"Are two better than one?" The Impact of Length of Time Spent in Kindergarten on Pupils' Mathematics Achievement of Primary school: A Case Study of Grade One Pupils in Jeddah, Saudi Arabia

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Abstract:
The purpose of this study was to investigate if there are any significant differences in the mathematical attainment of pupils' grade one of primary school in Jeddah, Kingdom of Saudi Arabia (KSA) between mathematics achievement of pupils who had spent two years in kindergarten, and those who had spent one year. Using purposive sampling technique for school selection, a total of 160 primary first grade (in the academic year 2009-2010) were randomly selected for the study from 4 selected primary schools in Jeddah. In addition, questionnaires for parents were distributed to each of pupils' sample. The result of the study indicated that: (1) there is a strong indication that attending kindergarten has been shown to be effective in supporting the mathematical education of first grade's pupils of primary school; and (2) the pupils who had attended kindergarten for two years significantly out-performed their peers who had attended kindergarten for one year. Finally, if the findings of this study are substantiated, we argue that there is a strong case to be made that kindergarten education in KSA should be extended as a right to all children.

Keywords: kindergarten ; primary school performance ; mathematical attainment ; early childhood education ; years spent in kindergarten .

هل عامين أفضل من عام؟ أثر مدة الالتحاق برياض الأطفال على التحصيل الدراسي لمادة الرياضيات لطلاب المرحلة الابتدائية (دراسة ميدانية بمدينة جدة)

الملخص:

تهدف هذه الدراسة إلى التحقق من هل هناك اختلاف في التحصيل الدراسي لمادة الرياضيات لطلاب الصف الأول الابتدائي في مدينة جدة بين الطلاب الملتحقين برياض الأطفال لسنة أو سنتان. تم اختيار عشوائي لعدد ١٦٠ طالب من طلاب الصف الأول الابتدائي (للعام الدراسي ١٤٣٠هـ/ ١٤٣١هـ) من أربعة مدارس ابتدائية من مدينة جدة، إضافة إلى توزيع استبانة إلى أولياء أمور الطلاب. أظهرت نتائج الدراسة أن الالتحاق برياض الأطفال كان له أثر في تعلم الرياضيات لطلاب الصف الأول الابتدائي، إضافة على أن التحصيل الدراسي للطلاب الملتحقين برياض الأطفال لعامين دراسيين أفضل من التحصيل الدراسي للطلاب الملتحقين برياض الأطفال لعام دراسي واحد. تؤكد نتائج الدراسة على أهمية جعل مرحلة رياض الأطفال مرحلة إلزامية في التعليم العام بالمملكة العربية السعودية.

الكلمات المفتاحية: رياض الأطفال ، التحصيل الدراسي في المرحلة الابتدائية ، اكتساب مادة الرياضيات ، تعليم الطفولة المبكر ، سنوات الدراسة برياض الأطفال .

1. Introduction

Evidence abounds in the literature of a direct link between attending kindergarten and mathematical attainment in the primary school [1]. There are many studies that suggests that new entrants into primary schools are better prepared for the school environment and that they do make better use of school resources if they have been exposed to kindergarten education prior to their entry into the regular school system [2]. This is probably not unexpected as such exposure would have prepared the new intakes for the 'world of school' because of the similarities between kindergarten and regular school environments. Kindergarten education is known to foster the development of some basic social skills and young learners lacking such skills risk 'peer rejection' and 'academic failure' [3]. It has been observed, for example, that pupils with pre-school experience tend to feel much more at home than their counterparts without such an experience during their first few days in school. Furthermore, most of them seldom cry and demand to go back home with their parents on their first day in school. Hadeed [4] has shown that kindergarten education seeks to expand the breath of experiences for the child making a contribution to the child's intellectual development. However French [5] confirmed the argument made by Hadeed and emphasised that kindergarten children undergo rapid intellectual and linguistic development. Cognitive processes that operate continually and without conscious effort or awareness on the part of the child power much of this development. However, for these cognitive processes to yield optimal development in cognitive and linguistic realms, children need to be immersed in an environment that is both experience-rich and language-rich. An experience-rich environment fuels development by providing events and materials that can be comprehended, represented, and further processed by the child, extensive opportunities for self-directed exploration, and adult support in interpreting experience. A language-rich environment includes ample opportunities for young children's authentic communication with adults because the adults' use of language is strongly redolent with an experiential environment and so supports children's acquisition of both the meaning and pragmatic functions of the language. Tudge and Doucet (2004) also indicted that children's early mathematical experiences play a significant role in the development of their

understanding of mathematics, and serve as a foundation for their cognitive development [6]. Starkey, Klein and Wakely [7] have identified that socio-economic related differences in mathematical knowledge begin in early childhood.

In the case of the Kingdom of Saudi Arabia (K.S.A.) kindergarten is not part of the formal education yet, since the child can join the primary school without having been to kindergarten [8]. Children who join the primary school at the age of six without being well prepared at home or through a kindergarten institution that enabled them to acquire some new cognitive, behavioral or social skills may face problems in acclimatization or academic achievement. It has been noticed, through the experience of teachers of Mathematics in the primary and intermediate schools, that the curve of progress of pupils in the primary school is low in mathematics in general and particularly in the basic mathematical skills: addition, subtraction, division, multiplication and solving some simple calculation questions. According to Mohy-Aldeen [9] the reasons for this include the concentration on memorization, ignoring individual differences among pupils, presenting mathematics in uninteresting ways, and using abstract ways unrelated to the child environment to present mathematical concepts making them disinterested in such concepts.

Kindergarten education is known to foster the development of some basic social skills and young learners lacking such skills risk 'peer rejection' and academic failure [3]. Taiwa and Tyolo [10] found that the scores in reading and mathematics achievement were much higher for kindergarten children than for non-kindergarten children. The same results have been repeated in some studies [11, 12, 13, 14, 15, 16, 17, 18, 19, 20,21]. On the other hand, Alokaily [22] and Stipek and Byler [23] identified a modest advantage in academic achievement for children who entered kindergarten during the first year of school, but this advantage disappeared by second and third grades. While a study by Maripatricia [24] showed that there was no significant difference between the experimental and control groups in mathematics achievement in relation to a variable of attending kindergarten.

2. The research problem

In the light of the above, the study reported here aimed at finding out whether there were significant differences on Mathematical

attainment of grade one primary age stage pupils in Jeddah (K.S.A) who had attended kindergarten and their peers who had not. The study was guided by the following research questions:

1. Is there a significant difference in the mathematical attainment of grade one primary age stage pupils in Jeddah who had attended kindergarten and their peers who had not?
2. Is there a significant difference in the mathematical attainment of grade one primary age stage pupils in Jeddah who had spent two years in kindergarten, and those who had spent one year?

3. The research methodology

The population of this study is provided by the first grade primary pupils in the academic year 2009/2010; a Mathematics Achievement Test was used to measure the achievement; in order to determine the differences between kindergarten attendants and non-attendants. The study sample was randomly chosen from one principal city, namely Jeddah. For the sake of obtaining the most optimal result, a decision was taken in favour of using two main methods of data collection; a questionnaire for parents and a Mathematics Achievement Test.

3.1. Parents' questionnaire

This questionnaire was used to collect data related to the pupils themselves and also data about the parents' background including employment patterns and levels of educational achievement.

3.2. The Mathematics Achievement Test

Mathematics achievement refers to the marks obtained by first grade primary pupils in a Mathematics test, which was used to measure the achievement of pupils in order to determine the differences between kindergarten attendees and non-attendees, and to correlate this to other study variables. The main reason for selecting the written test (mathematic achievement test) was to assess child achievement rather than another form of assessment. This was for its familiarity to local educators in Saudi Arabia. To some extent, the design of this element of the research has been influenced by a previous study carried out in Makkah [12]. It should be noted that test does not pet out to test the mathematics of the kindergarten but to valuate to the primary school education. In order to construct the

test for measuring the pupil's mathematics achievement, Kashkary [12] described clearly the steps necessary for constructing an achievement test.

3.3 The study sample

The design in this study required a sample which included two groups of pupils (kindergarten attendees and non-attendees), each consisting of 160 primary first grade from the city of Jeddah, in the academic year 2009-2010. The selection of the pupils in each of the above two groups was based on the following:

The first step was to determine the following objectives :

1. to compare differences in the mathematical achievement of pupils in first grade of primary school according to the following variables: kindergarten attendees (whether they had or had not).
2. to compare differences in the mathematical achievement of pupils who had attended kindergarten according to length of time spent in the kindergarten, kind of kindergarten.
3. Four boy schools were selected from the four areas of the city of Jeddah (North, South, East, and West Jeddah).
4. Forty first grade pupils were chosen from each of the four schools and the sample totaled 160 pupils.

3.4. Application of the achievement test

The test was administered as follows:

1. In each school, it was the class teacher's task to:
   a) explain the instructions, so as to aid the pupils in answering the test.
   b) give an example which was solved for each of the seven categories of the test.
   c) read each question to the pupils, who were then given time (60 minutes) to answer the questions.
2. The questionnaires for parents were distributed to each pupil sample to be delivered to his parents when the test was administered and collected from them the following day.

3.5. Data analysis

After collecting the data, a comparison was conducted using "independent sample *t*-test" [25, 26] to determine the differences between the effect of the attending kindergarten, length of time which the pupil spent in the kindergarten and kind of kindergarten on pupils' mathematics scores in first grade of primary school in respect of overall score and seven major classes of scores.

4. Results:

4.1. Characteristics of pupil sample

The characteristics of pupil sample were shown in Table 1. The study samples contained 160 pupils and in each group (kindergarten attendees and non-attendees), it was found that 78 pupils had attended kindergarten and 82 had not. However, with regard to the length of time which the pupils spent in the kindergarten, it was found that 32 pupils had attended kindergarten for less than one year, and 46 attended for one year or more. While in respect of the kind of kindergarten, it was found that 17 pupils had attended state kindergarten and 61 had attended private kindergarten.

4.2. the Effect of study variables on pupils' mathematical achievement.

An independent sample *t*-test was conducted to compare the effect of the study variables on pupils' Mathematical achievement in the first grade of primary school. The results indicated that, the Mathematical achievement scores of pupils who had attended kindergarten were statistically significant compared to those who had not in respect of overall score and seven major classes of scores (Table 2). It was also the case that children who had attended kindergarten for one year or more were consistently and significantly better adjusted than those who had attended kindergarten for less than one year in respect of overall score and seven major classes of scores (Table 3). On hand, an independent sample t-test was conducted to compare the kind of kindergarten (private or state), where there was no significant difference in Mathematical achievement of pupils who had attended private

kindergarten (M=28.2, SD=5.38), and with those who had attended state kindergarten [M= 26.2, SD= 7.83; t(1.87)].

5. Discussion

The results suggest that the Mathematical performance of the pupils who had attended kindergarten in the first grade was better than that who had not, and this effect was continued into the second and third grade of primary school. The same results have been repeated in some studies [10, 18, 19]. The study reported here suggests that the pupils with pre-school education experience significantly out-performed their counterparts without such an experience in Mathematics. Children who have gone through some form of early childhood intervention tend to acquire certain basic skills, which enable them to make an easier transition into primary school environment [2]. Bennett [27], based on a review of Ginsburg and Baron (1993) and Charlesworth (1997), noted that young children have a natural curiosity regarding mathematical events and that they build up a storehouse of mathematical knowledge through numerous kindergarten experiences.

Head Start staffs have reported that they often need two years to provide the full benefits of the programme [28]. Two years of kindergarten may improve the quality of experience by 1) strengthening implementation and service delivery, 2) increasing the opportunities for social and cognitive stimulation (e.g., parent involvement, achievement motivation), 3) providing additional health and nutritional services, and 4) assisting children who may need more time to get ready for school. Consequently, longer-term effectiveness may be enhanced. Analysis of our results shows that attending kindergarten for two years produces children who are consistently and significantly better adjusted than those who attended for one year. The same results have been reported by Chafel [29] who indicated "intuition and the insights of practitioners in the field suggest that a two-year, rather than a single year model is preferable". Reynolds [30] also suggested that both one and two-year kindergarten participants were consistently and significantly better adjusted than non-kindergarten participants, while two-year participants began and ended kindergarten more academically competent through the elementary grades than did one-year participants. Indeed, the "more is better" philosophy of early childhood intervention is increasingly recommended [28, 26, 28] In

addition, White [32] in a meta-analysis of 329 studies of early intervention for handicapped and economically disadvantaged children, reported that programs of longer duration were generally more effective than shorter programs of. White [32] also found that 22 of 52 reviews of early intervention cited showed that longer intervention was better, at least for academic achievement.

Some studies, however, suggest that the evidence for the benefit of a second year of kindergarten intervention is not conclusive, at least for economically disadvantaged students. Indeed, only four studies directly addressed the issue of two years versus one of kindergarten at ages three and four; they found no significant effects of a second year on children's adjustment [33, 34, 35]. Several explanations may account for these findings. Firstly, the studies used a relatively small sample size, thereby reducing their statistical power to detect statistically significant differences. For example, only 13 children participated in one year of the Perry Kindergarten Program [35, 36]. Studies with larger samples would increase statistical power, as well as provide more generalized estimates of effects [33, 34, 36]. Secondly, most of the studies tested model demonstration programs during the early years of programme implementation. Although the programs were implemented successfully, their impact may have been even greater at later stages of programs development.

6. Conclusion and recommendations

Improving the quality of education has been a major preoccupation of policy makers throughout the world. In this paper we present evidence that shows that investing in universal kindergarten education could be an important part of a productive strategy to achieve this goal. Specifically, the present study examined the impact of attending kindergarten on the Mathematical attainment of primary stage children in Jeddah, Saudi Arabia and found that attending kindergarten had a large positive effect on first grade's pupils of primary school and the pupils who had attended kindergarten for two years significantly out-performed their peers who had attended kindergarten for only one year. In addition, the impact of attending kindergarten and years spent in kindergarten was continued in the second and third grades.

The situation in relation to attending kindergarten in the Kingdom of Saudi Arabia is a mixed one. There are two types of kindergarten – state run and private. The state run system provides free pre-school education for the children of parents employed by the state. The private system operates on a basis of payment for entry. It is probable that (although, at present there is no firm evidence to support this) the children of parents who are not employed by the state may be excluded from pre-school education on the basis of income. Further, it could be argued, that it is these very children who would benefit most from a pre-school education. If our results presented here are substantiated then there is a strong indication that attending kindergarten has been shown to be effective in supporting the mathematical education of primary stage children (and, although we have no data from this study to suggest this contention, it is likely that such an advantage would also be indicated in other elements of early years education). If this is so, then it appears to us that all children should attend kindergarten before joining primary school; therefore, it is recommended that the Saudi Arabian government should work towards universalizing kindergarten education. Integrating kindergarten education into the current basic education could do this.

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Table 1: Distribution of pupil sample

Variable	Pupil Categories	Number of cases	Percentages (%)
Attending kindergarten	• Pupils attended kindergarten.	78	48.8
	• Pupils had not attended kindergarten.	82	51.3
	• **Total.**	160	100
Length of time spent in kindergarten	• Attended kindergarten for less than one year.	32	41.1
	• Attended kindergarten for one year or more.	46	58.9
	• **Total.**	78	100
Kindergarten kind	• Attended state kindergarten.	17	21.8
	• Attended private kindergarten.	61	78.2
	• **Total.**	78	100

Table 2: Effect of attending kindergarten on pupils' mathematical scores in respect of overall score and seven major classes of scores

Tests	Descriptive					
	Pupil Groups	**N**	**Mean**	**S.D**	**F**	**Sig.**
Overall score	Attended kindergarten	78	28.46	8.1		
	Did not attend kindergarten	82	15.12	7.07	115.32	0.000*
Numbers	Attended kindergarten	78	6.28	1.56		
	Did not attend kindergarten	82	5.22	1.68	11.49	0.000*
Mathematical operations	Attended kindergarten	78	6.68	3.06		
	Did not attend kindergarten	82	2.54	2.82	62.74	0.000*
Sets	Attended kindergarten	78	5.82	1.95		
	Did not attend kindergarten	82	2.81	1.54	89.75	0.000*
Fractions	Attended kindergarten	78	1.61	0.75		
	Did not attend kindergarten	82	0.86	0.95	36.1	0.000*
Time	Attended kindergarten	78	1.32	0.88		
	Did not attend kindergarten	82	0.68	0.90	23.665	0.000*
Geometrical diagrams	Attended kindergarten	78	2.72	0.51		
	Did not attend kindergarten	82	2.47	0.92	5.36	0.000*
Money	Attended kindergarten	78	4.03	2.31		
	Did not attend kindergarten	82	0.55	1.47	150.75	0.000*

Table 3: Effect of length of time spent in kindergarten on pupils' mathematical scores in respect of overall score and seven major classes of scores

Tests	Descriptive					
	Pupil Groups	**N**	**Mean**	**S.D**	**F**	**Sig.**
Overall score	Less than one year	32	26.73	7.31		
	One year or more	46	17.32	7.29	115.315	0.000*
Numbers	Less than one year	32	5.97	1.36		
	One year or more	46	5.93	1.97	11.499	0.000*
Mathematical operations	Less than one year	32	5.94	2.93		
	One year or more	46	2.85	3.16	62.740	0.000*
Sets	Less than one year	32	5.46	1.73		
	One year or more	46	3.61	1.76	89.748	0.000*
Fractions	Less than one year	32	1.77	0.62		
	One year or more	46	1.11	0.94	36.1	0.000*
Time	Less than one year	32	1.35	0.91		
	One year or more	46	0.91	0.93	23.66	0.000*
Geometrical diagrams	Less than one year	32	2.65	0.66		
	One year or more	46	2.47	0.83	5.36	0.000*
Money	Less than one year	32	3.49	2.33		
	One year or more	46	0.43	1.18	150.75	0.000*

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