

## The Effect of Big Math for Little Kids Program on Children’s Early Academic and Language Skills \*

### Küçük Çocuklar İçin Büyük Matematik Eğitim Programı’nın Çocukların Erken Akademik ve Dil Becerilerine Etkisi

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#### ABSTRACT

*This study aims to investigate the effect of Big Math for Little Kids Program on 61-72-month-old preschoolers’ early academic and language skills development. The sample for this study included 42 children in Ankara, Turkey. In this study, pretest – posttest experimental design with control group technique was used. With the aim of determining the children’s academic and linguistic skills, Kaufman Survey of Early Academic and Language Skills” were used both as pre and post-test in experiment and control groups. In the experiment group, to facilitate the children’s math skills development, Big Math for Little Kids program was implemented for 14 weeks. Consequently, it was found out a significant difference in favor of experiment group in terms of the effect of Big Math for Little Kids program.*

**Keywords:** Big math for little kids program, early academic and language skills, k-seals, preschool education

#### ÖZ

*Araştırmada 61-72 aylık çocukların matematik gelişimine “Küçük Çocuklar İçin Büyük Matematik Eğitimi (Big Math For Little Kids) Programı’nın etkisini incelemek amaçlanmıştır. Bu amaçla ön test/son test kontrol gruplu deneysel desen kullanılmış ve araştırmanın örneklemine Ankara ilinden deney ve kontrol grubu olmak üzere 42 çocuk dâhil edilmiştir. Çocukların erken akademik*

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ve dil becerilerini deęerlendirmek amacıyla "Kaufman Erken Akademik ve Dil Becerileri Arařtırma Testi" deney ve kontrol grubuna ön test ve son test olarak kullanılmıřtır. Deney grubunda, çocukların matematik becerilerini geliřtirmek amacıyla "Küçük Çocuklar İçin Büyük Matematik Eęitimi Programı", 14 hafta süreyle uygulanmıřtır. Arařtırma sonucunda; çocukların erken akademik ve dil becerileri üzerinde "Küçük Çocuklar İçin Büyük Matematik Eęitimi (Big Math For Little Kids) Programı"nın, kontrol grubu ile karşılařtırıldığında deney grubu lehine istatistiksel olarak anlamlı etkisinin olduęu tespit edilmiřtir.

**Anahtar Sözcükler:** Küçük çocuklar için büyük matematik eęitimi, erken akademik ve dil becerileri, K-EADBAT, okul öncesi eęitimi

## INTRODUCTION

Mathematics, a common language of all societies and cultures, enables individuals to acquire skills such as knowledge, attitude, analysis, synthesis, problem solving, evaluation, creativity and high-level thinking that will help the world and its interactions to be understood and systematical use of knowledge, attitudes and skills acquired through lifelong learning. Thus, mathematics is one of the basic skills that should be fostered both at home and school settings in early years by taking the child's curiosity, natural experiences and development into account. National Association for the Education of Young Children NAEYC (2002) and the National Council of Teachers of Mathematics NCTM (2002) emphasizes that in the ever-evolving and growing world, children must be involved in early mathematics programs that are developed in a way that is appropriate and systematically developed for children, with specific standards for raising children's basic skills, awareness and mathematical achievements. The children involved in this high-level mathematics program are able to gain skills such as comparison, matching, ranking, grouping, measuring, problem solving, analysis-synthesis, evaluation through games (Clement & Sarama, 2009). However, mathematics programs enriched by techniques such as games, songs, puzzles, storytelling, chatting, working with worksheets provide children with pleasure in mathematics and support the development of mathematical concepts and language and literacy skills (Ginsburg, Greenes & Balfanz, 2003; Jackman, 2005). Mathematical implementations integrated with language and literacy skills are used in the development of children's language and literacy skills, such as perception and attention development, receptive and expressive language skills, hand-eye coordination, part-whole relationship, communication. The early development of early academic and linguistic skills of children is possible with a conscious family and a teacher who will support children in the pre-school period in a social environment equipped with literacy and mathematics materials, and include various technically enriched qualified mathematics education programs (Clemson & Clemson, 2001; Clements & Sarama, 2009;Kandır & Yazıcı, 2011).

Similarly it is reported that a quality curriculum providing an environment in which there are adequate stimuli towards math and literacy together with informed parents and teachers who will encourage the child to make use of these materials has a crucial role in developing children's early academic and language skills (Neuman & Dickinson, 2002; Morrow & Gambrel, 2004; Thornton, Crim & Hawkins, 2009). On the other hand, teachers are necessarily seen as a need in this process by working, discussing, taking risks and respecting various learning approaches to learning and problem solving with the children so as to allow children to learn by engaging, doing and living with love and willingness to participate in these environments. (Greenes, Ginsburg & Balfanz, 2004; Ginsburg et al., 2003; Jackman, 2005; Kirova & Bhargava, 2002). Ginsburg et al., (2003) points out the fact that math activities in early childhood education should be integrated with other academic areas and melted into daily activities to give children an insight in basic math skills in a systematic and sequential way. This approach should also be followed both at home and school settings and all other activities should be enriched with a systematic math program (Clements & Sarama, 2009; Starkey, Klein & Wakeley 2004; Eliason & Jenkins, 2003). According to the relevant literature, "Big math for little kids", possessing all the necessary features (i.e. research-based, developmental, integrated with other areas, features based on logic, evaluation, process, spatial relations skills, enriching the learning environment and incorporating the family into the learning environment), which was originally developed by Ginsburg et al. (2003), implemented on 61-72 month old children for three years in New York, Massachusetts, Maryland, Texas, Wisconsin, England (Presser, Clements, Ginsburg, & Ertle, 2012) and adapted to 61-72 month old Turkish children and implemented in Turkey for one year by Çelik (2011), and it was found out to have effect on children's early math skills (as cited in Çelik 2012). Despite the fact that there are achievement indicators and activities to support children's mathematical skills in the Turkish Ministry of National Education's Early Childhood Education Program (2006/2013), the attitudes and knowledge levels of teachers on mathematics activities influence the quality of classroom practices (Klibanoff & Levine, 2006). It is a common issue that pre-school teachers are reluctant to prepare and implement mathematical

activities and materials, systematically incorporate mathematical concepts and skills into everyday learning streams and they also lack the skills to prepare learning environments and original materials enriching mathematical activities instead of using traditional teaching methods and techniques (NAEYC, 2001; Tarım & Bulut, 2006, Özdemir, 2016).

However, in the literature there are studies testing the effect of math educational programs (Starkey et al., 2004; Zur & Gelman, 2004; Turhan, 2004; Demirtaş, 2005; Alabay, 2006; Pagani, Jalbert & Girard, 2006; Canobi & Bethune, 2008) but few of the studies intended to find out the effect of math educational programs on children's early academic and language skills (Sarama, Lange, Clements & Wolfe, 2012). In the light of these findings, this study aimed to investigate the effect of "Big Math for Little Kids" on 61-72-month-old preschoolers' early academic and language skills.

Answers to following research questions were sought.

- Is there a significant difference between the Kaufman Survey of Early Academic and Language Skills subtests and total pretest scores of children in the control and experiment group?
- Is there a significant difference between the Kaufman Survey of Early Academic and Language Skills subtests and total posttest scores of children in the control and experiment group?
- Is there a significant difference between the Kaufman Survey of Early Academic and Language Skills subtests and total pretest – posttest scores of experiment group children?
- Is there a significant difference between the Kaufman Survey of Early Academic and Language Skills subtests and total pretest – posttest scores of control group children?
- Is there a significant difference between gain score from Kaufman Survey of Early Academic and Language Skills?

## METHODOLOGY

In this study, in order to investigate the effect of “Big Math for Little Kids” on 61-72-month-old children’s early academic and language skills, pretest – posttest quasi experimental design with control group was used.

### Study Group

The sample for this study included a randomly selected group of 42 children (control: 21; experiment: 21) who were attending to one of the preschool centers within elementary schools affiliated to the Ministry of National Education and located in Ankara. These children had never enrolled to a special math program before this study was carried out. Demographical information regarding the study group is presented in Table 1.

**Table 1.** Demographical Information Regarding the Study Group

<i>Demographical Characteristics of the First Study Group</i>		<i>Experiment</i>		<i>Control</i>	
		<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>
<i>Gender</i>	Female	11	52.4	10	47.6
	Male	10	47.6	11	52.4
	Total	21	100	21	100
<i>Birth Order</i>	First child	10	47.6	11	52.4
	Middle child or one of the middles	2	9.5	4	19.0
	Last child	9	42.9	6	28.6
	Total	21	100	21	100
<i>Number of Siblings</i>	Only child	6	28.6	6	28.6
	Two siblings	10	47.6	9	42.8
	Three siblings and more	5	23.8	6	28.6
	Total	21	100	21	100
<i>Prior Pre-School Education Status</i>	Attended	10	47.6	9	42.9
	Not-attended	11	52.4	12	57.1
	Total	21	100	21	100

In the experiment group, 52.4 % were female and 47.6 % were male; 47.6 % were the first child, 9.5 % were middle child and 42.9 % were the last child; 28.6 % were the only child, 47.6 % had one sibling and 23.8 had two siblings; 47.6 % received early

childhood education whereby 52.4 % did not. In the control group, 47.6 % were female and 52.4 % were male; 52.4 % were the first child, 19.0 % were middle child and 28.6 % were the last child; 28.6 % were the only child, 42.8 % had one sibling and 28.6 had two siblings; 42.9 % received early childhood education whereby 57.1 % did not.

Before the educational program was implemented, control and experiment group children's pretest scores from K-SEALS subtests and total were investigated and t-test was used to determine whether the group scores differ.

**Table 2.** Independent Samples T-test Results of Control and Experiment Group Children's Pretest Scores From K-SEALS Subtests and Total

Group	K-SEALS	n	M	SD	t	p
Experiment	Vocabulary (pre)	21	26.3	3.6	0.765	.449
Control	Vocabulary (pre)	21	25.5	3.2		
Experiment	Numbers, Letters & Words (pre)	21	12.2	7.2	-0.093	.926
Control	Numbers, Letters & Words (pre)	21	12.4	5.9		
Experiment	Articulation Survey (pre)	21	16.9	2.9	-0.317	.753
Control	Articulation Survey (pre)	21	17.1	1.9		
Experiment	K-SEALS (pre)	21	55.4	11.2	0.128	.899
Control	K-SEALS (pre)	21	55.0	7.8		

\*p<.05

Table 2 presents that no significant difference was found between control and experiment group children's K-SEALS Vocabulary subtest pretest mean scores ( $t=0.765$ ,  $p>.05$ ), Numbers, Letters & Words subtest pretest mean scores ( $t=-0.093$ ,  $p>.05$ ), Articulation Survey subtest pretest mean scores ( $t= -0.317$ ,  $p>.05$  and K-SEALS total pretest mean scores ( $t = 0.128$ ,  $p>.05$ ) according to the independent t-test results of K-SEALS subtest and total pretest scores. Evidently, this shows that similar characteristics were present on both the control and the experiment group children in terms of early academic and language skills.

### **Data Collection Tools**

In order to collect demographical data from parents “General Information Form” and with the aim of assessing the children’s early academic and language skills as a pretest and posttest, “Kaufman Survey of Early Academic and Language Skills” which was developed by Kaufman and Kaufman (1993) and adapted to Turkish children by Uyanik (2010) were used. In the General Information Form, items to query the child’s date of birth, gender, order of birth, number of siblings, and previous experience of early childhood education were present.

***Kaufman Survey of Early Academic and Language Skills (K-SEALS):*** The content organization of Kaufman Survey of Early Academic and Language Skills which was adapted to Turkish children by carrying out the necessary validity and reliability procedure is as follows: Subtests: Vocabulary (33 items); Numbers, Letters & Words (37 items); Articulation Survey (20 items) (Uyanik & Kandir, 2014).

During the process of carrying out the content validity analysis of Kaufman Survey of Early Academic and Language Skills, the test was initially translated into Turkish using the back-translation technique and then the researcher interviewed ten specialists for their evaluations on each item and the test as a whole. According to the specialist reviews, mod, median, minimum and maximum values were interpreted and a consistency among the views was found out before finalizing the last version of the test. In order to test the construct validity of Kaufman Survey of Early Academic and Language Skills, confirmatory factorial analysis was carried out with the purpose of determining the factorial structure by assuming each subtest of the survey (Word Knowledge, Numbers, Letter & Words, Articulation Survey) as one dimensional structure. As a result of the confirmatory factorial analysis, it was found out that most of the items which were confirmed to have one dimensional factorial structure within the subtests of the survey represented one dimensional factorial structure in general. According to the results of item – total score correlation and KR-20 reliability analysis of Kaufman Survey of Early Academic and Language Skills, KR-20 reliability coefficient of Kaufman Survey of Early Academic and Language Skills was .971 and

item – total correlation coefficients of most of the items were at high reliability level. KR-20 reliability coefficients for the subtest were as follows: Word Knowledge: .852, Numbers, Letters & Words: .982, Articulation Survey: .953. Moreover, item – total correlation coefficient of the items in the subtests was found out to be highly reliable. In the light of these findings, it can be suggested that Kaufman Survey of Early Academic and Language Skills can be used in the assessment of 61-72-month-old children with its high validity and reliability results. During the administration of the survey, the illustration related to the item was shown to the child and the instructions given on the back of the easel was read aloud before asking the child to respond. After each response, (1) for a correct answer or (0) for a wrong answer was recorded on a separate sheet. In the Word Knowledge and Numbers, Letters & Words subtest, if the child gives 5 consecutive wrong answers, the administrator interrupted the survey and passed on to another subtest. It took 15-20 minutes to administer the survey for each child. The raw score for each subtest was equal to the number of correct answers. At the end of the survey, sum of the correct answers for each subtest was calculated and recorded. Eventually, scores of each subtest were added and total score for Kaufman Survey of Early Academic and Language Skills was obtained (Uyanık & Kandır, 2014).

***The Adaptation of “Big Math for Little Kids Program” to Turkish Children:*** Big Math for Little Kids was originally developed by Ginsburg et al. (2003) and was implemented in New York, Massachusetts, Maryland, Texas, Wisconsin and in England on 61-72-month-old children for three years. Big Math for Little Kids Program intends to support Math development of 61-72-month-old preschoolers. In Big Math for Little Kids Program, there are six types of activities such as numbers, shapes, patterns and logic, evaluation, operating on numbers, spatial relations all of which are playful, joyful and free from prejudices. Big Math for Little Kids was adapted to Turkish children by Çelik (2011) (as cited in Çelik, 2012).

Big Math for Little Kids Program includes the following materials as a set;

***Information Booklet:*** Information about the foundations, development process, content, implementation and evaluation manual of the program is given in this booklet.

*Source for Educators:* Thematic books such as “What are Numbers? Shape of Objects, More Objects, Let’s Measure, Operating on Numbers and Let’s go around” and activities for each theme, recoverable sections for practical ideas for material development and concept development for children and finally evaluation forms are presented in this pack.

*In-classroom story books:* In this pack, story books for each theme are ready to use.  
*Take-home Story Books:* They are the black & white printed version of in classroom story books intended for use at home with parents (Çelik, 2012).

**Data Collection Process**

In order to investigate the effect of Big Math for Little Kids Program on children's early academic and language skills, Kaufman Survey of Early Academic and Language Skills was administered to both control and experiment groups as a pretest by taking the guidelines of the survey into account between the 13<sup>rd</sup> and 15<sup>th</sup> of February in 2011. After the administration of the pretests, the researchers implemented Big Math for Little Kids Program on experiment group. This program lasted 14 weeks on five days a week for 40-60 minutes per day. For the control group teachers kept on following the guidelines of Ministry of National Education Early Childhood Education Program for 36-72-Month-Old Children (2006). While implementing Big Math for Little Kids Program, the researchers selected the materials by taking their features into account. Meanwhile, the activities provided by the program were videotaped and photographed. Eventually, Kaufman Survey of Early Academic and Language Skills was re-administered to both groups as a posttest to identify the possible significant difference.

**Data Analysis**

Shapiro-Wilks normality test was applied to determine whether children's scores from Kaufman Survey of Early Academic and Language Skills showed normal distribution and normal distribution was found out for the values of both control and experiment group. In order to determine whether control and experiment groups showed similar background characteristics before the implementation, mean pretest scores of control and experiment group children were analyzed using independent samples t-test which is a parametric test suitable for the comparison of two groups. Paired samples t-test was used to find out whether experiment group children's mean scores from Kaufman Survey of Early Academic and Language Skills before and after the implementation of Big Math for Little Kids as pretest and posttest differ significantly. Similarly, paired samples t-test was used to find out whether control group children's mean scores from Kaufman Survey of Early Academic and Language Skills differ significantly. Since the posttest mean scores of both control and experiment groups were significantly higher than the pretest mean scores, the differences between the pretest and posttest scores

obtained from Kaufman Survey of Early Academic and Language Skills' subtests and total scores were found to identify which group was more successful in terms of posttest scores. Newly obtained difference values were analyzed using Independent Samples t-test in order to find out which group had higher values. Significance level was set at 0.05 for this analysis which meant that there was a significant difference if  $p < .05$  and if  $p > .05$  then the difference was not significant. Cohen (1988) defined effect sizes as "small,  $d = .2$ ," "medium,  $d = .5$ ," and "large,  $d = .8$ ".

### FINDINGS

Results corresponding to research questions are given as follows;

**Table 3.** Independent Samples t-test Results of Posttest Scores of Control and Experiment Group Children from K-SEALS

<i>Group</i>	<i>K-SEALS</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>Cohen's d</i>
<i>Experiment</i>	Word Knowledge (post)	21	29.8	2.9	4.063	.000*	1.24
<i>Control</i>	Word Knowledge (post)	21	26.0	3.2			
<i>Experiment</i>	Numbers, Letters & Words (post)	21	17.8	6.5	2.650	.011*	0.82
<i>Control</i>	Numbers, Letters & Words (post)	21	12.8	5.6			
<i>Experiment</i>	Articulation Survey (post)	21	18.7	1.6	2.472	.011*	0.76
<i>Control</i>	Articulation Survey (post)	21	17.4	1.8			
<i>Experiment</i>	K-SEALS Total (post)	21	66.2	9.2	3.879	.000*	1.20
<i>Control</i>	K-SEALS Total (post)	21	56.0	7.7			

\* $p < .05$

Table 3 presents the significant differences between the posttest mean scores of control and experiment group children from K-SEALS subtests and the test as a whole. Significant differences were found between posttest mean scores of Word Knowledge subtest ( $t = 4.063$ ,  $p > .05$ ,  $d = 1.24$ ), Numbers, Letters & Words subtest ( $t = 2.650$ ,  $p > .05$ ,  $d = 0.82$ ), Articulation Survey ( $t = 2.472$ ,  $p > .05$ ,  $d = 0.76$ ) and K-SEALS total ( $t = 3.879$ ,  $p > .05$ ,  $d = 1.20$ ).

**Table 4.** Paired Samples t-test Results of Pre-test – Post-test Scores of Experiment Group Children from K-SEALS Subtests and Total

<i>K-SEALS</i>		<i>n</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>Cohen's d</i>
<i>Word Knowledge</i>	Pre-test	21	26.3	3.6			
<i>Word Knowledge</i>	Post-test	21	29.8	2.9	-9.5	.0001*	1.07
<i>Numbers, Letters &amp; Words</i>	Pre-test	21	12.2	7.2			
<i>Numbers, Letters &amp; Words</i>	Post-test	21	17.8	6.5	-10.2	.0001*	0.81
<i>Articulation Survey</i>	Pre-test	21	16.9	2.9			
<i>Articulation Survey</i>	Post-test	21	18.7	1.6	-3.6	.0001*	0.76
<i>K-SEALS Total</i>	Pre-test	21	55.4	11.2			
<i>K-SEALS Total</i>	Post-test	21	66.2	9.2	-11.3	.0001*	1.05

\*p&lt;.05

Table 4 shows the significant differences between experiment group children's pretest and posttest mean scores from K-SEALS before and after the implementation which are as follows: Word Knowledge ( $t = -9.5$ ,  $p < .05$ ,  $d = 1.07$ ), Numbers, Letters & Words ( $t = -10.2$ ,  $p < .05$ ,  $d = 0.81$ ), Articulation Survey ( $t = -3.6$ ,  $p < .05$ ,  $d = 0.76$ ) and K-SEALS total ( $t = -11.3$ ,  $p < .05$ ,  $d = 1.05$ ). The difference was in favor of posttest scores. According to this finding, it can be suggested that Big Math for Little Kids Educational Program, which was implemented on experiment group, had effect on children's early academic and language skills.

**Table 5.** Paired Samples t-test Results of Pre-test – Post-test Scores of Control Group Children from K-SEALS Subtests and Total

<i>K-SEALS</i>		<i>n</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>Cohen's d</i>
<i>Word Knowledge</i>	Pre-test	21	25.5	3.2	-2.35	.029*	0.15
<i>Word Knowledge</i>	Post-test	21	26.0	3.2			
<i>Numbers, Letters &amp; Words</i>	Pre-test	21	12.4	5.9	-2.9	.029*	0.06
<i>Numbers, Letters &amp; Words</i>	Post-test	21	12.8	5.6			
<i>Articulation Survey</i>	Pre-test	21	17.1	1.9	-2.5	.021*	0.16
<i>Articulation Survey</i>	Post-test	21	17.4	1.8			
<i>K-SEALS Total</i>	Pre-test	21	55.0	7.8	-3.7	.001*	0.12
<i>K-SEALS Total</i>	Post-test	21	56.0	7.7			

\* $p < .05$ 

Table 5 shows the significant differences between control group children's pretest and posttest mean scores from K-SEALS which are as follows: Word Knowledge ( $t = -2.35$ ,  $p < .05$ ,  $d = 0.15$ ), Numbers, Letters & Words ( $t = -2.9$ ,  $p < .05$ ,  $d = 0.06$ ), Articulation Survey ( $t = -2.5$ ,  $p < .05$ ,  $d = 0.16$ ) and K-SEALS total ( $t = -3.7$ ,  $p < .05$ ,  $d = 0.12$ ). The difference was in favor of posttest scores and according to this similar finding it can be argued that Ministry of National Education Early Childhood Education Program for 36-72-Month-Old Children (2006) had also effect on children's early academic and language skills development.

**Table 6.** Independent Samples t-test Results of Newly Obtained Differences by Taking Control and Experiment Group Children's Posttest and Pretest Score Differences in K-SEALS

<i>K-SEALS</i>	<i>Group</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>Cohen'sd</i>
<i>Difference Score for Word Knowledge</i>	Experiment	21	3.5	1.7	7.222	.000*	2.20
	Control	21	0.5	0.9			
<i>Difference Score for Numbers, Letters &amp; Words</i>	Experiment	21	5.6	2.5	9.164	.000*	2.83
	Control	21	0.4	0.7			
<i>Difference Score for Articulation Survey</i>	Experiment	21	1.8	2.2	3.129	.003*	1.01
	Control	21	0.2	0.4			
<i>Difference Score for K-SEALS Total</i>	Experiment	21	10.8	4.4	9.889	.000*	5.79
	Control	21	1.0	1.2			

\*p&lt;.05

As presented in Table 6, according to Independent Samples t-test Results of Newly Obtained Differences by taking control and experiment group children's posttest and pretest score differences in K-SEALS, significant differences were found out between control and experiment group children's K-SEALS Word Knowledge subtest ( $t=7.222$ ,  $p>.05$ ,  $d=2.20$ ), Numbers, Letters & Words subtest ( $t=9.164$ ,  $p>.05$ ,  $d=2.83$ ), Articulation Survey subtest ( $t=3.129$ ,  $p>.05$ ,  $d=1.01$ ) and K-SEALS Total ( $t=9.889$ ,  $p>.05$ ,  $d=5.79$ ) difference mean scores. In the light of these findings, the difference mean scores were significantly higher in experiment group. Thus, it can be reported that Big Math for Little Kids Educational Program enhances children's early academic and language skills

## **CONCLUSION AND DISCUSSION**

In the relevant literature, there are studies investigating the effect of educational programs supporting children's Math skills (Clements & Sarama, 2007; Griffin, 2004, Mulligan, English, Mitchelmore, Welsby & Crevensten, 2011; Mulligan, English, Mitchelmore & Robertson, 2010). Having been acknowledged that developmental domains should be considered as a whole, educational programs intended for supporting children's Math skills will obviously affect children's academic and language skills (Clements & Sarama, 2009). In this study, in order to support 61-72-month-old preschoolers' academic and language skills Big Math for Little Kids Program – a systematical, well planned and inquiry based program including parent involvement activities - was implemented. Experiment group children's mean scores were found out to be significantly higher than those of control group children who did not receive treatment as the experiment group children attended Big Math for Little Kids Program. In addition, it was found out that experiment group children scored significantly higher after the treatment compared to their pretest scores. Moreover, newly obtained difference scores by subtracting posttest scores from pretest scores of children in both control and experiment groups were analyzed and it was found out that experiment group children's scores were significantly higher than those of control group children. These findings showed that Big Math for Little Kids Program was effectual in the development of early academic and language skills of 61-72-month-old children. Possible reasons why Big Math for Little Kids was found out to have effect on children's early academic and language skills were as follows: it integrates Math into daily activities and other academic areas (play, drama, early literacy, language, music, etc.), it sees children developmental areas as a whole, it allows the evaluation of children throughout the process with various techniques, it provides opportunities for parent involvement such as "family letters", "take home games", and "take home story books" all of which allow the practice of what has been learnt at home settings, it establishes a rich literacy environment through language, literacy and Math activities, it provides practice with words and sounds during the activities so that children practice

their phonological skills such as finding the homophones, distinguishing the different sound or saying out rhymes, singing aloud or reciting poems which also encourage them to spell or articulate the letters or sounds, it enables grounds for children to find out the number of letters or syllables in a word, it provides specially designed materials allowing children's active physical participation and active learning experience.

The findings of this study were similar to those of many previous studies in the literature which were as follows. Kandır, Yazıcı and Çelik (2016) carried out an experimental study investigating the effect of Big Math for Little Kids Program on 61-72-month-old children's literacy skills. They implemented Big Math for Little Kids Program on experiment group children for 14 weeks while the control group followed Ministry of National Education Early Childhood Education Program for 36-72-Month-Old Children (2006). As a result of the treatment, they found out that the experiment group children significantly scored higher in terms of literacy skills. Sarama et al. (2012), in their study which they investigated the effect of Building Blocks - Early Math educational program on children's oral language and literacy skills found out that children in the Building Blocks group outperformed children in the control group on four oral language subtests: ability to recall key words, use of complex utterances, willingness to reproduce narratives independently, and inferential reasoning. Therefore, both studies support the Big Math for Little Kids program's effect on children's vocabulary, letters and articulation skills.

In addition to Big Math for Little Kids program's effects found out on children's number knowledge and mathematics skills, Kaufmann, Delazer, Pohl, Semenza and Dowker (2005) carried out an experimental study to find out the effect of the educational program they developed in order to support children's numerical operational development. Teachers implemented Numerical Systems Program for 15 minutes each day for one academic semester and at the end of the study experiment group children's mean scores were found out to be higher. Clements and Sarama (2007) tried to show the efficiency of their software program which included inquiry based art, music, puzzle and storytelling activities. As a result, experiment group children who used the software scored remarkably higher compared to control group who followed

the normal program. Sophian (2004) intended to prepare children for the forthcoming Math learning areas in terms of Math concepts and developed an educational program for use both at Head Start centers and at home settings including target skills such as numbers and operations, shapes, spatial logic, measurement and forming patterns. In this study two control groups were designed and the researcher assigned 46 children in the experiment group to test the efficacy of the program. As a result, the program was found out to have increased children's Math development. Mulligan, Mitchelmore, Kemp, Marston and Highfield (2008) investigated the effect of Pattern and Structure Mathematics Awareness Program (PASMMap) by means of an experimental study. The program included activities such as counting, sharing, forming patterns, multi-dimensional thinking, spatial shapes, matching and finding similarities. 10 children in study group were administered Pattern and Structure Assessment – an instrument developed by the researchers - as pretest and posttest. As a result, they found out that children who enrolled to the program scored significantly higher. The studies carried out so far all emphasized the finding that children's early academic and language skills can be enhanced by well-planned and inquiry-based mathematics educational programs. On the other hand, in this study, the reason why control group children also scored significantly higher on the posttest compared to the pretest scores can be explained in a way that these children followed Ministry of National Education Early Childhood Education Program for 36-72-Month-Old Children during the study as this traditional program also included activities intended for the improvement of children's early academic and language skills. That is to say, the difference between the pretest / posttest scores that assess children's math skills in the control group may be related to the fact that classroom teachers included activities that support mathematical skills in the Turkish Ministry of National Education's program and ensured active participation of children. The students in the control group might somehow have had the concepts, words and achievement indicators regarding language, mathematics and literacy skills in the conventional program as they attend to preschools affiliated to the Turkish Ministry of National Education. Similarly, Kandır, Yazıcı and Çelik (2016), found out significant difference between the control group's pretest and posttest mean scores in

their study investigating the effect of Big Math for Little Kids on 61-72-month-old children during which the control group followed the Turkish Ministry of National Education Program. Likewise, they also reported that the mean scores obtained from the whole scale in the experimental group were higher than those of the control group, and according to this result, they concluded that Big Math for Little Kids program promoted the children's language and academic skills significantly.

At the end of this study, children in the experiment group (n=21) who received Big Math for Little Kids educational program, which was implemented for 14 weeks on five days a week for 40-60 minutes per day, were found out to have scored significantly higher in comparison with the control group (n=21) in terms of early academic and language skills. According to this finding, it can be concluded that Big Math for Little Kids Program is effectual on children's early academic and language skills. The same treatment can be implemented on a large-scale sampling at various socio economical settings or at selected schools in forthcoming studies. Finally, an educational program with the aim of informing parents and teachers about how they can support children's early literacy skills can be implemented and future studies can look for possible effects of such a program on children's early academic and language skills.

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## GENİŞ ÖZET

Matematik yaşamın her alanıyla ilişkili olduğundan matematiksel kavramlarla iç içe olan oyunlar oynama, öyküler anlatma, sohbet etme, çalışma kâğıtları ile çalışmalar yapma gibi yöntem ve tekniklerle bütünleştirilmiş eğitim programları çocukların matematiğin birçok alanıyla keyifle ilgilenmelerini, matematik dilini kullanmalarını sağlamakta (Ginsburg, Greenes ve Balfanz, 2003; Jackman, 2005) ve aynı zamanda çocukların dil ve okuma-yazma becerilerinin gelişimini de desteklemektedir (Clements ve Sarama, 2009: 1,2). Bu nedenle araştırma, anasınıfına devam eden 61-72 aylık çocukların erken akademik ve dil becerilerine “Küçük Çocuklar İçin Büyük Matematik Eğitimi (Big Math For Little Kids) Programı”nın etkisini incelemek amacıyla yapılmıştır. Araştırmanın çalışma grubunu 2010-2011 eğitim-öğretim yılında Ankara il merkezinde Milli Eğitim Bakanlığına bağlı ilköğretim okullarındaki anasınıfına devam eden daha önce özel bir matematik eğitim programı uygulanmamış, deney (n:21) ve kontrol (n:21) grubu olmak üzere toplam 42 çocuk oluşturmuştur. Araştırmada 61-72 aylık çocukların matematik gelişimine “Küçük Çocuklar İçin Büyük Matematik Eğitimi (Big Math For Little Kids) Programı”nın etkisini incelemek amacıyla ön test/son test kontrol gruplu deneysel desen kullanılmıştır. Araştırmada, çocukların erken akademik ve dil becerilerini değerlendirmek amacıyla orijinali Kaufman ve Kaufman (1993) tarafından Amerika’da geliştirilen ve Uyanık (2010) tarafından Türk çocukları için geçerlik güvenirlik çalışması yapılan “Kaufman Erken Akademik ve Dil Becerileri Araştırma Testi” deney ve kontrol grubuna ön test ve son test olarak kullanılmıştır. Deney grubuna 61-72 aylık çocukların matematik gelişimlerini desteklemek amacıyla Ginsburg ve diğerleri (2003) tarafından geliştirilen ve Çelik (2011) tarafından Türkçeye uyarlaması yapılan Küçük Çocuklar İçin Büyük Matematik Eğitimi (Big Math For Little Kids) Programı 14 hafta süre ile uygulanmıştır. Kontrol grubuna ise sınıf öğretmenleri tarafından MEB 36-72 Aylık Çocuklar İçin Okul Öncesi Eğitim Programı’nın uygulanmasına devam edilmiştir. Araştırma verilerinin analizinde, uygulanan programın etkisine ilişkin olarak deneysel çalışmadan elde edilen verilerin analizinde ise bağımlı ve bağımsız gruplarda t testi ile analiz edilmiştir. Araştırma sonucunda; çocukların erken akademik ve dil becerileri üzerinde “Küçük Çocuklar İçin Büyük Matematik Eğitimi (Big Math For Little Kids) Programı”nın, kontrol grubu ile karşılaştırıldığında deney grubu lehine istatistiksel olarak anlamlı etkisinin olduğu tespit edilmiştir. İlgili literatür incelendiğinde, bu araştırmanın bulgularının bir çok araştırma ile desteklendiği görülmektedir. Kandır, Yazıcı ve Çelik (2013) anasınıfına devam eden 61-72 aylık çocukların okuma yazma becerilerinde “Big Math For Little Kids” programının etkisini ortaya koymak amacıyla deney grubuna “Big Math For Little Kids” programını 14 hafta süre ile kontrol grubuna ise MEB 36-72 Aylık Çocuklar için Okul Öncesi Eğitim Programı’nı (2006) uygulamışlardır. Araştırmanın

*sonucunda deney grubunun puan ortalamasının kontrol grubuna göre daha yüksek olduğu sonucuna ulaşılmıştır. Kaufmann ve diğerleri (2005), çocuklarda sayı ve işlemler gelişimini desteklemeye yönelik hazırladıkları programın etkisini ortaya koymak amacıyla deney grubuna Sayı Sistemi Programını bir dönem boyunca her gün yaklaşık 15 dakika uygulanmışlardır. Araştırmanın sonucunda deney grubu çocukların puanlarının kontrol grubu çocuklarının puanlarından önemli düzeyde yüksek olduğu bulunmuştur. Araştırmaların sonuçları incelendiğinde çocukların erken akademik ve dil becerileri başarılarını arttırmada erken dönemde planlı, programlı ve araştırma temelli matematik eğitim program modellerinin ve bu programlarının uygulanmasının etkili olduğu görülmektedir. Araştırmadan elde edilen sonuçlara dayanarak; Big Math For Little Kids programının uygulanmasında aynı yöntem ve teknikler kullanılarak farklı sosyo-kültürel düzeyde yetişen çocukların ve pilot okullar seçilerek daha geniş örneklem grubunun bu eğitimden yararlanması sağlanarak programın etkililiği test edilebilir ve sonuçları test edilebilir. Anne babalara ve eğitimcilere yönelik okuma yazma becerilerini destekleyici matematik eğitim programları uygulanarak, uygulanan programın çocukların erken akademik ve dil becerilerine etkisi incelenebilir.*