Article

Access to Early Childhood Education and Academic Achievement in Elementary School[1]

Elaine Cristina Gardinal-Pizato[2]
Faculdades Integradas de Jaú, Jaú-SP, Brazil
Edna Maria Marturano
Universidade de São Paulo, Ribeirão Preto-SP, Brazil
Anne Marie Germaine Victorine Fontaine
Universidade do Porto, Porto, Portugal

Abstract: The conception that early childhood education (ECE) positively affects academic progress is well established. The purpose of this study was to verify the impact of time of exposure to ECE on the academic performance of children and evaluate their academic progress from the 3rd to the 5th grade when there is exposure to early childhood education. Participants were 294 public school students (both genders) divided into three groups: no ECE, one year of ECE, and two years of ECE. Academic achievement was assessed in the 3rd, 4th, and 5th grades through the judgment of teachers and collective written evaluations of the Portuguese language and mathematics. An Academic Achievement test was administered to 3rd and 5th year students. A multivariate analysis with repeated measures, controlled for socioeconomic level, showed ECE was consistently associated with greater achievement, though one extra year in ECE did not show any additional effect on academic performance. Further research is required due to the implications of this last result for public policies.

Keywords: early childhood education, academic achievement, elementary education

Acesso à Educação Infantil e Trajetórias de Desempenho Escolar no Ensino Fundamental

Resumo: No pressuposto de que a educação infantil (EI) contribui para trajetórias escolares mais favoráveis, o objetivo deste estudo foi verificar o impacto do tempo de exposição à educação infantil sobre o desempenho acadêmico e avaliar o progresso escolar das crianças, na trajetória do 3º ao 5º ano do ensino fundamental, em função da exposição à educação infantil. Participaram 294 alunos de escolas públicas, reunidos em três grupos: sem EI, com um ano de EI e com dois anos de EI. Avaliou-se o desempenho no 3º, 4º e 5º anos, por meio do julgamento do professor e provas coletivas. O Teste de Desempenho Escolar foi aplicado no 3º e 5º ano. Controlado o efeito do nível socioeconômico, a análise de variância com medidas repetidas mostrou que o acesso à EI foi consistentemente associado a melhor desempenho, porém um tempo maior de exposição à EI não teve efeito adicional. Dadas suas implicações para políticas públicas, este último resultado requer verificação e esclarecimento por meio de novas pesquisas.

Palavras-chave: educação infantil, rendimento escolar, ensino fundamental

Acceso a la Educación Preescolar y Trayectorias de Desempeño en la Escuela de Educación Primaria

Resumen: Bajo el presupuesto de que la educación preescolar (EP) afecta positivamente el progreso académico, esto estudio investigó el impacto del tiempo de exposición a la educación infantil en el desempeño académico y evaluar el progreso escolar de los niños, en la trayectoria del 3º al 5º año de la educación primaria, en función de la exposición a la educación preescolar. Participaron 294 niños y niñas, alumnos de escuelas públicas, en tres grupos: sin EP, con un año de EP o con dos años de EP. El desempeño escolar fue evaluado en el tercer, cuarto y quinto grado por los profesores y con pruebas colectivas de portugués y matemática. El Test de Desempeño Escolar fue aplicado en el tercer y en el quinto grado. Controlado el nivel socioeconómico, el análisis de variancia con medidas repetidas mostró que el acceso a la EP fue consistentemente asociado a un mejor desempeño, pero un año a más de frecuencia a la EP no tuvo efecto adicional. Esto último resultado requiere verificación y clarificación mediante nuevas investigaciones, dadas sus implicaciones para políticas públicas.

Palabras clave: crianza del nino, rendimiento escolar, enseñanza de primer grado

[2] Correspondence address:
Elaine Cristina Gardinal-Pizato. Rua Oswaldo Cruz, 103, Jardim Figueira Branca. CEP: 17.300-000. Dois Córregos-SP, Brazil. E-mail: egardinal@yahoo.com.br

The evidence of positive effects of early childhood education on later school performance is well established (Benitez & Flores, 2002; Entwisle & Alexander, 1998). Currently it is recognized around the world, that programs for young children constitute a good social and economic investment, given their wide and lasting benefits (Reynolds & Temple, 2008; Sassi, 2011). The issue of the impact of

early childhood education is particularly relevant in Brazil, where greater attention has been given to public policies for children in recent decades. Early childhood education is officially recognized as the first stage of basic education, in order to promote the integral development of the child (Law No. 9.394, 1996). The National Education Plan - NEP (Law No. 10.172, 2001) sets targets for expansion of crèche (up to age 3 years) and pre-school (4 to 5 years) services, aiming for universal access.

The coverage of early childhood education shows growth, albeit with regional differences and distortions related to socio-demographic variables (Campos, Fullgraf, & Wiggers, 2006). A recent survey indicates that the proportion of children aged 04-06 years who attended school in 2008 reached the national average of 80%, a rate that met the target of the NEP for 2010 in advance (Vieira, 2010). Early childhood education as an investment has attracted the attention of Brazilian researchers in the field of social economy, interested in identifying factors related to success in school life and the labor market. In a national survey with data from the public education system, obtained from the National Evaluation System of Fundamental Education (SAEB) 2003 and the Brazilian National Examination 2005, Felício and Vasconcellos (2007) found results suggestive of a causal relationship between early childhood education attendance and the results in mathematics in the fourth grade of elementary education. Curi and Menezes-Filho (2006) investigated the effect of early childhood education on the likelihood of completion of the education stages and on future wages, using data from the Survey of Living Standards (SLS) conducted by the IBGE and, for the performance in mathematics, from the SAEB. Their results indicate that having attended pre-school has positive and significant effects in all cases.

Data from the national literature mentioned in the preceding paragraphs suggest that early childhood education, though not having the official assignment of preparing the child to face the challenges of formal schooling (Law No. 9.394, 1996), operates as a constructor of facilitatory skills for a successful school trajectory, as highlighted in the international literature (Reynolds & Temple, 2008). From a developmental perspective, Trivellato-Ferreira and Marturano (2008) have noted effects which facilitate the transition to elementary education. In their study, children who completed one year of early childhood education, compared to their peers without such prior experience, were not only better assessed by their teachers regarding their performance in Portuguese and mathematics, but also did better in a standardized test of academic performance, were considered by the teachers as better adjusted in the classroom and reported, themselves, fewer symptoms of stress, as well as reduced vulnerability to stressful school events in the 1st year of elementary school.

This article examines the effects of exposure to early childhood education (ECE) from a developmental perspective, focusing on two, largely unexplored issues. The first is whether the length of exposure to ECE makes a difference in elementary education learning. Scattered studies suggest specific effects. Entwisle and Alexander (1998) verified that children with more time in early childhood education had better academic and socio-emotional results in the first grade. In Brazil, Curi and Menezes-Filho (2006) showed that students of the 4th grade who began their studies in nursery school scored highest in mathematics in SAEB Test-2003 compared to students who began their studies in pre-school.

The second issue examined in this article is how the access to ECE affects the school trajectory of the children in elementary education, in terms of performance advantage, observed in different school levels through cross-sectional studies. Is there a pattern over time? Does this advantage remains constant, decreases or, in contrast, increase as the children progress in the school?

The possibility of a stable pattern of differences is supported by longitudinal studies (Andersson, 2010; Landerl & Wimmer, 2008), as well as by research showing that the performance and skills of the children at the start of elementary school predict their school trajectory in the subsequent years (Crosnoe et al., 2010; Entwisle & Alexander, 1998; Malaspina & Rimm-Kaufman, 2008; McClelland, Acock, & Morrison, 2006). In Brazil, the practice of grouping students into homogeneous groups, often adopted in the schools (Cafiero, Rocha, & Soares, 2007), can be considered a factor for maintaining initial differences. Alternatively, it could be suggested that the differences will diminish over time due to a compensatory effect of exposure of the children to formal education. This hypothesis, as well as the preceding one, has no empirical basis directly related to the effect of ECE. However, the longitudinal study conducted by Alves and Soares (2008), regarding the effect of the schools on the learning of the Portuguese language and mathematics from the 5th grade, suggests effects of attenuation of differences as the children advance to higher levels. Their results showed that students with lower initial levels progressed, on average, more than students with higher initial levels, although the differences of level persisted at the end of the study. Parrila, Aunola, Leskinen, Nurmi and Kirby (2005) found similar results for reading performance in Canadian children followed from the 1st to 5th year: attenuation, but not enough to compensate for the initial differences.

The opposite alternative, that the differences in performance between children with and without prior access to ECE are accentuated throughout the elementary education is related to the evidence of the role of extra-school factors in the performance. Studies on the evaluation data of the teaching systems conducted in the country show that a significant portion of the variation in school results can be explained by circumstances outside the classroom, associated mainly with the social background of the students (Alves & Soares, 2008), which is also found in the international literature (Aikens & Barbarin, 2008).

As access to ECE is influenced by socioeconomic variables (Felício & Vasconcellos, 2007; Vieira 2010), the initial advantage of the children with access to ECE could be due, at least in part, to the more favorable socioeconomic conditions that, persisting throughout the school trajectory, continuously, positively and cumulatively influence the performance of this group, thus contributing to increase their advantage over the children without access to ECE. Alves & Soares (2008) detected an increase in the advantage associated with socioeconomic level between the 5th and 7th grade, only in relation to mathematics. Jordan, Kaplan, Ramineni and Locuniak (2009) found that low-income children progressed more slowly in mathematics, between the 1st and 3rd year, compared to medium to high income children. In this study, numeracy skills evaluated in early childhood education mediated the association between socioeconomic level and progress in mathematics.

A fourth possibility can be contemplated, that the effects are not global, but vary depending on the specific areas of focus. For example, Hinnant, O'Brien and Ghazarian (2009) verified that trajectories of performance in reading and arithmetic are affected differently by the expectations of the teacher at the beginning of elementary education.

Based on these considerations, the aim of this study was to verify the impact of length of exposure to early childhood education on academic performance and to evaluate the school progress of the children, in the trajectory from the 3rd to 5th year of elementary education, according to exposure to early childhood education. The length of exposure was defined in terms of complete annual cycles, ranging from zero to two years in ECE. To evaluate the performance the view of the teacher, the programmatic contents of each school level, and the progress in basic academic skills were taken into consideration. The period between the 3rd and 5th year (formerly 2nd and 4th grade) was chosen because it is the least investigated phase in the national studies on the effects of ECE. The socioeconomic level was taken into consideration, due to evidence that both access to EI and performance in elementary education are influenced by socioeconomic variables (Alves & Soares, 2008; Felício & Vasconcellos, 2007; Vieira, 2010).

Method

The study followed a longitudinal research design. The children were evaluated three times: in the second semester of the 3rd year (August-September), in the second semester of the 4th year (August-September) and in the first semester of the 5th year (May-June).

Participants

The study is part of a wider investigation. The study sample consisted of 294 children, 146 boys and 148 girls. All the students were considered potential participants that were aged between 7 years and 9 years and who attended the 3rd year of elementary education in 2007 in five public schools of a city, with approximately 24,000 inhabitants, of the state of São Paulo. The sample was configured at the beginning of 2007 and then followed longitudinally until 2009, when the students were already in the 5th year. In 2007 there were 372 students enrolled in the 3rd year throughout the municipality, of which 89% had prior access to ECE. A total of 351 children met the age criterion, of whom 336 participated in the first collection and 294 remained in the study until the end, this being 79% of the 3rd year school population in the public system in 2007.

The 294 participants who remained until the end of the study were divided into three groups according to the number of years in ECE: Group 0, with 30 students with no previous access to ECE, Group 1, with 78 students who had completed one year in ECE, Group 2, with 186 students who had completed two years in ECE. This distribution corresponds to a rate of 90% of children with access to ECE, a percentage similar to that found in the 3rd year school population at the initiation of the study. Table 1 shows the composition of the groups according to gender and socioeconomic class, with the classes grouped into three levels.

Table 1

Characterization of the Participants of the Three Groups Formed According to the Number of Years of Attendance of Early Childhood Education

Variable	G0		G1		G2		Total	
	N	%	*N*	%	*N*	%	*N*	%
Sex								
Male	15	10,3	40	27,4	91	62,3	146	100
Female	15	10,1	38	25,7	95	64,2	148	100
Socioeconomic class								
A - B	01	3,3	09	11,5	53	28,5	63	21,4
C	13	43,3	38	48,7	92	49,5	143	48,6
D - E	16	53,3	31	39,7	41	22,0	88	29,9
Total	30	10,2	78	26,5	186	63,3	294	100

Note. G0 = No early childhood education. G1 = One year of early childhood education. G2 = Two years of early childhood education.

Instruments

The instruments used are described below.

Brazilian Criteria for Economic Classification (Brazilian Association of Research Companies [ABEP], 2003): evaluates the socioeconomic level through information regarding the number of items of comfort that the family has access to, such as refrigerator, housemaid, automobile, etc.

Academic Competence Scale of the Social Skills Rating System- SSRS-BR (Bandeira, Del Prette, Del Prette, & Magalhães, 2009): consists of nine items in which the teacher evaluates the position of the child in relation to their classmates in reading, mathematics, motivation, encouragement by the parents, intellectual functioning and general behavior. The maximum score on the scale is 45. Bandeira et al. (2009) reported satisfactory levels of internal consistency and temporal stability for the Brazilian version of the scale.

Pedagogical Evaluation (Escolano, 2004): this evaluation is applied collectively in the classroom and aims to assess the academic performance of students in the first cycle of elementary education. It consists of two parts, one of Portuguese, comprising dictation tasks, reading comprehension and grammar questions, and the other of mathematics, with questions referring to the four operations, problems and, from the 5th grade, fractions. In the application, the instructions for each item of the task are given aloud by the examiner, passing on to the next when the children finish writing down their answers. In the present study the tests of level II (3rd year), III (4 years) and IV (5th year) were used, with a maximum score of 10. Escolano (2004) reported a high correlation (above 0.60) between the score obtained in these tests and the Final Cycle Evaluation conducted by the school in the 5th year (then the 4th grade).

School Performance Test (SPT) of Stein (1994): composed of three subtests - reading, writing and arithmetic, provides, in addition to the raw score, the classification of the child in relation to the grade. In this study the raw scores of the subtests were used, in order to measure the acquisitions in each school year, in relation to the previous year. The maximum score is 70 in reading, 35 in writing and 38 in arithmetic. The SPT presents good indices of internal consistency between 0.93 and 0.98 (Stein, 1994).

Procedure

Data collection. Data collection was performed in three steps. In the first, which occurred in the 3rd year of elementary education, each child participated in an individual session, in which the School Performance Test (SPT) was applied, and a collective session in their own class, in which the Pedagogical Evaluation II was applied. The SSRS-BR was completed by the teachers and the Economic Classification Criteria Brazil form was completed by the parents or guardians during parent meetings held by the schools. In the second step, which occurred in the 4th year of elementary education, each child participated in a collective session in their own class, in which the

Pedagogical Evaluation III was applied. The SSRS-BR was filled out by teachers. In this step the SPT was not applied, for budgetary reasons. In the third step, which occurred in the 5th year of elementary education, each child participated in an individual session, in which the School Performance Test (SPT) was applied, and a collective session in their own class, in which the Pedagogical Evaluation IV was applied. The SSRS-BR was filled out by the teachers.

Data analysis. The statistical analysis was performed using the SPSS v. 17.0 program. The equivalence of the groups, regarding gender, age, and socioeconomic classification, was tested with the use of the chi-square or analysis of variance (ANOVA) tests. To evaluate the effect of the early childhood education over time, analyses were performed using analysis of variance for repeated measures (MANOVA), with the years in ECE as the independent variable and the performance measures as the dependent variables. The possible influence of the socioeconomic level was controlled through its inclusion in the model as a covariate variable. If significant differences were observed, post-hoc tests were conducted to identify the factors responsible for these differences.

Ethical Considerations

The study met the guidelines and standards of Resolution 196/96 of the National Health Council of the Ministry of Health. After obtaining the consent of the directors for its performance, the project was submitted to the Research Ethics Committee of the Faculty of Philosophy, Sciences and Languages of Ribeirão Preto-USP (Protocol No. 306/2007-2007.1.335.59.0). After approval, consent of the parents for the participation of their children and of the teachers to participate as informants was obtained through signing the Terms of Free Prior Informed Consent. The children gave their verbal consent to participate.

Results

The groups did not differ regarding gender ($\chi^2 = 0.124$; $p = .94$), but differed regarding age (ANOVA: $F_{2.291} = 18.847$; $p < .001$). The post-hoc comparisons indicated that the participants in G1, with a mean age of 98.38 months, were significantly younger than those in G0 ($M = 101.27$) and G2 ($M = 101.96$). To verify whether the groups differed in relation to the socioeconomic indicator, an ANOVA was applied comparing the raw scores in the Brazil Economic Classification Criterion of the three groups. The results indicated a significant difference ($F_{2.291} = 14.34$; $p < .001$). The post-hoc analysis showed that the group with two years of ECE had a significantly higher mean (14.36) than the others: the group without ECE (10.87) and the group with one year of ECE (12.21). Similar results were obtained regarding the indicator of education of the head of the household and regarding the data of the stratification into five classes, provided by the instrument. There was no difference between G0 and G1. Therefore, the length of attendance of early childhood

education is associated with the socioeconomic level (SEL), while the access to ECE is not.

Furthermore, it was verified that the SEL is significantly associated with all the indicators of performance: academic competence ($F = 15.13$; $p < .001$); collective evaluation in Portuguese ($F = 32.77$; $p < .001$); performance in the SPT, reading ($F = 10.93$; $p < .001$) and writing ($F = 27.60$; $p < .001$) subtests; collective evaluation in mathematics ($F = 43.77$; $p < .001$) and performance in the SPT, arithmetic ($F = 49.03$; $p < .001$) subtest. Taken together, these results support the need for control of the SEL in the comparisons between defined groups according to their attendance of early childhood

education: The SEL was considered covariate in the analyses of variance performed.

Table 2 shows the means of the groups in the evaluations of performance performed in the 3rd, 4th and 5th years of elementary education. The results obtained through the analysis of variance with repeated measures allow the evaluation of the effect of the duration of exposure to ECE (intergroup independent variable: ECE), and the effect of length of exposure to elementary education (intra-subject independent variable: Time) on the various performance indicators (dependent variables), after controlling the SEL considered covariate.

Table 2

Means (and Standard Deviations) of the Indicators of Academic Performance, According to the Years in Early Childhood Education

Variable	G0 ($N = 30$)	G1 ($N = 78$)	G2 ($N = 186$)
	M (DP)	M (DP)	M (DP)
Academic competence - SSRS-P			
3rd year	23,1(9,2)	32,9 (8,7)	34,9 (9,4)
4th year	23,7 (11,8)	33,0 (9,1)	35,4 (9,0)
5th year	25,2 (9,9)	34,8 (7,9)	34,5 (10,0)
Portuguese - collective evaluation			
3rd year	2,9 (2,4)	5,7 (2,2)	6,2 (2,3)
4th year	3,5 (2,4)	5,6 (1,7)	6,2 (2,0)
5th year	2,6 (1,82)	4,8 (1,78)	5,3 (2,02)
Mathematics - collective evaluation			
3rd year	2,3 (2,11)	5,0 (2,79)	5,3 (2,7)
4th year	2,7 (2,88)	4,7 (2,90)	5,5 (2,7)
5th year	2,6 (2,31)	4,4 (2,1)	5,1 (2,4)
Reading - SPT			
3rd year	27,6 (29,5)	55,5 (19,2)	58,3 (18,4)
5th year	39,3 (27,1)	63,0 (8,3)	62,5 (12,0)
Writing - SPT			
3rd year	7,0 (7,9)	14,9 (7,5)	17,32 (8,1)
5th year	12,8 (10,7)	21,9 (7,39)	23,7 (8,2)
Arithmetic - SPT			
3rd year	4,8 (3,5)	8,8 (4,0)	10,0 (3,8)
5th year	9,8 (6,1)	16,1 (4,7)	17,8 (5,3)

Note. Mean scores of G0 = No ECE. G1 = One year of ECE. G2 = Two years of ECE. SSRS-P = Social Skills Rating System, teacher's version. SPT = School Performance Test.

In relation to academic competence, evaluated by the teacher, the intra-subject analysis did not detect significant differences between the measurements taken at different times in the school trajectory. According to the intergroup analysis performed, there was a significant effect for the access to early childhood education ($F_{2.291} = 18.02$; $p < .001$), with the socioeconomic level variable controlled. The results of the post-hoc tests indicate a significant difference between G0 and the other groups, but not between G1 and G2. There were no significant effects of interaction between time and years in early childhood education which

indicates that differences are maintained throughout the three years of schooling.

Regarding the performance in Portuguese, obtained in the collective evaluation, the results of the intra-subject analysis indicate a statistically significant effect of time on the sample as a whole. A decrease of the mean values from the 4th year to the 5th year was registered. The means of the 5th year are significantly lower than those of the 3rd and 4th years, which do not differ from one another (3rd year: $M = 5.74$; 4th year: $M = 5.76$; 5th year: $M = 4.89$; $F_{2.291} = 20.72$; $p < .005$).

According to the intergroup analysis, there was a significant effect in relation to the means of the groups with and without previous access to early childhood education ($F_{2.291}$ = 18.02; p <.001), with the socioeconomic level variable controlled. The results indicate that the attendance of early childhood education implies better performance in Portuguese at all evaluation moments (G0: 3.41; G1: 5.52; G2: 5.77; $F_{2.291}$ = 54.08; p <.001).

No significant effects of interaction between time and the years in early childhood education on the dependent variable were found. The absence of these interaction effects indicates that the differences between G0, G1 and G2 do not alter during the schooling.

For the academic performance in mathematics, in the intra-subject analysis, there were no significant differences found regarding time for the total sample. According to the intergroup analysis performed, similar to the performance in Portuguese, the data indicate that there is a significant effect of the access to early childhood education, socioeconomic level controlled. Significant differences were found between G0 and the other groups. The data indicate that the attendance of early childhood education implies better results in the performance in mathematics (G0: 3.08; G1: 4.96; G2: 5.11; $F_{2.291}$ = 10.77; p <.001).

There were no significant effects of interaction between time and years in early childhood education. The absence of these interaction effects indicates that the differences between G0, G1 and G2 do not alter during the schooling.

In relation to the performance in reading, as measured by the SPT in the 3rd and 5th years of elementary education, the results of the intra-subject analysis indicate a statistically significant increase in the mean values with the school progression, after control of the socioeconomic level. (3rd year: 47.29; 5th year: 55.52; $F_{1.291}$ = 51.24; p <.001). According to the intergroup analysis, there was a significant effect of the access to early childhood education. In fact, the results of the post-hoc tests indicate that there is a significant difference between G0 and the others, but not between G1 and G2, in the reading subtest (G0: 35.31; G1: 60.12; G2: 59.73; F2, 291= 33.02, p <.001). The results also show a significant interaction between years in early childhood education and school progress ($F_{2.292}$ = 3.36; p <.05). By examining the means it can be verified that this interaction effect reflects a greater increase of the mean of the group without early childhood education in relation to other groups. In G0, the mean changed from 27.63 to 39.33 between the 3rd and the 5th year, which rose by more than 11 points. In G1 the mean increased by approximately seven points (from 55.50 to 62.99) and in G2 by slightly more than four points (from 58.28 to 62.49). It should be noted that the means of G1 and G2 in the 5th year suggest a concentration of results close to the maximum score of the subtest, which is 70, which may lead to the consideration that there is a ceiling effect. Even with the attenuation of the discrepancies, there remains a significant difference between the group without ECE and the others.

Regarding the writing performance in the SPT, the results of the intra-subject analysis indicate that the performance increases significantly from the 3rd to the 5th year (3rd year: 13.58; 5th year: 20.03; $F_{1.292}$ = 39.98; p <.001). According to the analysis of the intergroup differences, significant differences were encountered between G0 and the other groups. The students who attended early childhood education presented better results in writing in relation to the students with no previous access to ECE. (G0: 11.33; G1: 19.09; G2: 20.00; $F_{2.291}$ = 16.83; p <.001). There were no significant effects of interaction found between time and years in early childhood education which indicates that the differences are maintained over the three years of schooling.

The results of the intra-subject, regarding the performance in the arithmetic subtest of the SPT, show an increase of the mean values of the 3rd year to the 5th year of elementary education (3rd year: 8.17; 5th year: 15.02; $F_{1.292}$ = 57.68; p <.001). According to the intergroup analysis there was a significant difference between G0 and the other groups: the attendance of early childhood education is reflected in better results in the performance in arithmetic. (G0: 8.30; G1: 12.91; G2: 13.57; $F_{2.291}$ = 22.36; p <.001).

The results also show a significant interaction between the years in early childhood education and the progress in elementary education ($F_{2.291}$ = 5.11; p <.05). The examination of the means indicates that this interaction effect reflects the higher increase of the means of G1 and G2 in relation to G0, between the 3rd and 5th year.

Discussion

The present study arose from the interest in exploring the effects of early childhood education from a developmental perspective. Two questions guided the research: does the length of exposure to early childhood education make a difference in learning throughout elementary education? How does the experience of early childhood education affect the school trajectory of the children? Thus, the aims pursued were to obtain indices of the effect of the length of exposure to early childhood education on the academic performance and to evaluate the school progress of the children, in the trajectory of the 3rd to 5th years of elementary education, according to the exposure to early childhood education. In the discussion of the results, it is important to consider the context in which the study was conducted: public schools in a municipality with fewer than 30,000 inhabitants, with a rate of access to early childhood education equal to 89%, higher than the national average of 2008 and the goal of the NEP for 2010 (Vieira, 2010).

In this context, the results strongly suggest that access to ECE favored the performance, which was expected based on the national and international literature (Benitez & Flores, 2002; Entwisle & Alexander, 1998; Felício & Vasconcelos; 2007; Reynolds & Temple, 2008; Trivellato-Ferreira & Marturano, 2008). The suggested effects were reinforced in

a model of analysis that controlled the possible effects of the socioeconomic level of the family. These are consistent results, affecting all the performance indicators used in the study: the classification of the student by the teacher, in relation to their classmates; a measurement of the domain of programmatic contents, made collectively in the classroom; a standardized test of individual application that allowed the evaluation of the progress in basic academic skills.

Though access to ECE was consistently associated with better performance, one more year of early childhood education attendance did not bring additional benefit for the 63% of participants who had the opportunity. This does not mean that children with two years of preschool education are not in a privileged situation. The fact that they come from families with more favorable socioeconomic indicators places them in a privileged position in relation to the other two groups, since most of the variation in the school results can be explained by factors associated with the social background of the students (Aikens & Barbarin, 2008; Alves & Soares, 2008). The control of the SEL allowed the two sources of influence to be disaggregated: The family status and the early childhood education attendance. Thus, through employing an analytical model that controlled the socioeconomic variable, the results showed no academic advantage of the children with two years of ECE in relation to their colleagues with one year of ECE; thus, the first question investigated in the study received a negative response, contrary to previous studies with positive results (Curi & Menezes-Filho, 2006; Entwisle & Alexander, 1998). With various objective tests in which there is good margin for individual differences, it is unlikely that this result is an artifact.

It should be noted that Curi and Menezes-Filho (2006) found better results in the SAEB-mathematics of 2003 in students in the 4th grade (corresponding to the current 5th year) with more time in early childhood education, even after the insertion of social indicators, such as maternal and paternal schooling, home computer, Internet access and type of school - public or private, into the prediction models. Some differences between the present study and these authors should be highlighted. Curi and Menezes-Filho worked with an extensive national sample, achieving a range of individual variation much greater than the present study, focusing on the school population of the public education system in a single municipality. Conversely, the 4th grade sample of the SAEB-2003, with ages ranging from 9 to 15 years, showed a clear inverse relationship between age and rate of access to early childhood education, and this relationship was stronger for nursery school than for pre-school. This peculiarity could have introduced into the study of Curi and Menezes-Filho a factor of confusion between the later access to early childhood education and delayed schooling trajectory due to factors not controlled in the study. This question remains open for investigation.

For the second question explored in this study, regarding how access to early childhood education would affect the school trajectory of children in elementary education, three alternatives were considered: (a) the differences favoring the children with access to ECE are stable, (b) the differences are attenuated with the advance of the education, (c) the differences are accentuated. The fourth alternative considered was that of heterogeneous trajectories, with specific effects for different content domains. The results generally supported the first alternative, with two exceptions. The hypothesis of attenuation was confirmed for the results of the reading subtest of the SPT and the hypothesis of amplification of differences was confirmed for the arithmetic subtest of the SPT.

The first alternative is that which finds further support in the literature, albeit indirect, from longitudinal studies unrelated to early childhood education. For example, the stability of the individual differences in performance is compatible with the observation that the skills evaluated in first school year are predictive of the results throughout the elementary education (Hughes & Kwok, 2007; Malaspina & Rimm-Kaufman, 2008; McClelland et al., 2006). Another argument in favor of stability refers to the practice, common in Brazilian schools, of grouping students into homogeneous classes, which may introduce an artificial factor of perpetuation of the initial differences (Cafiero et al., 2007).

The attenuation of the differences found in the reading subtest of the SPT is consistent with previous findings of Parrila et al. (2005), which could be considered a promising result in terms of the power of the school to reduce inequalities. However, in the interpretation of this result it must be considered that the mean of reading of G1 and G2 in the 5th year suggests a ceiling effect, since they are near the maximum score of the subtest, which is 70. Thus, it is unclear whether the reduction of the differences detected by the statistical test was not an artifact, since in the 5th year the test would not discriminate so well the students with better performance. A similar ceiling effect on the raw score of the reading subtest of the SPT was highlighted recently by Lúcio, Pinheiro and Nascimento (2009). Salles, Parente and Freitas (2010) point out that in the written system of Brazilian Portuguese there are fewer irregularities for reading, compared to writing, which may be related to the fact that children achieve accuracy earlier in reading.

The expansion of the advantage of the students with access to ECE was only effectively found in the arithmetic subtest of the SPT. The discrepancy of these results with respect to previous results apparently supports the fourth alternative proposed in the introduction - that the trajectories can vary depending on the specific curricular domain that is the focus of the investigation. It may be asked, however, why no similar tendency was observed in the results of the collective evaluation of mathematics, which in principle belongs to the same domain.

It is worth reflecting on the skills evaluated. The performance in arithmetic includes operations with numbers and the solution of problems; these, in turn, rely on different cognitive abilities. Calculation, the base for the operations,

demands attention and information processing speed, whereas the solution of problems depends largely on language skills (Fuchs et al., 2008). The arithmetic subtest of the SPT includes only operations, while the collective evaluation of mathematics also includes problems. The stability of the differences in performance, observed in the collective evaluation of mathematics, reproduces the results of Crosnoe et al. (2010) in their longitudinal study of the 1st to 5th year, with a focus on the problem-solving ability.

In search for explanations for the increase in the advantage of the students with ECE in the arithmetic subtest of the SPT, some possibilities can be raised. One of these is that children who start elementary education with the highest numerical competence progress faster in the learning of arithmetic (Jordan et al., 2009). Early childhood education, by adopting guidelines (Ministry of Education and Sport, 1998), probably contributes to the development of this ability, resulting from quotidian exposure to experiences with numbers.

Another possibility, which does not exclude the previous one, but rather complements it, is that ECE also favors the acquisition of behavior that the literature indicates is particularly relevant for progress in arithmetic. Among these, attention (Fuchs et al., 2008) as well as persistence and organization (Di Perna, Lei, & Reid, 2007), may be mentioned. The role of the pre-school in the development of non-academic skills relevant to performance in school and in life has been emphasized (Sassi, 2011).

Finally, the expectation of the teacher can be an influential variable in the expansion of the performance differences in arithmetic between children with and without prior access to ECE. This hypothesis makes sense through the combination of three pieces of empirical evidence: (a) Hinnant et al. (2009) demonstrated that the performance in mathematics (but not in reading) in the 5th year was associated with the expectations of the teacher in the 1st year, (b) the teacher forms more favorable expectations for students more socially skilled (Hinnant et al., 2009), and (c) ECE promotes social skills (Reynolds & Temple, 2008; Trivellato-Ferreira & Marturano, 2008).

The study generated additional information that should be discussed, yet has no direct relationship with the study aims. In all the groups, school progression was associated with better performance in the subtests of the SPT, whereas the evaluations of academic competence and mathematics showed no variation and the performance in the collective evaluation of Portuguese worsened between the 4th and 5th year. Of all these evaluations, only the SPT has a common base, allowing the verification of the progress between the 3rd and 5th year, as reported in previous studies (Dias, Enumo, & Turini, 2006). However, the worsening detected in the collective evaluation of Portuguese, consistent with the results of Escolano (2004), can not be easily analyzed, because the contents of the tests differ from year to year.

The socioeconomic indicator, controlled in the MANOVA, was present in diverse results. For the sample as a whole, the known association between socioeconomic level and performance was reproduced (Aikens & Barbarian, 2008). Recurrent in the national literature, this association attests that the Brazilian educational system has not been successful faced with the challenge of reducing the social inequalities in the country. This is not new information. However, it assumes a particular aspect when evaluating the extent to which the goals of the NEP for early childhood education in the last decade have been achieved (Vieira, 2010). As recognized in the text of the NEP (Law No. 10.172, 2001), there is a need not just to make access to early childhood education universal, but to ensure that children from less privileged backgrounds receive a high quality early childhood education, as a way to prevent the perpetuation of the differences due to social origin in the future trajectory of the students.

Final Considerations

The study has limitations that should be considered in the appreciation of the results. Data collection was conducted in a single municipality, therefore the results can not be generalized to the national reality. Variables related to the current school context were not taken into consideration, which could have influenced the results, for example, the quality of the elementary schools where the children study. The concentration of children without ECE in schools with fewer resources would be a perverse combination tending to perpetuate their initial disadvantage. Another influential condition, cited in this article but not investigated in relation to the participating schools, is the systematic grouping of students into homogeneous classes, which contributes to the maintenance of differences.

The fact that all the instruments were not applied systematically at the three evaluation moments may be indicated as a lesser limitation. However, it is emphasized that the limitation regarding the application of the SPT was somewhat neutralized by having other performance indicators that behaved, in the analyses, in an analogous way to the SPT, suppressing this gap in the 4th year.

The results of this study are suggestive of a strong and lasting impact of early childhood education on the school trajectory of the children, above and beyond the effect of their socioeconomic origin. It is indisputable that to attend ECE positively influences the performance, regardless of social class. Thus, the importance of guaranteeing all children access to quality early childhood education is reiterated. By demonstrating this fact prospectively, the study consolidates findings obtained previously in Brazil by means of retrospective studies.

Conversely, an issue is opened for discussion with important consequences for practices and public policies in the field of early childhood education, faced with the results that show no difference in performance between children with one or two years ECE, even though the latter, in the study sample, were doubly privileged - due to the additional year of ECE and the better socioeconomic situation of their families. Was

this an isolated finding, restricted to the municipality where the study was carried out, or does it represent a greater reality? Replication studies are needed to clarify this point.

References

Associação Brasileira de Empresas de Pesquisa. (2003). *Critério de classificação econômica Brasil: Dados com base no levantamento sócio-econômico, IBOPE, 2000.* Retrieved from http://www.abep.org/novo/Content. aspx?ContentID=302

Aikens, N. L., & Barbarin, O. (2008). Socioeconomic differences in reading trajectories: The contribution of family, neighborhood, and school contexts. *Journal of Educational Psychology, 100*(2), 235-251. doi:10.1037/0022-0663.100.2.235

Alves, M. T. G., & Soares, J. F. (2008). O efeito das escolas no aprendizado dos alunos: Um estudo com dados longitudinais no ensino fundamental. *Educação e Pesquisa, 34*(3), 527-544. doi:10.1590/S1517-97022008000300008

Andersson, U. (2010). Skill development in different components of arithmetic and basic cognitive functions: Findings from a 3-year longitudinal study of children with different types of learning difficulties. *Journal of Educational Psychology, 102*(1), 115-134. doi:10.1037/a0016838

Bandeira, M., Del Prette, Z. A. P., Del Prette, A., Magalhães, T. (2009). Validação das escalas de habilidades sociais, comportamentos problemáticos e competência acadêmica (SSRS-BR) para o ensino fundamental. *Psicologia: Teoria e Pesquisa, 25*(2), 271-282. doi:10.1590/S0102-37722009000200016

Benitez, Y. G., & Flores, S. M. (2002). Sondeo de habilidades preacadémicas en niños y niñas Mexicanos de estrato socioeconómico bajo. *Revista Interamericana de Psicología, 36*(1-2), 255-277.

Cafiero, D., Rocha, G., & Soares, J. F. (2007). Avaliação do ciclo inicial de alfabetização em Minas Gerais: O que indicam os primeiros resultados. *Língua Escrita,* (1), 84-102. Retrieved from http://www.ceale.fae.ufmg.br/nomade/midia/docs/234/phpzCunQx.pdf

Campos, M. M., Fullgraf, J., & Wiggers, V. (2006). A qualidade da educação infantil brasileira: Alguns resultados de pesquisa. *Cadernos de Pesquisa, 36*(127), 87-128. doi:10.1590/S0100-15742006000100005

Crosnoe, R., Morrison, F., Burchinal, M., Pianta, R., Keating, D., Friedman, S. L., & Clarke-Stewart, K. A. (2010). Instruction, teacher–student relations, and math achievement trajectories in elementary school. *Journal of Educational Psychology, 102*(2), 407-417. doi:10.1037/a0017762

Curi, A. Z., & Menezes-Filho, N. A. (2006). Os efeitos da pré-escola sobre os salários, a escolaridade e a proficiência escolar. *Anais do Encontro Nacional de Economia, 34.* Retrieved from http://www.anpec.org.br/encontro2006/artigos/A06A092.pdf

Di Perna, J. C., Lei, P.-W., & Reid, E. E. (2007). Kindergarten predictors of mathematical growth in the primary grades: An investigation using the Early Childhood Longitudinal Study - Kindergarten cohort. *Journal of Educational Psychology, 99*(2), 369-379. doi:10.1037/0022-0663.99.2.369

Dias, T. L., Enumo, S. R. F., & Turini, F. A. (2006). Avaliação do desempenho acadêmico de alunos do ensino fundamental em Vitória, Espírito Santo. *Estudos de Psicologia (Campinas), 23*(4), 381-390. doi:10.1590/S0103-166X2006000400006

Entwisle, D. R., & Alexander, K. L. (1998). Facilitating the transition to first grade: The nature of transition and research on factors affecting it. *The Elementary School Journal, 98*(4), 351-364. doi:10.1086/461901

Escolano, A. C. M. (2004). *Fatores de risco e proteção na trajetória de desenvolvimento de escolares de primeira à quarta série do ensino fundamental* (Unpublished Ph.D Thesis). Universidade de São Paulo, Ribeirão Preto, SP.

Felício, F., & Vasconcellos, L. (2007). O efeito da educação infantil sobre o desempenho escolar medido em exames padronizados. *Anais do Encontro Nacional de Economia, 35.* Retrieved from http://www.anpec.org.br/encontro2007/artigos/A07A093.pdf

Fuchs, L. S., Fuchs, D., Stuebing, K., Fletcher, J. M., Hamlett, C. L., & Lambert, W. (2008). Problem solving and computational skill: Are they shared or distinct aspects of mathematical cognition? *Journal of Educational Psychology, 100*(1), 30-47. doi:10.1037/0022-0663.100.1.30

Hinnant, J. B., O'Brien, M., & Ghazarian, S. R. (2009). The longitudinal relations of teacher expectations to achievement in the early school years. *Journal of Educational Psychology, 101*(3), 662-670. doi:10.1037/a0014306

Jordan, N. C., Kaplan, D., Ramineni, C., & Locuniak, M. N. (2009). Early math matters: Kindergarten number competence and later mathematics outcomes. *Developmental Psychology, 45*(3), 850-867. doi:10.1037/a0014939

Lei No. 9.394, de 20 de dezembro de 1996. (1996, 23 de dezembro). Estabelece as Diretrizes e Bases da Educação Nacional. *Diário Oficial da União, seção 1.*

Lei No. 10.172, de 09 de janeiro de 2001. (2001, 10 de janeiro). Aprova o Plano Nacional de Educação e dá outras providências. *Diário Oficial da União, seção 1.*

Lúcio, P. S., Pinheiro, A. M. V., & Nascimento, E. (2009). O impacto da mudança no critério de acerto na distribuição dos escores do subteste de leitura do teste de desempenho escolar. *Psicologia em Estudo, 14*(3), 593-601. doi:10.1590/S1413-73722009000300021

Malaspina, D., & Rimm-Kaufman, S. E. (2008). Early predictors of school performance declines at school transition points. *Research in Middle Level Education, 31*(9), 1-16.

McClelland, M. M., Acock, A. C., & Morrison, F. J. (2006). The impact of kindergarten learning-related skills on academic trajectories at the end of elementary school. *Early Childhood Research Quarterly, 21*(4), 471-490. doi:10.1016/j.ecresq.2006.09.003

Ministério da Educação e do Desporto. Secretaria de Educação Fundamental. (1998). *Referencial curricular nacional para a educação Infantil* (Vol. 3). Brasília, DF: MEC/SEF.

Parrila, R., Aunola, K., Leskinen, E., Nurmi, J.-E., & Kirby, J. R. (2005). Development of individual differences in reading: Results from longitudinal studies in English and Finnish. *Journal of Educational Psychology, 97*(3), 299-319. doi:10.1037/0022-0663.97.3.299

Reynolds, A. J., & Temple, J. A. (2008). Cost-effective early childhood development programs from preschool to third grade. *Annual Review of Clinical Psychology, 4*, 109-139. doi:10.1146/annurev.clinpsy.3.022806.091411

Salles, J. F., Parente, M. A. M. P., & Freitas, L. B. L. (2010). Leitura/escrita de crianças: comparações entre grupos de diferentes escolas públicas. *Paidéia (Ribeirão Preto), 20*(47), 335-344. doi:10.1590/S0103-863X2010000300006

Sassi, R. B. (2011). Got a raise? Thank your kindergarten teacher. *Journal of the American Academy of Child & Adolescent Psychiatry, 50*(1), 1-2. doi:10.1016/j.jaac.2010.10.003

Trivellato-Ferreira, M. C., & Marturano, E. M. (2008). Recursos da criança, da família e da escola predizem competência na transição da 1ª série. *Revista Interamericana de Psicología, 42*(3), 549-558.

Vieira, L. M. F. (2010). A educação infantil e o Plano Nacional de Educação: As propostas da CONAE 2010. *Educação & Sociedade, 31*(112), 809-831. doi:10.1590/S0101-73302010000300009

Elaine Cristina Gardinal-Pizato holds a PhD in Psychology from the Psychology Graduate Program of the Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto of the Universidade de São Paulo.

Edna Maria Marturano is a Full Professor of the Faculdade de Medicina de Ribeirão Preto of the Universidade de São Paulo.

Anne Marie Germaine Victorine Fontaine is a Full Professor of the Faculdade de Psicologia e de Ciências da Educação of the Universidade do Porto.