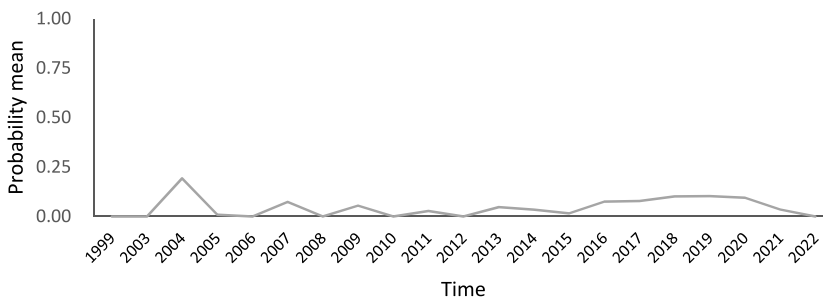
In 2014, education departments across various provinces and municipal education bureaus issued notices on the collection of outstanding cases of family education for young children. The launch of special reports on family education and the announcement of exceptional circumstances of mental health education for minors indicate that the promotion process of family education work has begun. This phase was characterized by a multi-level, multi-faceted approach, aiming for high-quality development through the diversification of family education. Fig. 5(a) displays the mean probability of parental ability from 1999 to 2022. Similarly, Fig. 5(b) illustrates the mean probability of school safeguards during the same period. Additionally, Fig. 5(c) showcases the mean probability of the institutional environment over the years 1999–2022. Furthermore, Fig. 5(d) represents the mean probability of government support spanning from 1999 to 2022. Fig. 5(e) provides the mean probability of social synergy over the period 1999 to 2022. Finally, Fig. 5(f) depicts the mean probability of quality development from 1999 to 2022.



(a) Theme 1: Parent ability



(b) Theme 2: School safeguards



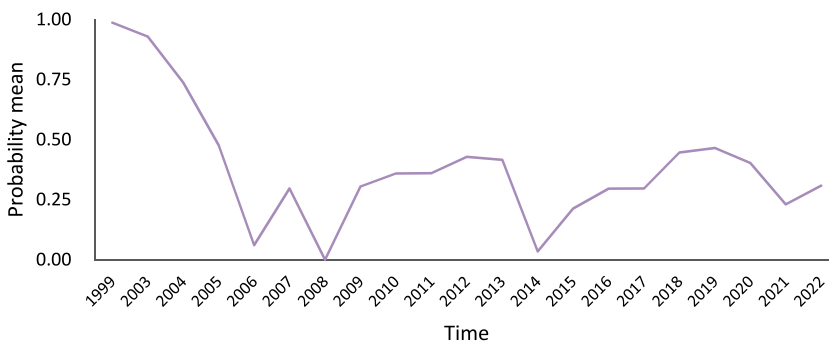
(c) Theme 3: Institutional environment

Fig. 5. The time trend of topic probability means.

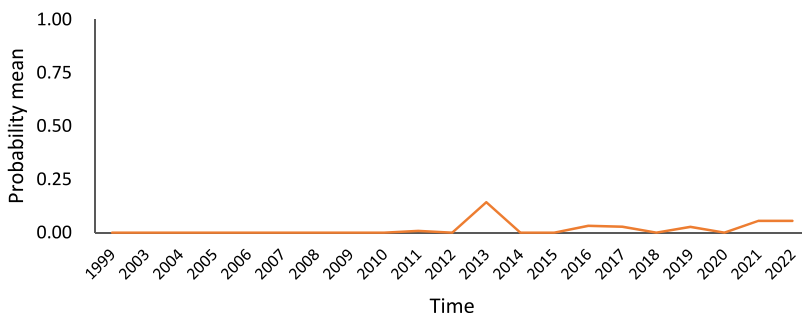
#### 4. Spatial characteristics of family education policy

##### 4.1. Quantity distribution of policies

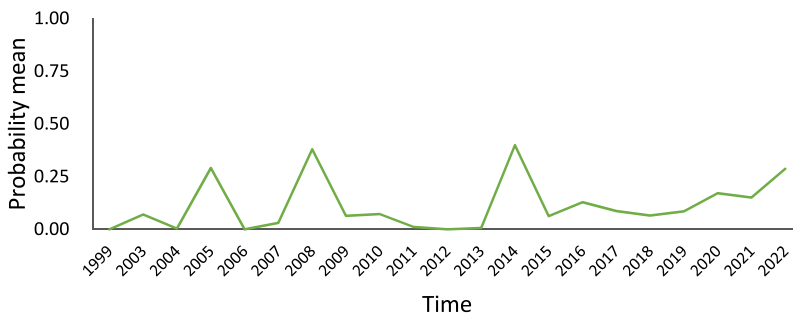
After conducting a search, 26 provinces had released policy documents related to keywords such as family education. Fig. 6 outlines the spatial distribution of the number of policies. It can be seen that provinces with fewer policies or missing data are generally concentrated in the West and Northeast. In contrast, provinces with many policies are distributed in East China, Central China, and South China. Among them, Jiangxi Province, Jiangsu Province, and Shandong Province ranked in the top three regarding the number of policies, 33, 28, and 25, respectively. The number of local family education policies presents an uneven distribution in space, showing a gradually decreasing distribution pattern in the east-central-west (Fig. 6).



(d) Theme 4: Government support



(e) Theme 5: Social synergy



(f) Theme 6: Quality development

Fig. 5. (continued).

#### 4.2. Distribution of policy topics

After obtaining the “document-topic” probability distribution through the LDA topic model, we classified all policy documents according to the provinces and regions to which they belong. Then, the topics and their probabilities of policy documents in each province are obtained. The mean value of topic probability was calculated by region with regional divisions based on the classification method of the National Bureau of Statistics. Fig. 7(a–f) present the spatial distribution of the probability mean of each theme. Fig. 7(a), (b), 7(c), 7(d), 7(e), and 7(f) show the spatial distribution of the probability mean of parent ability, school safeguards, institutional environment, government support, social synergy, and quality development, respectively.

The areas that have paid more attention to Theme 1 (Parent Ability), are concentrated in the Northeast, the middle reaches of the Yellow River, and the northwest. The average probability of the Northeast region on this topic is more than 70%. The policy content from the Shenyang Municipal Education Bureau and the Changchun Municipal Bureau of Education strongly emphasize the importance of improving parents’ quality of family education, making the theme of Parent Ability paramount in the Northeast’s family education policy. However, an excessive focus on one topic might lead to ignore others, such as school security and social synergy [10]. The Northeast region started issuing policies related to family education relatively late, with the earliest being in 2011, thus lagging in the development of family education work and is still in the primary stage of promoting work. Future policy design should consider



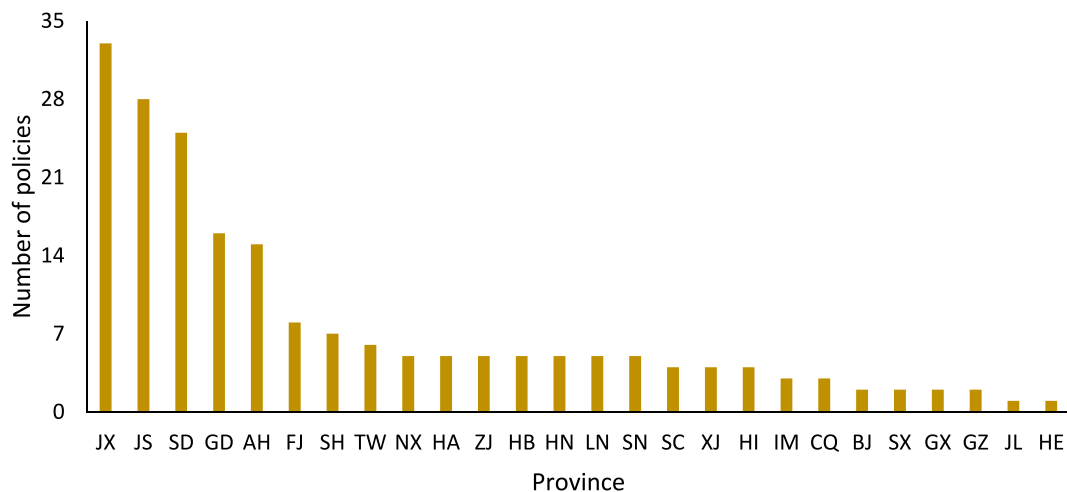


Fig. 6. Spatial distribution of policy quantity.

expanding home-school cooperation and encouraging social participation [8].

For Theme 2 (School Security), the probability mean is significantly higher in the eastern coastal areas compared to other areas. Since 2007, the Shanghai Municipal Education Commission has been evaluating family education model schools to enhance their influence and motivate society to pay more attention to family education. The implementation of this evaluation process has put pressure on schools at every level, necessitating the continuous strengthening their role in family education [43]. Furthermore, in 2012, the Zhejiang Provincial Department of Education issued guidance on “Improving the Home-School Cooperation Mechanism,” proposing optimization strategies based on establishing this mechanism. Schools are required to assimilate social education resources and broaden school classrooms to fulfill the educational needs of parents and communities [46]. These policies demonstrate the deep concern of eastern coastal provinces regarding school safety. In contrast, the Northwest, Southwest, and Northeast regions have relatively few policies on this subject. The successful experiences of the eastern coastal regions could serve as a valuable reference. Appropriate measures could be potentially adopted in these regions in the future.

Regarding Theme 3 (Institutional Environment), apart from the southwest region, most regions showed a low level of concern. Conversely, from the perspective of the spatial distribution of Theme 6 (Quality Development), the probability mean of the southwest region is zero. This could be attributed to the southwest region’s lack of geographical advantages, slower economic progress, and gradual social development. Hence, when formulating family education policies, the primary focus is on fundamental tasks and establishing an institutional environment to ensure progress in related work. However, further optimization of the family education system is not a primary consideration [47]. For instance, the policy content from the Education Department of Guangxi Zhuang Autonomous Region in 2016 mainly focuses on establishing an assistance mechanism for children in distress and ensuring the smooth progress of family education work for migrant children and left-behind children [17]. Lu and Pang [15] argue that the negative effects are greatest when both parents are absent, followed by the absence of the father, while the absence of the mother has minimal or no effect.

Regarding Theme 4 (Government Support), provinces in the middle reaches of the Yangtze River show a greater emphasis this theme. This reflects their focus on the management and supervisory role of government departments in family education work. For example, a notice issued by the Wuhan Municipal Education Bureau in 2009 regarding parent school work emphasizes the tasks of the education administrative department, including regular supervision and evaluation of the parent school, fostering a positive public opinion atmosphere, and active summarization and reflection [48]. This depicts the critical role of government departments in family education work. Hefei City, for example, expects county and district education authorities and women’s federations to organize work exchanges, promote typical experiences, arrange expert lectures, and establish practice bases.

Further, the probability mean of “Government Support” can somewhat reflect the government’s participation and involvement in family education. Furthermore, areas with a more centralized administrative system tend to have better implementation of government-led initiatives. Thus, provinces located in the middle reaches of the Yangtze River often have higher executive power and are more likely to succeed in implementing family education work.

Unlike other themes, all regions pay the least attention to Theme 5 (Social Synergy), with the eastern and northern coastal areas showing particularly weak attention. Based on the analysis, it’s apparent that family education work has transitioned from establishing schools for parents and improving parents’ educational abilities, to realizing home-school co-education and meeting the educational needs of parents, to government organization intervention for supervision and evaluation.

#### 4.3. Task development logic

As family education initiative advances, the next stage will call for increased participation and coordination from social

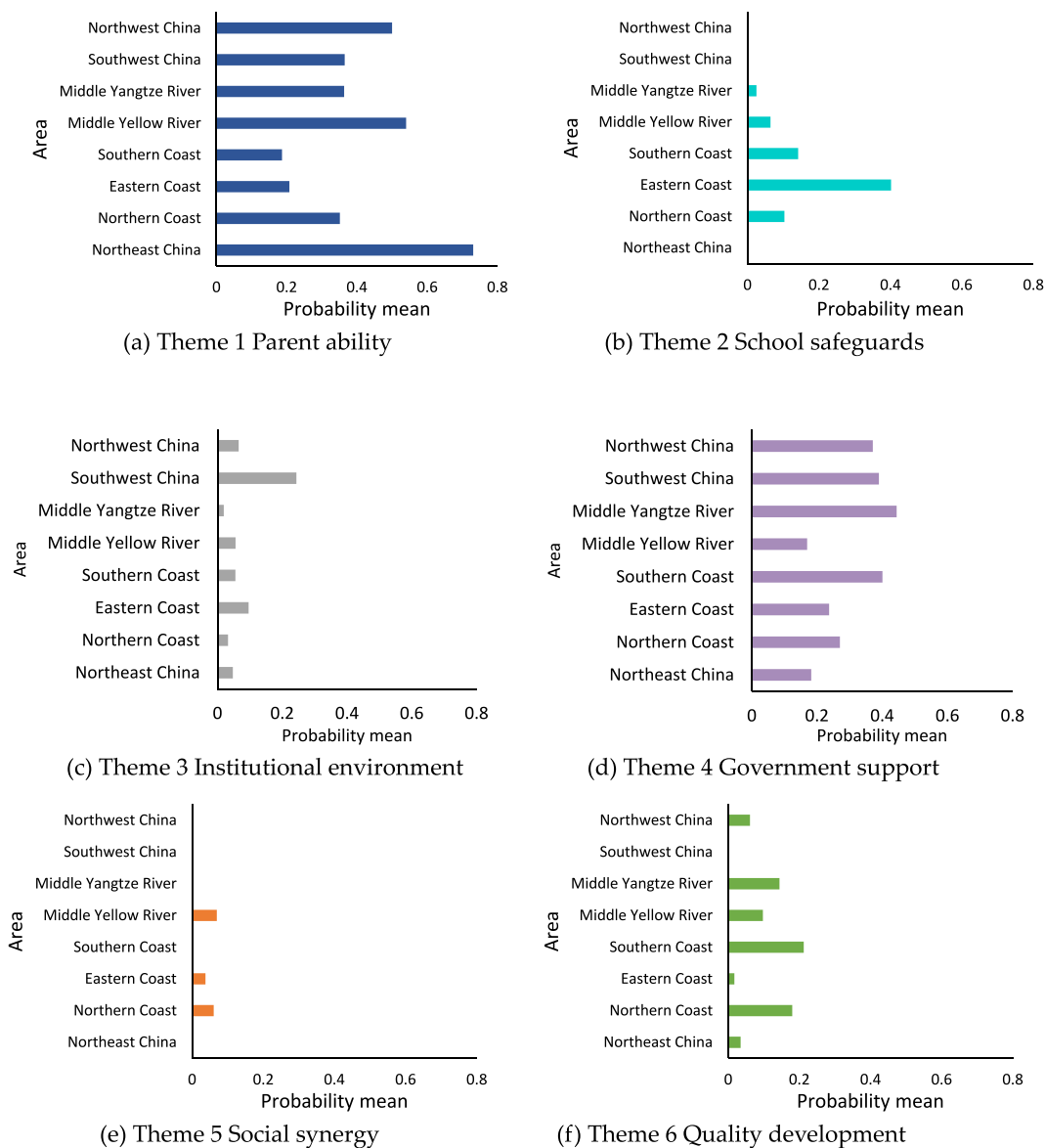


Fig. 7. Regional distribution of theme probability mean.

organizations. Benefiting from early modernization, rapid economic development, and abundant human capital, the eastern coastal areas have quickly progressed to this stage of social coordination in family education [49]. For example, in 2019, the Suzhou Municipal Education Bureau, along with other departments, launched a publicity campaign emphasizing social participation in family education. They invited media and community representatives to meetings and hosted lectures by renowned experts. Similarly, the northern coastal areas have gradually developed a tripartite synergy model for family education, involving homes, schools, and communities, thanks to their superior geographical locations and well-developed scientific, educational, and cultural endeavors. Evidence from Mentougou District, Beijing, indicates that the socialization of family education has been prioritized, expanding the social carriers of family education activities and elevating social forces to the level of government, family, and schools. Similarly, provinces located in the middle reaches of the Yellow River have recognized the importance of social coordination in their policy design, integrating social service organizations and higher education institutions when selecting and cultivating full-time and part-time family education team.

4.4. Spatial correlation analysis

To further explore the relationship between each theme and region, a spatial autocorrelation test was used to measure the spatial correlation of the samples, encompassing both global and local correlation characteristics [44]. Global autocorrelation reflects the agglomeration of research variables across space, while local autocorrelation highlights the specific spatial differences between

provinces [50]. The global Moran index (Moran’s I) was first used to study the overall correlation characteristics. The calculation results are shown in Table 3.

Table 3 reveals that Theme 1 and Theme 4 are positively correlated and significant at the 5% level, indicating a spatial spillover effect. Furthermore, local autocorrelation analysis was introduced to explore the correlation pattern between the probability mean of Theme 1 and Theme 4 in each province and its neighboring areas [51]. The specific results are shown in Table 4.

For Theme 1, provinces like Beijing, Hebei, and Liaoning are categorized as H - H type, indicating higher mean probabilities on parental ability in these provinces and their surrounding areas. These eight provinces could potentially influence neighboring provinces to increase focus on this subject. Conversely, L-L type provinces like Guangdong, Jiangsu, and Fujian pay less attention to “parental ability” in their family education policies, with no evident spillover effect. Shanxi, Sichuan, Shandong, and other provinces are L - H type, showing relatively low attention to Topic 1, despite the high attention from surrounding provinces. Only Shanghai, Chongqing, and Guangxi are H - L type, suggesting that their strong emphasis on “parental ability” can influence surrounding areas.

The spatial agglomeration of Theme 4 differs from that of Theme 1. Jiangxi, Fujian, Zhejiang, and other provinces are classified as H - H type, indicating that high attention to “government support” in policy content. Provinces like Hebei, Henan, and Liaoning, labeled as L - L type, focus more on other topics in family education policies. Furthermore, L - H type provinces include Sichuan, Hubei, Xinjiang, etc., where neighboring provinces place high emphasis on this topic. In contrast, only Anhui, Ningxia, Shanxi, and Inner Mongolia are H - L type provinces.

### 5. Conclusions and recommendations

Local family education policy includes six themes: parental ability, school security, institutional environment, government support, social coordination, and high-quality development. The themes of parental ability and government support occupy a significant position. This indicates that most local policies prioritize cultivating parents’ abilities to carry out family education and strengthening the government’s role in public affairs. These policies unite the dual roles of the educational subject and responsible subject to jointly advance family education. As provinces have progressively enacted regulations promoting family education, there’s increased focus on auxiliary forces like schools and society, drawing attention away from parental abilities and government support themes. The dual synergy of education and government supervision has evolved into a multi-synergy approach requiring participation from schools and society. Additionally, with family education gradually becoming more structured and the enactment of the Family Education Promotion Law, the theme of high-quality development has gained attention, signaling a transition from merely existing to excellent family education.

Based on the obtained conclusions, this study proposes the following optimization paths.

Firstly, promoting, empowering, and constructing a “government-family-school-society” multi-cooperative system are very important for family education. Strengthening parents’ primary role in family education can help actively address parenting dilemmas. Including family education in top-level government design, adhering to the principle of social welfare, providing public services for family education guidance, and ensuring proper supervision and evaluation are important. Schools, as suppliers, should establish family education guidance teams to alleviate parents’ anxieties through professional guidance, focusing on special families. Social participation is crucial, involving community committees in family-building activities and encouraging public cultural facility management units to use existing resources for regular family education guidance activities. The power of media can also be harnessed to improve family education and commend its practitioners.

Secondly, regional interconnection can clarify the status quo of local policies and draws on their advantages. From the analysis, it’s evident that different regions have distinct characteristics in the context of family education policy. In the future, western and northeastern regions should expand participation in family education, learning from the policy design of southeastern coastal regions, and shifting the focus from parents’ abilities to themes like school security and social synergy. Central regions should address the policy gaps in institutional environment and social coordination, providing guarantees and social support for family education’s in-depth development. Eastern regions can leverage their economic development advantages, focus on the theme of quality development in future policy layouts, introduce market methods, and extend the supporting industries of family education.

Finally, it is necessary to break down barriers and promote the inclusive and branded development of family education. School competition as the primary means of promoting family education can burden schools with high development costs and hinder resource mobility. Therefore, barriers between schools and urban and rural areas should be dismantled, promoting exchange activities to share experiences and achieve inclusive development of family education. Different cities, with their unique historical backgrounds and cultural advantages, should develop regionally characteristic family education brands, leveraging the unique local benefits of family education work.

Despite the study’s important results and contributions, there are certain limitations. First, this study was based on the textual corpus of family education policies, which may not properly reflect the complexities of those policies’ actual implementation and

**Table 3**  
The global Moran index of the mean probability of each topic.

Items	Theme 1	Theme 2	Theme 3	Theme 4	Theme 5	Theme 6
Theme name	Parent ability	School security	Environment system	Governmental support	Social coordination	Quality development
Moran’s I	0.243 **	- 0.100	- 0.054	0.234 **	- 0.052	- 0.161

Note: \*\* means significant at the 0.05 level.

**Table 4**  
Local autocorrelation analysis results of Theme 1 and Theme 4.

Items	H - H type	L - H type	L - L type	H - L type
Theme c 1	Beijing, Hebei, Liaoning, Jilin, Henan, Hubei, Xinjiang, Shaanxi	Shanxi, Sichuan, Shandong, Hunan, Ningxia, Inner Mongolia	Guangdong, Jiangsu, Fujian, Hainan, Jiangxi, Anhui, Guizhou, Zhejiang	Shanghai, Chongqing, Guangxi
Theme c 4	Jiangxi, Fujian, Zhejiang, Hainan, Guangxi, Guizhou, Hunan, Chongqing	Sichuan, Hubei, Xinjiang, Guangdong, Shanghai, Shaanxi	Hebei, Henan, Liaoning, Beijing, Shandong, Jiangsu, Jilin	Anhui, Ningxia, Shanxi, Inner Mongolia

effects. Second, unique local cultural and social variables may not be focused properly. Finally, this study focused six themes, other important themes may have been omitted.

Future studies may employ with mixed method approach, and obtain primary data from relevant stakeholders. Regional level research can help investigate the local dynamics of education policies. Future studies may also take more themes for indepth analysis and propose context specific family education policies.

#### Author contribution statement

Chenwei Ma, Chen Qirui: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

#### Funding statement

This study is supported by the phased achievement of the 2022 Sichuan Provincial Social Science Planning Project, and the grant number is SC22C059. The project title is "Research on the Endogenous Power and High-Quality Development of Family Education in Sichuan under the Background of the 'Double Reduction' Policy".

#### Data availability statement

Data will be made available on request.

#### Additional information

No additional information is available for this paper.

#### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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