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Early Childhood Educators' Practices in Education for Sustainable Development in China: Evidence from Shandong Province

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Abstract: Educators can drive educational change and enable children's learning for sustainable development. Early childhood education is an important component of Education for Sustainable Development (ESD), and analyzing early childhood educators' ESD practices can help advance the implementation and realization of ESD. However, the existing overseas studies' survey instruments do not systematically reflect the basic ideas of ESD. Furthermore, few studies have explored early childhood educators' ESD practices in China. Therefore, this study established a newly developed and validated instrument, the Early Childhood Educators' Education for Sustainable Development Practices Scale (ECEESDPS), to assess early childhood educators' ESD practices. We randomly surveyed 7287 early childhood educators from Shandong Province. The psychometric properties show that the ECEESDPS is a reliable and valid scale that contains four constructs: Values, Content, Competency, and Implementation. The descriptive statistics revealed that educators scored relatively higher for the Values and Implementation constructs, and lower for the Content and Competency constructs. These results suggest that early childhood educators' ESD practices are generally positive, which correlates with the theoretical background and policies of early childhood education in China. We provide implications for policy development and practical improvement.

Keywords: early childhood education; educators; educational practices; Education for Sustainable Development; sustainable development; sustainable development goal; UNESCO

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1. Introduction

Sustainable development concerns the survival and development of mankind. It originates from the recognition of and concern regarding economic, social, and environmental problems. In 1987, the World Commission on Environment and Development's report titled Our Common Future formally introduced the concept of sustainable development as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' [1]. After the concept was proposed, the United Nations (UN) issued a series of programs and recommendations dedicated to sustainable development, in which education was considered as one of the important approaches. Education for Sustainable Development (ESD) provides opportunities for people to acquire the knowledge, skills, values and attitudes that empower them to contribute to sustainable development.

The Global Action Programme on Education for Sustainable Development (GAP on ESD) states that: 'Political agreements, financial incentives, or technological solutions alone do not suffice to grapple with the challenges of sustainable development. It will require a wholesale change in the way we think and the way we act—a rethink of how we relate to one another and how we interact with the ecosystems that support our lives. This is where education has a critical role to play' [2].

Therefore, with the advancement of ESD, the role and importance of educators in ESD implementation has received increased attention. Educators' ESD knowledge, attitudes, and competencies can directly affect the effectiveness of ESD implementation, as the *GAP*

on ESD states that 'Educators and trainers are powerful agents of change for delivering the educational response to sustainable development' [2]. Furthermore, a growing number of studies have pointed out that early childhood education is an important component of ESD because it contributes to the development of individuals and families, so as to achieve a sustainable society [3,4]. Some international organizations, such as the United Nations Educational, Scientific and Cultural Organisation (UNESCO) and the World Organisation for Early Childhood Education (OMEP), have also provided support for Early Childhood Education for Sustainable Development (ECESD). For example, the *United Nations Decade of Education for Sustainable Development (2005–2014)* (*DESD*) and UNESCO's *GAP on ESD* both integrate early childhood education into ESD, while the OMEP has raised the ECESD awareness of each of its member countries by conducting seminars and international research projects.

Through such efforts, ECESD has become a research consensus among many international organizations and countries in recent years, and focusing on early childhood educators' ESD practices can help to promote the implementation and realization of ECESD. However, there are no specific policies on ECESD in China, nor have surveys been conducted on early childhood educators' practice of ESD. Based on this context, the aim of this study was to investigate early childhood educators' ESD practices in a province of China by developing and validating a scale, which will help to understand the reality of ECESD in China and provide corresponding empirical support for its subsequent improvement.

2. Literature Review

When the ESD concept was first proposed, the international early childhood education research focused on the value and significance of implementing ECESD [3,5], reflected on the existing early childhood education from the perspective of ESD [6,7], and explored the basic goals and contents of ECESD [8,9]. These studies provided the premise and foundation for the subsequent practice of ECESD.

With the advancement of ECESD, especially since the OMEP organized several international projects in 2009, the research on early childhood educators' ESD perceptions, attitudes, and practices has gradually increased worldwide. Regarding the participants, these studies investigated the ESD perceptions and practices of pre-service, student, and early childhood educators [10,11]. Regarding the research scope, these studies expanded from small sample surveys of individual kindergartens to large regional, national, and even international sample surveys [12,13]. In terms of the research methodology, these studies used a variety of methods such as questionnaires, textual analysis, and interviews [14,15]. Accordingly, they show that the early childhood educators' ESD perceptions and practices are complex and diverse.

2.1. Early Childhood Educators' ESD Perceptions

Studies have found that most early childhood educators are unfamiliar with ESD, and are more familiar with the concepts of nature education and environmental education [15,16]. Inoue et al. (2016) found that although the Australian government issued guidelines and curriculum programs regarding education for sustainability, around 60% of Queensland's early childhood educators remained unfamiliar with ESD [16]. Park et al. (2016) found that although educators had been exposed to ESD through training, workshops, etc., only 14% were familiar with ESD, and they generally reported that the biggest difficulty in implementing ESD was lack of knowledge [14].

Accordingly, most early childhood educators have a limited understanding of ESD. They focus mainly on the nature and environment fields and pay less attention to the society and economy fields. Inoue et al. (2016) revealed that only a few Australian early childhood educators had a comprehensive and systematic knowledge of ESD [16]. Although the educators described ESD using terms such as 'waste', 'natural resource management', and 'recycling benefits', they were unfamiliar with economic and social terms such as 'interdependence', 'diversity', 'equality', 'social justice', 'human rights', and 'economic

concerns'; moreover, they indicated that these contents were too complex, personal, and potentially offensive for young children [17]. Meanwhile, Hill et al.'s (2014) survey asked educators to provide five descriptors related to ESD. They found that the greatest number of terms was related to nature or the environment, while few terms were related to social justice, equity, and economic concepts [18].

To improve early childhood educators' unfamiliarity with and inadequate understanding of ESD, a growing number of studies have suggested that educators should systematically learn and understand ESD in a more varied manner [14,19]. Arlemalm-Hagser (2011) found that early childhood educators had a richer and more comprehensive understanding of ESD after receiving training; their understanding included values, nature, learning, and children's physical needs [11]. Dyment (2014) found that after participating in professional development workshops, educators' understanding of ESD expanded from the environment field to the society, policy, and economy fields, and that their confidence in implementing ESD increased [10].

2.2. Early Childhood Educators' ESD Practices

Regarding the ESD content to be implemented, the OMEP developed the Environmental Rating Scale for Sustainable Development in Early Childhood (ERS-SDEC) in 2015 to evaluate the practice of ESD. This scale includes three measurements of sustainable development: society, economy, and the environment. The scale has been pilot tested in several countries, and the results show that educators in all applicable countries generally have the highest scores in the environment field followed by the society field, whereas they score the lowest in the economy field [20]. Studies using other survey instruments have also obtained similar results; for example, educators scored 89% for the environmental dimension, 9% for the social dimension, 2% for the political dimension, and 0% for the economic dimension of ESD practices [18]. Further analysis has revealed that although educators organize many nature-based activities, these are mostly related to gardening and caring for animals, whereas fewer activities are related to saving resources, conservation, and environmental issues [15,16].

Regarding the ESD implementation approaches, Ingrid and Yoshie (2008) state that ESD can be implemented in early childhood education by using traditional strengths and characteristics, such as theme- or project-based interdisciplinary approaches, child-centered approaches, parent and community involvement, emphasis on holistic learning, and children's use of different senses to explore, express, and communicate [21]. Related studies have also pointed out that there are multiple ways to achieve ESD, such as through play, projects, technology, art, and outdoor activities [22,23]. However, several studies have found that educators' most commonly used teaching strategies when practicing ESD involve visual materials (e.g., books and drawings) and discussing related topics; furthermore, educators use less in-depth and systematic learning methods such as gameplay and project activities [16]. Although most educators implement ESD effectively through methods such as discussions, books, field trips, and roleplay, the most frequently used method is the circular discussion approach [14].

Regarding the effectiveness of ESD in practice, the literature generally supports the important role that educators play. For example, young children are capable of engaging in sustainable behaviours when guided by dedicated and professional educators [6]. Moreover, children's knowledge and understanding of sustainability topics are positively correlated with educators' instruction [24], and children can describe the environment in a variety of ways, which deepens their understanding of the planet and their personal responsibility towards sustainability [25]. Finally, ESD enhances children's ability to engage in dialogue, inquiry, and action regarding sustainability issues [26].

2.3. ECESD in China

In the Chinese context, the government has promoted and implemented sustainable development strategies to actively play a role in the promotion of ESD. For example, the

government has established the China Working Committee on Education for Sustainable Development to conduct research on major issues related to ESD, has built several experimental schools across China to practice ESD, and has actively promulgated several policies to publicize and promote ESD. In 1994, China's *Agenda 21—White Paper on China's Population, Environment and Development in the 21st Century* stated that 'the idea of sustainable development should be integrated into the entire educational process from primary to higher education' [27]. In 2010, the *Outline of the National Medium- and Long-term Education Reform and Development Plan (2010–2020)* asserted that 'education reform should adhere to comprehensive development and attach importance to safety education, life education, national defence education, and ESD' [28], which emphasizes ESD as an important theme of national education reform.

However, the Chinese government has not issued any specific policies, national standards, or guidelines on ESD, nor has it distinguished the focus of different educational stages when implementing ESD. Meanwhile, the experimental schools that have been built to practice ESD mainly include secondary and elementary schools, with less focus on kindergartens. In addition, the existing studies on ECESD in China have mostly clarified the value, meaning, or implementation of ECESD [29,30]; introduced the research progress of ECESD to foreign countries [31,32]; and considered the development direction of early childhood education, curriculum reform, or teacher training from the perspective of ESD [33–35]. Furthermore, educators' ESD perceptions and practices have been underexplored. Moreover, in terms of the research methods, the previous studies have mostly utilized theoretical thinking and literature reviews rather than survey methods such as questionnaires and interviews.

2.4. The Current Study

The UN states that ESD requires each country to conduct an appropriate exploration in the context of its cultural background and social reality [36]. However, the existing measurement tools used in international research may have validity problems when applied to the Chinese context, and the existing research perspectives do not systematically and comprehensively reflect the basic ideas of ESD. ESD involves changes in multiple dimensions such as educational content, values, capacity development, and teaching methods. Therefore, to systematically investigate how Chinese early childhood educators embody ESD in their daily teaching practices, we developed a new scale, the Early Childhood Educators' Education for Sustainable Development Practices Scale (ECEESDPS), to systematically analyze the characteristics of the current situation, reveal the existing problems, analyze the influencing factors, and provide a basis for subsequent improvements. This study attempts to answer the following questions:

1. What are the psychometric properties of the ECEESDPS?
2. What is the general situation of the early childhood educators' ESD practices in Shandong Province? Do they vary according to the educators' gender, educational background, and years of teaching experience?
3. What are the main factors that influence the early childhood educators' ESD practices?

3. Methods

3.1. Participants

We conducted a pilot study before the formal testing. In the pilot, we distributed 802 test scales, in accordance with the principles of randomization and convenience, and received 613 scales (return rate of 76.15%). We analyzed these valid survey data using item analysis, exploratory factor analysis, and reliability testing. We then conducted the formal survey after the scale was adjusted using the pilot study.

We selected Shandong Province as a representative province in which to investigate the status of early childhood educators' ESD practices using stratified random sampling. Shandong is a medium-developed province with a level of economic development that reflects the average of most provinces in China. In 2020, there were 24,701 registered

kindergartens serving 3,808,029 children in Shandong (according to the records of the Ministry of Education of the People's Republic of China), which is a relatively higher proportion that that of all provinces in China. First, we selected six cities (Jinan, Qingdao, Jining, Linyi, Dezhou, and Dongying) based on their geographical distribution, level of economic development, and resource accessibility. Then, we sampled three districts in each city (18 districts in total). We then selected 10 kindergartens in each district, and all educators in each kindergarten participated in the survey (180 kindergartens in total). The selected kindergartens covered different regions (e.g., urban, township, and rural areas), and the selected kindergarten educators covered as many different teaching years and educational backgrounds as possible. Finally, we distributed a total of 10,358 scales, of which 7287 were valid (return rate of 70.35%). We analyzed these valid data using confirmatory factor analysis (CFA) to verify the construct validity of the scale.

As is shown in Table 1, of the 7287 educators, 3.1% are male and 96.9% are female. Regarding education, 0.3% hold a postgraduate degree, 25.9% hold an undergraduate degree, 45.9% have a specialized degree, and 27.9% have received a high school education. In terms of teaching years, 52.7% have less than five years of teaching experience, 19.9% have 6–10 years, 9.6% have 11–15 years, and 17.8% have more than 16 years. In addition, 37.9% are from kindergartens in urban areas, 34.1% are from kindergartens in townships, 28% are from kindergartens in rural areas. In general, the proportion of educators in the formal study is close to the overall situation in China, and the survey sample is representative.

Table 1. Participants' characteristics (N = 7287).

		Sample *n* =	Sample Percent (%)
Gender	Male	227	3.1
	Female	7060	96.9
Educational background	Postgraduate degree	21	0.3
	Undergraduate degree	1889	25.9
	Specialized degree	3343	45.9
	High school education	2034	27.9
Teaching years	Below five years	3843	52.7
	6–10 years	1448	19.9
	11–15 years	698	9.6
	Over 16 years	1298	17.8
Location of kindergarten	Urban area	2761	37.9
	Township	2488	34.1
	Rural area	2038	28.

3.2. Methods

3.2.1. Initial Item Development

We constructed an analysis framework of ESD based on official UN documents [2,36–39] and related research. We upheld the following three principles during the construction process. First, we clarified the basic concepts of the official documents [2,36–39]. UNESCO, as the lead agency for ESD, plays a guiding role in ESD application. Accordingly, we analyzed the ESD documents issued by UNESCO and summarized the core ideas of ESD. Second, due to the wide scope of ESD in the official documents [2,36–39], we extracted the core ideas of ESD by capturing key factors, discarding minor factors, and combining similar factors. Third, since ESD is a lifelong education system, its proposed values, contents, and skills are aimed at promoting individuals' lifelong development. Since most of the UNESCO documents do not target specific age groups [38–40], we utilized relevant studies as a reference and selected appropriate goals and content to ensure the appropriateness of the analysis framework for early childhood education.

Based on the history of ESD, we selected several representative documents, including the *DESD*, *the GAP on ESD*, and *Transforming Our World: The 2030 Agenda for Sustainable Development (2030 Agenda)*. These documents represent the basic sustainable development goals (SDGs) and principles of ESD; thus, they serve as the bases for its implementation.

Among them, the *DESD* states that 'The overall goal of the ESD is to integrate the principles, values, and practices of sustainable development into all aspects of education and learning' [36]. The *GAP on ESD* states that 'ESD is holistic and transformational education which addresses learning content and outcomes, pedagogy and the learning environment. It achieves its purpose by transforming society' [2]. The *2030 Agenda* proposes that 'By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development' [37]. In conjunction with these statements, we then categorized the key concepts of ESD as Values, Content, Competency, and Implementation, and defined the essential dimensions of each construct as follows.

Regarding the Values construct, the main purpose of ESD is to transmit the fundamental values of sustainable development. As stated in *Shaping Tomorrow's Education 2012 Report on the UN DESD*, 'Education for sustainable development should take an integrated perspective, bringing together multiple dimensions of sustainable development, such as ecological, environmental, economic, social, cultural local, regional and global; past, present and future' [41]. A synthesis of relevant information shows that the values conveyed by ESD concern three main dimensions. The first is the ecosphere dimension. Sustainable development concerns the development of harmonious relationships between the economy, society, environment, and human beings, and requires the appropriate management of the relations between humans and nature and humans and society [40]. The second is the spatial dimension. Sustainable development is not just a national or regional problem but is a common problem faced by all mankind, and thus concerns the coordination between local and global development [42]. The third is the temporal dimension, in which sustainable development should be able to meet the various needs of the present without compromising the ability of future generations to meet their needs, so as to reconcile intergenerational relationships. To facilitate the subsequent analysis, we further divided the Values construct into four dimensions: humans and nature, humans and society, local and global, and present and future.

Regarding the Content construct, ESD mainly focuses on topics related to sustainable development. Various UNESCO documents state that sustainable development involves three fields: environment, economy, and society [2,38,39]. This is supported by the UN's *DESD*, which states that 'All sustainable development programs, including ESD, must consider the three spheres of sustainability: environment, society (including culture), and economy' [36]. Therefore, we divided the Content construct into three elements: environment, society, and economy. Considering the broad scope of the content of each field and the appropriateness of early childhood education, we incorporated the ERS-SDEC developed by the OMEP in 2015 as a reference source during the design of the subsequent items.

Regarding the Competency construct, one of the goals of ESD is to prepare citizens with several key competencies to enable their constructive and responsible participation in achieving a sustainable future. The *GAP on ESD* states that 'Learning outcomes of ESD include stimulating learning and promoting core competencies such as critical and systematic thinking, collaborative decision-making, and responsibility for and towards present and future generations' [2]. Furthermore, the *Education for Sustainable Development Goals: learning objectives* indicates that 'ESD can develop cross-cutting key competencies for sustainability that are relevant to all SDGs' [43]. The following key competencies are generally seen as being crucial for advancing sustainable development: systematic thinking, anticipatory competency, collaboration, critical thinking, and integrated problem-solving [44–46].

Based on the relevant materials, we classified the Competency construct into critical thinking, systematic thinking, collaborative ability, and problem-solving ability, for the following reasons. First, the concept of sustainable development is a manifestation of both critical thinking and a reflection on the existing social development model. Second, sustainable development is based on a relational perspective, since it involves dealing with the relationships between humans and ecology, different generations, and local and global.

Systematic thinking concerns the ability to recognize and understand inter-relationships, analyze complex systems, and consider how individual systems are embedded within different domains and scales [43]. Third, when sustainable development was first proposed, the UN had already established the need for partnerships and enhanced international co-operation to face mankind's common survival problems [47]. This ability to co-operate with others must be developed during the early years of childhood. Fourth, the ultimate goal of ESD is to develop the capacity to address non-sustainable issues and replace current non-sustainable habits and practices by developing creative solutions.

Regarding the Implementation construct, ESD should involve educational content and values, in addition to adaptive teaching approaches. The *DESD* states that 'Education for sustainable development is interdisciplinary, and uses a variety of pedagogical techniques that promote participatory learning and higher-order thinking skills' [36], and the *GAP on ESD* states that 'Designing teaching and learning in an interactive, learner-centred way that enables exploratory, action-oriented and transformative learning' [2]. Relevant studies have also pointed out that ECESD promotes taking children's perspectives and abilities seriously, so as to enable them to become problem finders, problem solvers, and actors in their lives through encouragement, support, and empowerment [48,49]. By synthesizing the above materials, we categorized three dimensions of the Implementation construct as child-centredness, child empowerment, and multiple synergies. In sum, we constructed a theoretical analytical framework for ESD to include four constructs and 14 dimensions, based on official UN documents [2,36–39] and related research (Figure 1).

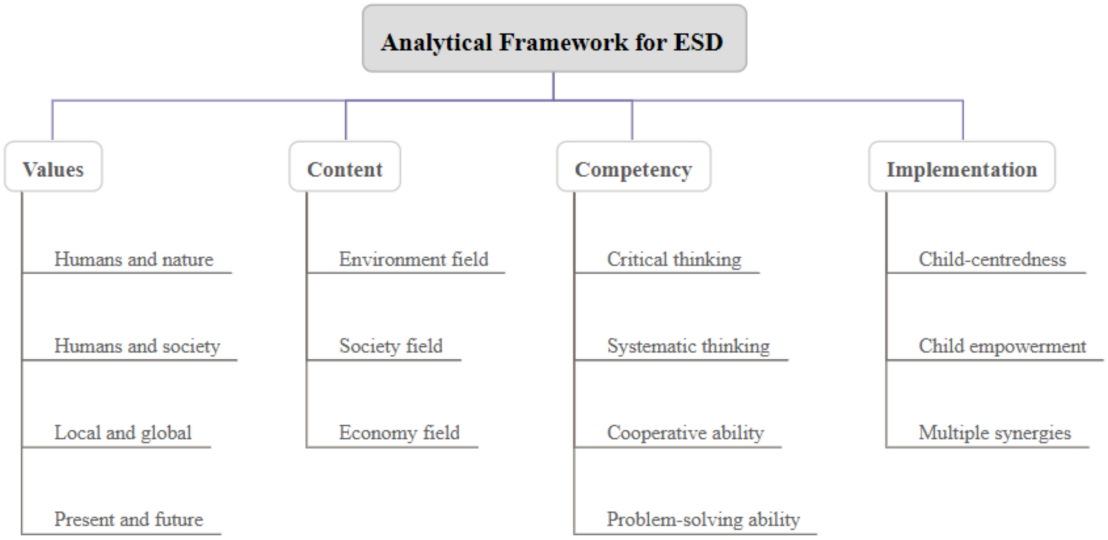

Figure 1. Analytical Framework for ESD.

3.2.2. The ECEESDPS

To further verify the theoretical analytical framework, we initially compiled 85 items (the item pool) based on the above dimensions. Then, we invited two professors, five doctoral students, and six master's students to evaluate each item. The evaluation criteria included items that had no repeated meanings, were concise and accurate expressions, reflected the theoretical conceptions, and could cover all dimensions. According to the experts' evaluation, we revised and initially resulted in a 72-item scale. In addition, the revised scale was sent to four principals and 15 early childhood educators for re-evaluation. The final version of the scale included the four constructs (Values, Content, Competency, and Implementation), 14 dimensions, and 63 items, including two reverse questions. Among them, 11 items concerned the Values construct (Qs. 1–11), 25 items concerned the Content construct (Qs. 12–36), 16 items concerned the Competency construct (Qs. 37–52), and 11 items concerned the Implementation construct (Qs. 53–63) to cover all the dimensions in the analytical framework (see Figures 2 and 3).

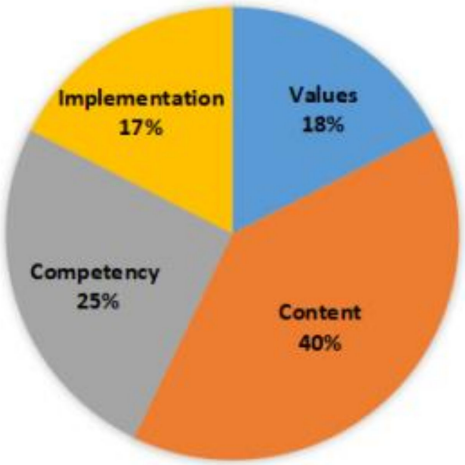

Figure 2. Coverage of items in each construct.

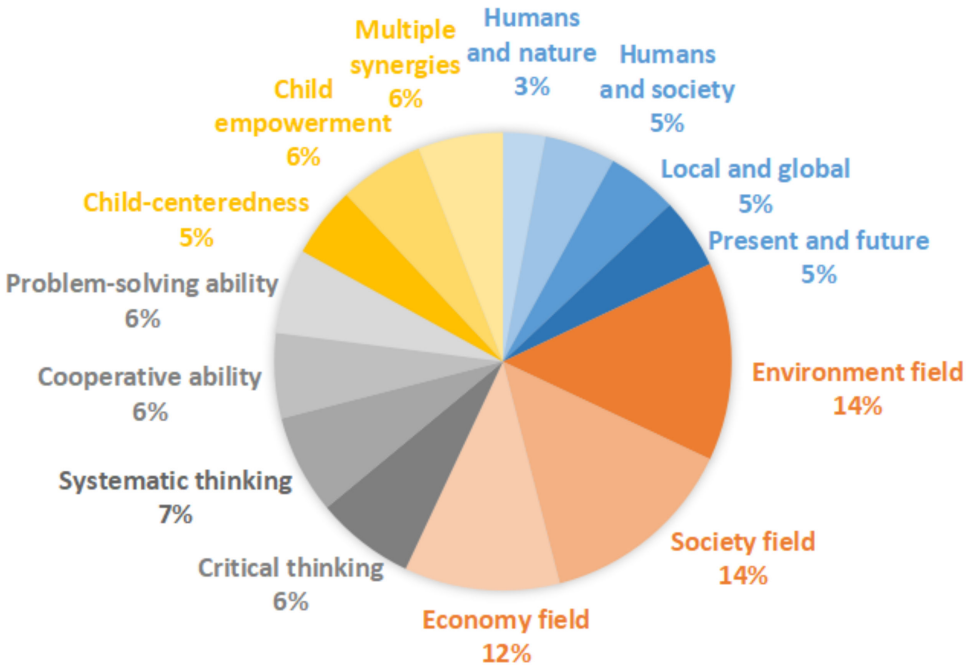

Figure 3. Coverage of items in each dimension.

The survey scale consisted of two sections. The first section was a demographic questionnaire that included the educators' gender, educational background, and teaching years. The second part was the ECEESDPS, which was rated using a 5-point Likert scale (1 = never, 2 = rarely, 3 = sometimes, 4 = often, and 5 = always) based on the respondents' personal experiences. The higher the average score for each dimension, the better the ESD practice was considered to be.

3.3. Procedure

The scale survey was created and conducted through the online survey platform, www.wjx.cn, accessed on 8 December 2021. Invalid data were selected and excluded according to the following standards: (1) it took less than 120 s to complete, (2) the answers of the scale had clear regularity, and (3) more than 90% of the options were the same. Then, we used IBM SPSS 22.0 software to conduct item analysis, exploratory factor analysis, and reliability analysis on the scale's pre-test data. We used MPLUS 7.0 software to perform CFA on the scale's formal survey data.

4. Results

4.1. Data Analysis

4.1.1. Item Analysis

The main purpose of the item analysis was to check the appropriateness or reliability of the scale's individual items. The analysis results could be used as a basis for screening or modifying each item. As a result, items 10 and 28 were deleted because the critical ratio of item 10 was 1.425, which was less than 3.000, and the significance was 0.155, which was greater than 0.05 [50]. The total correlation coefficient of item 28 was 0.375, which was lower than 0.4, indicating that the item was not homogeneous with the overall scale [50].

4.1.2. Exploratory Factor Analysis

We performed exploratory factor analysis on the pre-test data to investigate the structural rationality of the factors. According to the analysis results, the Kaiser–Meyer–Olkin (KMO) test result was 0.963 and Bartlett's spherical test value was χ^2 = 25,360.209, which showed a significance level of 0.01 or higher, indicating that the data had common factors and were suitable for factor analysis. Then, the factors were extracted by principal component analysis and varimax rotation. Stevens (1992) states that if there are more than 50 items in the factor analysis, then there is a possibility of extracting too many common factors; thus, the researcher should limit the number of factors extracted [51]. Since the number of items in our scale exceeded 50, four common factors were extracted based on the analytical framework described above.

As shown in Table 2, based on the factor analysis results, a total of seven items were deleted and 54 items (Appendix A) were retained by combining the following multiple screening criteria: (1) the factor loading of the item was less than 0.4, (2) the loadings of the problem items on more than two factors were less than 0.4, and (3) the number of items on a single factor was less than 3 [52]. We extracted a total of four factors; the cumulative variance contribution rate was 58.62%. The four constructs' eigenvalues were 21.57, 4.01, 3.79, and 2.28, respectively. According to the specific content of the items contained in each factor and the analytical framework of this study, we named the four extracted factors Values, Content, Competency, and Implementation, in that order.

4.1.3. Reliability Analysis

We focused on the scale's homogeneity reliability (Cronbach's alpha coefficient) and split-half reliability (Spearman–Brown coefficient). As shown in Table 3, the alpha coefficient of the total scale is 0.963, and of each factor are 0.921, 0.947, 0.943, and 0.933, respectively; all of which exceeded 0.9 [53]. The split-half reliability coefficient of the total scale is 0.856, and the split-half reliability coefficients of each factor range from 0.860 to 0.905 [54]. Therefore, our scale has good reliability.

4.1.4. Confirmatory Factor Analysis

We utilized AMOS 7.0 analysis software to test the stability of the factor structures. It has been noted that if there are too many items per scale dimension, then item parceling can be used. This means that two or more items from the same scale can be packaged into one indicator, and a synthetic score (total or mean) can be used as the new indicator for analysis. Since our scale included a large number of items, we adopted the packing method. The items under each dimension were randomly distributed in order, and the mean score of the items was taken and packaged into a group of items. The Values (10 items), Competency (14 items), and Implementation (11 items) constructs were packaged into three groups that included 3–4 items each; the Content construct (19 items) was packaged into four groups that included 4–5 items each.

Table 2. Exploratory factor analysis results (N = 613).

Item	Factor Loading				Extraction
	Values	Content	Competency	Implementation	
Q2	0.749				0.611
Q3	0.747				0.634
Q9	0.746				0.661
Q5	0.731				0.604
Q1	0.728				0.553
Q4	0.723				0.608
Q6	0.718				0.599
Q11	0.702				0.597
Q7	0.696				0.591
Q8	0.675				0.551
Q32		0.754			0.598
Q31		0.750			0.578
Q33		0.736			0.578
Q30		0.711			0.590
Q16		0.678			0.605
Q15		0.677			0.592
Q20		0.664			0.564
Q25		0.661			0.564
Q36		0.654			0.559
Q19		0.631			0.571
Q23		0.628			0.592
Q17		0.610			0.515
Q24		0.591			0.561
Q22		0.588			0.508
Q14		0.583			0.464
Q13		0.513			0.447
Q35		0.509			0.502
Q27		0.483			0.444
Q26		0.469			0.499
Q44			0.687		0.651
Q43			0.685		0.666
Q42			0.679		0.681
Q46			0.659		0.638
Q50			0.657		0.625
Q38			0.655		0.537
Q51			0.654		0.631
Q37			0.636		0.529
Q45			0.632		0.556
Q41			0.628		0.629
Q39			0.620		0.522
Q48			0.619		0.570
Q52			0.609		0.608
Q40			0.591		0.492
Q62				0.784	0.691
Q61				0.782	0.710
Q57				0.774	0.728
Q55				0.770	0.696
Q56				0.766	0.693
Q60				0.761	0.666
Q54				0.743	0.646
Q53				0.685	0.610
Q58				0.598	0.546
Q63				0.555	0.479
Q59				0.500	0.473

Note: The extraction method was principal component analysis. Rotation converged after 6 iterations.

Table 3. Reliability test results (N = 613).

	Number of Items	Cronbach α	Spearman–Brown
Total amount	54	0.970	0.856
Values	10	0.921	0.860
Content	19	0.947	0.892
Competency	14	0.943	0.870
Implementation	11	0.933	0.905

Then, we synthesized the analysis results according to the following indicators (see Table 4): χ^2/df of less than 2 indicates a good model fit, and less than or equal to 5 indicates an acceptable model fit. The root mean square error of approximation (RMSEA) of less than 0.05 indicates a good model fit; if it is in the range of 0.05–0.08, then it indicates an acceptable model fit [55]. Relative fit indices (GFI, IFI, NFI, RFI, CFI) closer to 1 indicate a good model fit, above 0.9 indicates an excellent model fit, and more than 0.8 means the model fit is acceptable [56].

Table 4. Confirmatory factor analysis results.

Indicator	χ^2/df	RMSEA	GFI	IFI	NFI	RFI	CFI
Sample n = 7287	27.360	0.060	0.963	0.978	0.977	0.970	0.978
Sample n = 800	4.700	0.068	0.943	0.969	0.961	0.948	0.969

When the sample size is 7287, then χ^2/df is 27.360, which is greater than 5. The RMSEA is 0.060, which is less than 0.08, so the fitness result is acceptable. The GFI, IFI, NFI, RFI, and CFI are all greater than 0.90, indicating the fitness result is acceptable. However, since the cardinality value is easily affected by the sample size, the larger the sample size, the larger the cardinality value ratio to the degree of freedom. Therefore, some studies have suggested that the overall fit of each fitting index should be examined comprehensively [57]. Based on this opinion, we randomly selected 800 samples from the 7287 total samples of our study and re-ran the CFA analysis. The results showed that $\chi^2/df = 4.700 < 5$; RMSEA = 0.068 < 0.08; and the relative fit indices (GFI, IFI, NFI, RFI, CFI) are all greater than 0.90. Therefore, the theoretical model fits the data statistically by combining several indicators, and indicates a reasonable theoretical structure.

4.2. Data Results

Overall, our self-developed scale had acceptable reliability and validity, and could be used as a valid tool to measure educators' ESD practices. We then analyzed data from 7287 formal scales to assess the general situation of early childhood educators' ESD practices and the differences in demographic variables.

4.3. Descriptive Analysis

4.3.1. Formatting of Mathematical Components

Table 5 shows the total mean and standard deviation (SD) of the early childhood educators' ESD practices. The total mean of all items is 4.270, and the mean scores of the four constructs are 4.810, 3.995, 4.142, and 4.418; all of which are greater than the theoretical mean of 3. This indicates that the early childhood educators' current ESD practices are generally at an upper-middle level. In particular, the Values score is the highest (M = 4.810, SD = 0.402) followed by that of Implementation (M = 4.418, SD = 0.571). However, the Competency (M = 4.142, SD = 0.629) and Content (M = 3.995, SD = 0.677) scores are relatively low.

Table 5. Statistical characteristics of the educators' overall characteristics.

	M ± SD
Total Amount	4.270 ± 0.480
Values	4.810 ± 0.402
Content	3.995 ± 0.677
Competency	4.142 ± 0.629
Implementation	4.418 ± 0.571

As shown in Figure 4, in the Values construct, 'humans and nature' (M = 4.840, SD = 0.426) and 'humans and society' (M = 4.834, SD = 0.400) have higher scores, whereas 'local and global' (M = 4.759, SD = 0.501) and 'present and future' (M = 4.822, SD = 0.455) have lower scores. In the Content construct, 'environment field' (M = 4.130, SD = 0.690) and 'society field' (M = 4.130, SD = 0.714) have higher scores, and the 'economy field' (M = 3.701, SD = 0.832) dimension has a lower score. In the Competency construct, 'collaborative ability' (M = 4.224, SD = 0.685) and 'problem-solving ability' (M = 4.173, SD = 0.715) have higher scores, and 'critical thinking' (M = 4.140, SD = 0.667) and 'systematic thinking' (M = 4.059, SD = 0.701) have relatively lower scores. In the Implementation construct, 'child-centredness' (M = 4.514, SD = 0.590) and 'multiple synergies' (M = 4.395, SD = 0.623) have higher scores, whereas 'child empowerment' (M = 4.370, SD = 0.646) has a lower score.

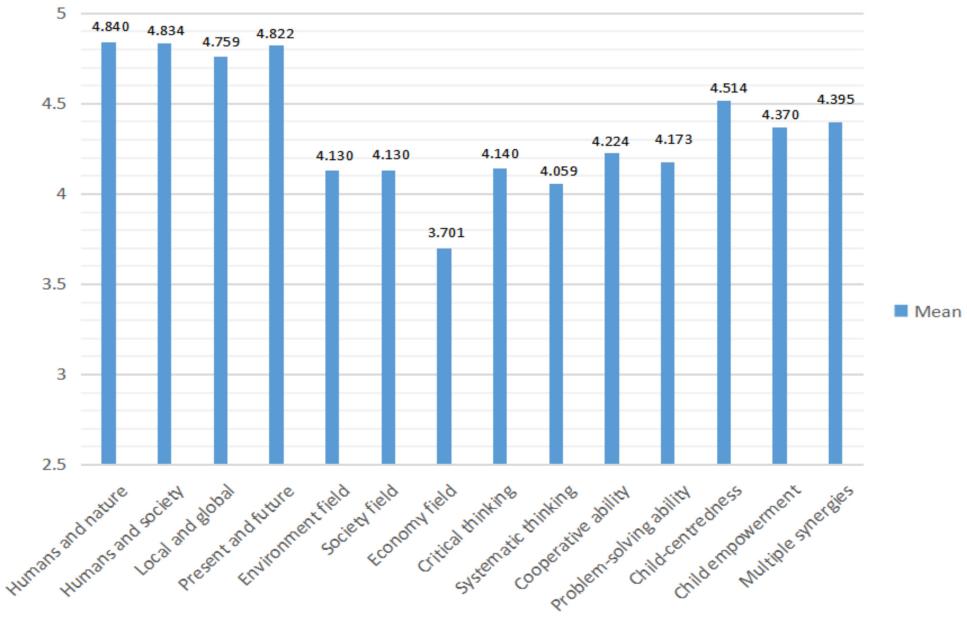

Figure 4. Comparison of mean scores of 14 dimensions.

Meanwhile, the mean scores of all 14 dimensions are higher than the theoretical mean of 3. Among all the dimensions, 'humans and nature', 'humans and society', 'present and future', and 'local and global' score relatively higher, and all are over 4.5. In comparison, 'economy field' and 'systematic thinking' show lower scores.

4.3.2. Difference Analysis

To further analyze early childhood educators' EDS practices, we conducted an independent samples *t*-test and a single factor analysis of variance (ANOVA) using gender, educational background, and teaching years as the independent variables and the four scale constructs (Values, Content, Competency, and Implementation) as the dependent variables. According to the independent samples *t*-test (Table 6), in terms of gender, the male scores are significantly lower than the female scores for Implementation ($t = -2.058$, $p = 0.040 < 0.05$, 95% CI [−0.1455, −0.004]). There are no significant differences in the scores

for Values (t = 0.163, p = 0.871, 95% CI [− 0.049, 0.058]), Content (t = −1.196, p = 0.232, 95% CI [−0.144, 0.035]), and Competency (t = −1.689, p = 0.091, 95% CI [− 0.155, 0.012]).

Table 6. Gender differences.

	Male	Female	T
Values	4.815 ± 0.393	4.810 ± 0.402	0.163
Content	3.942 ± 0.645	3.996 ± 0.678	−1.196
Competency	4.072 ± 0.618	4.144 ± 0.629	−1.689
Implementation	4.342 ± 0.571	4.421 ± 0.571	−2.058 *

Note: *: $p < 0.05$.

The ANOVA indicated significant differences in the four constructs among the early childhood educators who have different educational backgrounds ($p < 0.001$). To further analyze the differences in educational background, we conducted a post hoc analysis through a least significant difference (LSD) test. The results are as follows: Values shows 2, 3 > 1; 2, 3 > 4. Content shows 2, 3 > 4. Competency shows 2, 3 > 4. Implementation shows 2, 3 > 4 (Table 7).

Table 7. Educational background differences.

Educational Background	Values		Content		Competency		Implementation	
	M	SD	M	SD	M	SD	M	SD
Postgraduate degree (1)	4.624	0.585	3.932	0.590	4.013	0.688	4.346	0.673
Undergraduate degree (2)	4.842	0.356	4.064	0.672	4.174	0.623	4.470	0.557
Specialized degree (3)	4.822	0.397	4.037	0.649	4.174	0.602	4.452	0.551
High school education (4)	4.764	0.441	3.861	0.709	4.060	0.668	4.315	0.603
F	15.524 ***		37.711 ***		16.346 ***		31.751 ***	
Post analysis	2, 3 > 1 2, 3 > 4		2, 3 > 4		2, 3 > 4		2, 3 > 4	

Note: ***: $p < 0.001$.

Furthermore, the ANOVA shows significant differences in the ESD practice scores across the Values, Competency, and Implementation constructs for the early childhood educators who had different years of teaching experience ($p < 0.001$, $p < 0.05$). However, there is no significant difference in the scores for the Content construct. To further analyze the differences caused by years of teaching experience, we conducted post hoc analysis through LSD. The results are as follows: Values shows 1 < 2, 3, 4; Competency shows 1, 2 < 4; and Implementation shows 1 < 2, 3, 4 (Table 8).

Table 8. Teaching years differences.

Teaching Years	Values		Content		Competency		Implementation	
	M	SD	M	SD	M	SD	M	SD
Below 5 years (1)	4.790	0.426	3.980	0.707	4.124	0.644	4.384	0.585
6–10 years (2)	4.834	0.365	4.003	0.648	4.136	0.621	4.447	0.558
11–15 years (3)	4.845	0.356	4.044	0.654	4.167	0.612	4.473	0.543
Over 16 years (4)	4.825	0.387	4.000	0.628	4.187	0.598	4.460	0.552
F	87.128 ***		1.932		3.761 *		10.361 ***	
Post analysis	1 < 2, 3, 4				1, 2 < 4		1 < 2, 3, 4	

Note: *: $p < 0.05$, ***: $p < 0.001$.

5. Discussion

The purpose of this study was to develop an appropriate measurement tool to investigate Chinese early childhood educators' current ESD practices. Our survey found that

Chinese early childhood educators embodied the basic ideas of ESD in their daily teaching. This section discusses the factors that influenced the study results.

5.1. The ECEESDPS Is Reliable and Contextually Appropriate

We developed and validated the Early Childhood Educators' ESD Practices Scale, which has acceptable reliability and internal consistency. The scale has four constructs that cover values, educational content, competency development, and teaching methods related to ESD. It provides a comprehensive and systematic analytical framework for assessing ESD practices, which can help stakeholders understand the current situation and identify and solve problems, so as to promote the popularization and in-depth exploration of ESD.

5.2. Analysis of Factors Influencing Educators' Current ESD Practices

The survey results indicate that early childhood educators' ESD practices are generally positive. Among the four constructs, Values has the highest score. This may be because the Chinese government has promoted and implemented the SDGs. In particular, China's *Agenda 21* aims to:

'Strengthen cultural propaganda and scientific popularisation activities, organise the preparation and publication of popular science books, use mass communication media such as newspapers, movies and radio to conduct cultural propaganda and public education, hold various types of short training courses to raise the cultural and scientific level and sustainable development awareness of the entire population, and strengthen theoretical and moral education on sustainable development' [27].

This reflects the relevant requirement of UNESCO documents that governments need to use various approaches to communicate the SDGs to the public, such as policies, the Internet, books, and conferences [1,2]. Thus, the above measures have increased public awareness of and support for the SDGs, and provided a basis for subsequent engagement and action. This helps to explain why early childhood educators teach the values related to SDGs based on appropriate conditions during their daily teaching. In addition, of the four dimensions of the Values construct, the first two dimensions that have higher scores are related to the individual, which reflects that the educators' primary goal is to promote the development of the individual rather than promote sustainable natural, social, global, and even intergenerational development. However, the goal of ESD is not only to promote individual growth and development, but also to achieve sustainable development in the social, economic, and environmental fields through the role of individuals. As the *GAP on ESD* notes, 'To create a world that is more just, peaceful and sustainable, all individuals and societies must be equipped with and empowered by knowledge, skills and values as well as be instilled with a heightened awareness to drive such change' [2].

The higher score for the Implementation construct may stem from several factors. First, in recent years, preschool education in China has been influenced by the educational theories of scholars such as Froebel, Dewey, and Montessori [58–60]. These theories generally concern respect for children, child-centredness, and the integration of multiple approaches and resources, which are compatible with ESD to some extent. Some studies have analyzed how Dewey and Montessori's educational theories and associated ESD ideas correspond to the ideas within early childhood education theory [61,62]. Some studies have also pointed out that the basic principles of child-centredness and child consciousness have already been established in Chinese early childhood education theory [63,64].

Furthermore, the Chinese government has issued some important policy documents in recent years to guide educators' practical activities, such as the Guideline for Kindergarten Education, the Regulations for Kindergarten Work, and the Guidelines for Learning and Development of Children Aged 3–6. These documents not only indicate the basic philosophy and principles of preschool education in China, but also contain values related to ESD. They also assert that early childhood education should respect the rights of young children, focus on co-operation with families and communities, and emphasize the idea of

multiple educational approaches. Since these statements are compatible with ESD, they can help to implement ESD.

However, among the construct's three dimensions, child-centredness and multiple synergies had higher scores, whereas child empowerment had lower scores. The *GAP on ESD* states that ESD is grounded in a rights-based approach to education [2]. Relevant research also suggests that ESD empowers children by valuing, encouraging, and supporting them to become problem finders, solution providers, and actors in their own lives [49]. Thus, teachers need to actively empower children and regard them as agents and participants of change when practicing ESD.

The lower scores for the Competency construct may be related to the neglect in China's early childhood education policies. These policies currently focus more on the development of some basic competencies (e.g., self-care, physical movement, social adaptation, language expression, handling, and daily observation) than on critical thinking and systematic thinking. In addition, among the construct's four dimensions, co-operative ability and problem-solving ability had higher scores, whereas critical thinking and systematic thinking had lower scores. This may be because the Chinese kindergarten curriculum contains goals to promote children's social and linguistic communication skills in the social and language domains, and children's investigative and problem-solving skills in the science domain. Furthermore, critical thinking and systematic thinking receive less frequent mentions. However, the UNESCO document states that critical thinking and systematic thinking are key competencies needed for learners to become sustainable citizens and should be the main focus of ESD [65].

ESD involves knowledge of a wide range of ecosystems and human systems and can be divided into three fields: environment, society, and economy [2,36,37]. The current educational content covers the three fields mentioned above. This relates to the wide range of sources of early childhood education content, which can be divided into five domains: health, language, social, science, and art. These domains cover many aspects of children's lives and thus have some overlap with ESD. For example, the science domain covers natural resources and the growing of plants and animals, and the social domain includes compliance with social norms, solidarity, and friendliness, which are also important components of ESD.

However, Content has the lowest score of the four constructs. This may be because although educators practice relevant content during their teaching, the pre-existing content is the most compatible with the SDGs (e.g., exposure to natural materials and understanding of local culture), whereas specific content that is related to sustainable development (e.g., production and consumption, environmental issues, human rights, and multiple cultures) is less frequently involved. Moreover, among the three dimensions of this construct, the environment and society fields had higher scores, whereas the economy field had the lowest score. This result is not only consistent with the findings of related studies [20], but also correlates with the history of valuing nature and society in the theories that Chinese early childhood education is based on. For example, although the theories of Froebel, Dewey, and Chen Heqin advocate the importance of educational resources from natural and social aspects, they do not concern the economy field.

6. Conclusions, Limitations, and Implications

This study established a newly developed and validated instrument to assess early childhood educators' ESD practices in Shandong Province. The findings suggest that the ECEESDPS is a reliable and valid scale that contains four constructs: Values, Content, Competency, and Implementation. The statistical results show that educators' scores are generally positive, with relatively higher scores for Values and Implementation, and lower scores for Competency and Content. This relates to a variety of influences such as traditional early childhood education theory and early childhood education policies in China. Furthermore, the results of the independent samples *t*-test and ANOVA reveal that

educators' ESD practices vary according to gender, educational background, and teaching years (Figure 5).

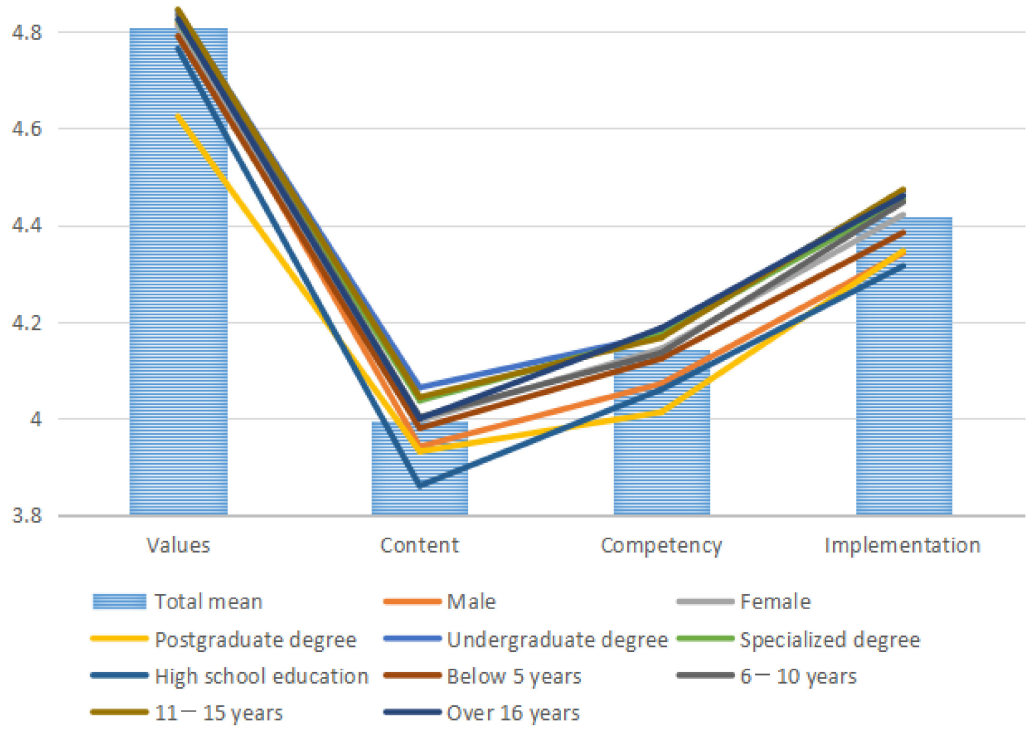

Figure 5. The general situation of early childhood educators' ESD practices.

This study has several limitations. First, we only investigated one province with a medium level of economic development; thus, our results are not sufficiently representative of the overall situation in China. In the future, more and less economically developed provinces should be selected to supplement some nationwide surveys. Second, we investigated ESD practices using four constructs (Values, Content, Competency, and Implementation), which are not comprehensive enough. For example, we did not involve other aspects, such as the construction of kindergarten environments, the management policy of kindergartens, and the use frequency of different implementation methods. Third, we did not conduct a weighted analysis of the analysis framework of ESD to determine the importance of each dimension. Moreover, we chose a quantitative approach to allow the educators to self-rate their ESD practices. The items described situations related to ESD and allowed participants to rate them based on their own experiences. In the future, this could be combined with an observational approach to investigate educators' daily teaching practices from a more objective perspective.

Nonetheless, this study has some important practical implications. First, it is the first study to assess the current situation of early childhood educators' ESD practices in China. By analyzing the characteristics of the current situation and revealing the problems and influencing factors, the research can provide a realistic basis for subsequent improvements. Second, this study's theoretical ESD framework analysis can provide a reference for policymakers and researchers to promote the popularization and progress of ECESD. Furthermore, we developed our scale based on the theoretical analysis framework, and it can be used as a valid research tool to investigate ESD practices. In addition, based on the survey results, we found that although educators embodied ESD in their teaching, there were differences in the scores of each dimension. Therefore, a multidimensional approach is needed to systematically enhance the cognitive and practical skills of early childhood educators to promote the achievement of ECESD.

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Informed Consent Statement: Informed consent was obtained from all individual participants included in the study.

Data Availability Statement: The data supporting the results of this study have been uploaded and are available from the corresponding author.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. The ECESDPS.

Construct	Dimension	Items	
Values	Humans and nature	1.	We should be close to nature and protect it
		2.	Social development should be accompanied by the protection of the environment
	Humans and society	3.	Be willing to socialize with others and be close to society
		4.	People should be united and friendly, cooperate and help each other
		5.	Care for public property and the public environment
	Local and global	6.	Our life is closely connected with the world
		7.	We love our homeland and are willing to understand and respect the cultures of other nations and countries
		8.	We accept and respect people with different living habits compared to our own
	Present and future	9.	We should protect and transmit the excellent traditional culture
		10.	We should leave a beautiful global environment to next generations
Content	Environment field	11.	Play with natural materials, such as water, sand and soil
		12.	Information about the impact of natural phenomena such as climate and temperature changes on our lives
		13.	Engage children in caring for animals/plants
		14.	Guide children to take action to improve the environmental problems around them
		15.	Discuss the impact of different transportation tools on nature
		16.	Learn about the life cycle of plants and animals (e.g., birth, aging, sickness and death) and learn to care for life
		17.	Organize discussions on environmental issues in their lives
	Society field	18.	Introduce the customs and habits of different regions and ethnic groups in China, such as costumes, festivals, etc.
		19.	Introduce buildings or places with local characteristics
		20.	Introduce the cultural contents of different countries and nations, such as architecture and festivals
		21.	Encourage children to get in touch with different people, such as different ages and occupations
		22.	Communicate to children that all people are equal, regardless of gender, ability, or occupation
		23.	Flexible adaptation of activities for children with special needs

Table A1. *Cont.*

Construct	Dimension	Items
	Economy field	24. Recycling of resources (materials), such as paper, water, etc. 25. Activities related to the production of goods or objects, such as the production of food and clothing
		26. Discuss or observe buying and selling activities in local shopping stores, supermarkets, and other commercial establishments 27. Activities related to the reorganization or distribution of resources (materials), such as donations, swaps, etc. 28. Activities related to consumption or shopping, such as organizing children's participation in the purchase of goods 29. Activities related to renewable energy, such as solar energy, wind energy, new energy vehicles, etc.
Competency	Critical thinking	30. Think independently without being influenced by others 31. Dare to express different views and state reasons for them 32. Dare to question or deny without trusting blindly 33. Can distinguish between facts and opinions, e.g., "It's raining today" is a fact and "I like rainy days" is an opinion
	Systematic thinking	34. Ability to collect information from multiple ways 35. Ability to find obvious connections between things 36. Ability to speculate about the consequences of events (actions) 37. Ability to connect different aspects of things and think them together
	Cooperative ability	38. Ability to cooperate with others in the division of tasks 39. Ability to negotiate and discuss with others 40. Ability to coordinate partnerships
	Problem-solving ability	41. Analyze the causes of problems 42. Trying to come up with solutions when faced with problems 43. Ability to practice and reflect on solutions
Implementation	Child-centeredness	44. The activities pay attention to the interests of children 45. The activities reflect the physical and mental development characteristics of children 46. The contents of the activities are integrated with children's daily life
	Child empowerment	47. Children are given the right to choose their own activity materials 48. Children are given the right to participate in the activities themselves 49. Children are given the right to make suggestions on curriculum activities 50. Children are given the right to make decisions on the content of the curriculum
	Multiple synergies	51. Diverse teaching methods are used in the activities 52. The activities are integrated with the contents of different fields. 53. A variety of materials are used in the activities 54. Multiple participants, including parents and community members, are encouraged to participate in the activities

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