Theory and Practice of a Chinese Pre-primary Education Indicator System

Liyan Huo, Qiangqiang Sun, and Hengbo Hu

Abstract It is an urgent and significant matter to build a Chinese pre-primary education indicator system. This system is expected to have both Chinese standpoints and international perspectives, and to be used to systematically guide and scientifically evaluate pre-primary education in China. This study, based on the internationally popular CIPP evaluation model, describes, explains, juxtaposes, and compares the pre-primary education indicator systems from the OECD, the UNESCO, the US, the UK, and other major international organizations and countries. The authors propose the theoretical framework of a Chinese pre-primary education indicator system, which includes factors such as background, input, process and output, the 10 first-level indicators (demographic characteristics, social welfare, the management system, resource allocation, curricular activities, kindergarten management, the teaching force, family support, the popularization of education, and child development), and 63 second-level indicators. In conclusion, the theoretical framework offers a value-oriented instrument for establishing the development goal of pre-primary education development in China, a structural instrument for a complete understanding of the current situation of China's pre-primary education, a methodological instrument for the scientific supervision and evaluation of China's pre-primary education, and a universal instrument for China's international exchanges and cooperation in the field of pre-primary education.

Keywords CIPP evaluation model · Pre-primary education · Education indicators

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A pre-primary education indicator system is a fundamental instrument for scientifically guiding and systematically assessing pre-primary education development using standardized and systematic impact factors. Within the current background of "ensuring people's access to childcare" and "improving pre-primary education," the development of the Chinese pre-primary education indicator system with Chinese standpoints, international perspectives and adhering to internal regularity of education, has become a major problem to be resolved. This paper attempts to employ the internationally recognized CIPP evaluation model as the theoretical framework, compare pre-primary education indicators of major international organization and countries, and establish the theoretical construct to guide the development of a systematic and sustainable pre-primary education indicator system with theoretical support, systematic analysis, process monitoring, development-orientation and driving force from reforms. This indicator system, with Chinese standpoints and Chinese discourse, is expected to serve the need of policies, promote reforms, facilitate international exchanges and tell Chinese stories to the world.

1 CIPP Evaluation Model and Development of the Pre-primary Education Indicator System

The theoretical framework informing the development of a pre-primary education indicator system must be internationally recognized and be suitable for its designated country. Although scholars have different ideas concerning the theoretical framework of the educational indicator system, currently most subscribe to the CIPP evaluation model formulated by the famous American scholar D. Stufflebeam in the 1960s; it is a comprehensive and dynamic system including context evaluation, input evaluation, process evaluation, and product evaluation. Stufflebeam pointed out that the ultimate purpose of education 'evaluation is not to demonstrate the attainment of educational goals but to improve education plans and education quality through evaluation (Huo 2000, p. 290).

The CIPP model informs the development of the indicator system in four ways. First, it further develops people's understanding regarding educational background, namely the relation between education and society, politics, economics, culture, and population; it expounds on the relation between education and society, and constitutes the examination of the decisive factors influencing education development, finding that the factors deciding education development exist not on campus, but off-campus. Second, it deepens people's understanding of education investment, namely the conditions of education implementation, education budget, and equipment. It analyzes the condition and factors that guarantee education development, and constitutes the examination of condition and factors that guarantee education development, finding that resource allotment and teacher team are the basic conditions for education quality. Third, it develops people's understanding of the education process, namely the efforts of schools, teachers, and parents in the education

process. It considers the qualitative factors that guarantee education development, and constitutes the examination of the inclusive factors affecting education development: process quality is the core of education quality and the sustained pursuit of education quality via improvement of the education plan. Fourth, it deepens people's understanding of education product, namely the education popularization level and child development level. It can evaluate the effectiveness of education development and constitutes the structural and developmental examination of education product, which is high-quality equity and quality with equity are eternal themes of education reform and development.

At the same time, it can be seen that the CIPP evaluation model guides us to view pre-primary education as an important part of social development, particularly as an important part of the social public service system. Thus pre-primary education evaluation should investigate the systematic impact of social, political, economic and cultural factors on pre-primary education, and investigate whether and how pre-primary education meets the demand of socio-political, economic and cultural development. It also guides us to view the pre-primary education resources offered by the government as the precondition of pre-primary education development. For this reason, pre-primary education evaluation should investigate the investment for school facilities and teachers as well as student expenditure per capita, and investigate whether and how the government resources are effectively being utilized, guide us to regard rationality, feasibility, and suitability as the core elements in pre-primary education quality. Therefore, pre-primary education evaluation should attach importance to curriculum plans and teaching plans, and sustained improvement of curriculum plans and teaching plans. It should guide us to regard the product evaluation of pre-primary education as an instrument for process improvement rather than an accreditation system. For this reason, the pre-primary education evaluation should focus on providing large amounts of rich, directional and practical information for national educational policy-making departments, educational management institutions, schools, as well as education evaluation institutions, and through this improve education process (Poliandri et al. 2010). The pre-primary education evaluation system guides countries to regard pre-primary education evaluation as a form of continuous feedback of pre-primary education results rather than a final report. Pre-primary education evaluation should make timely use of the information obtained from the continuous evaluation results to make suggestions for pre-primary education programs.

As demonstrated above, the CIPP evaluation model can help us understand, analyze and reformulate the factors in and out of the pre-primary education system as well as their impact on pre-primary education development, and it may become the most influential construct model to guide the development of our pre-primary education indicator system (Nuttall 1990).

2 Comparison of International Pre-primary Education Indicator Systems Using CIPP Evaluation Model

The studies concerned with indicator systems mainly include comparative studies, such as Education at a Glance, supervisory frameworks, Proposal for Key Principles of a Quality Framework for Early Childhood Education and Care, in addition to other development reports, such as Report of Education Development from Pre-primary to College 2015. Although these indicator systems have different goals, they can all be used to evaluate the development of pre-primary education development.

In recent years, many influential international organization and countries established pre-primary education indicator systems that incorporate common principles and their own characteristics (Scheerens 1990). They do that by combining diagnostic, formative and summative evaluation organically (Stufflebeam and Kellaghan 2003). These indicator systems have a positive and far-reaching impact on the education strategic planning and research of the current situation in different countries in the world, which lead these countries to set reasonable education development goals, scale, quality, and speed, and provide the education policymakers in these countries with value guide, as well as indicator introduction and data support.

This research adopts the CIPP evaluation as the basic framework of comparative analysis. It further adopts educational background, educational input, educational process, and educational product as the main dimensions. It compares and analyzes the pre-primary education indicator systems of international organizations and countries with international influence, so as to inform the construction of the Chinese pre-primary education indicator system. We chose 12 international indicator systems[1] with authority and representativeness, used the MAXQDA (MAX Qualitative Data Analysis) to conduct open coding and relational coding of the four dimensions of the CIPP; this is education background, education input, education process and education product, juxtaposed and compared the pre-primary education indicators of major international organizations and countries while exploring and perfecting the categories. The research used the "line-by-line analysis" method to analyze the pre-primary education indicators in the 12 samples, conceptually sorts all the indicators and gave each an independent code, and generated 203 independent codes at the open coding stage. After the open coding process, we conducted the first

[1](1) *Education at Glance*, published by OECD in 2015, coded O1; (2) *Starting Strong II: Early Childhood Education and Care* published by OECD, coded O2; (3) *Starting Strong IV: Monitoring Quality in Early Childhood Education and Care*, published by OECD, coded O3; (4) *Holistic Early Childhood Development Index*, published by UNESCO, coded U; (5) *Proposal for Key Principles of a Quality Framework for Early Childhood Education and Care*, published by EU, coded EU; (6) *Starting Well: Benchmarking Early Education across the World*, published by Economist Intelligence Unit, coded I; (7) *The State of Preschool—Preschool Yearbook 2015*, coded Al; (8) *Using the Early Years Evaluation Schedule*, coded E; (9) *International Comparison of Education Indicators*, published in Japan in 2013, coded J; (10) *National Plan of Action for Children*, published in India by Department of Women and Child Development, coded D; (11) *Education and Training Indicators*, published in Australia, coded AU; (12) *Development Report of Education from Pre-primary to College 2015 (Coûts, activités, résultats. Synthèses statistiques)*, published in France, coded F.

round of relational coding. This consisted of clustering the concepts generated in open coding. In this process, the researchers classified all materials, consolidated similar materials in the coding system, contrasted and compared the codes generated in the open coding phase, and grouped codes into categories, so that these categories have the biggest inner homogeneity and external heterogeneity. The researchers extracted 25 subcategories, such as a number of population, population structure, child protection, mother benefits, government management, government evaluation, from the 203 indicators. For example, "quality of indoor and outdoor learning environment," "promotion of equality and diversity," "inclusive environment" are classified into "curriculum environment." Later, the second round of relational coding generated 10 primary categories out of the 25 subcategories, such as "demographic characteristics," "social welfare," "government management," "resource allocation," "curriculum activities," "kindergarten management," "teacher team," "family support," "education popularization" and "child development." Finally, the third round of relational coding clustered four dimensions out of the 10 primary categories, including background, input, process, and product. The details are listed below.

2.1 Categories and Indicators of Education Background Dimension

According to the coding results, there are 32 occurrences in the indicator "education background" dimension. This can be categorized into "demographic characteristics" and "social welfare." The "demographic characteristics" category includes "population number" and "population structure." The "social welfare" category includes "child protection" and "mother benefits," as shown in Table 1.

2.2 Categories and Indicators of Educational Input Dimension

According to the coding results, there are 50 occurrences in the indicators of "education input" This can be divided into two categories. These are "government management" and "resource allocation." The "government management" category includes "explicit government management" and "government supervision and evaluation." The "resource allocation" category includes "expenditure input" and "material input," as shown in Table 2.

Table 1 Categories and indicators of educational background dimension

Dimensions	Primary category	Secondary category	Occurrence	Secondary indicators
D1 Background dimension	D1-1 Demographic characteristic	Number of population	7	Birth rate (O2); total population of the country (O2); birth certificate (U); birth registration (U); under-five mortality (F); rural population development (F); child number and family condition (EU)
		Population structure	4	Adult literacy (F); poor child ratio (O2); female labor participation (O2); under-six population (O2)
	D1-2 Social welfare	Child protection	14	Comprehensive prevention and medical service (O2); gender equality (O2); prevention of malnutrition (F); vaccination rate (F); monitor and feedback of growth and nutrition (U); compliance with the *United Nations Convention on the Rights of the Child* (U); child health (D); fight against illegal child transaction (D); protect disadvantaged children (D); fight against child labor (D); nutrition, water, and health (D); safeguard poor children (O3); children's freedom from domestic violence (O3); support for dropout and minority language children (A)

(continued)

Table 1 (continued)

Dimensions	Primary category	Secondary category	Occurrence	Secondary indicators
		Mother benefits	7	Mother benefits (O3); formal education of mothers (O3); policies to help poor families (O3); pregnant and maternal leave (D); pregnancy and delivery services (U); mother's health (D); work participation rate of mothers of children aged below 6 (O2)

2.3 Categories and Indicators of Educational Process Dimension

According to coding results, there are 84 occurrences of "education process" indicators, which included four categories. These include "curriculum activity," "kindergarten management," "teacher team" and "family support." The "curriculum activity" category includes "curriculum environment," "curriculum content" and "curriculum methodology." The "kindergarten management" category includes "management leadership" and "evaluation of improvement." The "teacher team" category includes "number of teachers," "teacher structure," "teacher benefits," "teacher training," and "teacher capability." The "family support" category includes "parent-kindergarten communication" and "parent-kindergarten cooperation," as shown in Table 3.

2.4 Categories and Indicators of Educational Product Dimension

According to coding results, there are 37 occurrences of "educational product," which can be divided into "education popularization" and "child development." The "education popularization" category includes "kindergarten enrollment rate" and "popularization of service." The "child development" category includes "academic achievement," "physical and mental health," and "learning quality." This is shown in Table 4.

Table 2 Categories and indicators of educational input dimension

Dimensions	Primary category	Secondary category	Occurrence	Secondary indicators
D2 Investment dimension	D2-1 Government management	Explicit government management	3	Clear stake-holder role (EU); access to kindergarten education as legal rights of children (EU); strategies of pre-primary children development by government (F)
		Government supervision and evaluation	3	Supervision and evaluation maximize children's rights and interest (EU); provide information of local, regional and national levels via supervision and evaluation (EU); establish universal pre-primary education funded by public fiscal support via supervision and evaluation as well as funding support

(continued)

Table 2 (continued)

Dimensions	Primary category	Secondary category	Occurrence	Secondary indicators
	D2-2 Resource allocation	Expenditure input	35	Total pre-primary education funding (O1); average pre-primary education funding per capita (O1); proportion of fiscal expenditure for pre-primary education in GDP (O1); proportions of public and private expenditure for pre-primary education (O1); total expenditure of the country and types of expenditure (F); education expenditure per capita (F); proportion of pre-primary education expenditure in GDP (F); average pre-primary education funding per capita (J); proportion of pre-primary education funding in fiscal expenditure (J); purposes of education expenditure (J); GDP and the proportion of school education expenditure (J); government expenditure and proportion of pre-primary education in public fiscal funding (J); proportions of public and private expenditure (J); average public fiscal expenditure for education per capita (E); total expenditure of pre-primary education and its proportion in GDP (E); average education expenditure for child per capita (E); total public expenditure for pre-primary education (E); proportion of education funding in GDP (E); investment in pre-primary education service (O2); service investment for children aged under 3 who are not enrolled in kindergarten (O2); social expenditure of pre-primary education (O2); average expenditure of parents (O2); average unit cost of pre-primary children (O2); social expenditure of pre-primary education (O2); government investment in pre-primary education (I); fees charged by private kindergartens (I); subsidies for underprivileged families (I); fiscal management of pre-primary education (O3); government investment in pre-primary education (EU); family investment in pre-primary education (EU); pre-primary education investment (EU); cost of preliminary projects of states (A); number of states whose projects require the providers' funding match that of donors for the projects (A); average expenditure of state budget for enrolled children per capita (A); total pre-primary education expenditure in all states (A)
		Material input	9	Indoor and outdoor space (U); health, hygiene, safety, learning and game materials (U); improved drinking water and hygiene equipment (U); work condition (U); food service and monitoring (D); maximum class scale (3 and 4 years old) (D); school facility (D); environment inclusion can facilitates the raise of child learning ability (AU); teaching condition (F)

Table 3 Categories and indicators of educational process dimensions

Dimensions	Primary category	Secondary category	Occurrence	Secondary indicators
D2 Process dimension	D2-1 Curriculum activity	Curriculum environment	4	Quality of indoor and outdoor learning environment (E); promote equity and diversity (E); environment inclusion can facilitate the improvement of child learning ability (AU); teaching condition (F)
		Curriculum content	8	Curriculum orientation (I); health and safety guide (I); early learning standard (A); realize potential through overall development (EU); create a curriculum based on education goals, value, and methods (EU); promote child health (AU); curriculum includes healthy food and body movement (AU); integrated learning framework that promotes child learning and development (AU)

(continued)

Table 3 (continued)

Dimensions	Primary category	Secondary category	Occurrence	Secondary indicators
		Curriculum methodology	18	Create an environment for child participation (D); create child game opportunity (D); protect child safety (AU); degree to which caregivers support children learning (AU); attentive attitude and reflection of educators in designing and implementing curriculum (AU); respect and equality between teachers and children (AU); facilitate children's autonomous learning (E); degree of safeguarding and promoting children's benefits (E); extra learning for children based on their need (E); the degree to which care-givers help children learn and develop (E); encourage children to develop actions that satisfy their own needs and those of others (E); create plans for each child (E); linkage between kindergarten and primary school (E); curriculum implementation (O3); response to children's individual need (O3); practice appropriate to children's age (O3); teaching (O3), the curriculum encourages cooperation among teachers, children and colleagues, and parents (EU)

(continued)

Table 3 (continued)

Dimensions	Primary category	Secondary category	Occurrence	Secondary indicators
	D2-2 Kindergarten management	Management leadership	10	Effective management system (AU); effective kindergarten leadership (AU); teachers possess ethics (AU); kindergarten management and leadership (E); the average amount of time at pre-primary education organization (E); main modes of a pre-primary education organization (E); the degree to which the organization meets children's needs (E); kindergarten planning (O3); human resources management (O3); leaders create opportunities for teachers' observation, reflection, teamwork and parent-kindergarten cooperation (EU)
		Evaluation improvement	3	Self-evaluation by organizations (O3); data collection mechanism (O3); continued improvement of organizations (E)
	Teacher team	Number of teachers	5	Teacher-child ratio (O1); teacher-child ratio (U); teacher-child ratio (I); teacher-child ratio (A); teacher-child ratio (J)

(continued)

Table 3 (continued)

Dimensions	Primary category	Secondary category	Occurrence	Secondary indicators
		Teacher structure	6	Distribution of teachers' age and sex (O1); the proportion of female teachers (EU); a number of children in each class (J); diploma of teachers (A); teacher certificate (U); recruit qualified staff (EU)
		Teacher benefits	6	Teacher salary (O1); create supportive environment (EU); paid maternal leave (EU); teacher salary (O3); average kindergarten teacher salary (I); proportion of part-time teachers (F)
		Teacher training	7	Continuous pre-service and in-service training (EU); the proportion of training (EU); teacher training (F); in-service training requirement (A); minimum time of compulsory professional training (U); minimum length of pre-service teacher training (U); kindergarten teacher training (I)

(continued)

Table 3 (continued)

Dimensions	Primary category	Secondary category	Occurrence	Secondary indicators
		Teacher capability	7	Ability to use information technology (O1); education and teaching time (O1); teaching sensitivity (O1); teacher-child interaction and relationship (O3); colleague cooperation (O3); teacher incentive (A); characteristics of teaching staff (F)
	Family support	Parent-kindergarten communication	4	Influence of family education on children (O1); expectation of parents who choose kindergartens (A); organization respect family's view of child-rearing and belief (AU); efficacy of communication between teachers and parents (E)
		Parent-kindergarten cooperation	6	Family expectations of early child development; teacher participation in family education (A); organizations respect families and keep supportive relationship with them (AU); cooperation between organization and other organizations (AU); parent participation in caring and education program (O3); cooperation between teachers and parents (O3)

Table 4 Categories and indicators of educational product dimension

Dimension	Primary category	Secondary category	Occurrence	Secondary indicators
D2 Product dimension	D2-1 Education popularization	Enrollment rate	14	Popularization rate of one-year pre-primary education (I); popularization rate of three-year pre-primary education (I); enrollment rate of children with disability (D); enrollment opportunities for children of appropriate age (D); enrollment rate of children aged 4 (J); enrollment of children aged 3–5 to pre-primary education (J); gross enrollment of pre-primary education (J); popularization rate of one-year pre-primary education (F); gross enrollment of pre-primary education in two years (F); enrollment rate (O1); enrollment rate of children aged 3 (U); children have had pre-primary education before Grade 1 (U); numbers of disabled children aged 3 and 4 admitted in kindergartens (A); a number of children admitted in kindergartens in preliminary projects (A)
		Popularization of service	3	Pre-primary education service that encourages participation, social integration and inclusive diversity (EU); provide all families and children with accessible and affordable pre-primary education (EU); provide children aged 3–5 with care and education (D)

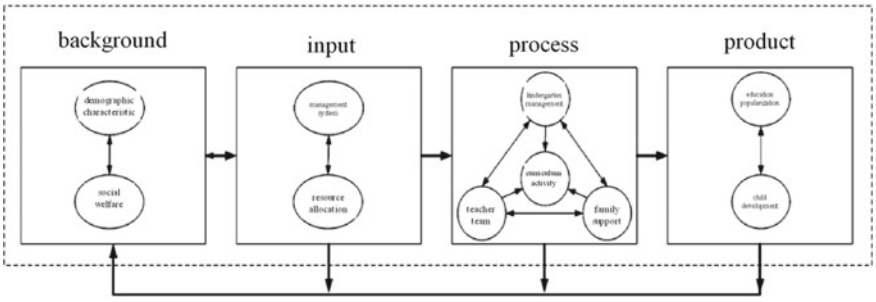
(continued)

Table 4 (continued)

Dimension	Primary category	Secondary category	Occurrence	Secondary indicators
	D2-2 Child development	Academic achievement	8	Academic achievement (O2); language, reading and writing (E); extent of active contribution (E); child development product (E); math (O3); science and information technology capacity (O3); Grade 1 repetition (U); connect to the world and make contribution (AU)
		Physical and mental health	8	Social affection (O3); practice capability (O3); body movement, health development (O3); development of healthy lifestyle; basic capability (E); the extent to which one feels safe (E); strong self-identification (AU); strong happiness (AU)
		Learning quality	4	Creativity (O3); autonomy (O3); confident and active learner and effective communicator (AU); children enjoy learning and progress (E)

3 Theoretical Construct of the Chinese Pre-primary Education Indicator System Based on the CIPP Model

As an important basis for the construction of a pre-primary education indicator system, theoretical frameworks play an important role in informing the value orientation and structural dimensions of indicator systems. As an evaluative theoretical framework of international influence and with wide applicability, the CIPP model can help reflect the changes in demand and supply, inner drive, development process and development product of pre-primary education in specific cultural backgrounds. Informed by the CIPP evaluation model and comparing its use by major international organization and countries, we developed the Chinese pre-primary education indicator system that includes explicit value orientation, complete structure, clear inner logic for specific analysis and consolidation, from the background of education, education input, education process, and education product dimensions. It does so by incorporating theoretical models, international experience, the real-life situation of the pre-primary education development in China, as shown in Fig. 1.



background	demographic characteristics
	social welfare
input	management system
	resource allocation
process	kindergarten management
	curriculum activity
	teacher team
	family support
product	education popularization
	child development

Fig. 1 Basic dimensions of Chinese pre-primary education indicator system and primary indicators

As shown in Fig. 1, the Chinese pre-primary education indicator system includes four dimensions, which are further classified into independent indicator systems for goal setting, condition evaluation, process evaluation, and product evaluation. The primary indicators include 10 indicators. These include demographic characteristics, social welfare, management system, resource allocation, curriculum activity, kindergarten management, teacher team, family support, education popularization, and child development. Demographic characteristics and social welfare are background indicators. Management system and resource allocation are input indicators. Curriculum activities, kindergarten management, teacher team, and family support are process indicators. Education popularization and child development are product indicators.

3.1 Theoretical Construct of Pre-primary Education Development Background Indicators

Regarding background indicators, research revealed that the current Chinese education yearbooks or education development statistical bulletins do not have information related to demographic characteristics and social welfare. Based on the needs of Chinese social development and international pre-primary education indicators informed by the CIPP evaluation model, the Chinese pre-primary education indicator system should increase indicators reflecting the background of education, primarily focusing on "demographic characteristics" and "social welfare."

Demographic characteristics and social welfare are important indicators reflecting the levels of socio-political development, economic development, and cultural development. They play decisive roles in pre-primary education development in a country, and are important indicators of pre-primary education development levels. Based on the Chinese condition and international experience, this research puts five items, such as "birth rate," "mortality rate" and "children aged below 6," under the secondary indicator of "demographic characteristic"; eight items, such as "gender equality," "mother benefits," "subsidies for poor children" are under the secondary indicator of "social welfare."

3.2 Theoretical Construct of Pre-primary Education Development Input Indicators

By combining the needs of Chinese society development and the international pre-primary education indicators informed by the CIPP evaluation model, we developed the Chinese pre-primary education indicator systems that focus on two primary indicators. These are "management system" and "resource allocation." The former is the basic guarantee of the latter and the latter is the main carrier of the former.

Regarding the management system, the current Chinese pre-primary education has problems, such as unclear division of responsibilities among different government departments, unreasonable allocation of rights and responsibilities among governments of different levels and a lack of overall coordination and fiscal guarantee due to the low level of responsible management subjects (Pang and Fan 2012). In order to implement the Outline of the National Program for Medium and Long Term Educational Ref*orm and Development (2010–2020)* and *Several Opinions on the Current Development of Pre-school Education by the State Council* (hereafter referred to as "*Several Opinions*"), which emphasized "government leadership" and "local responsibility and hierarchy management," the indicator system set "clear role and responsibility-sharing mechanism among the Central Government and the local governments," and the "relationship between education authority and government of the same level" as secondary indicators for the management system.

Regarding resource allocation, expenditure allocation should focus on the combination of absolute indicators and relative indicators. Absolute indicators are the basic indicators displaying overall numerical characteristics. Relative indicators are calculated by comparing two statistics, and their values are expressed in multiples and percentages. Generally speaking, the relative indicators of education funds are "the two proportions" required by the *Outline of National Medium and Long Term Education Reform and Development Plan (2010–2020).* They are the proportion of education expenditure in GDP and the proportion of pre-school education in GDP. Besides these, the "proportion of fiscal pre-primary education funds in fiscal education expenditure" and the "proportions of public and private expenditure" are relatively universal relative indicators in international literature. The commonly used absolute indicators include "public funding per capita" and "average expenditure of parents." The above relative and absolute indicators were included as development indicators of funding input. Besides funding input, we should include material input indicators, including "indoor activity space," "outdoor activity space" and "library resource."

3.3 Theoretical Construct of Pre-primary Education Development Process Indicators

Regarding the process indicators, based on the current situation of the Chinese pre-primary education development, which involves not only access to kindergartens but also access to quality kindergartens, combining the international pre-primary education indicators informed by the CIPP evaluation model, the Chinese pre-primary education indicator system should focus on the process indicators such as education plans, implementation of plans, team guarantees, parent-kindergarten interaction, which connect education input and education product. They also include "curriculum activity," "kindergarten management," "teacher team," and "family support" as four primary indicators under the education process indicator. Among them,

curriculum activities constitute the core factors. Kindergartens, teachers, and families are the participants of curriculum activities who play the management, leadership and support functions. These three participants interact with each other to ensure the continuous improvement of the design, implementation, and quality of curriculum activities.

Curriculum activities mainly include static structural elements and dynamic process elements. Structural elements include "curriculum orientation," "learning environment," and "teaching condition." Dynamic process elements include "teacher-child interaction," "facilitate autonomous learning" and "colleague cooperation."

Kindergarten management mainly includes kindergarten leadership and kindergarten improvement. Informed by international experience, the Chinese pre-primary education indicator system adopts "effective kindergarten leadership," the "degree to which the organization satisfies children's needs," "organization's self-evaluation and improvement" and "data collection mechanism" as the secondary indicators for "kindergarten management."

The adequacy and quality efficacy are two characteristics of the teacher team. The current Chinese indicators for kindergarten teacher team mainly include staff size, diplomas and professional titles of kindergarten heads and teachers (Department of Development Planning of Ministry of Education 2006). This only reflects the size of the kindergarten teacher team and basic information, and lacks indicators to substantially reflect the quality of kindergartens. International indicators involve the "qualification requirement of kindergarten teachers," "education and training," etc., comprehensively reflecting the quality of kindergarten teachers. Combining international experience and the Chinese indicator data, researchers will adopt the "teacher-child ratio" as an indicator for adequacy, and adopt "teacher salary and benefits," "ratio of certified teachers" and "ratio of trained teachers" as an indicator for efficacy.

Family support is an important element influencing young child development. As demonstrated by research literature, parents' participation in pre-primary education can ensure the consistency of young children's acquisition experience in different environments, and help develop young children's cognition and social affection, as well as prepare them for entry to schools (Desforges and Abouchaar 2003). According to the *Guideline to the Learning and Development of Children Aged 3–6*, teachers and parents should establish a cooperative and mutually supplementary relation between parents and kindergartens through a variety of effective means. Therefore, "effectiveness of communication between teacher and parents" and "teacher participation in family education" are designated as a secondary indicator of "joint education by parents and kindergarten."

3.4 Theoretical Construct of Pre-primary Education Development Product Indicators

Regarding the product indicators, research revealed that some pre-primary education indicator systems lacked the product indicators such as child development level. The *Report at 19th National Congress of the Communist Party of China* put forward the strategic plan of "ensuring people's access to childcare" and "improving pre-primary education," both pointing to fair and high-quality pre-primary education. Based on this, the indicator system should further focus on the fairness and quality of pre-primary education development. Fair pre-primary education refers to equity and public welfare, mainly reflected in the degree of popularization. High-quality pre-primary education refers to efficiency and quality, mainly reflected in the level of child development. This research combines the international pre-primary education indicators informed by the CIPP evaluation model and the reality of Chinese pre-primary education development and uses "popularization of education" and "child development" to reflect the product of education development. "Popularization" refers to the accessibility of pre-primary education, reflecting the solution of difficult access to kindergartens. "Child development" refers to children's development in five areas and the quality of learning, with children being the subjects and ultimate beneficiaries of pre-primary education.

Regarding education popularization, the *Outline of National Medium and Long Term Education Reform and Development Plan* stipulated that pre-primary education should be popularized by 2020. A one-year pre-primary education will have been popularized across the country; two-year pre-primary education will have been basically popularized, and three-year pre-primary education will have been popularized in areas where the conditions for it are available. Therefore, gross enrollment rates of one-year pre-primary education, two-year pre-primary education, and three-year pre-primary education, as well as gross enrollment of kindergartens for disabled children, are included in the pre-primary education indicator system as secondary indicators for pre-primary education popularization.

Regarding child development, informed by international indicators and the requirements of child development stipulated by the *Guideline to the Learning and Development of Children Aged 3–6*, the Chinese pre-primary education indicator system lists developments in health, language, society, science, and art as the secondary indicators of "child development." As an important internationally recognized domain of early learning, learning quality is one of the core components of pre-primary child learning and development (Copple and Bredekamp 2009). The promotion of children's development in the five areas should direct attention to the evaluation and development of their learning quality. The developments in five major areas interact with learning quality. The development of learning quality facilitates the development in five major areas. The development in five major areas can stimulate children's learning enthusiasm and interest and support the development of their learning quality.

International comparison and domestic analysis based on the CIPP evaluation model generated the Chinese pre-primary education indicator system, which includes 4 dimensions, 10 primary indicators, and 63 secondary indicators, as shown in Table 5.

4 The Applicability of the Theoretical Construct of the Chinese Pre-primary Education Indicator System

In the new era of the pre-primary education reform and standard development, the theory of pre-primary education indicator system will be of great relevance to (1) planning the pre-primary education development goals in China, especially the medium-term and long-term goals, (2) measuring the current situation of pre-primary education in China, especially the equity and quality of pre-primary education, (3) implementing the evaluation of pre-primary education development, especially the education improvement evaluation, (4) boosting pre-primary education international exchange, especially "Chinese storytelling." The expected applicability of the Chinese pre-primary education indicator system is reflected in the following four aspects.

4.1 Provide Value-Oriented Instrument Support for the Establishment of the Goal of the Pre-primary Education Development in China

The goal of pre-primary education development is the compass guiding further reform and standardization of pre-primary education. The goal is the expected results or conclusion. Indicators are the units or methodology used to measure goals. Without goals, indicators are meaningless. Without indicators, the goals cannot be realized. The theoretical construct of the Chinese pre-primary education indicator system, which contains Chinese perspectives and has an international horizon, can provide instrument support for setting the development goals of pre-primary education. The development of the indicator system is not to set goals and determine whether the goals have been achieved, but to guide the value orientation of the further reform of pre-primary education and its standardized development, and evaluate the appropriateness of reform and development plan and support the improvement of education quality. In this sense, the theoretical construct of the Chinese pre-primary education indicator system emphasizes that we should switch from the evaluation of pre-primary education itself to the evaluation of the social system, from input monitoring to input improvement, from process demonstration to process incentive, and from product accreditation to product-orientation.

Table 5 Theoretical construct of Chinese pre-primary education indicators

A Education background		B Education input		C Education process		D Education product	
Primary indicators	Secondary indicators	Primary indicators	Secondary indicators	Primary indicators	Secondary indicators	Primary indicators	Secondary indicators
A1 Demographic characteristics	A1-1 Birth rate	B1 Management system	B1-1 Clear role and responsibility of the Central Government	C1 Curriculum activity	C1-1 Curriculum orientation	D1 Child development	D1-1 Health development
			B1-2 Relationship between education authority and government of the same level		C1-2 Learning environment		
	A1-2 Mortality rate		B1-3 Government supervision and evaluation		C1-3 Teaching condition		
			B1-4 Pre-primary education sponsored by the local education authority		C1-4 Teacher-child interaction		D1-2 Language development
	A1-3 Number of children under six		B1-5 Access to kindergarten education as legal rights of children		C1-5 Facilitate autonomous learning		
	A1-4 Adult literacy	B2 Resource allocation	B2-1 Proportion of pre-primary education expenditure in GDP		C1-6 Linkage between kindergarten to primary school		

(continued)

Table 5 (continued)

A Education background		B Education input		C Education process		D Education product	
Primary indicators	Secondary indicators	Primary indicators	Secondary indicators	Primary indicators	Secondary indicators	Primary indicators	Secondary indicators
					C1-7 Teacher reflection		D1-3 Social development
	A1-5 Ratio of poor children		B2-2 Proportion of pre-primary education expenditure in government fiscal expenditure		C1-8 Colleague cooperation		
				C2 Kindergarten management	C2-1 Effective kindergarten leadership		
A2 Social welfare	A2-1 Gender equality		B2-3 Proportion of fiscal expenditure for pre-primary education in education		C2-2 Degree to which the organization meets children's need		D1-4 Science development
					C2-3 Self-evaluation and improvement by organizations		
	A2-2 Compliance with the *United Nations Convention on the Rights of the Child* by the state government		B2-4 Fiscal allotment for pre-primary education by governments		C2-4 Data collection mechanism		
				C3 Teacher team	C3-1 Teacher-child ratio		D1-5 Child art development

(continued)

Table 5 (continued)

A Education background		B Education input		C Education process		D Education product	
Primary indicators	Secondary indicators	Primary indicators	Secondary indicators	Primary indicators	Secondary indicators	Primary indicators	Secondary indicators
	A2-3 Comprehensive medical service		B2-5 Public funding allotted to each student		C3-2 Teacher salary and benefits		
	A2-4 Policies and projects that help poor family out of poverty				C3-3 Teacher age distribution		
			B2-6 Proportions of public and private expenditure		C3-4 Sex ratio of teachers		D1-6 Child learning quality
	A2-5 Mother benefits				C3-5 Ratio of certified teachers		
			B2-7 Average expenditure of parents		C3-6 Proportion of teachers with professional titles	D2 Education popularization	D2-1 Gross enrollment rate of one-year pre-primary education
	A2-6 Mother's formal education				C3-7 Ratio of trained teachers		
			B2-8 Indoor activity space		C3-8 length of teacher training		D2-2 Gross enrollment of two-year pre-primary education
	A2-7 Subsidies for poor children			C4 Family support	C4-1 Parent-kindergarten cooperation		

(continued)

Table 5 (continued)

A Education background		B Education input		C Education process		D Education product	
Primary indicators	Secondary indicators	Primary indicators	Secondary indicators	Primary indicators	Secondary indicators	Primary indicators	Secondary indicators
			B2-9 Outdoor activity space		C4-2 Parents' participation in pre-primary education		D2-3 Gross enrollment of three-year pre-primary education
	A2-8 Young children's social, political and cultural background				C4-3 Effectiveness of communication between teacher and parents		
			B2-10 Library resources		C4-4 Teacher participation in family education		D2-4 Enrollment rate of disabled children

These four value-related turns have important value leading function for the setting of Chinese pre-primary education goals, especially the medium and long-term development goals, and will be helpful for determining the development direction, development route and support strategies for the Chinese pre-primary education cause. They will help further adjust the policy system that regulates the development of pre-primary education as part of the government public service system, as well as systematically planning and leading the comprehensive and sustained development of the Chinese pre-primary education.

When one examines the current reports such as the *National Statistical Bulletin of Education Development* and *National Education Statistics*, they can find that some reports in China do not pay due attention to the background of education. In other words, they do not give enough attention to the social nature of education or pre-primary education, which constitute an important component of the public service system. Focusing on the background of education or social development and evolutionary factors is an important value-orientation of the Chinese pre-primary education indicator system, and is the embodiment of the political, economic and cultural background of the new era. It is a truthful and collective reflection of Chinese values, Chinese perspectives and actual conditions of China. Given the introduction of the universal two-child policy, the Chinese pre-primary education indicator system should pay more attention to the social development background of pre-primary education, especially the birth rate, mortality rate, number of children under six, etc., which have an important influence on the systematic planning of Chinese pre-primary education development goals, especially medium term and long term development goals, as well as systematic guidance of the direction, scale and quality of pre-primary education development. At the same time, with the increasing popularization of pre-primary education in China, raising the quality of pre-primary education should be an important goal of Chinese pre-primary education development. However, when we used the theoretical construct of the Chinese pre-primary education indicator system introduced in this paper to examine the existing reports, we found that they did not pay due attention to curricular activities, family support in education process, and child development in education product, although these indicators are key to measuring pre-primary education quality. As shown above, the indicator system constructed in this paper can effectively supplement the current indicator systems, scientifically set the Chinese pre-primary education development goals and indicator system, and lead the further reform of pre-primary education in the new era and standardize its development.

4.2 Provide a Structural Instrument for a Complete Understanding of the Current Situation of Pre-primary Education in China

The current situation of pre-primary education development is the original level on which pre-primary education is further reformed and developed in a standardized manner. After the value-orienting goals of pre-primary education development or such an indicator system are set, the structural prescription of the indicator system will be helpful for the comprehensive and systematic understanding of pre-primary education development. The Chinese pre-primary education indicator system, which has a comprehensive list of dimensions and clear indicators, can provide structural instrumental support for comprehensively understanding the Chinese pre-primary education development. The basic dimensions of the indicator system should cover not only internal aspects of pre-primary education, but also external aspects of pre-primary education. It should cover not only the input in pre-primary education, but also the process of pre-primary education and the quality of pre-primary education. In this sense, the theoretical construct of the indicator system emphasizes that the understanding of pre-primary education development should structurally include the education background dimension. This includes social factors, education input dimension, namely the resource factor, education process dimension, namely process quality factor, and education product dimension, namely product quality factor. In other words, the four dimensions or main factors, are independent of each other and related to each other, constituting an organic unity. They constitute a structural instrumental framework for collecting and analyzing current information of pre-primary education, and also a reference with which we construct a package of solutions to pre-primary education reform and development.

In recent years, with the development of society and the promulgation of papers such as *Outline of the National Program for Medium and Long Term Educational Reform and Development (2010–2020)* and *Several Opinions on the Current Development of Pre-school Education by the State Council*, the state government pays increasing attention to pre-primary education. The pre-primary education cause is developing quickly. Changes in pre-primary education in many aspects call for a comprehensive understanding. We used the indicator system constructed in this research to investigate the currently existing statistical reports, and found that some important indicators are missing. For example, the demographic characteristics and social welfare in the education background dimension, curriculum activities, family support, teacher training the in education process dimension, as well as child development in the education product dimension are missing, although the current reports have statistics of pre-primary education popularization, resource allocation, and teacher team. The absence of some important indicators or the lack of attention to certain indicators reflects the structural inadequacy of the indicator system.

In the new era of improving pre-primary education, the Chinese pre-primary education indicator system should pay more attention to the irreplaceability and interdependence of the structural indicators of pre-primary education, their systematic

description of goals, background, condition, strategies, and product of the "improving pre-primary education" strategic plan, which is of great importance for the comprehensive and systematic understanding of Chinese pre-primary education evaluation development, and the systematic planning of the routes and strategies leading to pre-primary education goals.

As shown above, the Chinese pre-primary education indicator system is of positive significance to constructing or reconstructing the structural instrument to understand and analyze pre-primary education development, and realizing the comprehensive and systematic understanding of the current development of the Chinese pre-primary education.

4.3 Provide a Methodological Instrument for the Scientific Supervision and Evaluation of Pre-primary Education in China

Strengthening the supervision and evaluation of pre-primary education guarantees the further and standardized reform of pre-primary education. This highlights the function of indicator systems' methodological guidance, which is based on value leading and structure prescription. Combining qualitative and quantitative indicators, as well as dynamic and static indicators, the theoretical construct developed by this research can provide a methodological instrument for the scientific supervision and evaluation of pre-primary education in China. The Chinese pre-primary education indicator system supports the position that supervision and evaluation should pay attention to not only the development of quantitative indicators, but also that of qualitative indicators. It should focus not only on the final report but also the continuous feedback on education development, so as to propose better suggestions. It is in this sense that the theoretical construct of the Chinese pre-primary education indicator system emphasizes that the focus of supervision and evaluation should switch from the accreditation result to improvement process, from criteria consistency to characteristics, from static presupposition to dynamic generation, from material structure to site status.

When one uses the theoretical construct of the indicator system constructed in this research to examine the current supervision and evaluation methodology, for example, *Interim Measures for Supervision and Evaluation of Pre-primary Education,* and other criteria for pre-primary education supervision and evaluation, they can find that the current Chinese pre-primary education supervision and evaluation, which are based on Tyler's goal-oriented model, are conducted by education administrative departments and supervisory departments. These top-down accreditation evaluations do not have the full play of improvement function, because the supervisory evaluation indicators pay more attention to input indicators than background indicators, process indicators, and product indicators. For example, the *Evaluation Standard of Kindergarten Grade in Zhejiang Province* has more than 70% of total

content devoted to the static input indicators, such as environment and texts. The lack of attention given to the background dimension may cause supervision and evaluation to neglect the reality of development. The lack of attention given to the process and product indicators, such as curriculum activities, family support, and child development may cause supervision and evaluation to neglect the quality of pre-primary education quality. The supervision and evaluation of pre-primary education in the new era should focus on individuality, pay more attention to the attitude of character and quality of children and teachers, as well as the characteristics of pre-primary education and innovations; it should focus on relationships, namely pay more attention to peer relation, teacher-child relation, parent-kindergarten relation, kindergarten-community relation; the focus should be placed on process, namely the everyday life of children, so as to evaluate and improve pre-primary education practice in the dynamic environment in reality.

As discussed above, this research will supplement the existing supervision and evaluation indicators, and promote the appropriate supervision and evaluation of pre-primary education in China.

4.4 Provide a Universal Instrument for International Exchanges and Cooperation in the Field of Pre-primary Education

International exchanges and cooperation in the field of pre-primary education are important means to raise the pre-primary education quality and increase the international influence of pre-primary education. As an important instrument for measuring the developments of pre-primary education, the indicator system can comprehensively present the overall condition of the pre-primary education in a country, so that different countries can learn about the pre-primary education development in other countries, learn about the successful practices of pre-primary education in other countries, and promote the excellent experience of their own pre-primary education. This is important to the enhancement of international exchanges and cooperation in the field of pre-primary education.

The theoretical construct of the pre-primary education indicator system proposed by this paper is based on international models, and comprehensively covers a wide range of indicators. This construct can provide universal and instrumental support for international exchanges and cooperation in the field of pre-primary education. The development of the indicator system not only solves the local pre-primary education development problem, but also includes connection with the international pre-primary education, which facilitates the comparison, analysis, reference, and sharing of pre-primary education indicators in other countries. For this reason, the theoretical construct of the Chinese pre-primary education indicator system emphasizes that, in order to support international exchanges and cooperation in the Chinese pre-primary education field, the development of the pre-primary education indicator

system should have a universal theoretical framework, logical rigorous indicator dimensions, comprehensive coverage of indicators of different levels, and the combination of qualitative and quantitative indicators. In other words, these four characteristics constitute the key to ensure that pre-primary education indicator system has international applicability, allow comparative analysis frameworks to be set up based on the pre-primary education indicator systems across different countries, so as to have mutual understanding, borrowing and sharing of pre-primary education development among different countries. The indicator system can be the universal instrument for China to connect its pre-primary education policy discourse, theory discourse and practice discourse to the world in the efforts to tell Chinese stories to the world in the new era.

Recently, the Chinese government attaches more and more importance to international exchanges and cooperation in the field of education. For example, the General Office of the CPC Central Committee and the State Council promulgated the *Opinions on the Opening up of Education in the New Era* in 2016, which explicitly required expansion of opening-up, strengthening of China's education, promotion of humanistic exchange, continuous improvement of China's education quality, and strengthening China's soft power and international influence (General Office of CPC Central Committee 2010). As pre-primary education is an important part of the education cause, international exchange and cooperation should be part of its mission, and the pre-primary education indicator system should play its role. However, the surveys of the existing statistical reports using the Chinese pre-primary education indicator system constructed by this paper have already made some findings. For example, the statistical indicators in these statistical reports are largely classified according to education objects, education investment, team, etc., describing the basic information such as scale and achievement of education in China"(Pang and Xiong 2013). Compared with the CIPP evaluation model, the indicator systems used in the existing reports lack clear theoretical frameworks. Their logic of indicator dimensions is not rigorous and lacks the educational background aspect. Their indicators are not comprehensive and lack process indicators such as curricular activities and family support; they focus more on quantitative indicators and ignore some qualitative indicators such as child development. As discussed above, the Chinese pre-primary education indicator system constructed in this paper provides a universal instrument for international exchanges and cooperation in the field of pre-primary education, and meets the needs of intercultural comparison, dialogue, and substantially strengthens the international influence of Chinese pre-primary education.

In conclusion, based on the CIPP model, this paper developed the Chinese pre-primary education indicator system from four dimensions, namely education background, educational input, education process and education product, which can reflect the external context, condition, internal drive and output performance of pre-primary education development. It provides scientific guidance and a systematic evaluation for pre-primary education development because it transforms the evaluation of education into the evaluation of the social system in which evaluation of education occurs.

It transforms the monitoring function into an input improvement function, transforms the process demonstration function to process stimulation function, and transforms from product assessment function to product guidance function.

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