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Effect of mathematics education program in linked to outdoor movement activities on the object manipulation abilities of young children

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Abstract

The purpose of this study to discover what effect the mathematics education program linked to outdoor movement activities have on the ability to manipulate objects. The subject of study was a kindergarten class. The experimental and comparative groups consisted of 20 people each. In order to verify the effect of applying the early childhood mathematics education program in connection with outdoor movement activities, a total of 15 weeks of program was conducted for young children. As a result of conducting this study, it was found that a mathematics education program linked to outdoor movement activities improves the ability to manipulate objects. The discussion based on the results of this study is as follows. First, we suggest to specific activities that can be performed in an outdoor environment should be developed and applied to the field of early childhood education. Second, we suggest that It is necessary to program various subjects that link to outdoor movement activities. Third, we suggest what various measures are needed to improve the young children's ability to manipulate objects.

Keywords: Early Childhood Education, Mathematics Education, Outdoor Movement Activity, Object Manipulation Ability, Young Children

1. INTRODUCTION

To adapt to the surrounding world, the young children need mathematics skills, and the young children are instinctively interested in mathematics [1]. The young children acquire their own mathematical concept by organizing and solving various mathematical relationships that they encounter while actively exploring the surrounding environments in a play situation or in everyday life [2]. Mathematical experience in everyday life is important for the development of mathematics abilities of the young children, and these perspectives support the importance of play and voluntary exploration of the young children, which are utilized in the existing approaches to mathematics education for the young children [3]. In this way, the young children should be encouraged to communicate with their peers and teachers about their understanding and drawing in synchronization so that they want to do math activities themselves [4].

The outdoor environment is the space where children can develop all areas of development even while having fun [5]. Proper use of the outdoor environment can make it a great educational space. The outdoor environment is an extension of a well-planned classroom that provides a variety of learning stimuli to the young children, and the rich surroundings and open spaces can help stimulate the mathematics experience [1].

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The young children tend to feel that mathematics is very difficult, and they can overcome the difficulties of mathematics by naturally performing mathematics education through play and activities in an outdoor environment.

The way to make mathematics education easier and more fun in the outdoor environment is to do movement activities using the concept of mathematics [3]. Various mathematical concepts can be included in the movement activities. It can expand the young children's mathematical experience through tool-based movement activities. Specifically, through movement activities, the young children can compose specific experiences on the relationship of quantity, number recognition, counting, space and geometry, patterns, and simple operations [6]. As such, the young children develop mathematical abilities and mathematical inclination through various mathematical experiences while performing movement activities with mathematical concepts applied outdoors. In particular, it is possible to enhance the young children's ability to manipulate objects through outdoor movement activities [7]. In recent, many studies have been conducted to approach to mathematics to the young children in terms of integrated activities [8-10]. Therefore, in this study, It would like to discover what effect the mathematics education program linked to outdoor movement activities have on the ability to manipulate objects. Following are the research questions.

Research question 1. What is the effect of mathematics activities in linked to outdoor movement activities on young children's object manipulation abilities?

2. METHODOLOGY

2.1. Research Subject

The subject of study was a kindergarten class in Gyeonggi-do, 5 years old. The experimental and comparative groups consisted of 20 people each. The mean age of the experimental group was 73.5 months ($SD=3.41$), which was not significantly different from that of the comparative group ($SD=3.25$) ($t=.60, p>.05$).

2.2. Experimental Measures

In order to verify the effect of applying the early childhood mathematics education program in connection with outdoor movement activities, a total of 15 weeks of program was conducted for young children 5 years of age in S kindergarten located in Gyeonggi-do from October 2014 to January 2015.

The preliminary inspection was conducted from September 15 to 19, 2014. The pre-test was conducted between September 24 to 29, 2014 in two groups of children, the experimental group and the comparative group. The main test was conducted for a total of 15 weeks in the experimental group from October 13, 2014 to January 23, 2015. The post-test was conducted from January 30 to February 5, 2015.

2.3. Experimental Tool

In order to measure the infant's object manipulation ability, the manipulation exercise among the basic exercise capability test tools[8], which was modified by Ulrich's Test of gross motor development-II[15] to suit the Korean situation, 6 Item used. The 6 items of manipulating exercise consist of striking ball, bouncing ball, catching ball, kicking ball, throwing overhand ball, and rolling ball. The test was conducted twice for each item, and was performed by displaying '1' point when successful, and '0' point if not.

2.4. Data Analysis

In this study, the effects of mathematics activities in connection with outdoor movement activities were investigated. To this end, pre- and post-tests were conducted in the experimental and comparative groups, respectively, to confirm how the manipulation ability of the infant changed. For the analysis, the spss 20 program was used, and the t-test between the experimental and comparative groups for pre-test and post-test was used.

3. RESULTS AND DISCUSSION

3.1. Effect on Overall Object Manipulation Ability

Table 1 shows the average and standard deviation of the pre-test and post-test adjusted post-test scores of the experimental group and the comparative group for the overall object manipulation ability according to the mathematics education program in connection with outdoor motion activities. As shown in Table 1, the mean of the pre-test of the experimental group for the overall object manipulation ability of the young children was 15.00, and the mean of the post-test was 31.90. In the case of the comparative group, the mean of pre-test was 14.45, and the mean of post-test was 18.95. In the case of the experimental group, the average of the post-test increased by 16.90 compared to the pre-test, and in the case of the comparative group, the average of the post-test score increased by 4.50 compared to the pre-test, and the experimental group showed more score increase.

Table 1. Score of overall object manipulation ability (N=20)

Group	Pre-test		Post-test		
	M	SD	M	Corrected M	SD
Experimental Group	15.00	8.05	31.90	31.71	5.98
Comparative Group	14.45	4.75	18.95	19.14	5.03

3.2. Effect on Stroke Ability

Among the stroke ability of sub-areas of object manipulation ability according to a mathematics education program linked to outdoor movement activities, if the average and standard deviation of the pre-test, post-test, adjusted post-score of the experimental group and the comparison group are presented, the following table 2. As shown in Table 2, the average of the pre-test of the experimental group for the stroke area among the sub-areas of manipulating objects was 3.50, and the average of the post-test was 8.35. In the case of the comparative group, the average of pre-tests was 3.20, and the average of post-tests was 4.05. In the case of the experimental group, the average of the post-test increased by 4.85 compared to the pre-test, and in the case of the comparative group, the average of the post-test score increased by 0.85 compared to the pre-test, and the experimental group showed more points.

Table 2. Score of stroke ability (N=20)

Group	Pre-test		Post-test		
	M	SD	M	Corrected M	SD
Experimental Group	3.50	1.93	8.35	8.27	1.31
Comparative Group	3.20	1.24	4.05	4.13	1.19

3.3. Effect on Bounce Ability

Among the bounce ability of sub-areas of object manipulation ability according to a mathematics education

program linked to outdoor movement activities, if the average and standard deviation of the pre-test, post-test, adjusted post-score of the experimental group and the comparison group are presented, the following table 3. As shown in Table 3, the average of the pre-test of the experimental group for the bounce area among the sub-areas of manipulating objects was 1.40, and the average of the post-test was 4.20. In the case of the comparative group, the average of pre-tests was 1.40, and the average of post-tests was 2.60. In the case of the experimental group, the average of the post-test increased by 2.80 compared to the pre-test, and in the case of the comparative group, the average of the post-test score increased by 1.20 compared to the pre-test, and the experimental group showed more points

Table 3. Score of bounce ability (N=20)

Group	Pre-test		Post-test		
	M	SD	M	Corrected M	SD
Experimental Group	1.40	1.14	4.20	4.20	1.58
Comparative Group	1.40	1.14	2.60	2.60	1.14

3.4. Effect on Catch Ability

Among the catch ability of sub-areas of object manipulation ability according to a mathematics education program linked to outdoor movement activities, if the average and standard deviation of the pre-test, post-test, adjusted post-score of the experimental group and the comparison group are presented, the following table 4. As shown in Table 4, the average of the pre-test of the experimental group for the catch area among the sub-areas of manipulating objects was 2.45, and the average of the post-test was 4.45. In the case of the comparative group, the average of pre-tests was 2.25, and the average of post-tests was 3.05. In the case of the experimental group, the average of the post-test increased by 2.00 compared to the pre-test, and in the case of the comparative group, the average of the post-test score increased by 0.80 compared to the pre-test, and the experimental group showed more points.

Table 4. Score of catch ability (N=20)

Group	Pre-test		Post-test		
	M	SD	M	Corrected M	SD
Experimental Group	2.45	1.76	4.45	4.40	1.10
Comparative Group	2.25	1.12	3.05	3.10	1.23

3.5. Effect on Kick Ability

Among the kick ability of sub-areas of object manipulation ability according to a mathematics education program linked to outdoor movement activities, if the average and standard deviation of the pre-test, post-test, adjusted post-score of the experimental group and the comparison group are presented, the following table 5. As shown in Table 5, the average of the pre-test of the experimental group for the kick area among the sub-areas of manipulating objects was 2.20, and the average of the post-test was 4.40. In the case of the comparative group, the average of pre-tests was 2.05, and the average of post-tests was 2.75. In the case of the experimental group, the average of the post-test increased by 2.20 compared to the pre-test, and in the case of the comparative group, the average of the post-test score increased by 0.70 compared to the pre-test, and the experimental group showed more points.

Table 5. Score of kick ability (N=20)

Group	Pre-test		Post-test		
	M	SD	M	<i>Corrected M</i>	SD
Experimental Group	2.20	1.94	4.40	4.35	1.60
Comparative Group	2.05	1.67	2.75	2.80	2.75

3.6. Effect on Throwing Overhand Ability

Among the throwing overhand ability of sub-areas of object manipulation ability according to a mathematics education program linked to outdoor movement activities, if the average and standard deviation of the pre-test, post-test, adjusted post-score of the experimental group and the comparison group are presented, the following table 6. As shown in Table 6, the average of the pre-test of the experimental group for the throwing overhand area among the sub-areas of manipulating objects was 3.45, and the average of the post-test was 4.65. In the case of the comparative group, the average of pre-tests was 3.55, and the average of post-tests was 2.65. In the case of the experimental group, the average of the post-test increased by 1.20 compared to the pre-test, and in the case of the comparative group, the average of the post-test score decreased by 0.90 compared to the pre-test, and the experimental group showed more points.

Table 6. Score of throwing overhand ability (N=20)

Group	Pre-test		Post-test		
	M	SD	M	<i>Corrected M</i>	SD
Experimental Group	3.45	1.99	4.65	4.65	1.47
Comparative Group	3.55	2.67	2.65	2.65	1.60

3.7. Effect on Rolling Ability

Among the throwing rolling ability of sub-areas of object manipulation ability according to a mathematics education program linked to outdoor movement activities, if the average and standard deviation of the pre-test, post-test, adjusted post-score of the experimental group and the comparison group are presented, the following table 7. As shown in Table 7, the average of the pre-test of the experimental group for the rolling area among the sub-areas of manipulating objects was 3.45, and the average of the post-test was 5.85. In the case of the comparative group, the average of pre-tests was 3.55, and the average of post-tests was 3.85. In the case of the experimental group, the average of the post-test increased by 2.40 compared to the pre-test, and in the case of the comparative group, the average of the post-test score increased by 0.30 compared to the pre-test, and the experimental group showed more points.

Table 7. Score of rolling ability (N=20)

Group	Pre-test		Post-test		
	M	SD	M	<i>Corrected M</i>	SD
Experimental Group	3.45	1.99	5.85	5.89	1.57
Comparative Group	3.55	2.67	3.85	3.81	2.28

4. CONCLUSION

As a result of conducting this study, it was found that a mathematics education program linked to outdoor movement activities improves the ability to manipulate objects. The discussion based on the results of this study is as follows. First, specific activities that can be performed in an outdoor environment should be developed and applied to the field of early childhood education. We suggest to more activities that satisfy the physical needs of young children in the outdoor environment. And a lot of specialized movement activities should be developed in the future. Second, It is necessary to program various subjects that link to outdoor movement activities. We suggest to various integrated programs based on the young children's movement experience are needed. Third, we suggest to various measures are needed to improve the young children's ability to manipulate objects. Providing activities that can enhance the ability to manipulate objects while children are movement in an outdoor environment because infants can improve their motor skills while experiencing a sense of accomplishment when they experience various movement activities in a pleasant situation. The suggestions of this study are as follows. First, outdoor movement activities and mathematics activities are linked. Second, it is necessary to provide math activities suitable for various types of outdoor environments.

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