

## Finding Clues and Implications for Success on the PISA: An Overview of Chinese, Singaporean, Estonian, Canadian, and Finnish Early Childhood Education and Care

### PISA'da Başarı İçin İpuçları ve Çıkarımlar Bulmak: Çin, Singapur, Estonya, Kanada ve Finlandiya Erken Çocukluk Eğitimi ve Bakımına Genel Bir Bakış

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**Abstract:** The significance of early childhood education and care (ECEC) with respect to the development and future success of children as well as the wellbeing of society has long been established. Hence, the intent of the study was to investigate ECEC in China, Singapore, Estonia, Canada, and Finland, where successful results on the Programme for International Student Assessment (PISA) have been a common occurrence. Using Bereday's model of comparative research, data were gathered from various sources and investigated. Thus, the demographic information, general outlook of educational systems, organization of ECEC, teacher qualifications, and funding and fees were illustrated to understand the future implications of ECEC. To provide better ECEC opportunities and ensure future success for learners, the significance of higher enrolment rates, a wider range of ECEC services, a higher GDP allocated to ECEC, better teacher qualifications, financial opportunities for families, a lower teacher-child ratio, and group size were highlighted.

**Keywords:** Early childhood education and care, PISA, educational systems, international assessment

**Öz:** Erken çocukluk eğitimi ve bakımının (EÇEB), çocukların gelişimi ve gelecekteki başarısı ile toplumun refahı açısından önemi uzun süredir ortaya konmaktadır. Bu bağlamda bu çalışmanın amacı, Uluslararası Öğrenci Değerlendirme Programı'nda (PISA) başarılı sonuçlar elde eden Çin, Singapur, Estonya, Kanada ve Finlandiya'daki erken çocukluk eğitimi ve bakımını incelemektir. Bereday'in karşılaştırmalı araştırma modeli kullanılarak çeşitli kaynaklardan veriler toplanmış ve toplanan bu kaynaklar araştırmacılar tarafından incelenmiştir. Böylece, EÇEB'in gelecekteki etkilerini anlamak için demografik bilgiler, eğitim sistemlerinin genel görünümü, EÇEB'in organizasyonu, öğretmen nitelikleri, finansman ve ücretler gösterilmiştir. Daha iyi erken çocukluk eğitimi ve bakımı fırsatları sunmak ve öğrencilerin gelecekte başarılı olmalarını sağlamak için daha yüksek kayıt oranları, daha geniş erken çocukluk eğitimi ve bakımı hizmetleri yelpazesi, erken çocukluk eğitimi ve bakımına ayrılan daha yüksek devlet harcamaları, daha iyi öğretmen nitelikleri, aileler için finansal fırsatlar, daha düşük öğretmen-çocuk oranı ve grup büyüklüğünün önemi vurgulanmıştır.

**Anahtar Kelimeler:** Erken çocukluk eğitimi ve bakımı, PISA, eğitim sistemleri, uluslararası değerlendirme

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## Introduction

The theoretical underpinnings of education have a pivotal role in the lives of individuals. Within a given culture, a substantial degree of education yields numerous beneficial effects on social and economic challenges, including but not limited to poverty, infant mortality, child marriage, child labor, and primary school dropout rates (Cahill, 2019). Hence, the three paramount subjects for nations revolve around the assessment, surveillance, and enhancement of educational achievement. In order to ascertain the global standing of a country or group of countries, various international assessments are employed to evaluate academic achievement and establish rankings over time. These assessments include the Trends in International Mathematics and Science Study (TIMSS), the Progress in International Reading Literacy Study (PIRLS), and the Programme for International Student Assessment (PISA) (Kılı Depren & Depren, 2022).

PISA, administered by the Organisation for Economic Co-operation and Development (OECD) since 2000, is a globally recognized assessment that has widespread participation. PISA evaluates students' proficiency in mathematics, science, and reading, making it the most widely attended international

monitoring study in this domain (OECD, 2019). In conjunction with cognitive assessments, surveys are administered at several levels within the educational ecosystem, encompassing students, teachers, and schools. These surveys serve to gather comprehensive data regarding the education systems of the countries involved in the study. PISA examines both the literary proficiency of pupils and the educational performance of nations. Detailed studies are conducted in each application, focusing on students' success in the chosen core area as well as numerous educational and economic variables (Suna et al., 2020).

Attendance at an early childhood (EC) institution is one of the educational variables mentioned. The PISA extensively gathers data pertaining to the presence and duration of pre-school education among the students partaking in the examination. The significance of early childhood education (ECE) in ensuring the future success of children has been prominently underscored in many OECD studies, such as the "Starting Strong" series (OECD, 2001, 2006, 2012, 2015b, 2017b). Additionally, there are several studies which present the correlation between attending an EC institution and PISA performance. To illustrate, according to a study conducted by Pholpirul (2017), ECEC leads to the positive development of

cognitive skills with respect to their long-term effects. Importantly, the cognitive skills of reading, mathematics, and science are tested through the Programme for International Student Assessment (PISA) (Pholphirul, 2017; Xu & Dronkers, 2016). Furthermore, if a student has attended ECEC, they are likely to have higher scores in reading by an increase of 5.2%, science by 5.4% higher, and mathematics by an increase of 6.7%. Thus, these results show that ECEC can significantly impact higher academic performance and cognitive skills; particularly in mathematics (Pholphirul, 2017). On the other hand, Aráuz (2017) investigated factors associated with the poor performance of eight Latin American countries on the PISA 2012 and found that children's attendance at ECEC is one of the key factors in their prospective academic performance. Likewise, Manu et al. (2021) longitudinally followed 1010 Finnish kindergarteners to understand the relationship between reading comprehension skills in the PISA and kindergarteners' pre-reading skills. They find that kindergartener pre-reading skills are prominent predictors of reading comprehension in the ninth grade. In light of these studies, it was clear that PISA scores are highly associated with attending ECEC. Thus, ECEC attendance can be predictive of students' future academic achievement (Herrerias, 2017). Yet, according to results from the 2015 PISA, to enhance academic achievement scores, at least two years of ECEC are needed (OECD, 2016b). Similarly, Aydın et al. (2018) posited that children in countries with higher achievement on the PISA 2015 attend ECEC programs for three to four years. For this reason, it is suggested by researchers that a long term and qualified ECEC is a primary key to success on the PISA.

As is shown in the research-based evidence, ECEC is a critical part of a society in achieving improvements in economic growth and social well-being, and as a result, policymakers should continue to focus on improving ECEC in terms of its quality and quantity (Author et al., 2022). Additionally, as is indicated in the studies referred to in the current research, there is a positive correlation between children attending a qualified ECEC at the appropriate stage of development and their future academic success. At this juncture, the question that arises is, "What type of early childhood education promotes the future success and well-being of students?" At this point, it is deemed essential to analyse the early childhood education of countries with high PISA scores and to identify the common or distinctive early childhood education practices employed by these nations. Policymakers in Türkiye and other developing nations with comparable socioeconomic structures may find these practices instructive. At that point, it might be essential to examine Türkiye's performance in reading, math, and science in the 2018 PISA assessment to conduct a significant comparison with other countries. The mean scores in reading, mathematics, and science for 79 countries on the PISA 2018 assessment varied as follows: 340-555, 325-591, and 336-590, respectively. Türkiye ranked 40th in reading, 42nd in math, and 39th in science out of 79 participating nations, with average scores of 466, 459, and 468, respectively. With the exception of math, Türkiye's reading and science scores are below the OECD averages. China, Singapore, Estonia, Canada, and Finland had the highest reading scores: 555, 549, 523, 520, and 520, respectively. Similarly, the mean math scores for China, Singapore, Estonia, Canada, and Finland

were 591, 569, 531, 523, and 512, respectively. Lastly, China scored 590, Singapore scored 551, Estonia scored 530, Finland scored 522, and Canada scored 518 (MONE, 2019; OECD, 2019d; 2019e). According to the statistics, Türkiye and other nations that have achieved comparable results should reassess and restructure their existing policies and practices pertaining to education, particularly ECE, which is regarded as a critical determinant in forecasting students' future academic achievements. For this reason, the purpose of this study was to investigate ECEC systems in the most successful countries according to the PISA 2018 results, which include China, Singapore, Estonia, Canada, and Finland. This study does not suggest that ECEC is solely responsible for success in PISA. The aforementioned countries were selected for the study to provide insight into their ECEC system and policies in order to find clues and implications for success. Depending on the rationale that qualified ECEC results lead to increased academic success in future life, the aim of this study was to describe, analyse, and compare ECEC in the targeted high-achieving countries in terms of its structural quality components, which include organizational information such as adult-child ratio, group size, government and policy level regulations, teacher qualifications, and finance and funding (Ishimine et al., 2010). Another motivation in this study was that by referring to developmentally appropriate practices in high-achieving countries, the aim was to present implications in relation to ECEC for developing and lower-achieving countries.

## Method

### Research Model

In the current study, the researchers utilized a juxtaposed research methodology advocated by Bereday (1964) according to a comparative research model. The comparative model of analysis provides a valuable guideline for researchers due to its systematization. According to Bereday's model, comparative analysis comprises four steps, including description, interpretation, juxtaposition, and comparison. Thus, with the help of juxtaposition, researchers have the chance to investigate various educational systems as well as contrast and allocate their principles and approaches in a parallel way (Bereday, 1964). In the current study, predictions were made using this model by examining descriptive research data from five countries and making comparisons within the sub-components.

### Data Collection Procedure

The researchers in this comparative study utilized the document review method, which is a qualitative research approach. In the field of comparative education, the literature is defined as either a primary, secondary, or auxiliary source (Bereday, 1964). In this study, sources from the official reports of governments and ministries, books, leaflets, and other such materials were analysed for research review purposes. The researchers also selected sources such as scientific articles, official websites, and reports. For data collection, first, databases and websites were searched using keywords. In Table 1, information regarding the keyword searches along with the databases, academic articles, and websites is provided.

**Table 1.** Keywords and databases

Keywords	Educational systems Organization of the ECEC Teacher Qualifications Funding and Fees
Database	Academic Websites
	SCOPUS, Springer, Ebsco, OECDiLibrary, World Bank Data Catalog, Web of Science, DOAJ European Commission, Ministry of Education, United Nations Development Programme (UNDP), United Nations (UN), National Center on Education and the Economy (NCEE), National Agency for Education (EDUFI), Government websites, Ministry of Social and Family Development, Government Official Statistics, Child Care Resource and Research Unit, Early Childhood Workforce Initiative, ResearchGate, Systems of Early Education and Professionalization (SEEPRO)

The researchers identified a total of 7461 academic articles and reports by using the keywords in the specific databases mentioned in Table 1. Furthermore, a total of 35 websites were selected following the keyword search and a quick pre-review regarding their relation to the current subject of study. These materials are marked with a \*\* in the end-text reference. Additionally, the researchers utilized specific criteria to narrow down the article and report search such as being a full-text article, being from the social sciences or educational sciences, as well as being an open-access and peer-reviewed article. After applying these criteria, the researchers reviewed articles and reports in the databases according to their titles and removed any duplicates. Next, the remaining articles and reports were reviewed by scanning their abstracts. The process of quickly scanning the article and report abstracts was to eliminate any that were irrelevant. Finally, a total of 17 journal articles and reports were chosen from databases which met the established criteria. As shown in Table 2, these studies investigate professional development, the general educational system, human development indicators, the world population, quality, policies, cultural foundations, and the development of ECEC. Out of 17 documents, ten studies examine China, five

studies examine Finland, and four studies examine other countries as shown in Table 2.

## Findings

### Demographic Information for the Countries

China, Singapore, Estonia, Canada, and Finland all possess a variety of discrete similarities and dissimilarities. The general demographic information regarding the countries being investigated is presented in Table 3. As can be seen in Table 3, while China is a heavily-populated country, the other countries have a low population (United Nations [UN], 2019). Only China and Finland are considered to have homogeneous populations with regards to ethnicity. According to the United Nations Development Programme (UNDP, 2020), except for China, all four countries in this study are considered to be very highly developed nations. Moreover, the amount of financial allocation to education (The World Bank, 2021a) as well as being considered highly or very highly-developed (UNDP, 2020) are the most remarkable and frequently occurring points among all countries in this study.

**Table 2.** Articles and reports from selected databases\*

Article	Subject	Investigated countries
1 Author et al., 2022	Professional development of teachers	Finland, Estonia, Singapore, China
2 Hu & Szente, 2009	Quality of ECEC	China
3 Li & Wang, 2017	Development of ECEC	China
4 Liu & Pan, 2013	Policy on ECEC	China
5 Manning et al., 2019	Teacher qualification in ECEC (meta-analysis)	No specific country
6 OECD, 2015a	Educational context, policies, and reforms	Canada
7 OECD, 2016a	Overview of the school system and reforms	China
8 OECD, 2019a	Educational structure, performance and finances	Canada
9 OECD, 2019b	Educational structure, performance and finances	Finland
10 OECD, 2021b	Educational inequalities and outcomes	China
11 Qi & Melhuish, 2017	Development of ECEC	China
12 Salminen, 2017	ECEC system	Finland
13 Santiago et al., 2016	School resources (funding, organization and teaching profession)	Estonia
14 UNDP, 2020	Human development indicators	Finland, Estonia, Singapore, China and Canada
15 UN, 2019	World population	Finland, Estonia, Singapore, China and Canada
16 Zhang, 2016	ECEC system	Singapore
17 Zhu, 2009	Cultural foundations and policies of the ECEC	China

\*Articles and reports are marked with a \* in the end-text reference.

**Table 3.** General demographic information of the countries

Countries	Location	Population (UN, 2019)	Ethnicity	Human Development Index (UNDP, 2020)	Government Expenditure on Education (% of GDP) (The World Bank, 2021a)
China	Eastern Asia	1.439 billion	Homogeneous	highly developed	3.5 (2019)
Singapore	South-eastern Asia	5.850 million	Heterogeneous	very highly developed	2.9 (2013)
Estonia	Northern Europe	1.327 million	Heterogeneous	very highly developed	5 (2017)
Canada	Northern America	37.742 million	Heterogeneous	very highly developed	5.3 (2011)
Finland	Northern Europe	5.541 million	Homogeneous	very highly developed	6.4 (2017)

**Table 4.** Educational systems of countries

Countries	Compulsory ECEC	Years of Compulsory Education
China	No	9 years
Singapore	No	6 years
Estonia	No	9 years
Canada	Changes by province	10 years (Changes by province)
Finland	No*	10 years

\*reflects the specific situation in Finland.

### General Outlook of the Education Systems of the Countries

The information in Table 4 represents a summary of information related to the educational systems of the countries studied. As can be seen in Table 4, ECEC is not compulsory in most of these countries. However, the governments of China, Singapore, and Estonia have utilized various strategies to enhance ECEC, such as advocating for individuals to consider private kindergartens, expanding funding for ECEC (OECD, 2016a), developing resources for curriculum, enhancing teacher training qualifications and standards (Ministry of Education [MOE], 2021a; Tan et al., 2016), as well as providing various chances for pre-primary education such as day nurseries, nursery schools or special nursery schools (Santiago et al., 2016; Teichmann et al., 2014). As Canada has a decentralized educational system, some differences can be seen between each province. Furthermore, while in some Canadian provinces, ECEC is compulsory, in others it is not (OECD, 2015a). Also, different from the other countries researched, in Finland, compulsory education comprises one year of pre-primary education as well as nine years of basic education (Finnish National Agency for Education [EDUFI], 2018).

### Organization of the ECEC

The organization of ECEC and related information for Canada, China, Singapore, Estonia, and Finland are presented in Table 5. As is indicated in Table 5, each country provides various institutions for delivering ECEC. To illustrate, kindergarten and childcare centres/programs are some commonly used names for these institutions, whereas nursery school, pre-school, pre-primary school, and daycare centres are rarely used as names for these institutions. In the following section, detailed information related to these institutions within Canada and Finland is provided.

According to the Childcare Resources and Research Unit (2021), in Canada, ECEC services have a variety of differences. For example, kindergarten services are provided for all five-year-old children in every Canadian province and territory. On the other hand, kindergarten services for three- and four-year-old children are available in Ontario and Saskatchewan (Friendly et al., 2018a). While in the provinces of Nova Scotia and Quebec, they also provide kindergarten programs for four-year-olds (Friendly et al., 2018b). Along with kindergartens, childcare programs are provided in various ways, such as childcare centres, nurseries, and regulated family (home) care.

As in Canada, ECEC services in China are provided through various institutions. For example, kindergartens are provided for young children between the ages of three and six (Hu & Szente, 2009), whereas preschool is provided for children between the ages of five and six. Additionally, nurseries are provided for children from birth up to the age of three (Zhu, 2009). Qi and Melhuish (2017) state that apart from the previously mentioned services of nursery, preschool, and kindergarten, there is also a relatively new childcare service to provide early learning and development for children from birth up to three years of age.

As for Singapore, two types of ECEC services are available for young children. The first is childcare centres which are for children ranging from two months to six-years-old, and type two is kindergartens that serve children ranging from two years old to six years old (Neuman, 2019). In the second type of service, children are grouped by age and trained together. For this reason, each age group is categorized by a group name, such as pre-nursery classes, nursery one and two, and kindergarten one and two. To illustrate, children younger than three-years-old attend pre-nursery classes as part of their preschool education, while three-year-olds attend nursery one, four-year-olds attend nursery two, five-year-olds attend kindergarten one and six-year-olds attend kindergarten two (Zhang, 2016).

In Estonia, the government provides three types of ECEC services for children from birth to the age of three years old, kindergarten/pre-primary school for children up to seven years old, and preschool/pre-primary school for children with special needs up to seven years old (Ministry of Education and Research [MoER], 2015). The MoER (2015) states that kindergarten groups can be based on the age of children, such as younger (three to five years old), medium (five to six years old), and older (six to seven years old). While mixed age groups are also an alternative option for preschools, forming groups with both special needs children and those showing healthy development is also a common practice in many preschools.

Salminen (2017) reports that ECEC in Finland is provided through two types of services, including daycare centres and home-based care. Home-based care is preferred for younger children as the first step to ECEC and to act as a transition to daycare centres. In daycare centres, groups are initially formed according to the children's ages; however, more flexible and mixed-age groups may be preferred depending on the needs of the daycare centre. In addition to daycare centres, pre-primary education can be provided in a primary school in separate or

mixed classes with first- or second-grade peers (Official Statistics Finland, 2019). Also, daycare and home-based services, clubs, ECEC activities orchestrated by municipalities, as well as church and non-governmental institutions, provide various part-time services for promoting child development (European Commission/EACEA/Eurydice, 2022b). Importantly, apart from China, all the countries investigated have both full-day and half-day services (European Commission/EACEA/Eurydice, 2022b; Friendly et al., 2018a; MoER, 2015; Qi & Melhuish, 2017; Salminen, 2017).

As for compulsory education, in China, Singapore, and Estonia, pre-primary education is not compulsory, whereas in Finland, it has been compulsory since 2015 (European Commission/EACEA/Eurydice, 2022a; MOE, 2021b; National Center on Education and the Economy [NCEE], 2021; Salminen, 2017). However, compulsory education legislation in Canada differs based on the individual territories and provinces (Friendly et al., 2018a). In contrast to the uncommon practice of compulsory education occurring among the target countries, many parents prefer to enroll children in ECEC services, and as a result, high enrolment rates in ECEC can draw attention.

ECEC services are mostly provided by the government in countries such as Canada, Estonia, and Finland, in contrast to Singapore and China (MoER, 2022; Ministry of Social and Family Development [MSF], 2021; OECD, 2019a, 2019b, 2021b; Singapore Department of Statistics [DOS], 2022). Furthermore, private institutions tend to be more common in China and Singapore, as can be seen in Table 5. In Estonia and Finland, the government and municipalities are responsible for providing ECEC to young children (European Commission/EACEA/Eurydice, 2022a, 2022b). Also, in Estonia, private and public ECEC services are available for parents' to freely choose, and municipalities within the country are responsible for providing those services (MoER, 2022). Thus, either private or publicly funded institutions within the target countries provide the two options for children to attend ECEC.

Importantly, the enrolment rates are nearly universal in Estonia and Singapore, with 91.3% and 92%, respectively (OECD, 2019c; National Institute of Education, 2023). On the other hand, Finland with 88.2% and China with 85.2 % have lower enrolment rates (Ministry of Education, People's Republic of China [MoE P.R.C.] & Xinhua, 2021; OECD, 2019c). Moreover, the lowest enrolment rate in ECEC institutions is in Canada with 60% (Statistics Canada, 2019). The reason for the low enrolment rate in Finland is that parents often prefer to enroll their older children in ECEC services rather than the younger children (Salminen, 2017). Furthermore, Finland also offers a rich variety of other forms of ECEC, and as a result, childcare benefits such as childcare leave and child home care allowance are available (European Commission/EACEA/Eurydice, 2022c). The reasons for the low ECEC enrollment rate in Canada are similar. For example, other available options, such as care by relatives or non-relatives and before-and-after school programs, might be the cause of low enrolment (Statistics Canada, 2019). On the other hand, locating information regarding China is difficult to find and the enrolment rate for three-year-old children and pre-primary school students according to the Chinese Ministry of Education, does not include any age-specific descriptions. Most recent information regarding enrolment in ECEC services provided by the Chinese Ministry of Education is

listed under the heading of media highlights, and no further explanation of low enrolment is mentioned (MoE P.R.C. & Xinhua, 2021).

The teacher-child ratio was determined beforehand for all five target countries, however, in Canada, depending on the specific province or territory, the ratio requirements change (Friendly et al., 2018a). For example, in classes for young children older than three-years-old, the teacher-child ratio in Finland is 1:7, while in Estonia it is 1:10 (European Commission/EACEA/Eurydice, 2022d; Salminen, 2017). Singapore has a 1:15 teacher-child ratio in classes for three- to four-year-old children, and 1:25 for four- to seven-year-old children (Zhang, 2016). Also, it is reported that in rural China, class size is rather larger than requirements, and it is officially stated that the approximate number is 1:16 (MoE P.R.C., 2020; Qi & Melhuish, 2017). According to Qi and Melhuish (2017), the reason for larger class sizes is the lack of kindergarten opportunities and teaching staff. Furthermore, in most cases, preschools in urban areas are often more crowded due to the higher population density. Also, ECEC services provided in China and Finland cover children from birth to six years old, however, as shown in Table 5, each country's coverage of ECEC by age differs. In addition to the teacher-child ratio, group size requirements are specified by the government and Ministry of Education in China, Finland, and Estonia (European Commission/EACEA/Eurydice, 2022c; Qi & Melhuish, 2017; Santiago et al., 2016). For example, in Estonia, group size in crèche is up to 14, in pre-primary up to 20, and in mixed groups up to 18 children (Santiago et al., 2016). However, group size information regarding Singapore was not available. While the requirements in Canada are again dependent on region (Friendly et al., 2018a), as can be seen in Table 5, with respect to group size, it can be said that group size and the related regulations are different for each country. Finally, as an investment for younger generations, the amount of GDP that is slated for ECEC in both Finland and Estonia, is above the OECD average of 0.7%. According to the OECD, this statistical data provides total public expenditure for ECEC as a percentage of GDP (OECD, 2019c). While Canada fails to reach the OECD average, on the bright side, a new national budget released in April 2021 was promising in terms of improving early child care and education (Child Care Resource and Research Unit, 2021; OECD, 2019c). China and Singapore did not provide a percentage of GDP spent towards ECEC, but it is indicated that a higher allocation has been made to ECEC compared to previous years (MoE P.R.C., 2021; MSF, 2019). Since both Singapore and China provided information related to monetary funds allocated to education, ECEC and GDP percentage accounted for general education systems. Several calculations revealed that the GDP percentage of ECEC accounted for 0.30 and 0.33, respectively (DOS, 2023; MOE P.R.C., 2023a, 2023b; MSF, 2022).

### Teacher Qualifications

Teacher qualifications are a significant element of ECEC (Manning et al., 2019). Among the five countries investigated, both Canada and China have teacher qualification requirements which are less optimal than the other countries studied. In both Canada and China, teacher certification is required, but no degree in an early childhood education specialization is required (Friendly et al., 2018a; Friendly et al., 2021; Qi & Melhuish, 2017). For example, in Canada, only Edwards Island, Ontario, and Quebec require specialization in early childhood education for kindergarten teachers. Whereas

in Singapore and Estonia, teachers are required to possess a bachelor's degree in education, and in Finnish daycare centres, one out of every three teachers must have a bachelor's degree in education or social sciences (Neuman, 2019; Salminen, 2017; Veisson, 2017).

When talking about teacher qualifications, it is not enough to focus only on graduation requirements. Another issue that determines teacher qualification and must be emphasized is in-service teacher education (Author, 2022). In five of these countries, it is emphasized that teachers should develop themselves as they continue in the profession after graduation. Three methods are generally used for this development: a mentoring system, in-service training, and higher education. The mentoring system used in China and Finland involves pairing novice teachers with a more experienced teacher and receiving help with teaching methods, materials, lesson plans, assessment, etc. In the mentoring system, the experienced teacher visits the novice teacher's classroom from time to time, observes the lesson, and provides feedback after the lesson.

In this way, the professional development of the novice teacher is supported by providing one-to-one support. In addition to the mentoring system, in-service training is used in the aforementioned five countries to improve teachers' qualifications. Teachers are encouraged to attend seminars and courses organized by municipalities or universities on various topics. Finally, countries like Singapore and Finland use higher education to improve teachers' qualifications. Teachers are motivated to pursue graduate education, and their salaries are not docked when they take time off for higher education. In this way, all teachers, whether experienced or inexperienced, are encouraged to update their knowledge and improve themselves (Author, 2022).

### Funding and Fees

Funding for ECEC services and childcare benefits for families is an integral part of all countries childcare policies. Thus, as displayed in Table 6, the ECEC regulations and policies of Canada, China, Singapore, Estonia, and Finland show both similarities and differences.

In Canada, kindergarten programs for all five-year-old children are free (Friendly et al., 2018a). Similarly, in Finland, compulsory education is free, therefore, pre-primary education is free (European Commission/EACEA/Eurydice, 2022b). Funding for compulsory education in Finland is provided by both local authorities and the national government (EDUFI, 2020). Furthermore, 75 percent of ECEC funding in Finland is provided by local authorities, while the local authorities also receive ECEC designated funding from the national government (EDUFI, 2018). As a result, funding provided by the national government is determined according to the number of children who attend compulsory education within a specified area, and factors such as population density, parent(s) educational background, and the density of foreign languages spoken, all play a role in the amount of ECEC funding allocated (EDUFI, 2020). However, both in Canada and Finland, funding for ECEC programs for children younger than five years old is primarily the responsibility of parents (EDUFI, 2020; Friendly et al., 2018a). For example, in Finland, parents whose children attend programs other than pre-primary school, pay fees ranging from 0 to 289 euros for a full-day program (European Commission/EACEA/Eurydice, 2022b). These fees can differ based on the financial status of families (EDUFI, 2018). In regard to China, information about the fees for ECEC was very limited. According to the MoE

P.R.C. (2019, 2020), the government controls the tuition fees for ECEC programs, which range from approximately 600 to 800 yuan per year.

Estonia and Singapore have different policies regarding ECEC fees in relation to both Finland and Canada. For example, children from disadvantaged backgrounds are supported by the government in both Singapore and Estonia (MoER, 2022; Neuman, 2019). While in Singapore, the government provides funding to non-profit organizations, and in turn these organizations provide aid for ECEC fees to approximately 45,000 eligible families (Neuman, 2019). In Estonia, municipalities financially support private and public ECEC services at an amount decided upon by the municipality (MoER, 2015). Thus, fees may vary according to a child's age, the financial background of the family, the centre's expenditures, and other considerations, but generally range from 0 to 58 euros with an average of 26.10 euros (MoER, 2022).

In a totally different example, China's funding to promote public ECEC services declined in comparison to previous years, and instead, private ECEC programs were encouraged (Li & Wang, 2017). Importantly, the private ECEC institutions are not supported through national funding (Hu & Szente, 2009), therefore, in these cases, the families are the primary source of funding for these ECEC institutions (Liu & Pan, 2013).

### Discussion

In the current study, it was found that successful results on the PISA may be an indicator of effective and qualified ECEC programs; therefore, information regarding ECEC in China, Singapore, Estonia, Canada, and Finland was provided. There are a variety of reasons behind the success of these countries regarding their PISA results and investment in ECEC.

In the literature, it was revealed that higher percentages of GDP were spent on education within the target/high achieving countries (The State Council of the People's Republic of China, 2019; Statistics Canada, 2017; The World Bank, 2021a). Shafiq (2010) also argues that the economy is closely associated with education in both positive and negative ways. It is argued that economic difficulties are associated with a lower ratio of adults in the labor force as well as less qualified schooling and, in turn, lower enrollment rates. Whereas the countries previously mentioned, exhibited an opposite pattern. This means that the countries mentioned are highly or very highly developed and therefore likely have more resources to put towards qualified education (UNDP, 2020). Another striking issue might be that the higher GDP per capita allocated towards education within these select countries results from a lower fertility rate. The World Bank (2020) also provides fertility rate data which supports this argument, for example, the global fertility rate is 2.41%, while the fertility rate in China is 1.69%, 1.14% in Singapore, 1.67% in Estonia, 1.49% in Canada, and 1.41% in Finland. As was previously suggested, fertility rates in the targeted countries are lower than the global rate, which in turn might lead to an allocation of more resources per child. Moreover, governmental childcare support may be related to strategies for overcoming low fertility rates. For example, Kim et al. (2017) emphasize that although the outcome is yet to be explored, governments might prefer childcare support as a way of managing low fertility rates within their country.

**Table 5.** Organization of ECEC and related information

	<b>Canada</b>	<b>China</b>	<b>Singapore</b>	<b>Estonia</b>	<b>Finland</b>
Services	Kindergarten, Childcare programs (Center, nursery school, regulated family (home) care)	Kindergarten, preschool, nursery, early learning & development centers	Kindergarten, childcare centers	Crèche, Pre-primary/kindergarten, primary school for children with special needs	Daycare center, home-based care
Length	Full day (May change)	Full day	Half day (may change)	Full day (may change)	Half day (may change)
Compulsory schooling	Not compulsory (Depending on provinces)	Not compulsory	Not compulsory	Not compulsory	Not compulsory*
Distribution of public & private	7% private, 93% public	57% private, 43% public	1.6% public**	97.1% public, 2.9% private	86% public, 14% private
Enrolment rate	60	85.2	92	91.3	88.2
Ratio	Ranges by province or territory Ontario 0-3 years = 1:3 to 1:8 above 3 years = 1:8 to 1:13	15.9	0-3 years = 1:8 to 1:12, above 3 years = 1:15 to 1:25	0-3 years = 1:7, above 3 years = 1:10	0-3 years = 1:4, above 3 = 1:7
Coverage of age	0-5 years	0-6 years	2 months-6 years	1.5-7 years	0-6 years
Group size	Ranges by province or territory Ontario <18 months = 10 18-30 months = 15 30 months-6 years (preschool) = 24 44-68 months (kindergarten) = 26	20-35 child (with 2 teachers and 1 care worker)	Not specified	Crèche - up to 14 children, Pre-primary - up to 20 children, Mixed groups - up to 18 children	Up to 20 children with extra trained person
GDP on ECE	0.28%	0.33% **	0.30% **	0.86%	1.13%

\*In Finland, compulsory schooling includes one-year of pre-primary education for six-year-olds

\*\*No data could be found, so the necessary calculations were completed through data from references.

**Table 6.** Funding and fees of ECEC by country

	<b>Canada</b>	<b>China</b>	<b>Singapore</b>	<b>Estonia</b>	<b>Finland</b>
Fee	Free (pre-primary) Paid education (for children younger than five years old)	Not specified Government controlled tuition fee-app. 600-800 yuan per year	\$400-2000	No more than 20% of minimum wage – approximately 0-58 €	Free (pre-primary 0-289 € (for children younger than five- years-old)
Funding	Parents (for children younger than five years old)	Parents	State-funded (children from disadvantaged backgrounds)	State-funded (children from disadvantaged backgrounds)	Local authorities & federal government (pre-primary) Parents (for children younger than five years old)

Another issue is that quality indicators such as teacher-child ratio, educational level of teachers, and group size are essential to ECEC when it comes to the comparison of educational systems (OECD, 2006). The reason for this occurring has been demonstrated in earlier research: better and longer-lasting outcomes are associated with attending high quality ECEC programs (Early et al., 2007). Therefore, higher outcomes on the PISA might be related to not only the presence of ECEC in high achieving countries but also due to having qualified ECEC within these countries. Importantly, Pianta et al. (2009), emphasize that the teacher-child ratio is closely related to high quality learning opportunities. Similarly, lower child-adult ratios across various types of ECEC institutions are supportive of the child-adult learning relationship due to the low ratios allowing the adult educators and caregivers to focus more attention on the needs of each child as well as decrease the amount of time spent in classroom management (OECD, 2021a). The OECD average child-adult ratio across countries is 10 children for every teacher working in ECEC institutions, yet this ratio ranges from 31 in the United Kingdom to three in Denmark, Iceland, and New Zealand (2021a). As for the target countries in this study, it was suggested in the findings that the teacher-child ratio was around or slightly higher than the OECD average and, as a result, could be a primary reason explaining the quality of ECEC services as well as the indirect reason for their success in PISA.

As was mentioned previously, another significant finding was that China, Singapore, Estonia, Canada, and Finland resemble one another in terms of either having high enrolment rates in ECEC or by providing rich opportunities for childcare. This finding can be justified for several reasons. For example, first, this could be related to a cultural understanding of the role of women within the workplace (OECD, 2021a). According to this point of view, target countries tend to pay more attention to women in the labor force (The World Bank, 2021b), and as a result, they provide a greater variety of ECEC services (i.e., home-based care, kindergarten, crèche, clubs, etc.) which serve children from birth to the age of six years old. In this way, children can benefit from ECEC over the long term. As indicated in OECD (2016b), at least two years of ECEC is necessary to enhance PISA academic achievement scores. This argument is backed up by Aydın, Selvitopu and Kaya (2018), who assert that children in high achieving countries for the PISA 2015 attend ECEC programs for approximately three to four years. Another argument to explain the high enrolment rates, can be the fees and

funds related to ECEC services. Again, as indicated in the study findings, when ECEC opportunities were provided by governments, it was shown that those countries generally provided state funded education or free government schools. In many cases, the governments predetermine the cost of education. For example, the OECD (2021a) suggests that public financial support is critically important for the development and quality of ECEC services due to the fact that funding allows for the training of ECEC staff as well as providing qualified materials and equipment. From this point of view, it can be argued that high-achieving countries enable ECEC programs to train their staff as well as obtain better materials for supporting children's development. Thus, qualified ECEC, which is seen as a key feature for future academic success, is provided for all children within these countries. Additionally, one prominent implication for the higher-achieving countries is that in countries such as Finland, the cost of ECEC is predetermined based on parental income. Thus, due to the range of predetermined costs, which is dependent on the parents' income level, the parents may or may not be required to pay for ECEC services. Importantly, this implies that the parents of disadvantaged and/or immigrant children may benefit from ECEC services. This is extremely essential for providing equity in education among all social groups as well as providing opportunities for children and parents from diverse backgrounds and reaching higher educational outcomes in general (Makarova, 2016). On the other hand, the OECD (2017b) claims that if ECEC services are not utilized due to a lack of financial support, especially among children from disadvantaged backgrounds, their participation in ECEC will be greatly affected by their parents' lower financial status. The claims that ECEC has a possible effect on decreasing inequalities within the field of education can be substantiated (Ehrlich et al., 2013). From this point of view, the fee and funding practices of the five targeted countries may be associated with the high enrolment rates in ECEC as well as indirectly with increased educational outcomes.

Another reason behind the success of ECEC and PISA results may be related to teacher qualifications. For example, although teacher qualifications in Canada and China are lower than others, the United Nations Educational, Scientific, and Cultural Organization (UNESCO, 2014) emphasizes that teachers should have at least a secondary education for teaching in ECEC. Thus, as is stated in the literature, China and Canada do require more expertise than is stated as the minimum



qualification by UNESCO. Yet, this case might be related to the high population ratio of these two countries. As indicated in the findings of the current study, Canada and China have 37.7 million and 1.4 billion people, respectively (UN, 2019). As a result, these countries may need to employ a greater number of ECEC staff, which may lead them to accept less qualified workers in the ECEC setting. On the other hand, this situation has implications for the global community, particularly for the countries that are low achievers in PISA. First, countries may be high achievers in PISA even if they have a high population. Second, countries should make policies considering their own local conditions. As for the practices of other high-achieving countries regarding teacher qualification, according to the findings of this study, there were slightly different practices; for example, at least a BA or certification in teaching is a must to be employed in ECEC. Thus, this could be related to their success in PISA and the relationship between professional development and PISA performance, which are evident in many other studies and reports (OECD, 2017a; Author et al., 2022).

Considering all the things highlighted, it is important to mention that China in many cases provided an exception regarding the PISA results, more specifically the results from Shanghai. This controversy relates particularly to the representativeness and credibility of data collected from China (Xu & Dronkers, 2016); therefore, it is prudent to evaluate the data from China with caution.

### Conclusion and Implications

In light of the findings in this study, suggestions for Türkiye and other developing and low achieving countries regarding PISA are presented in the following section. What is prevalent across these countries is that, although ECE is not compulsory, most of the countries have a high enrolment rate. Two major factors are believed to be closely related to this situation. The first is the widespread understanding of the significance of ECE. Therefore, policies should be formulated to increase awareness of ECE in developing societies, and the significance of this education should be emphasized on every platform. Consequently, it is anticipated that the demand for formal ECE will increase. At this point, there is a need to analyze the situation in Türkiye. Despite the fact that early childhood education is not mandatory in Türkiye, the most recent MoNE statistics (2022-2023) indicate that the net enrolment rate for children between the ages of three and five is 51.38%, while it is 84.95% for children aged five. While the enrolment rate for five-year-old preschoolers is satisfactory, efforts should be made to enhance and expand enrolment for younger children. Long-term early childhood education is significantly more beneficial for future academic achievement than the short one. As for other developing countries, the OECD (2020) asserted that approximately 20% of students who participated in the PISA 2018 test in OECD countries indicated that they had not been enrolled in pre-primary education. Over fifty percent of the pupils in fourteen economies and countries had not attended pre-primary education or attended pre-primary education for less than one year. Similarly, Türkiye, Bosnia and Herzegovina, Baku (Azerbaijan), Colombia, Kosovo, Saudi Arabia, and Serbia, all had pre-primary education deprivation rates ranging from 65 to 75 percent (OECD, 2020).

In addition to institutional preschool education, the availability of alternative ECEC services such as home care and play centres in these countries may reduce the burden of institutional preschool education and enable more children to receive ECEC. Consequently, countries with large populations, such as Türkiye, are able to provide ECE services that can serve as an alternative to institutional early childhood education by taking into account local requirements and economic resources. Thus, the number of children with access to ECE can be expanded, and existing economic resources can be effectively utilized. As a result, more children may benefit from ECEC over the long term as parents have more options for choosing the appropriate ECEC opportunity for their children as well as which best suits the parents' working schedule (i.e., half-day, full-day, club, home-based, daycare, etc.). In Türkiye, home-based early childhood education is not available. Early childhood education (ECE) is primarily provided through institutions under the responsibility of the Ministry of National Education (MONE) and the Ministry of Family, Labor, and Social Services. These two Ministries oversee a range of educational options, including nursery classes, practice classes, nursery schools or kindergartens, daycare centers, and infant schools (MONE, 2022; Avcı et al., 2023). Despite the variability observed in institution-based early education, an alternative approach is required, such as home-based ECE, to address the cultural practice of entrusting children under the age of three to childminders or grandparents who lack official childcare education. Home-based education, facilitated by certified childminders, could potentially serve as a viable substitute for these age groups and older children. This may potentially reduce the financial pressure that institution-based education places on the whole country. Furthermore, if institutions serve children from birth to the six years old it might encourage parents to prefer institutionally based ECE.

Lastly, it is necessary to eliminate inequalities due to social injustice as a way of improving the enrolment rate of ECEC. For example, in the high achieving countries in this study, fees for ECEC can be determined based on parental income, and as in the case of Singapore, the government provides funding to non-profit organizations, and in turn, these organizations provide ECEC aid to eligible families. In these cases, minorities, such as immigrants or children from disadvantaged backgrounds, should be greatly encouraged to attend ECEC. Given that Türkiye and many other societies are becoming more heterogeneous, it is believed that such policies are necessary to secure educational equality. In Türkiye, ECE is offered free of charge at state-operated early childhood education facilities, primarily supported by the Ministry of National Education. Parents are required to pay a minimal charge known as a supplemental payment ("*katkı payı*" in Turkish) to support children's requirements, self-care, and educational program expenditures. The Contribution Charge Determination Commission establishes the contribution charge annually in April. The additional fee is based on socio-economic factors and is waived for parents from disadvantaged backgrounds (MONE, 2014). Free ECE, however, covers six hours per day. Parents are required to pay an additional fee for extended ECE (European Commission / EACEA / Eurydice, 2023). According to the OECD (2020), in 68 out of 78 nations and economies with

comparable data, pupils who did not attend pre-primary education were more likely to be socio-economically disadvantaged and enrolled in schools with greater disadvantages by the age of 15.

Importantly, to achieve the regulations previously mentioned, as in countries who are high-achieving on the PISA, it is essential to raise the total amount of expenditures on education, and in particular on ECEC. Thus, these expenditures should be used to improve the quality of ECEC, such as the level of teacher-child ratio, class size, and teacher qualifications. As a result, by following these suggestions, not only the quantity but also the quality of ECEC may increase within countries which are low-achieving on the PISA. Yet, in comparison to the OECD average of USD 12,647, Türkiye annually allocates USD 5,352 per full-time equivalent pupil across all levels of education (adjusted for purchasing power and including expenditure on research and development). The expenditure per pupil amounts to 19% of the per capita GDP, a figure that falls short of the OECD average of 27% (OECD, 2023). Thus, the group must consist of a minimum of 10 children and a maximum of 20 children (MONE, 2014). On average, in OECD nations, there are 15 children per teacher in pre-primary education, with significant differences between countries (OECD, 2021a). ECE teachers with BAs from the education faculty work for MONE-affiliated institutions (MONE, 2014). Creche and daycare teachers are expected to be preschool education teachers, child development and education graduates, or graduates of vocational high schools for girls' child development and education departments (Ministry of Family, Labor, and Social Services, 2016). According to the regulations, while it is favorable for MONE-affiliated kindergartens to have qualified teachers, private institutions are more permissible in hiring teachers with lower qualifications.

### Author Contributions

All authors were equally involved in all processes of the manuscript. All authors have read and approved the final version of the manuscript.

### Ethical Declaration

The authors declare that the study was not subject to ethics committee approval and that the rules set by the Committee on Publication Ethics (COPE) were followed throughout the study.

### Conflicts of interest

The authors declare that there is no conflict of interest with any institution or person within the scope of the study.

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