

A Study on the Early Childhood Mathematics Teachers' Perceptions and Practices in Support of the Goals and Contents of Early Childhood Mathematics Education

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Abstract

This research was conducted to identify relationships between the teachers' perceptions of the goals and contents for the early childhood mathematics education and their practices in support of them. Also, differences were examined in the teachers' perceptions and practices between the subgroups by teacher's education and the ages of the children under their care. A questionnaire survey was conducted among a total of 132 early childhood mathematics teachers in Seoul and Gyeonggi-do, South Korea, and its results are as follows: (1) in terms of the teachers' perceptions of the goals and contents of early childhood mathematics education, the perceptions of the teachers with higher educational levels and of those who were in charge of older children were higher; (2) with regard to the teachers' practices in support of the goals and contents of early childhood mathematics education, the practices of the teachers with higher educational levels and of those who were in charge of older children were higher; and (3) it was found that the teachers generally did not realize the necessity of evaluation in early childhood mathematics education, and that the teaching method that was mainly used by the early childhood mathematics teachers was manipulative play or games. Along with the main results of this study, implications for research and practice are discussed.

Keywords : early childhood mathematics education, teachers' perceptions, teachers' practices.

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Introduction

As the current society is steadily transforming and moving beyond a simple information-oriented one to a highly conceptual and tactile one, the scope of the use of mathematical abilities is expanding and is increasingly including a variety of fields, such as computer science, finance, medical science, space science, and the arts. Therefore, the basic mathematical abilities of children are currently being emphasized. Mathematics education in the early childhood years is given more importance now than it has ever been given before because early childhood is a decisive period for the development of mathematical abilities. To illustrate, NCTM, which published “The Curriculum and Evaluation Standards for Mathematics in School” in 1989 and “The Principles and Standards for Mathematics in School” in 2000, first presented the standards for mathematics education linked to the 12th grade, including the prekindergarten and kindergarten levels. In addition, NCTM, in association with NAEYC, published “Early Childhood Mathematics Education: Promoting a Good Start” as a guide for teachers in 2000, and revised it recently (2010). New Zealand is putting into practice a program aimed at enhancing their teachers’ abilities through continuing professional development (PD) in mathematics (Jennifer, 2009). These movements can be seen as efforts to more systematically execute mathematics education from early childhood, based on the recognition of the importance of early childhood mathematics education in the development of mathematical abilities.

In South Korea, the goal of mathematics education in early childhood is to develop the basic abilities and attitudes that are necessary for children to explore various subjects and phenomena in line with their interests (Ministry of Education and Human Resources Development, 2007). Mathematics education is also viewed as a process in which young children connect informal mathematical concepts to the order and meaning of the situations and events taking place in their daily lives. The understanding of basic mathematical concepts, the improvement of mathematical-problem-solving skills, and the formation of a positive attitude towards mathematics can be cited as the concrete goals of early childhood mathematics education (Moon,

2009). The contents of early childhood mathematics education in both the NCTM standards (2000) and the kindergarten curriculum of South Korea include numbers and calculation, spaces and figures, measurement, regularity, and materials analysis and probability. To achieve these learning goals, the teachers who are tasked to do so must be keenly aware of the goals and contents of early childhood mathematics education and must apply these to their classes.

It was found, however, that the early childhood teachers in South Korea have negative attitudes towards mathematics and lack a sense of confidence in teaching it (Jung, 2001). Furthermore, given their lack of confidence in teaching mathematics, the early childhood mathematics teachers have failed to use the informal mathematical knowledge of their young students as a starting point, and to effectively connect it with mathematical activities (Han & Park, 2004). If the teachers are to enhance their young pupils' mathematical abilities, they need to have faith in their being effective teachers, must have accurate and high perceptions of their mathematics knowledge, and must employ effective mathematics teaching methods/approaches (Lim, 2009; Yeo, 2004; Kim, 2003).

As the most important variable in education institutions is the teachers, even when top-level programs based on excellent theories are implemented and new materials are provided, effective education cannot be guaranteed unless the teachers can correctly recognize and use these. The NCTM (2000) mathematics standards also stressed that the professional teaching function of teachers matters if they are to provide their pupils/students with opportunities to solve problems in their everyday life and to link concrete experiences that stimulate their thinking to abstract mathematical thinking. In particular, as the learning opportunities of learners are determined by how their teachers teach what they are supposed to teach (Lee, 2000), the teachers' perceptions of the goals and contents of mathematics education, and the practice of real activities, must be reinforced.

It is extremely important to develop mathematical abilities in early childhood, and to do this, the early childhood mathematics teachers should have a high-level recognition of the science of mathematics education and should connect it to real

practice. Therefore, this study was conducted to examine the early childhood mathematics teachers' perceptions and practices in support of the goals and contents of early childhood mathematics education, and to determine the teaching and evaluation methods/approaches that are currently being used by the early childhood mathematics teachers. To enhance the development of mathematical abilities in early childhood, this study will serve as an important basic material in developing and operating an education program designed to promote the professional development of early childhood mathematics teachers. Towards this end, the following research issues were investigated:

1. How different are the early childhood mathematics teachers' perceptions of the goals and contents of early childhood mathematics education according to the types of institutions where they are teaching, their educational levels, and the ages of the children they are teaching?
2. How different are the early childhood mathematics teachers' practices in support of the goals and contents of early childhood mathematics education according to the types of institutions where they are teaching, their educational levels, and the ages of the children they are teaching?
3. Is there a difference between how the early childhood mathematics teachers perceive the goals and contents of early childhood mathematics education and such teachers' practical behaviors?
4. What teaching and evaluation methods/approaches are currently being used by the early childhood mathematics teachers?

Methods

Participants

Copies of the questionnaire were given to 200 teachers who were teaching in kindergartens and childcare centers located in Seoul and Gyeonggi-do, South Korea, and a total of 132 completed questionnaires were collected, representing 66% of the questionnaires that were distributed to the teachers.

Table 1. *Backgrounds of the Teachers included in the Survey* *N=132*

Background Variable	Area	N (%)
Types of institutions where the teachers are teaching	Childcare center	58 (43.9)
	Private kindergarten	74 (56.1)
Teachers' education levels	Childcare teacher training center certificate holder	11 (8.3)
	College graduate	76 (57.6)
	Higher-degree holder	45 (34.1)
Ages of the children taught by the teacher	3 years old	36 (27.3)
	4 years old	53 (40.2)
	5 years old	43 (32.6)

Measures

The questionnaire that was constructed and used for this study was developed and revised by the researchers based on the questionnaires that were developed by Park (2000), Song (2006), Bae (2003), and Hwang (2006), and on the questionnaire that was developed by Jung (2006) by referring to the sixth kindergarten mathematics curriculum and the seventh revised kindergarten mathematics curriculum. The questionnaire for the present study was also developed by referring to South Korea's seventh kindergarten mathematics curriculum and the mathematics curriculum of the standard childcare curriculum. To verify its appropriateness, a preliminary survey was conducted among the 200 teachers who attended the workshop of the teachers in the kindergartens and childcare centers in Seoul and Gyunggido, South Korea, but as it was found that the survey respondents' understanding of the early childhood mathematics education contents and teaching methods/approaches was not sufficient, the questionnaire's contents were supplemented and revised. In a second attempt to verify the questionnaire's appropriateness, the presurvey was revised and its apparent appropriateness was examined by four experts: a professor and three doctoral-degree holders.

The questionnaire for "perceptions and practices in support of the goals and contents of early childhood mathematics education" had a five-level scoring scale.

“Purpose of education” was assigned a total of 15 points covering three items while “contents of education” was assigned a total of 25 points covering five items. “Mathematics teaching method and evaluation status” was addressed through multiple-choice items, in which the respondents were asked to pick only one option pertaining to the method that they were chiefly using.

Table 2. *Structure of the Questionnaire*

	Item (No. of Questions)	Contents
Perceptions and practices in support of the goals and contents of early childhood mathematics education	Goals of education (three questions)	Understanding of the basic concepts and principles of mathematics Improvement of mathematical-problem-solving and thinking skills Development of a positive attitude towards mathematics
	Contents of education (five questions)	Number and operations Spatial geometry Measurement Pattern Data analysis and probability
Teaching and evaluation methods/approaches currently being used	Teaching approaches/methods used (one question)	Literary approach Social approach Scientific (cooking) approach Manipulated play/game Expression (art, musical movement) Theme and project approach Other
	Necessity of evaluation (one question)	Necessary Optional Not necessary
	Evaluation methods used (one question)	Portfolio assessment Development report Checklist Does not evaluate Other

Data Analysis

One-way ANOVA was used to determine the relationships between the teachers' perceptions and practices in support of early childhood mathematics education and the type of institution where they are teaching, the ages of the children they are teaching, and their educational levels. A t test was conducted to determine if there was a difference between the teachers' perceptions of the goals and contents of early childhood mathematics education and their practices in support of such, and frequency analysis was used to examine the early childhood mathematics teaching and evaluation methods/approaches that are currently being used by the teachers. For the processing of the data obtained for analysis purposes, SPSS 11.0 was used.

Results

1. The Differences in the Teachers' Perceptions of the Goals and Contents of Early Childhood Mathematics Education by the Subjects' Background Characteristics

In this study, a t test was conducted to verify the differences in the teachers' perceptions of the goals and contents of early childhood mathematics education according to the types of institutions where they were teaching, and an F test was conducted to verify the differences in the same according to the teachers' educational levels and the ages of the children they were teaching. Table 3, 4, and 5 present the teachers' perceptions of the goals and contents of early childhood mathematics education according to the types of institutions where they were teaching, their educational levels, and the ages of the children they were teaching, respectively.

Table 3. *Teachers' Perceptions of the Goals and Contents of Early Childhood Mathematics Education According to the Types of Institutions Where They Were Teaching* $M(SD)$

Area \ Type	Childcare Center Teachers	Kindergarten Teachers	t
Goals of education	12.14 (2.28)	12.31 (1.92)	0.47
Contents of education	18.97 (3.76)	19.91 (3.99)	1.37

When the teachers' perceptions of the goals of early childhood mathematics education were examined according to the types of institutions where they were teaching, it was found that the teachers who were teaching in childcare centers had an average score of 12.14 points ($SD=2.28$) while those who were teaching in kindergartens had an average score of 12.31 points ($SD=1.92$). Regarding the teachers' perceptions of the contents of early childhood mathematics education, the results showed that the childcare center teachers had an average score of 18.97 points ($SD=3.76$) while the kindergarten teachers had an average score of 19.91 points ($SD=3.99$). These differences were not significant. That is to say, it was found that the childcare center and kindergarten teachers had the same perceptions of the goals and contents of early childhood mathematics education.

Table 4. Teachers' Perceptions of the Goals and Contents of Early Childhood Mathematics Education according to their Educational Levels $M(SD)$

Area \ Educational Level	Childcare Teacher Training Center Certificate Holders	College Graduates	Higher-Degree Holders	F	$Scheffé$
Goals of education	11.55 (3.39)	11.78 (1.80)	13.18 (1.84)	7.80**	a, b<c
Contents of education	18.00 (5.40)	18.83 (3.64)	20.98 (3.55)	5.51**	a, b<c

* $p<.05$, ** $p<.01$, *** $p<.001$

When the teachers' perceptions of the goals of early childhood mathematics education were examined according to the teachers' educational levels, the teachers who were childcare teacher training center certificate holders were found to have an average score of 11.55 points ($SD=3.39$), those who were college graduates 11.78 points ($SD=1.80$), and those who were higher-degree holders 13.18 points ($SD=1.84$). These differences show some meaningful variance in the statistics ($F=7.80$, $p<.01$). Based on the results of the *Scheffé* confirmation, it was determined that the teachers

who were higher-degree holders had higher perceptions of the goals of early childhood mathematics than the teachers who were childcare teacher training center certificate holders and college graduates.

When the teachers' perceptions of the contents of early childhood mathematics education were examined according to the teachers' educational levels, the teachers who were childcare teacher training center certificate holders were found to have an average score of 18.00 points ($SD=5.40$), those who were college graduates 18.83 points ($SD=3.64$), and those who were higher-degree holders 20.98 points ($SD=3.55$). These differences show some meaningful variance in the statistics ($F=5.51$, $p<.01$). Based on the results of the *Scheffé* confirmation, it was determined that the teachers who were higher-degree holders had higher perceptions of the contents of early childhood mathematics education than the teachers who were childcare teacher training center certificate holders and college graduates.

Table 5. Teachers' Perceptions of the Goals and Contents of Early Childhood Mathematics Education according to the Ages of the Children they were Teaching $M(SD)$

Area	Children's Ages			F	<i>Scheffé</i>
	3 Years Old	4 Years Old	5 Years Old		
Goals of education	11.75 (1.78)	12 (2.29)	12.93 (1.91)	3.87*	a<c
Contents of education	19.5 (3.16)	18.53 (4.34)	20.67 (3.64)	3.74*	a<c

* $p<.05$, ** $p<.01$, *** $p<.001$

When the teachers' perceptions of the goals of early childhood mathematics education were examined according to the ages of the children the teachers were teaching, it was found that the teachers who were teaching three-year-old children had an average score of 11.75 points ($SD=1.78$), those who were teaching four-year-old children 12 points ($SD=2.29$), and those who were teaching five-year-old children 12.93 points ($SD=1.91$). These differences show some meaningful variance in the statistics ($F=7.80$, $p<.05$). Based on the results of the *Scheffé* confirmation, it was determined that the teachers who were teaching five-year-old children had

higher perceptions of the goals of early childhood mathematics education than the teachers who were teaching three-year-old children.

When the teachers' perceptions of the contents of early childhood mathematics education were examined according to the ages of the children the teachers were teaching, it was found that the teachers who were teaching three-year-old children had an average score of 19.5 points ($SD=3.16$), those who were teaching four-year-old children 18.53 points ($SD=4.34$), and those who were teaching five-year-old children 20.67 points ($SD=3.64$). These differences show some meaningful variance in the statistics ($F=3.74, p<.05$). Based on the results of the *Scheffé* confirmation, it was determined that the teachers who were teaching five-year-old children had higher perceptions of the contents of early childhood mathematics education than the teachers who were teaching three-year-old children.

2. The Differences in the Teachers' Practices in Support of the Goals and Contents of Early Childhood Mathematics Education by the Subjects' Background Characteristics

In this research, a *t* test was conducted to verify the difference in the teachers' practices in support of the goals and contents of early childhood mathematics education according to the types of institutions where the teachers were teaching. An *F* test was also conducted to verify the difference in the same according to the teachers' educational levels and the ages of the children they were teaching. Table 6, 7, and 8 present the teachers' practices in support of the goals and contents of early childhood mathematics education according to the types of institutions where the teachers were teaching, their educational levels, and the ages of the children in their classes, respectively.

When the teacher's practices in support of the goals of early childhood mathematics education were examined according to the types of institutions where the teachers were teaching, it was found that the childcare center teachers had an average score of 9.81 points ($SD=1.98$) while the kindergarten teachers had an average score of 9.86 points ($SD=1.31$). Moreover, as regards the teachers' practices

in support of the contents of early childhood mathematics education, the childcare center teachers showed an average of 16.33 points ($SD=3.37$) while the kindergarten teachers showed an average of 16.74 points ($SD=2.40$). These results do not show any meaningful difference between the two groups. That is to say, the childcare center and kindergarten teachers did not differ in their practices in support of the goals and contents of early childhood mathematics education.

Table 6. Teachers' practices in support of the goals and contents of early childhood mathematics education according to the types of institutions where the teachers were teaching $M(SD)$

Area \ Institution Type	Childcare Center	Kindergarten	t
Goals of education	9.81 (1.98)	9.86 (1.31)	0.14
Contents of education	16.33 (3.37)	16.74 (2.40)	0.82

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 7. Teachers' practices in support of the goals and contents of early childhood mathematics education according to the teachers' educational levels $M(SD)$

Area \ Educational Level	Childcare Teacher Training Center Certificate Holders	College Graduates	Higher-Degree Holders	F	Scheffé
Goals of education	8.55 (3.24)	9.95 (1.42)	9.96 (1.28)	3.91*	a<b, c
Contents of education	14.27 (5.33)	16.68 (2.55)	16.91 (2.31)	4.11*	a<b, c

* $p < .05$, ** $p < .01$, *** $p < .001$

When the teachers' practices in support of the goals of early childhood mathematics education were examined according to the teachers' educational levels, it was found that the teachers who were childcare teacher training center certificate holders had an average score of 8.55 points ($SD=3.24$), those who were college graduates 9.95 points ($SD=1.42$), and those who were higher-degree holders 9.96

points ($SD=1.28$). These differences show some meaningful variance in the statistics ($F=3.91$, $p<.05$), and based on the results of the *Scheffé* confirmation, it was determined that the teachers who were college graduates and above had a higher rate of practices in support of the goals of early childhood mathematics education than the teachers who were childcare teacher training center certificate holders.

When the teachers' practices in support of the contents of early childhood mathematics education were examined according to the teachers' educational levels, it was found that the teachers who were childcare teacher training center certificate holders had an average score of 14.27 points ($SD=5.33$), those who were college graduates 16.68 points ($SD=2.55$), and those who were higher-degree holders 16.91 points ($SD=2.31$). These differences show some meaningful variance in the statistics ($F=4.11$, $p<.05$), and based on the results of the *Scheffé* confirmation, it was determined that the teachers who were college graduates and above had a higher rate of practices in support of the contents of early childhood mathematics education than the teachers who were childcare teacher training center certificate holders.

Table 8. *Teachers' Practices in Support of the Goals and Contents of Early childhood Mathematics Education according to the Ages of the Children the Teachers were Teaching* $M(SD)$

Area	Children's Ages	3 Years Old	4 Years Old	5 Years Old	F	<i>Scheffé</i>
Goals of education		9.75 (1.75)	9.57 (1.7)	10.23 (1.38)	2.08	.
Contents of education		16.81 (2.9)	15.79 (2.88)	17.3 (2.62)	3.63*	a<c

* $p<.05$, ** $p<.01$, *** $p<.001$

When the teachers' practices in support of the goals of early childhood mathematics education were examined according to the ages of the children the teachers were teaching, it was found that the teachers who were teaching three-year-old children had an average score of 9.75 points ($SD=1.75$), those who were teaching

four-year-old children 9.57 points ($SD=1.7$), and those who were teaching five-year-old children 10.23 points ($SD=1.38$). These differences in the teachers' scores do not show any meaningful variance statistically.

When the teachers' practices in support of the contents of early childhood mathematics education were examined according to the ages of the children the teachers were teaching, it was found that the teachers who were teaching three-year-old children had an average score of 16.81 points ($SD=2.9$), those who were reaching four-year-old children 15.79 points ($SD=2.88$), and those who were teaching five-year-old children 17.3 points ($SD=2.62$). These differences show some meaningful variance in the statistics ($F=3.63$, $p<.05$), and based on the results of the *Scheffé* confirmation, it was determined that the teachers who were teaching five-year-old children have a higher rate of practices in support of the contents of early childhood mathematics education than the teachers who were teaching three-year-old children.

3. The Differences in the Teachers' Perceptions about the Goals and Contents of Early Childhood Mathematics and their Practices in Support of Such

In this research, a *t* test was conducted to verify if there was any difference between the teachers' perceptions of the goals and contents of early childhood mathematics education and their practices in support of them. Table 9 presents the comparison of the teachers' perceptions of the goals and contents of early childhood mathematics education and their practices in support of them.

Table 9. *Difference between the Teachers' Perceptions of the Goals and Contents of Early Childhood Mathematics Education and their Practices in Support of such* *M(SD)*

Type	Comparison Items	Perceptions	Practices	<i>t</i>
Goals of education		12.23 (2.08)	9.83 (1.63)	12.60***
Contents of education		19.50 (3.90)	16.56 (2.86)	9.47***

* $p<.05$, ** $p<.01$, *** $p<.001$

The average score that the teachers obtained for their perceptions of the goals of early childhood mathematics education was 12.23 points ($SD=2.28$) while the average score that they obtained for their practices in support of such was 9.83 points ($SD=1.63$). These differences show some meaningful variance in the statistics ($t=12.60, p<.001$). On the other hand, the average score that the teachers obtained for their perceptions of the contents of early childhood mathematics education was 19.50 points ($SD=3.90$) while the average score that they obtained for their practices in support of such was 16.56 points ($SD=2.86$). These differences show some meaningful variance in the statistics ($t=9.47, p<.001$). That is to say, it was found that the teachers' perceptions of the goals and contents of early childhood mathematics education were high while their practices were poor.

4. The Teaching and Evaluation Methods or Approaches Currently being Used by the Early Childhood Mathematics Teachers

In this study, the teaching and evaluation methods/approaches that are currently being used by the early childhood mathematics teachers were examined. For this, frequency analysis was conducted, the results of which are shown in Table 10 and in Fig. 1 and 2.

Sixty teachers (45.4%) marked "manipulative play/games" as the main teaching method/approach that they are currently using, which indicates that it is the most popular method/approach currently being used by early childhood mathematics teachers. The second most frequently chosen option was the theme and project approach ($n=38, 28.8\%$), and the third was the literary approach ($n=13, 9.8\%$). On the necessity of evaluation in early childhood mathematics education, the teachers checked the following: "optional" ($n=80, 60.6\%$), "necessary" ($n=40, 30.3\%$), and "not necessary" ($n=12, 9.1\%$). These results indicate that most teachers do not realize that evaluation is necessary in early childhood mathematics education.

As for the evaluation method that the early childhood mathematics teachers are currently employing, portfolio assessment ($n=46, 34.8\%$) was the most common, followed by checklist ($n=28, 21.2\%$) and development report ($n=18, 13.6\%$). Thirty-

nine teachers (29.5%), however, checked “does not evaluate,” which indicates that many early childhood mathematics teachers do not evaluate their pupils’ learning in their classrooms.

Table 10. *The Teaching and Evaluation Methods/Approaches Currently being Used by the Early Childhood Mathematics Teachers*

Area	Subordinate Factors	N (%)
Teaching methods/approaches currently being used	Literary approach	13 (9.8)
	Social approach	9 (6.8)
	Scientific (cooking) approach	7 (5.3)
	Manipulative play/games	60 (45.5)
	Expression (art, musical movement)	5 (3.8)
	Theme and project approach	38 (28.8)
	Other	0 (0)
Necessity of evaluation in early childhood mathematics education	Necessary	40 (30.3)
	Optional	80 (60.6)
	Not necessary	12 (9.1)
Evaluation method currently being used	Portfolio assessment	46 (34.8)
	Development report	18 (13.6)
	Checklist	28 (21.2)
	Does not evaluate	39 (29.5)
	Other	1 (.8)



Figure 1. Teaching methods/approaches currently being used by the early childhood mathematics teachers



Figure 2. Evaluation methods currently being used by the early childhood mathematics teachers.

Discussion

This research was conducted to analyze the early childhood mathematics teachers' perceptions and practices in support of the goals and contents of early childhood mathematics education, and to investigate the difference between the teachers' perceptions and practices. Based on the findings of this research as regards each research problem, the following conclusions can be drawn:

1. The Differences in the Teachers' Perceptions of the Goals and Contents of Early Childhood Mathematics Education by the Subjects' Background Characteristics

The early childhood mathematics teachers' perceptions of the goals and contents of early childhood mathematics education did not vary according to the types of institutions where the teachers were teaching, but a difference was shown according to the teachers' educational levels and the ages of the children the teachers were teaching. It was found that while there is no difference according to the types of institutions where the teachers were teaching, the teachers who were college graduates or who were higher-degree holders had a higher perception of the goals and contents of early childhood mathematics education than the teachers who were early childhood teacher training center certificate holders and college graduates.

These research results are similar to those obtained by Bae (2003), who studied the teachers' perceptions of mathematics education, and to those obtained by a number of studies that were conducted on the effectiveness of teaching mathematics (Lim, 2009; Lim, 2006; Yeo, 2004; Han, Lim, 2003). In other words, early childhood mathematics teachers with higher educational levels generally have positive perceptions of early childhood mathematics education. This can contribute to the improvement of the effectiveness of teaching mathematics to young children, which in turn will have a positive effect on the practical application of early childhood mathematics teaching in the classroom.

Most childcare teacher training centers and technical colleges have so far taught their students an integrated form of mathematics and science, which can have an effect on the results of this study. In other words, as the professors in such institutions must teach their students two subjects in one semester, their lectures can be regarded as inevitably insufficient both practically and theoretically. However, as the subjects of mathematics and science should be separated beginning in 2011 in most early childhood teacher training institutions, it is expected that the future teachers will obtain good-quality training in early childhood mathematics teaching.

It was shown in this study that the teachers who were teaching five-year-old children had higher perceptions of the goals and contents of early childhood mathematics education than those who were teaching three-year-old children. The study results revealed that teachers have an incorrect perception of the research area of the Kindergarten Education Curriculum (2007), which states that the goals and contents of mathematics education for children aged three to five should be presented according to their level. That is, while the mathematics curriculum of South Korea is differently applied in terms of its contents according to the age and development level of the learners, there should be no difference in terms of the quantity of subject matter to be taught to the learners across levels. Therefore, it is wrong for the teachers in charge of three-year children to have a low perception of the goals and contents of early childhood mathematics education as well as a low rate of support

practices. As their low perception of the goals and contents of early childhood mathematics education may be connected their the low rate of support practices, teachers should be taught and trained in the use of desirable teaching methods/approaches for early childhood mathematics education according to the age and development level of the children they are teaching.

2. The Differences in the Teachers' Practices in Support of the Goals and Contents of Early Childhood Mathematics Education by the Subjects' Background Characteristics

It was found that while the practices of the early childhood mathematics teachers did not vary according to the types of institutions where the teachers were teaching, a difference was shown according to the teachers' educational levels and the ages of the children they were teaching. It was also found that while there were no differences according to the types of institutions where the teachers were teaching, the teachers who were college graduates or higher-degree holders had a higher rate of practices in support of the goals and contents of early childhood mathematics education than those who were childcare teacher training center certificate holders. This research problem backs up research problem 1, which shows that teachers with higher educational levels have a positive perception of the goals and contents of early childhood mathematics education. It was found that the teachers who had higher educational levels demonstrated a high perception of the goals and contents of early childhood mathematics education and a higher rate of practices in support of them. This can also be interpreted as showing that teachers with higher educational levels have a greater interest in what is going on and can change how they perceive things.

While there was no statistically meaningful difference in the early childhood mathematics teachers' practices in support of early childhood mathematics education according to the ages of the children they were teaching, it was found that the homeroom teachers of five-year-old children had a higher rate of practices in support of the contents of early childhood mathematics education than the homeroom

teachers of three-year-old children. This has much to do with research problem 1. In other words, the homeroom teachers of three-year-old children who have a low perception of the goals and contents of early childhood mathematics education performed poorly. In the final analysis, this shows that the teachers' low perception of the goals and contents of early childhood mathematics education is linked to their low performance. As this phenomenon can take place among the teachers who teach children aged three and below, the systematic operation of teacher training urgently needs development-related understanding and education pertaining to early childhood mathematics education.

3. The Differences in the Teachers' Perceptions about the Goals and Contents of Early Childhood Mathematics and their Practices in Support of Such

A difference was shown between the teachers' perceptions of the goals and contents of early childhood mathematics education and their practices in support of them. It was found that such teachers' practical performance was lower than how they actually perceived the goals and contents of early childhood mathematics education.

Most of the early childhood mathematics teachers in South Korea are female and thus may have a vague sense of anxiety or a low self-respect as mathematics teachers. The reason for this is that the male and female students in South Korea show some differences in their choices of courses in middle and high school, where their subjects and majors are divided, and in their choices of majors in university. The female students show a preference for language-related subjects, where their performance is generally excellent, and unlike the male students, they try to avoid mathematics and science, and their performance in such fields is generally poor (Hwang, 2009). In other words, most early childhood education majors are female students, and even after they become teachers, they may hesitate to teach mathematics to young children because they have a poor knowledge of the subject and thus lack a sense of confidence in teaching it.

In practice, the teachers of young children fail to use the latter's informal basic mathematical knowledge as the starting point of their teaching, by connecting it to effective mathematics activities, owing to their negative attitude towards and lack of confidence in teaching mathematics (Jung, 2001; Han & Park, 2004). Desirable education can be carried out only when the early childhood mathematics teachers have a high perception of the goals and contents of early childhood mathematics education, and only when there is only a minimal difference between their perception of, and their practices in support of these. To provide young children with an opportunity to solve the mathematics-related problems in their everyday life, and to connect their concrete experiences to abstract mathematical ideas, it is important for the early childhood mathematics teachers to function professionally (NCTM, 2000). Therefore, the teachers' views of the goals of early childhood mathematics education, their knowledge of and attitudes towards mathematics, and the teaching methods/approaches that they employ will largely and directly affect early childhood mathematics education (Moon, 2009). Therefore, an alternative plan should be drawn up to reinforce the early childhood mathematics teachers' perception of early childhood mathematics education as well as their practical teaching activities.

4. The Teaching and Evaluation Methods or Approaches Currently being Used by the Early Childhood Mathematics Teachers

It was found that the teaching method of manipulative play or games (45.5%) is currently most widely used by the early childhood mathematics teachers, followed by the subject-oriented integration method (28.8%), and that the use of all the other teaching methods/approaches accounts for only less than 10%. These results are similar to those obtained by Kim (2009), Park (2000), and Bae and Seo (2003) in their respective studies. The early childhood education institutions in South Korea are largely using commercialized mathematics teaching materials and tools. These teaching tools, which make use of games or manipulative play, consist mainly of board games or manipulative-play teaching tools (for inserting, erecting, or fitting).

They are created to allow young children to engage in manipulative play or games as free-selection activities.

But early childhood mathematics education should be conducted in an integrated way, along with various activities in the realms of art, music, literature, and social science, in addition to manipulative play or games, and it is desirable to enhance young children's mathematical abilities in various ways in everyday life experiences. To enable the teachers to enhance young children's mathematical abilities, they should be aware of effective mathematics teaching methods /approaches (Lim 2009; Yeo, 2004; Kim, 2003). Thus, there is a need to develop and operate teacher training programs for this purpose.

In addition, a number of teachers do not recognize the necessity of evaluation in early childhood mathematics education, and 29.5% of the early childhood mathematics teachers do not conduct evaluation at all. If mathematics activities that are meaningful to young children are to be implemented, it is desirable to teach them in a small group, after evaluating the children's mathematical abilities. As teachers, however, are not aware of how important it is to evaluate the children's mathematical abilities in early childhood mathematics education, there is a need to educate the teachers on this point. Portfolio evaluation is the most commonly used method for teaching mathematics to young children, which shows that as an integrated education is stressed in early childhood education, the flexible evaluation of the young learners' mathematical abilities in various respects is considered to be significant.

Conclusion

The results of this research show that there is a difference between the early childhood mathematics teachers' perceptions of the goals and contents of early childhood mathematics education and their practices in support of them. Based on the study results, the following conclusions can be drawn:

- (1) As the early childhood mathematics teachers who are college graduates or higher-degree holders have a higher perception of the goals and contents of

early childhood mathematics education than the teachers who are childcare teacher training center certificate holders or college graduates, mathematics education should be reinforced in early childhood teacher training institutions. Most of the childcare teacher training centers and technical colleges in South Korea have so far taught their students an integrated form of mathematics and science, but as the subjects of mathematics and science should be separated beginning in 2011 in most early childhood teacher training institutions, it is expected that the future teachers will obtain good-quality training in early childhood mathematics teaching.

- (2) As a big difference was shown between the early childhood mathematics teachers' perceptions of the goals and contents of early childhood mathematics education and their practices in support of them, a mathematics teacher training program should be developed for the incumbent early childhood mathematics teachers, and it should be systematically executed. In particular, as most of the current early childhood mathematics teachers are female, they may have a vague sense of anxiety or a low sense of self-respect as mathematics teachers. Therefore, an interesting education program should be developed with proper mathematics education contents and methods/approaches that will help the future teachers overcome the aforementioned problem, and that is appropriate to the level of the children's development and will be executed in the form of a workshop.

In addition, a way of upgrading the educational levels of all the early childhood mathematics teachers in South Korea should be sought. It can be seen as a desirable phenomenon for enhancing the quality of early childhood mathematics education in the country that the incumbent early childhood mathematics teachers enroll in a graduate school of education or attend a social-education institution where they can be reeducated. At the same time, the working conditions of the early childhood mathematics teachers in the country should be improved in order to make them feel both psychologically

and materially comfortable enough to pursue reeducation.

- (3) The homeroom teachers of three-year-old children have a lower rate of practices in support of the goals and contents of mathematics education than the homeroom teachers of five-year-old children. Therefore, the difference in mathematics education according to the learners' ages and development levels should be included in the country's teacher education programs.
- (4) It is desirable for the early childhood mathematics teachers to make use of effective teaching methods/approaches that can help their young pupils develop the basic mathematical abilities, such as the project-oriented method, the literary approach, and integrated activities with other subjects, in addition to manipulative play or games.
- (5) Lastly, teacher education should aim at making the teachers recognize the importance and necessity of evaluating mathematics education even at the early childhood level.

The limitations of this research are as follows:

- (1) In this research, the practices of the early childhood mathematics teachers were examined only through a questionnaire survey instead of by directly observing them. Therefore, it was possible for them to choose an option in the questionnaire only on a universal level (e.g., literary approach, theme and project approach, etc.).
- (2) The subjects were comparatively few and were limited to teachers working in Seoul and Gyeonggi-do. To obtain more generalized research findings, it is necessary for further studies to be conducted involving teachers in other provinces.

The following recommendations are hereby made for the development of early childhood mathematics education in the country, and for further studies:

- (1) A perception investigation research can be done by classifying the contents of

early childhood mathematics education in a more detailed way.

- (2) Extending the study subjects to include teachers in other regions in South Korea as well as parents and future teachers will allow the results of this research to be more accurately analyzed.
- (3) Analysis is needed to further explain why the early childhood mathematics teachers' perceptions and practices in support of the goals and contents of early childhood mathematics education vary, as was concretely determined by this study.
- (4) To clearly understand the early childhood mathematics teachers' perceptions and practices in support of the goals and contents of early childhood mathematics education, it is important to directly look at the current pertinent situation, such as the activity materials that are currently being used by the teachers, and to analyze these.
- (5) Lastly, as this study was conducted with the end goal of developing instructional materials and teaching tools that can be used by early childhood mathematics teachers, it is desirable to develop mathematics teaching materials and tools that can be applied to on-the-spot early childhood education, based on further researches.

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