

## Article

# The Sustainability of Early Childhood Education in Chinese Teachers' Perspective: Evidence from a National Validation Study

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**Abstract:** This study aims to evaluate the sustainability of early childhood education (ECE) from Chinese teachers' perspectives using a newly developed and validated instrument, the *Sustainability of Early Childhood Education Rating Scale* (SECERS). Altogether, 3636 teachers nationwide were randomly surveyed. First, analysis of the psychometric properties indicated that SECERS was a reliable and valid scale with three constructs: sustainability in ecology, sustainability in management, and sustainability in policy. Second, Chinese teachers positively evaluated sustainability in ecology but negatively evaluated it in policy. Third, latent profile analysis yielded the best-fit model with four profiles: low-, middle-, upper-middle-, and high-level profiles of teacher evaluations. Last, hierarchical regression analysis found that kindergarten quality grades played a key role in predicting the sustainability of ECE evaluation. The findings demonstrate the necessity of providing effective policy and management support to promote the sustainable development of ECE in China.

**Keywords:** sustainability; early childhood education; rating scale; development and validation; evaluation; China

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## 1. Introduction

Early childhood education (ECE) has long been neglected in China, causing the widely reported “3A” problems: accessibility (difficult to enter a kindergarten), affordability (expensive tuition), and accountability (poor quality and no monitoring system) [1,2]. To solve these problems, the central government promulgated the *Several Views on the Development of Preschool Education by the State Council and Outline of China's National Plan for Medium and Long-term Education Reform and Development* (2010–2020) in 2010, aiming to enable more children to receive adequate and satisfactory ECE services. Consequently, according to the latest statistics from the Ministry of Education, the gross enrolment rate of ECE has increased from 56.6% in 2010 to 88.1% in 2021, which is a remarkable achievement [3,4]. Accordingly, the “3A” problems were effectively alleviated, more and more families have benefited from the enhanced ECE services, and a tentative balance between supply and demand has been achieved.

However, this balance is to be broken by another pressing developmental crisis: the population of China is ageing rapidly, threatening its sustainable development. The Chinese government has dramatically changed its fertility policy to optimise the population structure to tackle this challenge. In 2016, it ended the one-child policy that had lasted for more than 30 years and encouraged each family to have two children. Still, the two-child policy lasted only six years and was replaced by the ‘three-child policy’ (encouraging each

family to have three children) in 2021 [5]. This change in birth policy is bound to impact the development of ECE. For instance, an increased birth rate means more demand for ECE services and more need for teachers and teacher educators. Therefore, one might doubt whether this new ‘three-child policy’ will break the supply-demand balance and pose some threats to the sustainable development of ECE in China. This study aimed to explore these threats through a national validation study of the Sustainability of Early Childhood Education Rating Scale (SECERS).

## 2. Literature Review

### 2.1. Sustainability: Towards Quality Early Childhood Education

Sustainability is a process or state that can be maintained for a long time [6]. Sustainability in ECE tends to focus on the provision of accessible, flexible, affordable, and high-quality care and education, and, more generally, on how sustainable the ECE “system” is over time [7–9]. However, there is no unified definition of the sustainability of ECE, which is generally understood as the perfection and permanence of a series of systems and mechanisms to ensure the development of ECE in the context of achieving high-quality development of education [10,11]. In other words, the sustainability of ECE refers to the harmony, efficiency, and long-term nature of promoting the high-quality development of ECE. In addition, previous studies found that the factors affecting the sustainability of ECE can be roughly divided into three aspects: micro-, meso-, and macro-.

First, the macro-level focuses on the sustainability of policy support for ECE. The term sustainability is now widely used in ECE policy [12], which refers to whether the policy itself could be sustainable and sustain the development of ECE [13,14]. An effective, sustainable education policy should refresh and innovate with the contemporary economic and social needs over time [15]. Sustainable preschool policy depends on various factors, such as the sustainability of the policy provision per se over time, the continued financial input of the government, and the perspectives of key stakeholders in the policy [15,16].

Second, the meso-level focuses on the sustainability of ECE management. ECE management plays an important role in leading, organising, and monitoring the development of ECE, and its premise is to promote the healthy and sustainable development of ECE [17–19]. The construction of the ECE management system should take the public’s diverse needs at its core, and the government, market, and society should make full use of their respective advantages to continue to solve the problems [20,21].

Finally, the micro-level focuses on the sustainability of the environmental ecology of ECE. Raban & Kilderry [22] suggested that what is usually missing from the dialogue on sustainability is a reference to environmental sustainability, where the environmental impact of ECE infrastructure, duplication of resources, and so on would be considered. In addition to the sustainability of the environment ecology, the sustainability of education ecology is also important. As an important part of ECE, it differs over regions, cultures, and times [23]. Therefore, ecological sustainability in ECE includes a sustainable environmental and educational ecology [24].

In general, sustainability is the core proposition of ECE development. However, previous studies have addressed the sustainability of ECE primarily by analysing past and present government ECE policies, strategies, and their impacts, and predictably examining whether they could be economically and socially sustainable [17,19]. On the other hand, no research has developed relevant measures to measure the sustainability of ECE from the stakeholders’ perspectives, as evaluation requires the participation of stakeholders [25,26]. Therefore, based on previous research conclusions and combined with the development status of China’s ECE, this study has proposed a set of core indicators that affect the development of ECE and then explored the sustainability of ECE from Chinese teachers’ perspectives, aiming to better promote the high-quality development of ECE.

## 2.2. Teacher Involvement in Evaluating Early Childhood Education

The most important stakeholders in evaluating the sustainability of ECE in this study should be teachers. However, it is not until the fourth generation of evaluation that the stakeholder viewpoint comes into people's sight. The fourth generation of evaluation theory determines the stakeholder as an important element of evaluation [27]. Furthermore, in the relevant policy texts of ECE in China, such as the Measures for the Supervision and Evaluation of Universal Preschool Education in County Areas [28], it is also mentioned that the participation of stakeholders is an important indicator of ECE evaluation, and multiple parties should be encouraged to participate in the evaluation, and third-party evaluation should be actively introduced. According to the stakeholder theory, kindergarten teachers are the key perceivers of ECE development, have direct experience in the provision of ECE services and the development of kindergartens, and play a crucial role in the development of ECE. Reviewing existing studies, we can find that teachers' participation in evaluation is usually carried out in the way of teachers' perception. The evaluation is roughly carried out from the following perspectives: (1) teachers' perception of educational evaluation tools. For instance, teachers' perception of the practice and implementation of "continuous assessment", a comprehensive, systematic, cumulative, and guiding child assessment tool [29,30]; (2) investigated teachers' perceptions of national/state programs, including evaluations of the relevant national programs, perceptions of the evaluation process the teachers participated in [31]; improved by evaluating teachers' perceptions of interstate programs and their implementation effects [32]; (3) the perception of the status of educational practice. In addition, teachers play an important role in assessing creativity in preschool [33] and perceptions of preschool readiness [34].

In addition, there are multiple factors influencing teachers' perception and evaluation. Previous studies have shown that a person's intention to act is shaped by personal, social, and educational backgrounds [35,36]. Teachers construct their own knowledge, skills, and job-related knowledge system, which is important for their perception of policy [37]. Teaching experience, socioeconomic status and ethnicity are closely related to teachers' perception of policies and evaluation of students [38]. At the school level, trust and support in school leadership significantly impact teachers' perception of policies [39]. Yan et al. [40] suggested that personal factors (e.g., education and training, attitudes, skills) and contextual factors (e.g., school environment, external policies, working conditions) can influence teachers' evaluation practices. All of these studies are based on western background. In addition, some Chinese studies have found that age, teaching age, geographical area, and school grade are important factors affecting teacher perception and evaluation [41,42]. From previous studies, it can be found that most of the factors affecting teachers' perception come from subjective, school, and social environments. However, under the unique social context of China, there are still many influencing factors that can be explored, such as teachers' professional titles. Therefore, this study assumes that teachers' age, years of teaching experience, professional titles, and the quality grade, type, and location of their kindergartens affect Chinese teachers' perception and evaluation.

To sum up, as the gatekeeper of ECE, teachers' views are very important. However, there are few studies on ECE programmes in China from the perspective of teachers' perception, and most of them are based on the evaluation of ECE from the parents' perspective [2,43,44]. Moreover, teacher evaluation is related to the sustainable development of ECE, the government's policy-making, and whether the needs of stakeholders can be met. Therefore, the evaluation of the sustainability of ECE should attach importance to teachers' participation. Further, to reveal potential differences in teachers' evaluation of the sustainability of ECE in a better way, this study employed a person-centred approach (latent profile analysis) that differs from the variable-centred approach, which can uncover more "unobserved" subgroups in large heterogeneous populations [45].

Therefore, this study aimed to understand the status of ECE sustainability from the perspective of Chinese teachers to find practical problems and better promote the high-

quality development of ECE. In particular, this study aimed to address the following research questions:

- 1 Is the Sustainability of Early Childhood Education Rating Scale reliable?
- 2 How do kindergarten teachers evaluate the sustainability of ECE in China? What are the problems with the sustainability of ECE based on teachers' perspectives?
- 3 What are the primary factors influencing kindergarten teachers' evaluation of the sustainability of ECE?

Accordingly, the following hypotheses will be examined in this study:

**Hypotheses (H1):** *The Sustainability of Early Childhood Education Rating Scale is a reliable scale.*

**Hypotheses (H2):** *The kindergarten teachers highly evaluate the sustainability of ECE in China.*

**Hypotheses (H3):** *There are some factors influencing kindergarten teachers' evaluation of the sustainability of ECE in China.*

### 3. Material and Methods

#### 3.1. Participants

Stratified random sampling was employed to recruit teachers and principals from Chinese kindergartens. First, 12 provinces representing eastern, central, and western China were randomly selected, including Shanghai, Jiangsu, Guangdong, Liaoning, Fujian, and Zhejiang; Heilongjiang and Shanxi; Sichuan, Gansu, Xinjiang, and Guizhou. Second, the provincial education ministers randomly selected sample cities in their region: three districts in Shanghai, four cities in Jiangsu, two cities in Guangdong, two cities in Liaoning, four cities in Fujian, two cities in Zhejiang, two cities in Heilongjiang, three cities in Shanxi, twenty cities in Sichuan, nine cities in Gansu, three cities in Xinjiang, and four cities in Guizhou. These cities were diversified and complicated in terms of economic and social development, ranging from the most developed cities (such as Shanghai) to the least developed ones (such as Guizhou). Third, education authorities in each participating city published the questionnaire online. Finally, 3636 valid questionnaires were returned, and the participants were diverse: 34.0% were from eastern regions, 16.4% were from central regions, and 49.6% were from western regions. According to China's administrative divisions, the participants were distributed among urban cities (47.6%), counties (34.7%), villages (15.5%), and the countryside (2.3%). From the perspective of official documents, the ECE institutions include public kindergartens and universal and low-cost private kindergartens. About 74.3% of the participants were from public kindergartens run by the educational department, 5.2% were from public kindergartens run by the non-educational department, and 20.0% were from universal and low-cost private kindergartens. Generally, Chinese kindergartens are roughly classified into four quality grades (five-star, four-star, three-star, two-star and below) according to China's kindergarten grading system. Further, teachers' gender, age, years of teaching experience, professional title, and establishment were also collected (see Table 1).

**Table 1.** Participants' characteristics (N = 3636).

Demographic Characteristics	N	%
Gender		
Male	89	2.4%
Female	3547	97.6%
Age		
≤25	631	17.4%
26–30	1030	28.3%

31–45	1368	37.6%
46–50	331	9.1%
≥51	276	7.6%
Years of teaching experience		
≤5	1333	36.7%
6–10	941	25.9%
11–15	378	10.4%
16–20	229	6.3%
≥21	755	20.8%
Establishment		
Yes	1619	44.5%
No	2017	55.5%
Professional title		
No title	1761	48.4%
Junior	517	14.2%
Associate	259	7.1%
Middle	820	22.6%
Sub-senior	272	7.5%
Senior	7	0.2%
Kindergarten quality grade		
Five-star	1453	40.0%
Four-star	1035	28.5%
Three-star	841	23.1%
Two-star and below	307	8.4%
Geographical area		
Urban city	1730	47.6%
County	1261	34.7%
Village	563	15.5%
Countryside	82	2.3%
Kindergarten type		
Public kindergarten run by educational department	2720	74.8%
Public kindergarten run by non-educational department	188	5.2%
Universal and low-cost private kindergarten	728	20.0%

### 3.2. Measures

#### 3.2.1. Initial Item Development

This study adopted three frameworks (sustainability in ecology, sustainability in management, and sustainability in policy) to formulate the index system and survey scale. The formulation of the theoretical framework of the sustainability of ECE in China has a solid foundation.

First, we conducted an extensive document analysis of relevant policy documents, such as the Measures for the Supervision and Evaluation of Universal Preschool Education in County Areas (“the Measures”) [28] and Early Childhood and Care Education Quality Assessment Indicators [46]. In addition, we also analysed the pilot measures and three-year development plans issued by the sampled provinces and regions in this study.

Second, we conducted group interviews with relevant experts in the field of ECE. For instance, 16 experts (one university professor, one principal, five teachers with more than five years of work experience in kindergarten, two administrative experts with more than 15 years of work experience, and seven Master’s and PhD students in preschool education) were selected to conduct focus group interviews. In response to some questions, such as “What should be included in the evaluation of the sustainability of ECE?” Afterwards, experts put forward constructive opinions on the evaluation perspectives and evaluation

content. The experts' opinions have converged on a conclusion that the sustainability of ECE should include the interaction between ECE and the environment, the supervision of the quality of ECE, and the support of government policies. Accordingly, we designed an evaluation system that includes three value goals: "sustainability in ecology, sustainability in management, and sustainability in policy". "Sustainability in ecology" refers to the sustainability of ECE environmental ecology and education ecology, whether it can meet the needs of children to grow up in a healthy natural environment and a scientific, educational environment. "Sustainability in management" refers to the sustainability of the ECE management system itself and whether it can make reasonable planning and management to ensure the adequacy of ECE resources and promote its high-quality development. "Sustainability in policy" refers to the sustainability of the policy itself and whether the policy can guarantee the development of kindergartens and teachers who are the "energy source" of ECE.

Third, we conducted document analysis on the relevant policy documents, such as *the Measures*, and formulated evaluation indicators associated with three constructs, six dimensions, and 38 indicators. To optimise the indicators of sustainable ECE and test their content validity, we consulted the above-mentioned 16 experts in two rounds of focus group interviews; the experts highly recognised the indicators and made some suggestions. For instance, due to the different evaluation standards for kindergartens in different places, the content of "kindergarten grade" is prone to ambiguity and needs to be revised.

Finally, the first author analysed the above review and interview results, which were categorised into 38 items. The second author reviewed these items and gave suggestions for modification. We then employed convenience sampling in the pilot study, recruiting 250 teachers from Liaoning and Sichuan provinces to fill out a questionnaire, provide feedback on the wording of the items, and identify any unreasonable responses. These items were finally revised based on their feedback to improve clarity and readability. As a result, the final draft includes three constructs, six dimensions, and 38 indicators (see Appendix A).

### 3.2.2. Sustainability of Early Childhood Education Rating Scale (SECERS)

The study used two measures, a demographic questionnaire and the SECERS. The teachers completed both measures. The first part is a demographic questionnaire that includes the teacher's age, years of teaching experience, establishment, professional title, position, quality grade, type, geographical area, and region of the kindergarten in which the teacher works. The second part is the SECERS with 38 testing items, using a 5-point Likert scale (1 = *Strongly disagree* to 5 = *Strongly agree*). The items in the SECERS reflect various aspects of the sustainability of ECE (e.g., the item "Kindergarten have safe and effective management goals of saving water, electricity and paper." and the item "The government has a clear development plan for early childhood education."). Scores for the 3 constructs are calculated using the statistical mean of all corresponding items contained in each construct. The higher the average score, the better the teachers' evaluation of the sustainability of ECE.

### 3.3. Procedures

Ethical procedures were followed throughout the research process. First, the study was approved by the ethical review board of the first author's university with approval number "HR198-2022" before data collection. Second, consent was obtained from the educational directors and the principals of participating kindergartens. Third, we included a brief introduction to the survey at the beginning of the questionnaire. Teachers were advised that informed consent would be assumed if they completed the questionnaire, and that data would be completely confidential and only available to the research team. Teachers were also told that their participation was entirely voluntary, and they were free to withdraw from this study at any time without any consequences.

Questionnaires were distributed online using [www.wjx.cn](http://www.wjx.cn) (accessed on 8 March 2022), China's leading online survey platform. Overall, 3805 participants completed the questionnaire. 67 questionnaires were deleted for the following reasons: (1) participants completed the questionnaire in less than 80 s, or (2) over 90% of their responses to scaled questions were identical. A total of 3636 valid questionnaires were included in the final dataset (a 95% response rate).

### 3.4. Data Analysis

The questionnaire data were analysed using MPLUS 8.3 and IBM SPSS 26.0. First, the psychometric properties of SECERS were analysed by item analysis, exploratory factor analysis (EFA), and confirmatory factor analysis (CFA) to explore and verify the construct validity and reliability of the SECERS. Second, a latent profile analysis was used to generate the latent profile of Chinese kindergarten teachers' evaluation. Third, teachers' main predictors of ECE were examined by hierarchical regression analysis. Finally, with the kindergarten quality grade as the independent variable, we further explored the differences between the three constructs and total scores of SECERS in the sustainability of ECE by using ANOVA analysis.

## 4. Results

### 4.1. Psychometric Properties of SECERS

#### 4.1.1. Item Analysis

Item analysis was adopted to test the adequacy of 38 testing items. After analysing the items by the extreme value comparison method and the homogeneity test method, it was decided to keep them all. The reasons are as follows: First, the factor loadings of all items are between 0.63–0.86, all greater than 0.45. Second, the correlation coefficients between items and the total score are between 0.56 and 0.82, greater than 0.40.

#### 4.1.2. Exploratory Factor Analysis (EFA)

SPSS 26.0 was used to perform principal axis decomposition on the first half of the sample ( $n = 1818$ ), and the samples were selected by random sampling method to explore the structure of SECERS in the Chinese context. First, fitness tests showed that this set of data was well suited for EFA: KMO = 0.987, Bartlett's test of sphericity  $\chi^2 = 96152.746$  ( $df = 703$ ,  $p < 0.001$ ). Second, a three-factor model was generated for the scale using the principal-axis factoring (PAF) of the direct oblimin method, which could explain 78.98% of the total variance, implying that the construct validity of the SECERS was satisfactory. The eigenvalues of the three constructs are 27.08, 1.79, and 1.14, respectively. Third, the factor loadings of the items are between 0.52–0.81, which are all greater than .45; the common degree is between 0.82 and 0.86, which are all greater than .20 (see Table 2). In addition, the common factor of the factor structure is also relatively stable, so there is no need to delete any items.

This study adjusted the items according to the results of exploratory factor analysis (Table 2). The variance interpretation rate of the first factor is 27.08%, and all 15 testing items come from the dimensions of the original assumption, covering the environmental ecology and educational ecology of kindergartens; therefore, it is still named "Sustainability in ecology". The variance interpretation rate of the second factor was 1.79%; most of the 11 testing items included come from the assumption of the second dimension in advance. Combined with the content of the current second dimension, it is found that it includes reasonable planning and management to ensure the adequacy and high-quality development of inclusive ECE resources. Therefore, this dimension is still named "Sustainability in management". The variance interpretation rate of the third factor is 1.14%, and most of the 12 testing items included come from the assumption of the third dimension in advance. Combined with the content of the third dimension, it is found that it contains supporting policies to ensure the sustainable development of kindergartens and

teachers, so it is still named “Sustainability in policy”. Therefore, the SECERS is still composed of sustainability in ecology, sustainability in management and sustainability in policy three dimensions. However, only the dimensions to which individual items belong are adjusted. All of these will be discussed in the next section.

**Table 2.** Exploratory factor analysis results of SECERS.

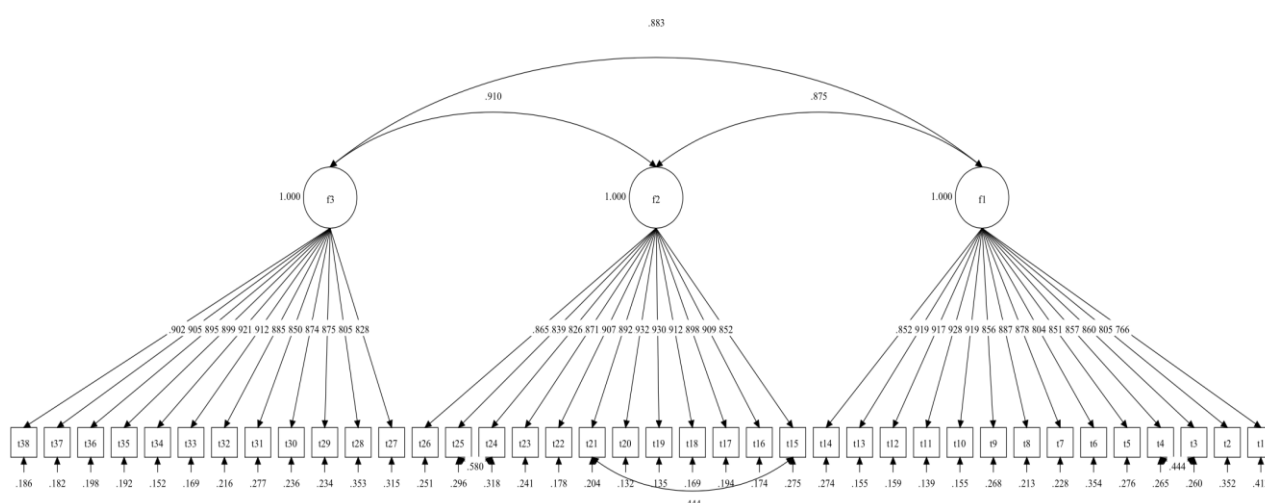
Item	Factor Loading			Extraction
	1 (15)	2 (11)	3 (12)	
4	0.81			0.82
5	0.80			0.79
8	0.79			0.81
7	0.77			0.79
3	0.77			0.80
11	0.76			0.85
10	0.76			0.83
12	0.71			0.82
13	0.71			0.82
9	0.70			0.74
2	0.68			0.70
14	0.67			0.73
32	0.67			0.79
1	0.58			0.63
6	0.52			0.66
29		0.72		0.84
36		0.72		0.78
37		0.71		0.79
35		0.70		0.80
31		0.70		0.85
30		0.70		0.86
28		0.70		0.81
34		0.68		0.82
38		0.68		0.79
27		0.66		0.83
33		0.62		0.83
19			0.77	0.79
18			0.74	0.81
20			0.72	0.80
17			0.71	0.81
15			0.71	0.76
16			0.71	0.70
21			0.68	0.83
22			0.66	0.83
23			0.58	0.78
24			0.56	0.76
25			0.55	0.79
26			0.54	0.79
Total Explained Variance				78.98%

Note. Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalization; Rotation converged after 9 iterations.



#### 4.1.3. Confirmatory Factor Analysis (CFA)

CFA analysis was performed on the second half of the data ( $n = 1818$ ) to confirm the previously proposed three-factor structure of the EFA results. According to accepted standards—‘the smaller the  $\chi^2/df$ , the better the model fitting’, the model fitting effect is acceptable when the  $\chi^2/df$  is less than 5. The values of the indicators TLI and CFI can be between 0 and 1. The closer the value is to 1, the better the model’s fit. Usually, the model fitting effect is better when these indicators are greater than 0.90. The recommended critical value for SRMR is 0.08, and SRMR less than 0.05 is a good fit [47]. As with SRMR, the closer RMSEA is to 0, the better the model fit. For RMSEA, a value less than or equal to .08 is usually used as the criterion [48]. The first-order CFA results verify that the three-factor structural model fits the data perfectly. The model showed high fit, indicating good model fit,  $\chi^2 = 16,225.293$ ,  $df = 120$ ,  $p < 0.000$ , CFI = 0.92, TLI = 0.92, SRMR = 0.03, RMSEA = 0.08 (90% CI [0.07, 0.08]), AIC = 177,743.511, BIC = 178,487.348 (see Figure 1).



**Figure 1.** CFA of SECERS. Model fit:  $\chi^2 = 16,225.293$ ,  $df = 120$ ,  $p < 0.000$ , CFI = 0.92, TLI = 0.92, SRMR = 0.03, RMSEA = 0.08 (90% CI [0.07, 0.08]), AIC = 177,743.511, BIC = 178,487.348.

#### 4.1.4. Reliability Analysis

As shown in Table 3, the Cronbach’s  $\alpha$  value for the SECERS was 0.99, and the reliability of each factor was above 0.91, reaching above 0.90, indicating excellent reliability [49]. The split-half reliability ranged between 0.89 and 0.91, indicating that the internal consistency reliability ranged from excellent to acceptable [50]. Further, the correlation matrix between the three constructs ranged from 0.86, 0.87, and 0.89 ( $p < 0.001$ ), indicating high reliability.

**Table 3.** Item means, standard deviations, and reliability of SECERS.

Dimension	M	SD	Cronbach’s Alpha ( $\alpha$ )	Split-Half Reliability
tTotal score of SECERS	4.15	0.80	0.99	0.97
Sustainability in ecology	4.25	0.76	0.94	0.89
Sustainability in management	4.14	0.83	0.92	0.90
Sustainability in policy	4.07	0.83	0.91	0.91

#### 4.2. Descriptive Analysis of the SECERS in China

Most (57.8%) Chinese teachers rated the sustainability of ECE positively, with a mean total score of SECERS being higher than 4.0 ( $M = 4.06$ ,  $SD = 0.74$ ). Specifically, sustainability in ecology had the highest score ( $M = 4.25$ ,  $SD = 0.76$ ), followed by sustainability in management ( $M = 4.14$ ,  $SD = 0.83$ ) and sustainability in policy ( $M = 4.07$ ,  $SD = 0.83$ ), which indicated that teachers are more receptive to sustainable ECE. Among the 38 testing items, the item with the lowest score includes “the support policy for rural transfer kindergarten teachers has been effectively implemented and implemented.” ( $M = 3.99$ ,  $SD = 0.96$ ) “Have a complete channel for professional title evaluation and employment, and the proportion of teachers with senior professional title has gradually increased.” ( $M = 3.93$ ,  $SD = 1.05$ ), “Public cultural service institutions such as public museums, libraries, art galleries and science and technology museums provide children with public welfare services suitable for their physical and mental development.” ( $M = 3.98$ ,  $SD = 1.04$ ) “The region often holds public welfare lectures, training, practice teaching and other activities.” ( $M = 3.98$ ,  $SD = 1.03$ ) (Table 3). It indicates that teachers have negative views on the above 4 items.

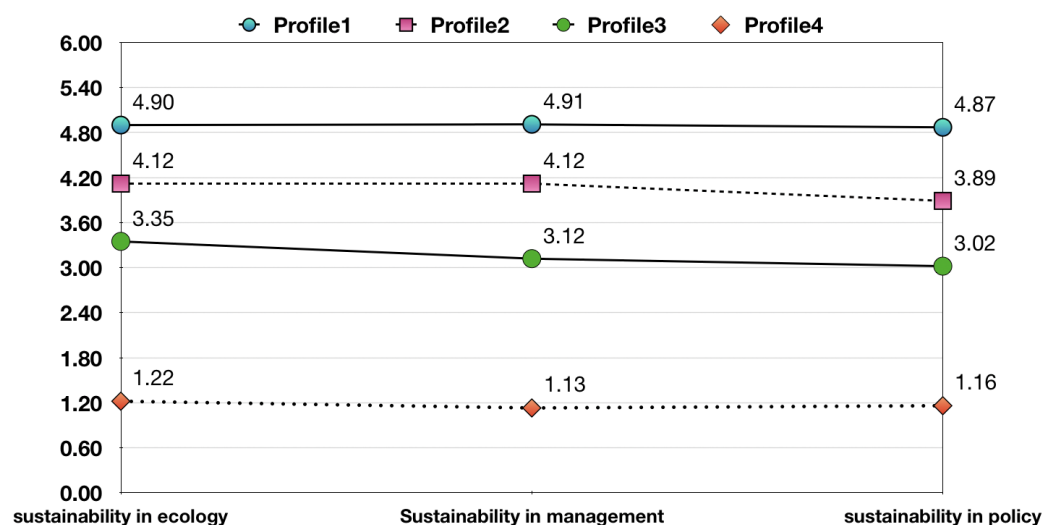
#### 4.3. Latent Profile Analysis of SECE Evaluation

To explore the potential characteristics of teachers’ evaluations of the sustainability of ECE, series models with different numbers of “latent” classes were estimated. According to the results of all model fitting indicators, a four-profile model was considered the perfect model. Table 4 presents this four-profile model, which was selected because it had the highest entropy (0.957), lower AIC (12,826.469) and BIC values (12,938.044), a slightly lower aBIC value (12,880.849), and a statistically significant LMRT value ( $p < 0.001$ ). The lower the AIC, BIC, and aBIC values, the higher the entropy value, which indicates a better model fit. The entropy values of the models in this study were all over 0.90. In addition, the best LPA practices concerning the interpretability and simplicity of the identified profiles were considered. A subjective judgment was also made on the surface validity of the profile. As noted above, the four-profile structure was found the most suitable. The proportions of the four identified profiles and their response probabilities in the three dimensions of the SECERS are shown in Figure 2. Below, we briefly outline the four classes represented 1.7%, 16.8%, 40.8%, and 40.7% of the sample, respectively.

Table 4 and Figure 2 show that different profiles have different characteristics in three constructs. The following is an analysis of the characteristics of four different groups of teachers. Teachers in Profile 1 had the lowest scores on the three dimensions; this group was named the “Low Level” group, with the least number of participants; only 61 (1.7%) teachers belonged to this group. Teachers in Profile 2 scored relatively higher on three dimensions than in Profile 1; this group was named the “Middle Level” group, and 611 (16.8%) teachers belonged to this group. Teachers in Profile 3 scored higher on the three dimensions than those with the Profile 1 and Profile 2 but lower than those with the Profile 4; this group was named the “Upper-Middle Level” group, with the largest number of participants, 1492 (41.0%) teachers belonging to this group. Finally, teachers in Profile 4 scored the highest on the three dimensions; thus, are named the “High Level” group, and 1472 (40.5%) teachers belonged to this group.

**Table 4.** Latent profile analysis model-fit statistics of the potential models.

Model	AIC	BIC	aBIC	LMRT (p)	BLRT (p)	Entropy	Class Probability
2	21,469.839	21,531.825	21,500.050	0.0000	0.0000	0.863	0.245/0.755
3	17,098.073	17,184.854	17,140.369	0.0000	0.0000	0.948	0.018/0.517/0.465
4	12,826.469	12,938.044	12,880.849	0.0000	0.0000	0.957	0.017/0.168/0.410/0.405
5	12,384.545	12,520.915	12,451.010	0.5137	0.0000	0.933	0.017/0.365/0.076/0.163/0.380



**Figure 2.** The four profiles based on mean scores on valuing of three characters of the sustainability of ECE ( $N = 3636$ ). Profile 1 = *Low Level* ( $n = 61$ ); Profile 2 = *Middle Level* ( $n = 611$ ); Profile 3 = *Upper-Middle Level* ( $n = 1492$ ); Profile 4 = *High Level* ( $n = 1472$ ).

Chi-square analysis was used to investigate the differences among the demographic variables of the four profiles, namely, low-level, middle-level, upper-middle-level and high-level. As shown in Table 5, chi-square tests revealed that the four profiles were differentiated by age ( $\chi^2 (12, N = 3636) = 230.543, p < 0.05$ , Cramer's  $V = 00.046$  and Somer's  $d = 00.034$ ), establishment ( $\chi^2 (3, N = 3636) = 190.552, p < 0.001$ , Cramer's  $V = 00.073$  and Somer's  $d = -00.054$ ), kindergarten quality grade ( $\chi^2 (9, N = 3636) = 1900.408, p < 0.001$ , Cramer's  $V = 00.132$  and Somer's  $d = -00.165$ ), geographical area ( $\chi^2 (9, N = 3636) = 650.766, p < 0.001$ , Cramer's  $V = 00.078$  and Somer's  $d = -00.106$ ).

**Profile 1: Low-Level.** The major features of the low-level group were as follows: aged less than 25 (2.7%), with no establishment (1.9%), in the countryside (3.7%), kindergartens with two stars and below (3.3%). This result shows that young teachers with no establishment from two-star and below kindergartens in the countryside are more likely to negatively evaluate ECE's sustainability.

**Profile 2: Middle-Level.** The major features of the middle-level group were as follows: aged less than 25 (20.1%), with no establishment (19.1%), in the village (20.2%), kindergartens with two-star and below (33.9%). This result shows that young teachers with no establishment from two-star and below kindergartens in the village are more likely to have a middle-level evaluation of the sustainability of ECE.

**Profile 3: Upper-Middle-Level.** The major features of the upper-middle-level group were as follows: aged 46–50 (42.6%) and over 50 years old (42.0%), have an establishment (42.3%), in the county (44.1%) kindergartens with four stars (45.5%). This result shows that middle-aged teachers from four-star kindergartens in the county are more likely to have an upper-middle level evaluation of the sustainability of ECE.

**Profile 4: High-Level.** The major features of the high-level group were as follows: over 50 years old (42.4%), have an establishment (42.4%), in the urban city (46.6%), kindergartens with five stars (49.3%). This result shows that old teachers from five-star kindergartens in the urban city have establishment are more likely to have a positive evaluation of the sustainability of ECE.

**Table 5.** Demographic characteristics by the four profiles.

Variable	Profile 1 <i>n</i> = 61	Profile 2 <i>n</i> = 611	Profile 3 <i>n</i> = 1492	Profile 4 <i>n</i> = 1472	$\chi^2$	Cramer's V	Somer's d
Age					23.543 *	0.046 *	0.034 *
≤25	2.7%	20.1%	39.6%	37.6%			
26–30	2.2%	16.8%	40.1%	40.9%			
31–45	0.7%	16.2%	41.8%	41.3%			
46–50	2.4%	15.1%	42.6%	39.9%			
≥51	1.1%	14.5%	42.0%	42.4%			
Establishment					19.552 ***	0.073 ***	−0.054 ***
Yes	1.4%	14.0%	42.3%	42.4%			
No	1.9%	19.1%	40.0%	39.0%			
Kindergarten quality grade					190.408 ***	0.132 ***	−0.165 ***
Five-star	1.9%	10.8%	37.9%	49.3%			
Four-star	1.4%	13.7%	45.5%	39.3%			
Three-star	1.0%	24.7%	40.8%	33.5%			
Two-star and below	3.3%	33.9%	34.9%	28.0%			
Geographical area					65.766 ***	0.078 ***	−0.106 ***
Urban city	1.5%	13.1%	38.7%	46.6%			
County	1.7%	20.1%	44.1%	34.0%			
Village	1.8%	20.2%	41.4%	36.6%			
Country-side	3.7%	19.5%	40.2%	36.6%			

Note. Profile 1 = *Low Level*; profile 2 = *Middle Level*; profile 3 = *Upper-Middle Level*; Profile 4 = *High Level*. \*  $p < 0.05$ , \*\*\*  $p < 0.001$ .

#### 4.4. Predictors of SECE Evaluation by Teachers

Spearman correlation analysis was conducted to explore the variables correlated with teachers' evaluations in China. As shown in Table 6, the following variables significantly correlated with the total score of SECERS ( $ps < 0.01$ ): age (≤25 years, 26–30 years, 31–45 years, 46–50 years, ≥51 years), years of teaching experience (≤5 years, 6–10 years, 11–15 years, 16–20 years, ≥21 years), professional title (no title, junior, associate, middle, sub-senior, senior), establishment (yes, no), kindergarten quality grade (five-star, four-star, three-star, two-star and below), geographical area (urban city, village, countryside, county).

**Table 6.** Correlation analysis between contributors and SECERS.

Variables	1	2	3	4	5	6	7	8
1. Total score of SECERS	— —							
2. Age	−0.034 *	— —						
3. Years of teaching experience	−0.071 **	0.781 **	— —					
4. Professional title	−0.072 **	0.550 **	0.675 **	— —				
5. Establishment	−0.052 **	0.336 **	0.406 **	0.555 **	— —			
6. Kindergarten quality grade	−0.239 **	0.018	0.061 **	−0.019	−0.015	— —		
7. Geographical area	−0.097 **	−0.004	0.026	0.027	0.001	−0.158 **	— —	
8. Kindergarten type	−0.006	−0.151 **	−0.181 **	−0.260* *	−0.535 **	0.118 **	−0.158 **	— —

Note. \*  $p < 0.05$ , \*\*  $p < 0.010$ .

Last, a 3-step hierarchical regression analysis was conducted, using the enter method to predict the total score of SECERS. The independent variables are nested in three levels: (1) personal variables: age, years of teaching experience, professional title; (2) kindergarten variables: kindergarten quality grade; and (3) regional factors: geographical area of the kindergarten. Accordingly, the teacher's personal variable was entered in step 1. Then, in step 2, the kindergarten variable was entered. Finally, in step 3, a regional variable was entered.

The changes in  $R^2$  between the three steps showed that: (1) Teachers' age and years of teaching experience could jointly explain 8.7% of the total SECERS score, which is the lowest percentage in this study. They were found to be a negative predictor of teacher evaluations. (2) Kindergarten quality grade factor can significantly predict 6.3% of the total SECERS score. (3) Geographical location can explain 6.5% of the change in the total score. Both kindergarten quality grade and geographical area factors were negative predictors of teachers' evaluations.

In conclusion, the hierarchical regression analysis indicated that kindergarten quality grade is an important predictor of Chinese teachers' evaluation of the sustainability of ECE. For one thing, kindergartens with higher quality grades are more likely to be recognised by teachers than those with lower quality grades. For another thing, the higher the level of kindergartens with higher quality grades, the higher the teacher evaluated them. Furthermore, teachers' personal factors, including age and years of teaching experience, have a significant negative impact on teachers' evaluation, accounting for 8.7% of the change. The older the teacher, the lower the rating. Geographical factors also affect teacher evaluation, and urban teachers are rated higher than rural teachers (Table 7).

**Table 7.** Summary of hierarchical regression analyses predicting teacher evaluation.

	$\beta$	$R^2$	$\Delta R^2$	F Value
Step 1		0.087	— —	7.077 ***
Years of teaching experience	−1.628 **			
Age	−1.579 *			
Establishment	−0.975			
Professional title	−0.803			

Step 2		0.253	0.063	50.664 ***
Years of teaching experience	−0.749 **			
Age	−1.126 *			
Establishment	−1.143			
Professional title	−1.299			
Kindergarten quality grade	−7.246 ***			
Step 3		0.259	0.065	44.178 ***
Years of teaching experience	−0.718			
Age	−1.053			
Establishment	−1.2			
Professional title	−1.246 *			
Kindergarten quality grade	−6.962 ***			
Geographical area	−1.963 **			

Note. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

#### 4.5. Kindergarten Quality Grade Differences in Rating SECE

As shown above, the kindergarten quality grade was a key predictor of the sustainability of ECE evaluation. Therefore, a set of ANOVA with kindergarten quality grade as the independent variable was performed to further explore significant differences in the sustainability of ECE development. As shown in Table 8, the results showed the total score ( $F(3695) = 75.391$ ,  $p < 0.001$ ) and all three dimensions: sustainability in ecology ( $F(3695) = 71.389$ ,  $p < 0.001$ ), sustainability in management ( $F(3,695) = 64.013$ ,  $p < 0.001$ ), sustainability in policy ( $F(3695) = 71.669$ ,  $p < 0.001$ ). Using a follow-up analysis of Scheffe's post hoc test, it was shown that five-star kindergartens scored significantly higher than other graded kindergartens ( $p < 0.001$ ), and kindergartens with three-star, two-star and below significantly had the lowest scores in all three dimensions ( $p < 0.001$ ).

**Table 8.** The one-way ANOVA analysis of different grades of kindergartens for all the constructs of the sustainability of ECE.

Constructs	Five-Star	Four-Star	Three-Star	Two-Star and Below	F Value
Total score of SECERS	4.49 (0.80)	4.33 (0.74)	4.12 (0.70)	3.9 (0.83)	75.391 ***
Sustainability in ecology	4.43 (0.77)	4.29 (0.72)	4.08 (0.69)	3.87 (0.82)	71.389 ***
Sustainability in management	4.29 (0.84)	4.12 (0.79)	3.90 (0.79)	3.70 (0.85)	64.013 ***
Sustainability in policy	4.36 (0.83)	4.19 (0.78)	4.00 (0.75)	3.79 (0.88)	71.669 ***

Note. \*\*\* $p < 0.001$ .

## 5. Discussion

The main purpose of this study was to develop and validate the Sustainability of Early Childhood Education Rating Scale to evaluate the sustainability of ECE in China. The results show that the psychometric properties are robust and that the scale provides a valid measure of sustainable ECE in the Chinese context, supporting Hypothesis 1. To develop and justify the scale item, stakeholders were interviewed for their views on ECE. Further, this national survey study provides an empirical basis for the sustainability of ECE, showing that environment and education ecology, and quality assurance and management are more sustainable, supporting Hypothesis 2. Still, the sustainability of ECE

policies needs to be improved. Last, kindergarten quality grade was found to be a significant predictor of the sustainability of ECE, supporting Hypothesis 3.

### *5.1. Sustainability of ECE Rating Scale Is Reliable and Valid*

Rooted in the value goals of the sustainability of ECE, this study develops and validates SECERS with three constructs and satisfactory construct validity in the Chinese context. These three constructs have close internal logical relations. They combine inside and outside, link closely, complement each other, and jointly constitute the analysis framework of sustainability of ECE. For instance, sustainable policy support will affect the management of ECE, making a difference to the natural and scientific ecology of kindergarten [19]. Thus, it can be invoked as evidence that the three dimensions are interrelated. This study also found that the scale has satisfactory reliability and internal consistency. It provides a comprehensive framework to reflect teachers' evaluations of the sustainability of ECE development. The content of the scale is closely related to the guarantee of ECE funding and quality and sustainability for teachers and kindergartens. It provides critical evidence on core aspects of the sustainability of ECE development so that more children and families enjoy equitably quality ECE. Therefore, the psychometric properties together confirm that SECERS is a suitable tool to evaluate the sustainability of ECE in China.

### *5.2. The Developmental Sustainability of Early Childhood Education*

This study found that most teachers (57.8%) rated the sustainability of ECE positively, indicating that the sustainability of ECE has reached an acceptable level in China. In particular, teachers gave the highest rating to sustainability in ecology. This result showed that the environmental and educational ecology of kindergartens are recognised by teachers, which may be related to China's continuous emphasis on the improvement of ECE quality in recent years [10,21]; the promotion of scientific and game-based education and the prohibition of kindergarten teaching primary school content [51].

This study also found that kindergarten teachers rated the sustainability of ECE policies (policy support for teacher and kindergarten development) as the lowest. ECE institutions and kindergarten teachers are the "energy source" of ECE, shouldering the task of receiving and educating children [52]. However, the imperfection of existing policies to support the development of kindergartens and teachers restricts the sustainable development of ECE. This study conducted interviews with several teachers before the SECERS was developed. Teachers generally expressed their thirst for improving teachers' rights, interests, and social status. Pang et al. [53] believed that teachers' social security laid an essential foundation for the construction and quality improvement of kindergarten teachers. Unfortunately, the treatment of kindergarten teachers in China is relatively poor, especially lacking policy guarantees such as wages and social security. Moreover, the funds for the protection of teachers' salaries without establishment (temporary workers) are limited, which leads to a big gap between them and those with establishment (long-term employment) [11,53]. Whether core rights and interests such as salary and benefits are effectively protected is an important factor affecting the composition of the teaching staff as well as the quality of ECE. Although teachers are supported in the form of teaching allowance and social security sharing, the support is limited [54]. Moreover, China has not yet issued a special law on ECE, and the identity of kindergarten teachers as professionals specialising in ECE has not been clearly defined in the law. Consequently, it is not surprising that there is a long-term lack of supporting policies such as salary, establishment, and professional title for kindergarten teachers [18,55].

In addition, there are also limitations in supporting policies for kindergarten development. Existing policy support for kindergarten development is weak, manifested in the single support mode and lack of support standards [54]. This is reflected in less application of support methods such as degree expansion and financial subsidies. China is vast in territory, and the level of economic development varies greatly among provinces. This is also reflected in the development support for ECE. Some provinces have not set a per-

child subsidy standard for kindergartens. At the same time, the lack of a clear financial investment guarantee entity makes it more difficult to implement support policies.

### *5.3. Factors Influencing Teachers' Evaluations of the Sustainability of Early Childhood Education*

This study identified four profiles of sustainability in ECE in China: low, middle, upper-middle, and high, which can reflect the distribution of the demographic characteristics of Chinese teachers. In particular, younger teachers without establishment in three-star, two-star, and below kindergartens are more likely to make neutral or even negative evaluations of the sustainability of ECE. On the other hand, older teachers with the establishment in urban cities and counties are more likely to make positive evaluations of the sustainability of ECE.

Generally speaking, kindergartens in urban cities and villages have more educational resources than those in counties, so their facilities can meet national standards [56], and teachers in these kindergartens score the sustainability of ECE relatively higher. However, Jiang & Lan [56] also concluded that there are significant differences in kindergarten operating conditions among urban cities, villages, the countryside, and counties, and the running conditions of village and countryside kindergartens have greatly improved in recent years, but rural kindergartens are still a weakness. Further, this study also found that the teachers with establishment rated the sustainability of ECE higher. In China, public kindergartens are state-owned assets to obtain more welfare security and better quality [57]. Therefore, they can provide teachers with more establishments, but most teachers in private kindergartens have no establishment. Therefore, it can be seen that teachers who have establishment usually belong to public kindergartens of good quality.

Furthermore, this study found that the three constructs had the same level in each profile, indicating an interrelationship in terms of the sustainability of ECE. This study also found that the sustainability in policy scored the lowest in the sustainability of ECE with low, middle, and upper-middle evaluation levels. In contrast, sustainability in management scored the lowest in the sustainability of ECE with low evaluation levels, showing that a more complete and sustainable policy support mechanism needs to be provided for areas with low sustainability of ECE. While for areas with the lowest sustainability of ECE and ensuring sustainable policy support, it is also necessary to ensure quality assurance and management. Only more targeted solutions to the problems in the sustainability of ECE can ensure better development of ECE. And make more children enjoy high-quality and sustainable ECE resources.

### *5.4. Disparities between Kindergarten Quality Grade*

This study found that the higher the quality grade of the kindergarten where the teacher is located, the higher the evaluation of the sustainability of ECE, and there is a large gap in the sustainability of ECE between kindergartens of different quality grades. Kindergarten is a crucial carrier of ECE development and reflects the development of ECE to a certain extent. Kindergarten teachers evaluate the sustainability of ECE based on their perception of the kindergarten they work in. The quality grading system of Chinese kindergartens could be viewed as an important incentive for the unreasonable allocation of ECE resources. The higher the quality grade, the better the financial support and management of the government [2,54]. In this process, the development of kindergartens with low-quality grades cannot catch up with that of high-quality grades. Although kindergartens with different quality grades have been produced after evaluation, kindergartens with low-quality levels deserve special attention. However, previous studies have found that kindergartens do not get more policy support because of the low-quality grades [58]. Therefore, the government is more inclined to financially support high-level kindergartens. This also leads to the Matthew effect, that is, the stronger the kindergarten with good quality, the worse the kindergarten with poor quality [2,58]. This is also the reason why teachers from low-quality kindergartens give low ratings to the sustainability of ECE.



## 6. Conclusions, Limitations, and Implications

This study aimed to evaluate the sustainability of ECE from the perspective of teachers, whose perspectives are important as key stakeholders in ECE evaluation. Therefore, involving kindergarten teachers from different backgrounds and regions in the sustainability of ECE evaluation will help to understand the sustainability of ECE. First, the three constructs of SECERS: sustainability in ecology, sustainability in management, and sustainability in policy, were reliable and valid. They rated sustainability in ecology the highest, followed by sustainability in management and sustainability in policy. Second, we identified four profiles of teacher evaluation that reflect the four levels of sustainability of ECE. Teachers' background and location have a significant influence on the sustainability of ECE evaluation and also reflect various social factors that affect the sustainable development of ECE. Finally, the difference in kindergarten quality grades in ECE sustainability evaluation indicates that kindergarten quality grade is a key factor affecting teacher evaluation and also a key problem restricting the sustainable development of ECE.

This study had some limitations. First, this study only evaluated the sustainability of ECE from the perspective of teachers. Future studies should include a wider range of participants and examine the current situation of ECE sustainability from a more comprehensive perspective. Second, this study only compiled the teacher subjective evaluation scale from the subjective perspective of teachers, and the results of subjective evaluation are uncertain. Therefore, future research should add educational panel data as a supplement. Third, there is an imbalance in the selection of subjects. For instance, most teachers come from public kindergartens run by educational departments (74.8%), and only a few teachers come from other types of kindergartens. In addition, teachers from rural areas are the least (2.7%). Therefore, follow-up research should pay attention to the balance of sampling. Fourth, this study only evaluated the three constructs of sustainability: sustainability in ecology, sustainability in management, and sustainability in politics. In the future, management as a tactic ("internal management") and politics as a strategy ("external management") should also be studied, and more efforts should be directed to solving the identified problems.

This study is the first national survey to develop and validate a scale to evaluate the sustainability of ECE from a teacher's perspective. This newly developed scale can be used as a research tool to understand the sustainability of ECE. It provides evidential support for the areas of concern to support the in-depth sustainable development of ECE. These areas include sustainability in ecology, sustainability in management, and sustainability in policy. Researchers and policymakers can systematically understand the development of ECE through the framework of SECERS, which is conducive to solving practical problems in ECE and providing a basis for promoting the healthy and sustainable development of ECE. This has positive implications for improving the quality and sustainability of ECE in China and policy formulation in other regions. At the same time, the research conclusions also make teachers aware of their status in the development of ECE, which can stimulate their internal drive for professional development and eventually enhance their professionalism. It is worth mentioning that most teachers have recognised the sustainability of ECE in China. However, some problems have also been found: the ecological sustainability and management sustainability of ECE in China can be guaranteed. However, the policy support for the sustainability of ECE still needs to be strengthened, such as policies to support the development of teachers and kindergartens. Regarding geographical differences, China is a country with a large area, and there are huge differences in economic development levels among different regions. Such differences are also reflected in the professional development and remuneration of teachers in different regions, as well as the availability of software and hardware resources of different kindergartens and the quality grade of kindergartens. Teachers and kindergartens in highly developed areas always enjoy high-quality resources. This requires special policy attention to teachers and kindergartens in vulnerable areas. To achieve higher quality and sustainable ECE in the next stage, it is necessary to improve ECE policies.

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**Institutional Review Board Statement:** The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of East China Normal University (HR 198-2022 and date of approval 8 March 2022).

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**Data Availability Statement:** The data presented in this study are available on request from the corresponding author. The data are not publicly available due to the ethical requirement.

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## Appendix A. Sustainability of Early Childhood Education Rating Scale

Dimension	Definition	Indicators
A Sustainability in ecology	The sustainability of ECE environmental ecology and education ecology, whether it can meet the needs of children to grow up in a healthy natural environment and a scientific-educational environment.	A1 Kindergarten environmental Ecology (waste utilisation; pollution control; energy saving targets; clean and tidy environment; etc.)
		A2 Kindergarten education ecology (education mode informatisation; scientific education activities; harmonious relationship; standardised course connection; individualised education; etc.)
B Sustainability in management	The sustainability of the ECE management system itself, and whether it can make reasonable planning and management to ensure the adequacy of ECE resources and promote its high-quality development.	B1 Encourage social group participation (social forces organise kindergartens; parenting guidance services; public welfare education services; etc.)
		B2 Ensure the quality of education (layout planning; investment; balanced development progress; supervisory & feedback; etc.)
C Sustainability in policy	The sustainability of the policy itself, and whether it can guarantee the development of kindergartens and teachers who are the “energy source” of ECE.	C1 Policies to support faculty development (supporting policies for teachers’ job transfer; professional title evaluation and employment channel; salary guarantee mechanism; etc.)
		C2 Policies to support kindergarten development (coordinated development of different types of kindergartens; reasonable sharing of ECE costs; incentive mechanism for the private kindergartens; etc.)

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