

Preschool Attendance to Age 3 and Its Impact on Academic Achievement in Grade 4

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Abstract

The research literature on the link between early childhood education and future achievement focuses primarily on children ages 3–6. The current study, in contrast, focuses on children ages 0–3, the most important years in a child’s development. The goal of the study is to examine the connection between preschool attendance during this period and achievement in reading comprehension in primary school, as measured by the standardized tests given in Grade 4. In addition, we look at whether that relationship differs between Jews and Arabs and according to socioeconomic status. We hypothesize that attending preschool at these ages does not contribute to academic achievement due to the low quality of preschool frameworks in Israel. Another hypothesis examined is that the connection between preschool attendance at these ages and academic achievement is stronger among Arabs and among children from weaker socioeconomic backgrounds, based on studies that show that children from families of lower socioeconomic status are generally the main beneficiaries of preschool attendance.

The research is based on data from the PIRLS 2016 survey, which includes tests to evaluate reading comprehension among Grade 4 students and questionnaires distributed to students and their parents that are used to gather information on preschool attendance, home environment, and the extent to which the home environment supports early literacy skills.

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The main finding of this study is that preschool attendance at ages 0–3 does not contribute to academic achievement in Grade 4. Another finding is that there is a difference in participation rates between Jews and Arabs and according to socioeconomic status, with higher attendance rates among Jews and among children from stronger socioeconomic backgrounds.

Introduction

This study examines the link between enrollment in early childhood education and care frameworks for very young children and achievement on reading exams in Grade 4. The study differentiates between children who participate in a preschool program for ages 0–3 and those who do not. The starting point of the study is that preschool attendance can improve later achievements, as shown in research literature in this area. According to the literature, this positive relationship with achievement is dependent on two main factors: the quality of the preschool framework and the target population. A higher-quality early education and care framework (ECEC) will have a stronger and more persistent effect (Britto et al., 2011; OECD, 2018; Peisner-Feinberg et al., 2001). The literature also shows that the link between participation in early childhood education and care frameworks and later academic achievement varies according to socioeconomic status.

A recently published study by Zontag et al. (2020) is, as far as we know, the only in-depth examination of the relationship between preschool attendance and academic achievement in Israel. The study shows that although Israeli preschool frameworks have a low level of structural quality in an international comparison, preschool attendance contributes to a child's future achievement. It also finds that while attendance from age 3–6 contributes to achievement, attendance from birth to age 2 does not and may even reduce achievement, primarily among Arab children and children from families of lower socioeconomic status.

This finding of Zontag et al. is based on data from the PISA test, in which the reported age of preschool entry is not completely reliable. The participants in the study, who were 15-years-old at the time, were asked at what age they began attending preschool. It is questionable whether the respondents were able to provide accurate information and how they understood the term "preschool." In other words, did they understand the term in its broad sense as any framework for children from birth on or in its narrow sense, namely

a framework for age 3 or 4 and upward? This doubt as to the reliability of the measurement makes it important to reexamine the finding that early preschool attendance can harm future achievement.

The importance of very early childhood in individual development

The environment during a child's early years has a significant effect on later life outcomes. The development of the brain and, in turn, the individual's behavior is shaped by a combination of genetics and environment. The study of brain development shows that by the age of five the brain has achieved 95% of its eventual size. Accordingly, researchers have concluded that during infancy the brain is particularly sensitive to stimulation from the environment and the influence of educational and enriching experiences. As a result, this period is critical in an individual's mental, emotional, and behavioral development (Nelson & Sheridan, 2011; Noble et al., 2015).

Researchers view the ability of the brain to change in response to repeated environmental stimulation as proof of its flexibility or the plasticity of the nervous system. The extent of the brain's flexibility is dependent on the stage of development and varies across the regions of the brain. Thus, for example, the parts of the brain responsible for essential bodily functions, such as breathing and heartbeat, are less flexible than the parts responsible for emotions and cognition. Although the flexibility of the brain diminishes with age, there always remains a certain amount of flexibility, which makes it possible for an individual to learn even late in life (Perry, 2006). As mentioned, the ability of the developing brain to adapt is the result of a combination of genetics and the environment. While genes regulate the development and function of the neural networks that make up the brain, the environment — which even affects the fetus — alters the expression of genes and thus affects the development and functioning of the baby's brain (Kandel et al., 2013). A person's brain creates and reinforces the connections between synapses in order to prepare it to deal with experiences. Thus, to the extent that a baby is exposed to a specific stimulant, such as hearing speech, the synapses related to this experience are reinforced, and, in the absence of such stimulation, the relevant synapses are liable to disappear. In this process of generation, reinforcement and disappearance of synapses, the brain adapts to the environment as part of its normal development. For example, children growing up in extreme climatic

conditions or in a non-conventional family framework will learn how to function in their unique conditions. Among infants that are not exposed to stimulation at a young age, developmental gaps appear and it is difficult to close them, in view of the decline in brain flexibility over the years. Thus, it can be said that stimulation of the brain and dedicated childcare are two essential factors for a baby's normal development (Child Welfare Information Gateway, 2015).

Just as positive experiences during infancy support the brain's normal development, negative experiences, such as family violence or economic distress and neglect by parents or care providers, can hinder development. Negative experiences during the early years of life create and reinforce synapses that are connected to those experiences in a way that prepares the child to deal with them and, at the same time, reduces the ability to respond to a supportive environment due to a lack of appropriate stimulation (Shonkoff & Phillips, 2000). The adverse effects of negative experiences include developmental delays (cognitive-behavioral, emotional-social, or physical), difficulty in forming interpersonal relationships, memory deficits, low emotion-regulating abilities, and lowered mental or cognitive functioning (Child Welfare Information Gateway, 2015). The effects of negative experiences in infancy on behavioral, social, and emotional functioning vary according to a variety of factors, including age and the frequency of the negative experience.

Widening inequality during early childhood

Many studies point to the variation in both cognitive and non-cognitive abilities among children from families of varying socioeconomic status. According to these studies, large differences can already be seen during a child's early years as a result of their family's socioeconomic status (Brooks-Gunn & Duncan, 1997; Hart & Risley, 1999) and they widen with age (Bradbury et al., 2015; Feinstein, 2003). The basis for future development and the development of cognitive abilities takes shape in the early years of life (Parks & Bradley, 1991), during a period when experiences are determined to a large extent by the family's socioeconomic characteristics (Carneiro & Heckman, 2003; Kulic et al., 2019).

Inequality of educational opportunity is a phenomenon that is influenced by social status (Jackson, 2013). Its main impact is a result of the link between social status and academic achievement. Children from families with stronger socioeconomic backgrounds have better learning capabilities on average than children from weaker socioeconomic backgrounds (Jackson, 2013).

Secondary effects are the result of choices made by the parents with respect to their children's education. These secondary effects vary according to the background of the parents (Breen & Goldthorpe, 1997; Jackson, 2013). Parents with more education tend to attribute greater importance to education and care in early childhood; they are familiar with the education system and they know how they and their children should conduct themselves in order to gain the maximum benefit from the framework (Lareau & Weinger, 2003). A relatively high share of more educated parents choose to send their children to early childhood education frameworks and they also tend to choose higher-quality frameworks for their children, which are often less accessible to families of lower socioeconomic status (Kulic et al., 2019).

The link between early childhood education and future academic achievement

According to research in this area, the type of education a child receives, the age of entrance into an ECEC framework, and the length of time spent in the framework are important factors affecting cognitive and non-cognitive developmental opportunities (Early & Burchinal, 2001; Fuller et al., 1996). The characteristics of the framework are also an important factor in child development, since they affect a child's physical and social environment and both the cognitive and non-cognitive stimulation they are exposed to (Kulic et al., 2019).

There is a broad consensus in the literature regarding the contribution of attending a high-quality preschool at ages 0–3 and ages 3–6 to a child's cognitive development (Lee et al., 1990; Burchinal et al., 2000; Magnuson et al., 2007) and also for the child's non-cognitive — that is social and emotional — development (Gupta & Simonsen, 2010). In contrast, there is disagreement as to the size of the contribution and its persistence (Barnett, 2011). Similarly, most studies report a positive effect of attendance during very early childhood on future academic achievement while only a few report a negative effect. Some of these studies, for example, find that starting preschool at too early an age is liable to harm a child's achievements (DeCicca & Smith, 2013) and social abilities (Vandell & Corasaniti, 1990), while others show that too many hours spent in preschool can harm future academic achievement (Gupta & Simonsen, 2010).

The literature also indicates that the effect of preschool attendance varies according to the quality of the preschool framework and the child's background. Higher-quality educational frameworks are linked to healthier cognitive and social development, and the effect of high-quality preschool is greater among children from families with a low socioeconomic status (Caughy, DiPietro & Strombino, 1994; McCartney et al., 2007). Most researchers agree that attending a high-quality preschool framework in early childhood contributes to a child's development and may help reduce social disparities (Del Boca, 2015) and narrow gaps in academic achievement between children from different socioeconomic backgrounds (Geoffroy et al., 2010), as well as impact employment opportunities later in life (Barnett, 2011).

Although studies have again and again emphasized the importance of the early years on the neurological, physiological, cognitive, and emotional development of children, most of the research literature that relates to the effect of preschool focuses on ages 3–6, while there are far fewer studies of the 0–3 age group. Among the few — though important — studies of the effect of preschool attendance up to the age of 3 is the evaluative research of Love et al. (2003), which examines the effects of Early Head Start, an intervention program carried out in the US by the federal government, for children up to the age of three from disadvantaged socioeconomic backgrounds. This program began in the mid-1990s with the goal of supporting the development and health of children from poorer socioeconomic backgrounds. The services provided by the program included high-quality early childhood education and care from birth to age three, evaluation of development, health services, and guidance for parents. The research, which followed about 3,000 children in 17 programs, found that the programs contributed to the cognitive, and emotional development as well as the language acquisition of three-year-olds. In particular, it was found that spending more time in preschool is related to higher cognitive and language abilities.

Another important study that looks at the effect of preschool attendance from birth is part of an intervention program called the Abecedarian Project, which operated during the 1970s and was aimed at children from disadvantaged backgrounds without regard to race although 89% of those who participated in the program were Black. The study included 111 children from disadvantaged families who were randomly assigned to a treatment group or a control group. The children in the treatment group benefited from intensive childcare in a high-quality educational framework and bi-weekly

home visits from the age of three months until their entry into primary school. The study showed that attending a high-quality preschool framework had a long-term effect on child development. Thus, the children in the treatment group showed cognitive improvement that continued until the age of 21 and was manifested in higher academic achievement on average than children in the control group. Furthermore, among children in the treatment group, there were fewer behavioral problems, such as drug and alcohol abuse, and their health indices were higher relative to those of children in the control group (Campbell et al., 2002).

As noted, there are a greater number of studies on the effect of early childhood education and its effects for children ages 3–6 than from ages 0–3. One of better-known studies is the Early Childhood Longitudinal Study which examined the effect of a US government program called Head Start. This program began in 1965 as part of the War on Poverty and was aimed at improving school preparedness among children ages 3–5 through the provision of educational, healthcare, social, and nutrition services to children and their families. One of the main services offered by the program was education in a daycare center (Puma et al., 2012). However, studies showed that the effects of the program on the children's academic abilities were short-lived and that they had dissipated by the end of Grade 3 (Barnett, 2011).

The ECLS-K study looked at the degree of school preparedness among children who had participated in the Head Start program relative to children who had attended other preschool frameworks or had been home-schooled. The research found that children who had participated in the Head Start program had higher academic achievement than those who did not participate in preschool, but not higher than children who had attended other preschool frameworks. It was also found that the contribution of attending preschool was higher for children of parents with less education and for children who attended for more than 20 hours per week. Furthermore, there were more behavioral problems observed among children of parents with higher education levels who participated in the Head Start program than among children of parents with less education in the program or children who did not attend any preschool framework. Finally, longer hours of attendance was found to be linked to the development of behavioral problems (Lee et al., 2014).

The famous intervention program, the Perry School Project, conducted in the US between 1962 and 1967, was designed to examine the effect of high-quality early education frameworks for young children living in poverty. The children

participating in the program were primarily Black children ages 3–5 from weaker economic backgrounds. They attended a daycare center for half the day five times a week, which was combined with weekly home visits (Schweinhart et al., 2003). They benefited from a high-quality preschool framework, in which the educational staff had teaching certificates and at least an undergraduate degree in education. Furthermore, the program put emphasis on the development of physical, mental, and social abilities (Manning & Patterson, 2006). In the short term, participation in the program contributed to academic achievement and increased IQ. This cognitive contribution weakened after the children entered school, but was still statistically significant during their school years. In addition to the contribution to cognitive development, a positive and statistically significant correlation was found between participation in the program and the children's level of income in adulthood, and a negative and statistically significant correlation was found between participation in the program and levels of criminal behavior (Schweinhart et al., 2003).

Despite the importance of early childhood education for child development and the reduction of inequality, there has been little research on this topic in Israel. As far as we know, the only study in Israel that has looked at the relationship between early childhood education and care and academic achievement in primary school is that of Zontag et al. (2020). That study relied on three databases: the Social Survey carried out in 2004 by the Central Bureau of Statistics (CBS), which included the Meitzav scores in science or math when the children were in Grade 5 and 8; data from the 2016 PIRLS test; and data from the 2018 PISA test. The Social Survey combined with the Meitzav scores pointed to a positive and statistically significant correlation between attending an ECEC framework at ages 2–4 and academic achievement measured by the Meitzav exam in Grade 5 and 8. The data from the PIRLS test indicated that longer attendance in such a framework is positively related to achievement in reading comprehension (primarily among children of less-educated mothers); and the PISA data revealed a non-linear correlation between age on entering an ECEC framework and academic achievement in Grade 9 and 10. Children who started preschool at an early age (age 1–2 for Arabs and age 1 for Jews) and children who started preschool at a later age (4–6 for Jews and 6 for Arabs) have lower achievement on average than children who started somewhere in between (ages 2–3 for Jews and 3–4 of Arabs). These findings suggest the possibility that attending preschool at an early age does not affect future academic achievement or perhaps even lowers it, particularly among Arabs and among children from families of a low socioeconomic status.

However, this research suffers from methodological problems that call into question the reliability of any specific finding regarding possible harm, or the lack of benefit, from an early start in an ECEC framework. This research is based on PISA test results in which the starting age for preschool is through self-report of 15-year-olds, and it may be that the reporting of an event that occurred at such a young age is unreliable. Moreover, the exam students were asked about the date they started “preschool” and it is unclear how they understood that term – literally or as a general term for all types of preschool. In view of its importance, we reexamined this issue using more reliable data, namely the PIRLS test scores for 2016 in which the parents of children in Grade 4 were asked three separate questions: Did your child start preschool between birth and 3-years-old? Did your child start preschool between age 3 and 6? And finally, for how many years was your child in preschool? We assume that this measurement is more reliable than that of the PISA test. It should be noted that Zontag et al. analyzed the PIRLS data but did not differentiate between children who attended preschool from ages 0–3 and those who attended between ages 3–6.

Quality of the preschool framework

As mentioned, a high-quality preschool framework can provide children with the resources necessary for the development of both cognitive and non-cognitive abilities and can compensate for a family environment that is not supportive of learning and development (Esping-Andersen et al., 2012; Heckman, 2011). The research literature distinguishes between two measures of quality for early childhood education and care frameworks: structural quality and process quality. Structural quality refers to the structural characteristics of the frameworks, such as the quality of the buildings and facilities, the training and formal education of the educational staff, and the child-staff ratio (Vandell & Wolfe, 2000). There is research that points to a link between the structural characteristics of educational frameworks and the development of children’s cognitive abilities (Burchinal et al., 1996; Clarke-Stewart et al., 2002) while in contrast other studies did not find such a relationship (Pianta et al., 2016).

Process quality relates to the day-to-day experiences of children in the educational framework, including interaction with the educational staff and with each other and their involvement in activities of various sorts. Studies have found that strong and positive relationships between the staff and children contribute to the development of social abilities and that participation in a

variety of activities, such as art, board games, and role-playing contribute to cognitive development (Jamison et al., 2014; Kontos & Wilcox-Herzog, 1997).

In a recent OECD report, it was claimed that process quality is the more important measure (OECD, 2020b); nonetheless, the two measures of quality are interrelated. Thus, for example, the ratio of children to staff, which is a factor in structural quality, is related to the quality of interaction between the staff and the children, which is a factor in process quality. A low ratio gives the staff more time to devote to each child and can improve the educational processes in the preschool framework. As mentioned, it has been found that high-quality early education frameworks have a strong and positive long-term effect on child development, particularly in the case of families from more disadvantaged socioeconomic status (Love et al., 2003; Heckman, 2011; Peisner-Feinberg, 2001), and for those same children, low-quality education is liable to harm child development.

Early education frameworks in Israel

Israel is known to be a country with a high fertility rate relative to other developed countries. The fertility rate in Israel is the highest in the OECD: 3 live births on average per woman as opposed to 1.6 in the other member states (OECD, 2020a). Accordingly, the share of children in the population in Israel is also high. As of 2020, 28% of the population in Israel were 14-years-old or younger, as opposed to an average of 16% in Europe and 25% for the world as a whole (UN, 2021). The younger age groups in Israel are significantly larger than the adult age groups and the average share of the population ages 0–2 is expected to grow to between 20% and 30% by 2040 (Weinreb, 2020). In view of the high share of children in the population and the relatively rapid growth rate of that group, there is increasing demand for early education and care frameworks. As a result, there are an increasing number of private for-profit preschools, particularly for the 0–3 age group (Rabinowitz, 2020). According to OECD figures, in 2018, about 35% of children under the age of 1 and 60% of children under the age of 3 attended early childhood frameworks, which is significantly higher than the average of 35% for the OECD. Of all the OECD countries, only Iceland and South Korea have higher rates of attendance (OECD, 2020b). The amount of time a child ages 0–3 spends in these frameworks is also higher in Israel than in many of the OECD countries. According to certain estimates, it ranges from 30 to 40 weekly hours (Vaknin, 2020) and according to other estimates it is more than 50 weekly hours (Moshel, 2015).

Many of the preschool frameworks are not under government supervision and it is not possible to know whether they meet existing quality standards (Rabinowitz et al., 2020). However, even in the case of ECEC frameworks that are under government supervision, during the years that our research focuses on (see below), supervision and enforcement were not sufficiently effective and insufficient emphasis was placed on the quality of education and care, particularly in frameworks for the 0–3 age group (Trajtenberg Committee Report, 2011, pp. 111–118). As in many European countries, the education system for very young children in Israel is fragmented between various government authorities. The government body responsible for supervision of early childhood frameworks for children ages 0–3 is the Daycare and Nurseries Division within the Ministry of Labor, Social Affairs and Social Services while the Ministry of Education is responsible for preschool frameworks for children ages 3–6 (Weissblau, 2015). The frameworks under the responsibility of the Ministry of Education can be divided into two categories: official preschool frameworks that are required to adhere to the curriculum determined by the Ministry of Education and are eligible for full public financing; and recognized unofficial preschool frameworks (private preschools) that are owned by public or private entities (RAMA, 2019). Although this kind of division is to be found in most European countries and other countries with a liberal economic approach, it is often subject to criticism based on the claim that it leads to fragmentation and is characterized by a lack of coordination and continuity between frameworks (Weissblau, 2015).

The quality of preschool frameworks for children aged 3–6 in Israel

The Teaching and Learning International Survey (TALIS) measures the quality of preschools for young children. It is based on self-reporting by the preschool staff on various topics related to their work, combined with administrative information on preschool frameworks for young children in the participating countries. TALIS 2018 looked at the pre-primary school stage of education (ages 3–6) in nine countries that varied according to their location and culture, as well as the organization and structure of their education system for early education (RAMA, 2019). A separate TALIS study looked at the age group 0–3 (Ministry of Labor, Social Affairs and Social Services, 2019).

The structural characteristics of preschool frameworks in Israel indicate a low level of structural quality relative to other countries in TALIS 2018. Thus, for example, the average number of children in a preschool class in Israel is on average 50% higher than in the other countries participating in the study (an average of 29 children per class in Israel as opposed to 20 in the other countries) (RAMA, 2019). In contrast, the number of staff members in preschool frameworks in Israel is about 23% lower than the average for the other countries (5 staff members per class as opposed to 7 in the other countries). In Israel, there is an average of two staff members for a group of 29 children while in the other countries there are 3 for a group of 20 on average. Also the level of education and training of staff members in Israel is relatively low, particularly among the support staff. Thus, while 95% of the preschool teachers have an academic degree, only 7% of the support staff have one and most of them (69%) have a high school education or less (RAMA, 2019).

The process characteristics of the preschool frameworks were measured in the TALIS research by means of self-reporting by the members of the staff regarding the extent to which they make use of practices that encourage learning and development among the children. The measurement of process quality in the preschool frameworks by means of self-reporting of the staff is convenient and relatively cheap, but its reliability is in dispute. There are studies that claim that self-reporting by educational staff of the learning process in classrooms is unreliable (Hook & Rosenshine, 1979; Wubbels et al., 1992) while others claim that self-reporting by the educational staff may be more reliable than reports from students or external observers (Kozziol & Burns, 1986). Whatever the case, the reports by staff members with regard to the use of practices to advance the learning and cognitive development of the children, as well as their social and emotional welfare, place Israel at a relatively higher ranking than other countries where process quality was measured (RAMA, 2019).

Quality of preschool frameworks for children from birth to age 3 in Israel

Apart from the data gathered on the nine countries participating in the TALIS study of preschool education for children ages 3–6, data were also gathered for preschool frameworks serving children ages 0–3 in four countries: Israel, Norway, Denmark, and Germany. The data are from survey questionnaires

and staff self-reporting combined with administrative information on early education frameworks for children ages 0–3. The data were gathered for early education frameworks under the supervision of the Ministry of Labor, Social Affairs and Social Services, which account for about one-quarter of all children ages 0–3 in such frameworks in Israel (Ministry of Labor, Social Affairs and Social Services, 2019).

As noted previously in the discussion of preschool frameworks for children ages 3–5, the measures of structural quality for early education frameworks for children ages 0–3 indicate they are of a low quality. The education of the staff is fairly low: about 37% of the staff have a high school education or less and only 12% had a bachelor's degree or higher. The rest of the staff have non-academic post-high school education. For comparison, in Germany, 70% of the staff have at least a bachelor's degree and, in Norway, the figure is about 50% (Ministry of Labor, Social Affairs and Social Services, 2019). Early education staff training for work with children ages 0–3 in Israel does not meet the standards linked to improved achievement and a narrowing of gaps in the research literature and, most of the staff start working without training and attend a basic training course (Daycare Worker Class 1) while on the job (Moshel, 2015). The average number of children in an early education daycare center in Israel is about 60; but many of them have more children registered. Thus, in 52% of the daycare centers in Israel that participated in the sample, there are, on average, about 80 young children registered, while the standard for the size of a supervised daycare center is 15–27 young children, depending on age. Supervision by the Ministry of Labor, Social Affairs and Social Services of early educational frameworks for children ages 0–3 does not cover pedagogic supervision. Furthermore, there are no uniform standards for curriculum in these frameworks and each daycare operator makes independent decisions in this regard (Moshel, 2015).

The research questions

Our research questions relate to the relation between attendance in an ECEC framework in Israel and academic achievement in school. We first ask whether attendance in an early education and care framework in Israel at ages 0–3 contributes to later academic achievement despite the fairly low level of structural quality in Israel. Second, we ask if the duration of attendance (in years) contributes to cognitive development, as expressed in academic

achievement. Finally, we try to identify the differences between Jews and Arabs and between socioeconomic groups with respect to the link between ECEC attendance at ages 0–3 and academic achievement.

The data and the research variables

To conduct this study, we made use of data from the PIRLS 2016 exams. PIRLS is one of the projects of the International Association for the Evaluation of Educational Achievement. The research has been conducted once every five years since 2001, and it examines achievement in reading for students in Grade 4. Reading achievement assessment is based on reading comprehension of 12 texts, half of which are related to reading with the aim of learning new material and half of which are related to reading for pleasure. The texts are tailored to Grade 4 students with respect to content and level of difficulty, while taking into consideration cultural differences (Martin, Mullis & Hooper, 2017). In order to keep the test short, students are presented with only two texts, such that each student answers a different set of questions from a number of test versions. On the basis of the students' answers to these questions, five plausible values of the variable are calculated for each student. In order to accurately estimate the students' reading achievements, the regressions, in which reading achievement is the dependent variable, are estimated using a PV function in Stata, which takes into account all five values of the variable.

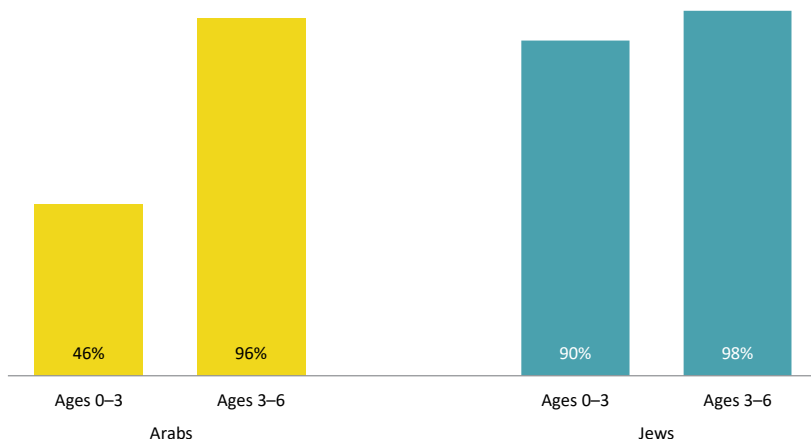
In addition to measuring the student's reading achievement, questionnaires are distributed to students and parents to gather information on the home environment and the degree to which it supports the development of early literacy skills, along with information on behaviors and opinions of students with regard to reading and literacy (Mullis & Martin, 2015). Attendance at an early education framework is measured through parent questionnaires, which ask about their attendance at an ECEC framework between ages 0–3 and between ages 3–6. Unfortunately, the PIRLS research does not ask the duration of attendance in each of these frameworks; however, the parents are asked about the total number of years that their children attended ECEC frameworks in early childhood. The data for the current study relate to the most recent round of the PIRLS research, which was conducted in Israel in 2016. The data includes 3,366 Grade 4 students who were born in Israel and were sampled from 159 schools.

A major limitation of the PIRLS data is that it does not provide any indication of the quality of the preschool frameworks. Therefore, we are unable to determine whether the presence or absence of a contribution to academic achievement is affected by the quality of the preschool framework. Based on the many studies of the importance of the quality of educational frameworks and others which describe the low quality of these frameworks in Israel, we can assume, though not with complete certainty, that the quality of preschool frameworks in Israel has a negative effect on the contribution of preschool attendance to academic achievement, particularly for children ages 0–3, due to the lack of government supervision over most of these frameworks during the years in which the children were in attendance.

Measurement of preschool attendance

As mentioned, the main independent variables in our research are attendance at an ECEC framework for children ages 0–3 and the total number of years of attendance. Figure 1 presents the share of children attending an ECEC framework for ages 0–3 and preschool for ages 3–6, for Jews and Arabs separately.

Figure 1. Rates of attendance at an ECEC framework, ages 0–3 and 3–6, by sector

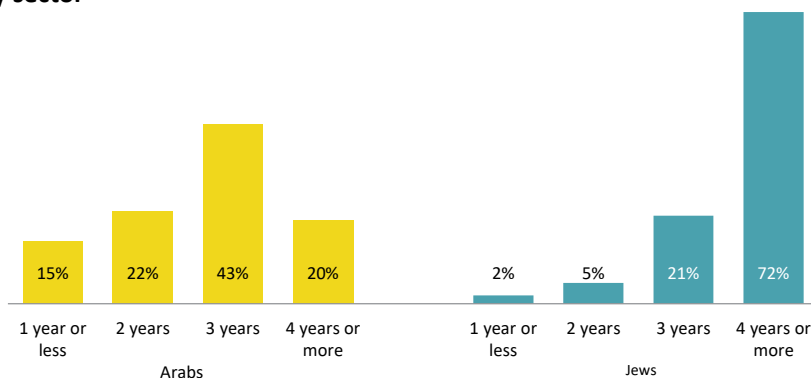


Source: Hai Vaknin and Yossi Shavit, Taub Center | Data: PIRLS 2016

Figure 1 indicates that the rate of attendance to a preschool framework for children ages 3–6 is similar for Jews and Arabs. Thus, attendance is almost universal for both groups: 98% for the Jewish sample and 96% for the Arab sample. In contrast, the rates of attendance at an ECEC framework for children ages 0–3 differs significantly between Arabs and Jews: 9 of every 10 Jewish children in the sample attended such a framework while less than half (46%) of the Arab children in the sample attended.

As mentioned, apart from the question of preschool attendance the parents were also asked about the total number of years that their child had attended preschool and the possible answers ranged from “did not attend at all” to “four or more years.” Figure 2 presents the distribution of number of years of preschool attendance for Jews and Arabs separately.

Figure 2. The distribution of the number of years of preschool attendance, by sector



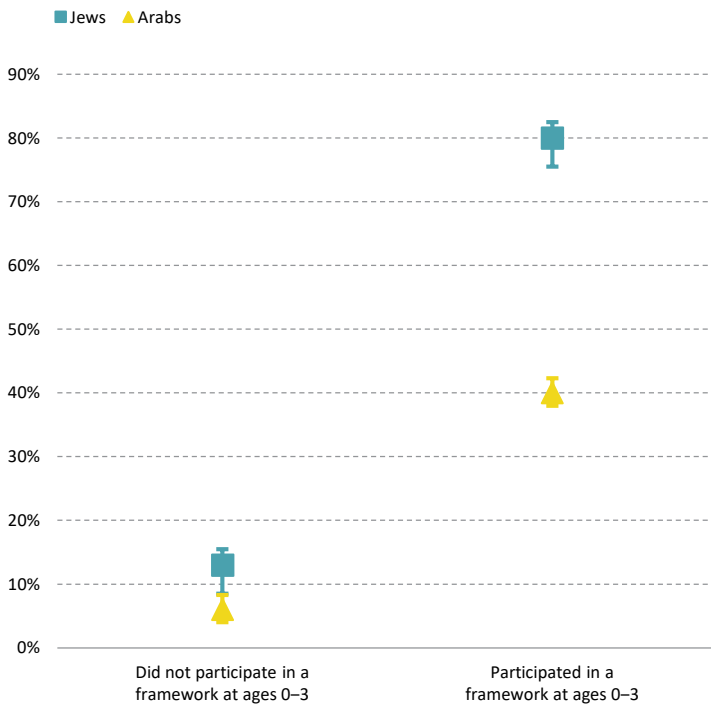
Source: Hai Vaknin and Yossi Shavit, Taub Center | Data: PIRLS 2016

Only a small minority of Jewish children spent one year or less (2%) or two years (5%) in preschool. The most common number of years in preschool among Jews is four or more years (72%), which reflects the high attendance rate among Jews for ages 0–3 and ages 3–6. In contrast, only a minority of the Arab children (20%) attended preschool for four years or more and the most common number of years was three (43%).¹ The figure shows that the variance

1 Among Arab parents who reported that their child attended an ECEC framework for the 0–3 age group (Figure 3), only 40% answered that they attended for four years or more. It can be assumed that a not insignificant share of the Arab children in the sample were in a preschool framework for the age group 3–6 on a non-continuous basis and therefore they did not accumulate the maximum number of years during this period. Unfortunately, we cannot test this hypothesis using the data at our disposal.

of the distribution of Arabs across the various categories is large relative to that of Jews. Therefore, it can be concluded that the large majority of Jewish children start daycare before reaching the age of three, while among Arabs that share is significantly lower.² Figure 3 presents the share of Jewish and Arab children who spent four or more years in a preschool setting according to their attendance at ages 0–3 in a daycare setting.

Figure 3. Preschool attendance rates for four or more years according to attendance or non-attendance at an ECEC framework for ages 0–3, by sector



Note: Confidence interval of 95%.

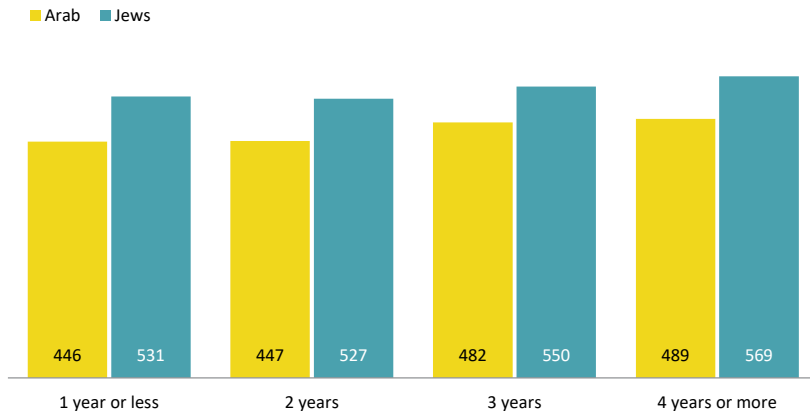
Source: Hai Vaknin and Yossi Shavit, Taub Center | Data: PIRLS 2016

- 2 It should be noted that the data were collected in 2016 and that the children were in preschool for age 3 about seven years previously, i.e. prior to the Trajtenberg reform which introduced free obligatory education from age 3 and made preschool attendance among 3-year-olds almost universal.

The figure shows that among children who did not attend daycare prior to the age of three, very few attended preschool for four years or more. Among Arab children who attended daycare at ages 0–3, only about 40% were in preschool frameworks for four years or more. In contrast, among Jews who attended daycare for ages 0–3 the share is about 80%, which is double that of Arabs.

Figure 4 presents average reading achievements for Jewish and Arab children by years of preschool attendance. Apart from the large difference in average achievement between Jews and Arabs in reading, it appears that, in general, average achievement increases with the number of years of preschool attendance. In both groups, there is a large jump in achievement in reading between two years in preschool and three years in preschool. Among Jews — though not among Arabs — there is another jump between three years and four years or more. It appears that in comparison to three years in preschool, four years or more in preschool does not contribute to achievement among Arabs as it does for Jews.

Figure 4. Average achievement in reading according to number of years of preschool attendance and sector



Source: Hai Vaknin and Yossi Shavit, Taub Center | Data: PIRLS 2016

Control variables

The control variables used in the study can be divided into two groups: characteristics of children and characteristics of parents. The former include age at the time of the survey (2016) and gender according to the students' responses in Grade 4. Students were asked to provide their date of birth (month and year) and their gender. Age in the sample ranged from 8.5 to 11.5, with an average of 9.96. Only a small share of the sample was younger than 9 (0.24%) or older than 11 (0.54%). Gender was distributed as follows: 49.5% boys and 50.5% girls. Gender is a dummy variable with a value of 1 for girls and 0 for boys.

The parents' characteristics include mother's education level and father's occupation. These variables serve as an indicator — one that is widely accepted in the literature — of the family's socioeconomic status (see, for example, Blau & Duncan, 1967). Mother's education level is a dummy variable on the basis of the parents' responses to a closed question on the highest level of education completed by the child's mother. If a mother had an academic education, the variable took a value of 1. Father's occupation is also a dummy variable built according to the parents' responses to a closed question regarding the occupation of the child's father. If the father was a professional or in a managerial occupation, the variable was given a value of 1. Since these two variables have a relatively high rate of missing values (8% for mother's education and 20% for father's occupation), we created additional dummy variables for the missing values and included them in the regression equations.³

Table 1 shows the averages and standard deviations for the dependent variable and the control variables for the entire sample and for Jews and Arabs separately. There is a large difference in average scores on the PIRLS test between Jews and Arabs. According to the literature, and in view of the importance of socioeconomic status, some of this difference can be explained by the socioeconomic differences between Jews and Arabs in the sample. As mentioned, we used mothers' education and father's occupation as indicators

3 We estimated these equations using the listwise deletion method. In other words, observations with missing values in the measures of these two background variables were omitted. There was no significant change in the outcome as a result. Ideally, we would estimate these regression using the multiple imputation method for missing values; however, we did not find a way to do this with regressions that are part of a plausible values analysis. Therefore, we included the missing values observations in the analysis and presented the missing values as dummy variables.

of socioeconomic status. The share of mothers with an academic education among Jews in the sample is almost double that among Arabs in the sample and the share of fathers who are professionals or managers is three times higher among Jews in the sample than among Arabs. The correlation coefficient between mother's education and father's occupation is 0.40 for Jews and 0.34 for Arabs with a 0.01 significance level. With respect to the missing values of these variables, it can be seen that, among the Arabs in the sample, there are many more missing values, and there are more missing values in the father's occupation variable than the mother's education variable.

Table 1. Average scores and standard deviation for the research variables

Variable	Total		Arabs		Jews	
	Mean score	Standard deviation	Mean score	Standard deviation	Mean score	Standard deviation
PIRLS test score, 4 th grade	534	147.30	846	178.20	562***	131.32
Age	69.9	0.34	9.92	0.32	9.98***	40.3
Gender (1 = girl)	20.5	0.49	0.53	0.49	0.52	0.49
Mother's education (1 = higher education)	0.46	0.49	0.28	0.45	0.54***	0.49
Mother's education (1 = missing value)	0.08	0.01	0.13	0.01	0.05***	0.01
Father's occupation (1 = free professional or management)	0.48	0.49	0.21	0.41	0.58***	0.49
Father's occupation (1 = missing value)	0.19	0.01	0.28	0.01	0.15***	0.01

Significance is the difference between the average score for Jewish students and the average score for Arab students: *** $p < 0.01$.

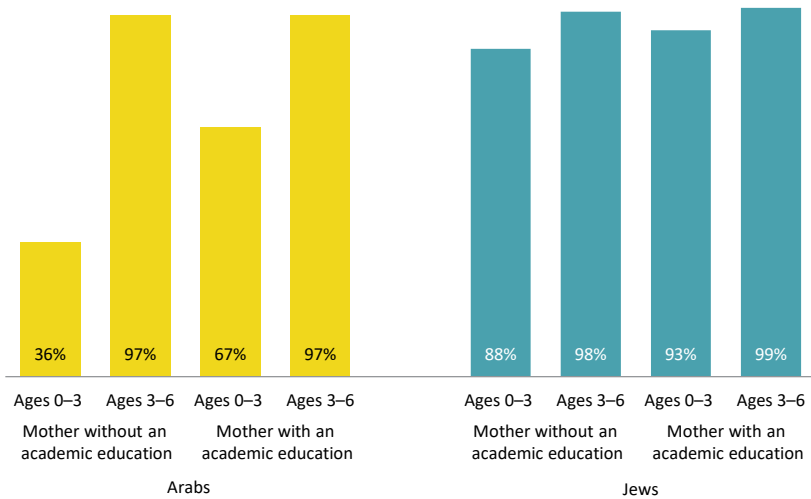
Source: Hai Vaknin and Yossi Shavit, Taub Center

Rates of preschool attendance

Figure 5 presents the preschool attendance rates by mother's education and sector. It can be seen that, among Arabs, the rate of attendance in an ECEC framework for the 0–3 age group among children of mothers with an academic education is almost double that of children of mothers with less education (67% vs 36%). Also among Jews, there is a difference in rates of attendance between children of mothers with an academic education and children of mothers without one; however, the difference is small and rates of attendance in both groups are very high (93% and 88%, respectively). With respect to

attendance in preschool frameworks for ages 3–6, it appears that in neither sectors is there a link between mother’s education and rate of attendance, which is almost universal. The same finding was observed in a previous study carried out for preschool frameworks in Israel (Vaknin, 2020).

Figure 5. Rates of preschool attendance according to mother’s education and sector



Source: Hai Vaknin and Yossi Shavit, Taub Center | Data: PIRLS 2016

Table 2 presents the results of three binomial logistic regressions to test the relationship between the independent variables and the likelihood of attending an ECEC framework at ages 0–3 (Model 1) and ages 3–6 (Model 2) and the likelihood of spending four years or more in preschool (Model 3). As mentioned, to deal with missing values in mother’s education and father’s occupation and to avoid bias in the regression results, we chose to also control for missing values in these variables by assigning them dummy variables. Furthermore, we included interactions intended to detect statistically significant differences between Arabs and Jews in the statistical effect of mother’s education and father’s occupation on the likelihood of attending an educational framework.

Like the pattern we saw in Figure 5, Model 1 in Table 2 shows large and statistically significant differences between Jews and Arabs in the relationship between mother's education and ECEC attendance for ages 0–3. In both sectors, the likelihood of attending and ECEC framework for children of mothers with a high level of education is higher than for children of mothers with a low level of education; among Arabs, the difference is very large. A similar pattern is observed with regard to father's occupation, although the difference between Jews and Arabs is not statistically significant. In addition, there is a large difference between Jews and Arabs in the likelihood of attendance even when controlling for other variables included in the model.

Model 2 repeats the analysis for the ratio of the likelihood of attending preschool for ages 3–6. Recall that in Figure 5 there was no major difference in rates of preschool attendance for ages 3–6 by sector or according to socioeconomic status, as defined by mother's education and father's occupation. A similar pattern also appears in the coefficients of Model 2: there are no statistically significant differences according to sector, gender, or socioeconomic status. The variables that indicate missing values for mother's education and father's occupation do not have statistically significant coefficients, which apparently indicates that parents who did not answer the relevant questions in the questionnaire did not explicitly state whether their child attended preschool frameworks.

Model 3, which estimates the relationships between background variables and the relative likelihood of attending preschool for four years or more, shows a similar — though not identical — pattern to those observed in Model 1. This is also to be expected since most of the children who attended preschool for four years or more started attending prior to the age of three while attendance to a preschool for ages 3–6 is almost universal and there is almost no difference according to sector, gender or socioeconomic status, as defined by mother's education and the father's occupation.

Table 2. Logistic regression to test the probabilities of participation in an ECEC framework at ages birth to 3 (Model 1), to be in an educational framework for ages 3 to 6 (Model 2), or to be in a framework for 4 years or more (Model 3)

Variable	Model 1 Ratio of probability of participation ages birth to 3	Model 2 Ratio of probability of participation ages 3–6	Model 3 Ratio of probability of participation for 4 years or more
Sector (1 = Arab)	0.08***	0.77	0.08***
Gender (1 = girl)	0.94	1.06	0.96
Mother's education (Missing value is no higher education)			
Higher education	1.51**	1.17	1.68***
Missing value	0.92	0.34**	0.54***
Father's occupation (Missing value is not in a free profession or management)			
Free profession or management	1.49**	1.92	1.46***
Missing value	0.69	0.44**	0.71*
Interactions			
Father's occupation in a free profession or management X Arab sector	0.80	0.73	1.08
Father's occupation missing value X Arab sector	1.26	0.96	1.32
Mother has higher education X Arab sector	2.27***	1.16	1.59**
Mother's education is missing value X Arab sector	1.97**	0.77	2.90***
Constant	7.20***	49.27***	1.92***
Pseudo R ²	0.23	0.09	0.21
Observations	3,178	3,273	3,302

*p < 0.10; **p < 0.05; ***p < 0.01.

Source: Hai Vaknin and Yossi Shavit, Taub Center

Findings regarding the relationship between educational framework attendance and academic achievement

As noted, the main goal of the research is to determine whether attending an early education framework contributes to a child's future achievement. As can be seen in Figure 5, among both Jews and Arabs, there are very few children in the sample who did not attend preschool for ages 3–6 and, therefore, it is not possible to reliably estimate the differences in achievement according to attendance to these preschool frameworks. In contrast, the data do allow us to estimate the differences in achievement in the case of early education frameworks for ages 0–3. Similarly, this can be measured according to the length of preschool attendance as reported by the parents. In Table 3, we estimate the effect of attending an early education framework for ages 0–3 on children who attended a preschool framework for ages 3–6. In other words, we omitted the few percent of children who did not attend preschool from age 3 and onward.

The first regression in Table 3 includes only the variable for attendance at an ECEC framework for ages 0–3. The findings indicate a large and positive correlation between these variables. After adding control variables to the second regression equation, the positive contribution of attending an educational framework for ages 0–3 disappeared almost entirely and is not statistically significant. In Model 3, we also included interactions between educational framework attendance on the one hand and mother's education and sector on the other. The interactions test whether the relationship between attending a framework at ages 0–3 and later academic achievement varies by the mother's education and the child's gender. It can be seen that their coefficients are not statistically significant. In other words, there is no difference between Jews and Arabs or by socioeconomic status in the relationship between education framework attendance for ages 0–3 and academic achievement.

Table 3. Linear regression to test the correlation between participation in an ECEC framework for ages birth to 3 and reading achievements in Grade 4 in Israel for children who participated in an educational framework for ages 3 to 6

Variable	Model 1	Model 2	Model 3
Participation in an ECEC framework 0–3	63.82*** (5.44)	6.70 (5.35)	14.64 (7.89)
Sector (1 = Arab)		-68.45*** (6.16)	-62.08*** (8.58)
Gender (1 = girl)		11.14*** (3.37)	11.02*** (3.38)
Age		8.56** (4.17)	8.55** (4.15)
Mother's education (Missing value is no higher education)			
Higher education		30.62*** (3.28)	39.73*** (5.79)
Missing value		-11.55 (7.29)	-8.52 (11.29)
Father's occupation (Missing value is not a free profession or management)			
Free profession or management		24.22*** (3.74)	24.34*** (3.76)
Missing value		-10.85** (4.74)	-10.83** (4.78)
Interactions			
Mother with higher education X Participation in a framework ages 0–3			-10.72 (6.79)
Mother's education missing value X Participation in a framework ages 0–3			-3.95 (12.09)
Arab sector X Participation in a framework ages 0–3			-8.56 (9.79)
Constant	489.82*** (4.91)	440.01*** (41.70)	433.43*** (41.12)
N	3,021	3,021	3,021
R ²	0.09	0.31	0.31

p < 0.05; *p < 0.01.

Standard error in parentheses.

Source: Hai Vaknin and Yossi Shavit, Taub Center

After testing the contribution of attending preschool to achievement in reading, we estimated two additional regressions (Table 4). The first included dummy variables for years of preschool attendance and omitted the category of three years of attendance in order to test whether attendance for four years or more is preferable to three years and whether attendance of three years is preferable to a shorter period. The second regression includes the control variables. The results indicate that, before controlling for background variables, attendance for one or two years has a negative effect on achievement in reading relative to attendance for three years, while attendance for four years or more has a positive effect. Once the control variables are introduced, the regression results show that attendance for three years is still preferable, with statistical significance, over a shorter period of attendance; however, attendance for four years or more does not contribute to achievement more than attendance for three years.

This finding is consistent with that from Table 3 previously. Attending preschool from ages 3–6 is equivalent to attendance for three years and is preferable — in terms of achievement in reading — over one or two years of attendance from ages 3–6. In contrast, attending for four or more is possible only by starting at the age of 2 or younger, which does not contribute to achievement more than three years of attendance between the ages of 3 and 6.

Table 4. Linear regression to test the correlation between years in an ECEC framework and reading achievements

Variable	Model 1	Model 2
Number of years in a framework (Missing value is 3 years)		
0–1	-50.07*** (9.60)	-22.73*** (7.51)
2	-44.41*** (6.79)	-26.02*** (5.94)
4+	42.72*** (4.44)	5.94 (3.92)
Sector (1 = Arab)		-63.24*** (5.50)
Gender (1 = girl)		12.19*** (3.23)
Age		6.51* (3.74)
Mother's education (Missing value is no higher education)		
Higher education		28.11*** (3.28)
Missing value		-9.12 (6.29)
Father's occupation (Missing value is not a free profession or management)		
Free profession or management		22.50*** (3.61)
Missing value		-11.79*** (4.35)
Constant	518.73*** (4.38)	465.07*** (37.60)
Observations	3,302	3,302
R ²	0.14	0.33

*p < 0.10; **p < 0.05; ***p < 0.01.

Standard error in parentheses.

Source: Hai Vaknin and Yossi Shavit, Taub Center

Discussion and conclusion

In this study, we tested the relationship between attendance at an early childhood education and care framework and achievement on reading achievement tests in Grade 4 in Israel. According to the literature, attending a high-quality early education framework can contribute to cognitive development, including academic achievement, particularly among children from disadvantaged socioeconomic background. In contrast, attending a low-quality framework does not contribute to cognitive development and may even hinder a child's development.

Daycare and preschool attendance rates are particularly high in Israel, especially in the case of preschool frameworks for ages 3–6. However, the quality of these frameworks is fairly low relative to other Western countries. This is reflected in the large number of children in each framework, the small number of staff members, and the low level of their education (particularly among the support staff). Until recently, the lack of supervision by the Ministry of Labor, Social Affairs and Social Services over early education frameworks and the low level of public investment per child in that age group have also been notable.

Research on the impact of participation in an early childhood framework and later academic achievement is not new. The majority of studies, though, have focused on the effect of attending preschool frameworks for ages 3–6 rather than 0–3, even though research has shown the importance of the early years of life in both cognitive and non-cognitive development. One of the advantages of the current study is its focus on the relationship between attendance in an ECEC framework (from birth to age 3) in Israel and academic achievement.

In the study, we analyzed data from the PIRLS 2016 exam, which includes measures of early education attendance for ages 0–3 and ages 3–6 and data for achievement in reading in Grade 4. Furthermore, the data include the children's characteristics (such as age, gender, and sector) and the family's socioeconomic background (mother's education and father's occupation).

As in previous studies, the findings show high rates of preschool attendance between ages 3 and 6 in Israel, both among Arabs and Jews and without any major difference according to socioeconomic status (as measured by mother's education and father's occupation). In contrast, there is a large gap in rates of preschool attendance between birth and age 3 according to both sector and socioeconomic status. Jews attend such preschool frameworks at

a significantly higher rate than Arabs; however, even within the Arab sector, there are major differences in rates of preschool attendance according to socioeconomic status.

Our findings partially support those of Zontag et al. (2020), who found that attending an ECEC framework between birth and age 3 does not contribute to achievement and perhaps even hinders it. Our findings show that attending an early education framework between birth and age 3 indeed does not contribute to achievement in reading in primary school. Nonetheless, and in contrast to Zontag et al., no evidence was found that attending such a framework between birth and age 3 harms achievement among children from weaker socioeconomic backgrounds or among Arab children.

The fact that attendance to an early education framework for children between birth and age 3 fails to contribute to future academic achievement may be the result of the situation of these frameworks in Israel. As noted, there is no standard curriculum in these frameworks, they are of lower quality than those in the OECD countries, and there is only limited supervision over them. If their quality was higher, we would expect to find, according to the literature, that attendance positively contributes to later achievement in reading particularly among children from families of low socioeconomic status.

Our research has several major limitations, including the lack of any measure of education framework quality. As a result, we were unable to arrive at unambiguous conclusions with respect to those variables that limit the contribution of early childhood education and care between birth and age 3. Furthermore, it would have been preferable to have data tracking the children from their time in preschool up to primary school; unfortunately, such data do not exist for Israel. The PIRLS data provide us with a reasonable alternative but not one without problems. First, the data distinguish between education frameworks for birth to 3 years old and those for ages 3 to 6, but not between types of education frameworks (daycare, pre-nursery school or private pre-nursery school for children up to the age of three, a private or municipal preschool school for children aged 3 and up) or their quality. Second, the PIRLS data do not include measures of important family background variables, such as parents' income and number of children at home. The mother's education and the father's occupation were measured at the time when the child was in Grade 4 and not for any earlier age and the time when the child attended an early education framework. Finally, our research is only correlative and we have no possibility of determining whether attendance at an early education

framework or non-attendance has a direct effect on a child's achievement in reading but only whether there is a correlation — or, as in our case, a lack of correlation — between early education framework attendance and achievement in reading.

This paper was written in September 2021. Only in the current school year did daycare centers and pre-nursery schools (ECEC frameworks for children from birth to age 3) come under government supervision and it may take several months or even years until this is fully implemented. The law specifies a number of criteria for the quality of these frameworks, including educational requirements and on-the-job training for staff members, limits on the number of children in a framework, the maximum staff to child ratio, standards for physical and safety conditions, etc. It is the hope that the implementation of the law's provisions will increase the contribution of early childhood education to children's cognitive development and future academic achievement and will support the advancement of children from disadvantaged socioeconomic backgrounds and reduce gaps in achievement due to socioeconomic status.

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