EFFECTS OF PLAY-GENERATED CURRICULUM VERSUS CURRICULUM-GENERATED PLAY INSTRUCTION ON EARLY CHILDHOOD PRE-SERVICE TEACHERS' MATHEMATICS TEACHING EFFICACY

Lutfi Incikabi
Kastamonu University, Kastamonu, Turkey

Hatice Sancar-Tokmak
Mersin University, Mersin, Turkey

Abstract

This research aimed to examine changes in mathematics teaching efficacy beliefs among early childhood pre-service teachers who utilized play-generated curriculum instruction and the ones who utilized curriculum-generated play instruction. Among the participants (N=72) were second-year college students from Early Childhood Education. This research was an experimental research utilizing the static-group pretest-posttest design supported with qualitative data. The results of the research demonstrated that both curriculum-generated play and play-generated curriculum instruction led to a statistically significant improvement in the pre-service teachers' mathematics teaching efficacy beliefs. The qualitative data showed that both groups of pre-service teachers learned linking play with instruction through teaching experiences, and gained knowledge about instruction design, pedagogy, and a variety of plays for educating young children. Moreover, both groups of pre-service teachers stated that their opinions regarding play activities changed in that they started to see incorporating playful activities as a useful and joyful teaching method.
Key words: *curriculum-generated play; play-generated curriculum; early childhood education; mathematics teaching self-efficacy*.

Introduction

Educators and researchers in the field of early childhood education have agreed that children learn and grow through play activities (Fromberg, 2002, Manning-Morton & Thorp, 2003, Van Hoorn, Nourot, Scales, & Alward, 2014; Wood & Attfield, 2005). Ginsburg (2007) states that play provides both cognitive and social enrichment opportunities for young children. Children are socialized, learn to communicate, negotiate with others, and understand their perspectives by interacting with peers and teachers through play (Pramling-Samuelsson & Fleer, 2010; Manning-Morton & Thorp, 2003). Johnson, Christie, and Yawkey (1999) pointed out that children, with the help from their peers, construct their own knowledge about mathematics in a play-based learning activity. Moreover, according to Mayesky (2002), creativity is increased through play and exploration. One of the criticisms of early childhood curriculum and its applications is the expectations from the programmes to teach specific outcomes that is also defined for older students. (Kagan & Cohen, 1997). This excessive burden limits times for children to engage in joyful activities such as play (Beauchat, Blamey, & Walpole, 2010). This case is also notable in mathematics, which is particularly known as one of the hardest fields to teach young children (Pound, 2008). However, Johnson et al. (1999) suggest teaching mathematics through play, because the basic characteristics of play offer the following advantages:

- Play develops positive attitudes toward learning since it is fun and enjoyable.
- Nonliteral nature of play makes academic activities significant to children.
- During play activities, means are more important than ends.
- Play provides a broad spectrum of learning opportunities. Students can learn a variety of different skills and concepts with multiple ways.

Some researchers have investigated using plays as a medium for teaching and development of children (Berk, 1994; Mallory & New, 1999). Trawick-Smith and Dziurgot (2011) state that: "When teachers and parents choose not to interact with children at play, these authors contend, they are missing opportunities to foster early development."(p. 110). The results of studies have shown that play training is beneficial to support academic and social development of children (e.g., Enz & Christie 1993; Levy, Wolfgang, & Koorland, 1992; Vukelich, 1994).

Some researchers provided different teaching interactions between play and curriculum (Van Hoorn, Nourot, Scales, & Alward, 2014; Wood & Attfield, 2005). Although there is substantial evidence on learning through play, there has been less evidence on teaching through play (Wood, 2004). The interaction between play and pedagogy has long been a controversial area due to ideological commitment to free play and free choice (Wood, 2004). However, recent theoretical and policy changes have shifted the focus on a better understanding of the distinctive purposes and nature of play in education settings, and of the role of adults in planning for play and playfulness in child-initiated or teacher-directed activities (Wood & Attfield, 2005).

One of the fundamental principles in early childhood education is the importance of play to children's learning and development. Wood and Attfield (2005) identify three levels that are useful to comprehend the relationship between play, learning and development. The first and broad level sees play as a tool for holistic development of the child that includes cognitive, affective and psycho-motor development. The second level relates play with the curriculum models such as the Stepping stones, while the third level investigates cognitive processes that link play and learning. Moreover, Trawick-Smith and Dziurgot (2011) and Jung (2013) state that the interaction of teachers with children affects the benefits of play for the development of young children. For that reason, a teacher's interaction approaches to provide learning experiences are crucial and should be researched. Johnson et al. (1999) mention two approaches to teach as regards to play and curriculum: a curriculum-generated play and play-generated curriculum. The former is based on the idea that teachers provide play experiences to young children to teach concepts and basic skills in the curriculum areas while the latter is based on the idea that teachers extract learning experiences related to concepts and basic skills in the curriculum areas from children's free-play (Johnson et al. 1999). According to Johnson et al. (1999), two components of curriculum-generated play are Initial Learning, wherein teachers arrange the play activities and assess children's learning, and Practice and Consolidation, wherein teachers offer direct instruction and then arrange play activities to help children practice the target skills. They separated the play-generated curriculum into three models: the juxtaposition model, in which teachers extract ideas from free play and use them to prepare related activities in the daily schedule; the integration model, in which teachers watch children's free play and try to take advantage of teachable moments; and the segregation model, which involves using recreational play without targeting children's education (Johnson et al, 1999).

As children possess an intrinsic motivation to play, it follows that effective provision should capitalize on play as a preferred learning style. According to Tucker (2014), “Good practice would suggest that practitioners should both harness play as an appropriate learning style and ensure that the children they teach make agreed progress in their mathematical understanding.” (pp. 8). Moreover, children should be encouraged to make connections between the different aspects of mathematics. According to Haylock and Cockburn (2013) children must construct a network of connections among the different types of mathematical experiences (such as manipulating concrete objects, symbols, and language) in order to achieve the required understanding of mathematical concepts. To achieve this target, play can be used as a tool that facilitates learning by providing a natural motivation for the children to learn.

Teachers’ roles in play activities are important to provide play-based learning experiences for young children and infants (Jung, 2013). The research conducted by Jung (2013) suggested that “The multidimensional nature of infant teaching and caring must be taken into account in preparing infant teachers for the roles that they will take on in supporting infant learning through play.” (p.11).

Teachers’ performance is affected by teachers’ self-efficacy regarding their teaching (Dembo & Gibson, 1985). Bandura (1997) first described perceived self-efficacy in Social Learning Theory as ‘beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments’ (Bandura, 1997, p.3). According to Bandura (1997), the situation (or context) and the results of the actions to be performed affect the individuals’ self-efficacy.

Teachers who believe student learning can be influenced by effective teaching (outcomes expectancy beliefs) and who also have confidence in their own teaching abilities (self-efficacy beliefs) should persist longer, provide a greater academic focus in the classroom, and exhibit different types of feedback than teachers who have lower expectations concerning their ability to influence student learning (Gibson & Dembo, 1984, p. 570).

A number of studies related to teachers’ self-efficacy beliefs have shown that teachers with high levels of self-efficacy are more eager to teach, are quicker to make important decisions, during instruction are more open to apply new teaching strategies and ideas, are less critical of students’ mistakes, and experience less stress (Gibson & Dembo, 1984; Riggs & Enochs, 1990). Moreover, Zengin (2003) found that teachers who had high self-efficacy could prepare better lesson plans and focus more on students’ success and development as compared to teachers who have low self-efficacy. The longitudinal research of Hoy and Spero (2005) showed that pre-service teachers’ efficacy increased significantly during student teaching but decreased significantly during the first year of teaching. Bursal and Paznokas (2006) found that there was a negative relationship between mathematics anxiety and the confidence scores as concerns teaching elementary mathematics and elementary science. Comparing primary school teachers’ and mathematics teachers’ self-efficacy to teach according to new curriculum guidelines, Isler and Cakiroglu (2009) found that the primary school teachers had significantly higher self-efficacy beliefs about the new curriculum than mathematics teachers.

Problem of Research

The current research, designed using the literature review as its basis, aimed to compare the self-efficacy scores (in terms of their teaching efficacy, self-efficacy, and outcome expectancy beliefs) of early childhood pre-service teachers who used play-generated curriculum instruction, and those who employed curriculum-generated play instruction. In line with this aim, the research question was,

'Is there any significant difference in terms of teaching efficacy beliefs considering self-efficacy and outcome expectancy between the early childhood pre-service teachers, who enacted play-generated curriculum instruction and the ones, who utilized curriculum-generated instruction?'

Methodology of Research

General Background of Research

This research has been an experimental research supported with qualitative data. The current research utilized the static-group pretest-posttest design, in which two already existing groups that are pretested and that receive different treatments (Fraenkel & Wallen, 2000). The work by Johnson and Christensen (1995) states that experimental researches are the most reliable tools to identify causal relationships by allowing "to observe under controlled conditions the effects of systemically changing one or more variables" (p.39). In this research, the pre-service teachers' math teaching beliefs were used as the dependent variable, while the play-generated curriculum and curriculum generated play instructions (teaching method) were taken as the independent variables.

Sample of Research

The participants of both groups used as samples of the research were from Early Childhood Education Department in a university located in the southern part of Turkey. Convenience sampling strategies were applied because participants from the two groups were the students who registered for *Play in Early Childhood* course. In the play-generated curriculum group (group A), there were 37 participants, while in the curriculum-generated play group (group B) there were 35 participants. All the participants voluntarily participated in the research. The *Play in Early Childhood* course was offered by a lecturer with a background in mathematics education. The lecturer's research interests include early childhood curriculum development and early childhood pre-service teachers' mathematics education.

The participants' demographics were collected through a demographics questionnaire that was developed by the researchers. The results of the demographic questionnaire with respect to the group A and group B were shown in Table 1.

Table 1. The curriculum generated play and play generated curriculum instruction groups' demographics.

	Group A (Play generated curriculum)	Group B (Curriculum generated play)
Number of participants	37	35
The major	All of the participants from Early Childhood Education Department	All of the participants from Early Childhood Education Department
Age (mean of the group)	19.7	19.5
Gender	32 females, 5 males	29 females, 6 males
GPA	3.1	3.0
Teaching in pre-schools	10 pre-service teachers pointed out that they had an experience of teaching in a pre-school	8 of the participants pointed out that they had an experience of teaching in a pre-schools
If yes, how long (average)	11.8 months	10.5 months
Lessons related to play / play development	7 participants pointed out that they took lessons related play or play development, and activities in these courses mostly consisted of inspection of children's development stages, preparing activities for developing children's skills such as problem solving and creativity.	6 out of 35 participants stated that they took lessons related play or play development, and activities in these courses mostly consisted of inspection of children's development stages, preparing hand-made toys for children, designing instruction based on their observation on preschools.

The participants (n=37) in the group A were from Early Childhood Education department and in their second-year in the university. They were registered for *Play in Early Childhood* course. The ages of students ranged from 18 to 24 with an average age of 19.7. Their (n= 37) average GPA was 3.1 (based on 0-4 scale). Ten of the pre-service teachers stated they had taught in pre-schools previously, with an average of 11.8 months. Moreover, among all participants, only seven students stated that they enacted lessons related to play or play development, and activities in these courses (play or play development in courses they taught) mostly consisted of inspecting children's development stages and preparing activities to improve children's skills such as problem solving and creativity.

In the group B, all of the participants (n=35) were from Early Childhood Education and in their second year in university. They were also registered for *Play Development in Early Childhood.* The ages of pre-service teachers ranged from 18 to 21, with the average age being 19.5. Twenty-nine of them were females while 6 were males. The average GPA of these group participants was 3.0 (based on 0-4 scale). The numbers of participants who pointed out that they had experience teaching in a preschool were 8. The average teaching time of the participants was 10.5 months. Moreover, 6 out of 35 participants stated that they used lessons related to play or play development, and activities in these courses (play or play development in courses they taught) mostly consisted of inspecting children's development stages, preparing hand-made toys for children, and designing instruction based on their observations in preschools.

Instruments

Five instruments were used to collect data in the current research. These instruments were as follows:

Demographics questionnaire

This questionnaire was developed by the researchers to collect data on pre-service teachers' demographics and had been checked by an expert before distribution. There were questions about students' age, gender, GPA, major, and whether they taught or worked in preschools or child care centres, if their answers were yes, the participants were asked how long the course lasted, if there was any play or play development lesson they incorporated, what the types of activities required in the course(s) they took.

Mathematics Teaching Efficacy Belief Instrument (MTEBI)

This instrument was developed by Enochs et al. (2000) for pre-service teachers based on Riggs and Enochs' (1990) 'Elementary Teacher's Science Teaching Efficacy Belief Instrument', which included two dimensions: Personal science teaching efficacy belief and science teaching outcome expectancy. The MTEBI consists of two subscales, namely the Personal Mathematics Teaching Efficacy (PMTE) and the Mathematics Teaching Outcome Expectancy (MTOE). The PMTE subscale includes 13 items; five of them are negatively-worded items and eight of them are positively-worded items. The MTOE subscale consists of eight items, all of which were positively worded items.

The instrument has a Likert scale with five response categories (5=strongly agree, 4= agree, 3=uncertain, 2=disagree, and 1=strongly disagree). Possible scores on the PMTE scale range from 13 (13x1) to 65 (13x5); MTOE scores may range from 8 (8x1) to 40 (8x5); and MTEBI scale range from 21 (21x1) to 105 (21x5). Sahinkaya (2008) translated the MTEBI instrument into Turkish and applied it to 150 Turkish mathematics pre-service teachers to assess validity and reliability of the translated version. The results showed an alpha coefficient of 0.80 for the MTEBI scale with an alpha coefficient 0.79 for the PMTE subscale and an alpha coefficient of 0.73 for the MTOE subscale.

First open-ended questionnaire

This instrument was developed by the researchers to collect data on pre-service teachers' knowledge about curriculum-generated play, play-generated curriculum, and play use as a teaching method in preschools. The questionnaire included three questions: 'What does curriculum-generated play mean to you?'; 'What does play-generated curriculum mean to you?' and 'What do you know about play use in preschools?'

Observation form

The fourth instrument was the observation form prepared by the researchers and checked by an external expert. The form has three parts: a) the approaches (specifically, components of play-generated curriculum and curriculum-generated play approaches) to teach as regards play and curriculum by pre-service teachers, b) difficulties that the pre-service teachers met and c) methods they used to tackle these difficulties.

Last open-ended questionnaire

The fifth and last instrument was an *open-ended questionnaire* proposed at the end of the experiment. The pre-service teachers answered two questions prepared by the researchers: (1) 'What are the advantages/disadvantages of using curriculum-generated play/play-generated curriculum instruction in teaching?' and (2) 'What are the difficulties confronted during the process of preparation and implementation of the lesson plan utilizing a curriculum-generated play/play-generated curriculum plan approach?'

Procedures

The procedure for the research consisted of several steps (see Figure 1). First, the seventy-two (72) pre-service teachers from the Early Childhood Education programme who registered *Play in Early Childhood Education* course were classified as Group A and Group B by school system. Second, the curriculum-generated play and play-generated curriculum instruction were designed for the Group A and Group B pre-service teachers. Third, the MTEBI and demographics questionnaire were applied at the beginning of the course.

Fourth, the treatment based on the play-generated curriculum instruction was offered to the group A while the curriculum-generated play was offered to the pre-service teachers placed in group B. The group A pre-service teachers searched for the definition and characteristics of play (free play), 'Theories of play', and 'Play types'. Then, they searched a play (free play) related to mathematics and presented the characteristics of these free plays during the course. Their starting point was finding a free play and looking for the mathematical ideas reflected in this play. During the next four weeks, pre-service teachers learned how to select a play including choosing mathematical behaviours (objectives), preparing a plan to achieve them, and applying that plan inside the classroom. As a project, each pre-service teacher prepared a play plan individually and then worked within his or her group to decide the best plan and subsequently to present it to their classmates.

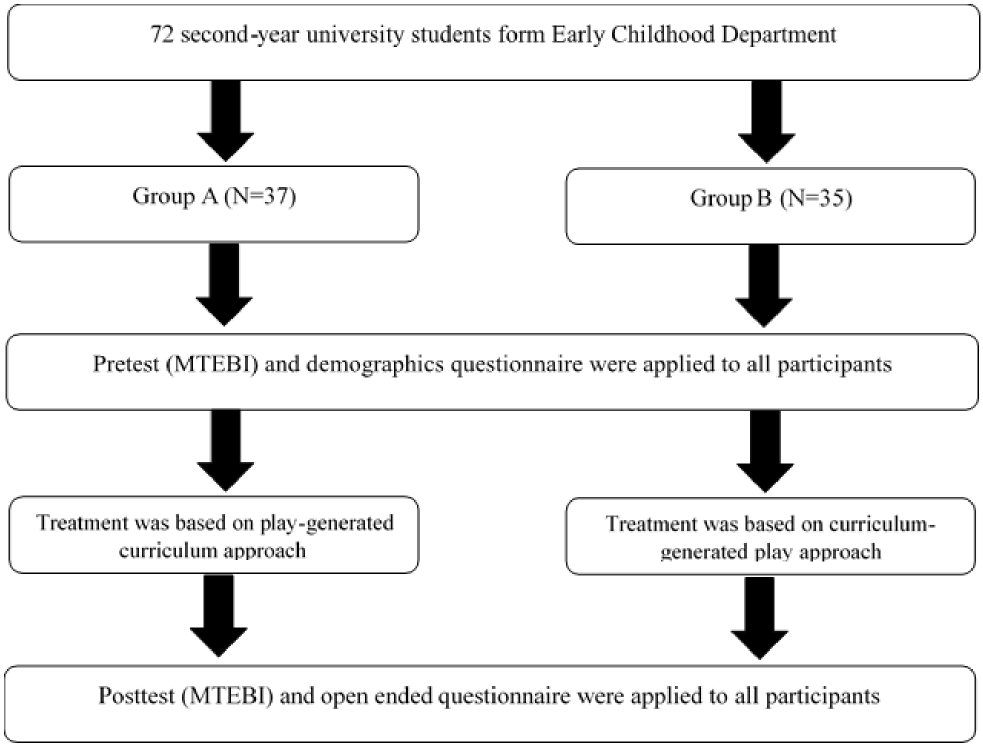

Figure 1: Procedure of the research.

The group B pre-service teachers discussed the definition of 'play' and 'play's' contribution to and the importance for child's development. Being different from Group A, pre-service teachers in group B searched the national Early Childhood Education Curriculum (ECEC) Mathematics Programme and then pre-service teachers selected one of the subjects in Mathematics Programme in the national ECEC individually. They came together with group members and decided on one of the subjects for teaching practice. Their starting activity was to come up with a mathematical concept to teach children. Next, the pre-service teachers searched individually to find a play to teach mathematics subjects chosen with group members. The pre-service teachers discussed the play they chose in terms of play types and theories. Each pre-service teacher prepared a lesson plan that included the play that they had decided. Then, the group members came together again and discussed each member's plan and constructed a new one for teaching practice. All the groups (n=9) taught mathematics through plays. Two groups' pre-service teachers did not have a chance to teach in real contexts to young children; instead, they taught to their friends who took the *Play in Early Childhood* course. Fifth, the MTEBI and open-ended questionnaire were given to all pre-service teachers in both groups.

Data Analysis

Quantitative data coming from the MTEB instrument was analyzed by means of paired and independent samples *t*-tests, using a two-tailed 0.05 criterion, in order to check whether there is a meaningful difference within and between pre- and post- test mathematics teaching belief scores of pre-service teachers in group A and group B. Before application of independent t-test analysis, assumptions as normality, homogeneity of variances, and independent of observations were controlled (Table 2).

Table 2. Kolmogorov-Smirnov test results for MTEB instrument.

	Group	K-S Statistics	df	p
PMTEB	A	0,137	37	0.078
	B	0,121	35	0.200
MTOE	A	0,134	37	0.094
	B	0,130	35	0.144
MTEB	A	0,133	37	0.095
	B	0,121	35	0.200

Qualitative data coming from open-ended questions were analyzed by content analysis technique. Two experts (one from the field of mathematics education and the other form the field of computer education and instructional technology) evaluated pre-service teachers' responses and constructed emerging categories. Miles and Huberman's (1994) formula was applied to calculate inter-rater reliability which was found as .87.

Internal Validity

According to Fraenkel and Wallen (2000), one thing to consider regarding the static-group pretest-posttest is the possibility of some uncontrolled-for threats to internal validity appearing that they might affect the results on the post-test. These threats and how they were coped with within the research are as follows:

- *Experimental mortality* was controlled for in the current research because no dropouts were observed across the comparison groups during the experiment.
- *Location,* a minor problem in the static-group pre-test-post-test design, was controlled by administering the treatment in the same classroom throughout the research.
- *Data collector characteristics,* which can be a design problem when using different collectors for different methods, were controlled in the research by employing the same lecturer for all of the participants.
- *Statistical regression* was not a problem in this research because participants were chosen using a convenience sample rather than selecting the subjects on a basis such as extreme scores.
- *Implementation* was controlled for the research by having all of the subjects instructed by the same lecturer.

Moreover, according to Creswell and Plano Clark (2007) researchers used qualitative data to compare or validate quantitative results when the methodology included quantitative data mainly and qualitative part only used to support quantitative results. In the current research, both experimental groups of pre-service teachers filled open-ended questionnaires, and also in-class observations were conducted to reach a conclusion, whether the quantitative results were parallel to qualitative results.

Ethical issues

Guidelines of ethical conduct have been followed during the data collection processes. Participants were assigned pseudonyms during the research to maintain confidentiality, as they were also students enrolled in the course for credit. Moreover, all pre-service teachers participated in the research voluntarily.

Results of Research

The results of the research reflected pre-service teachers' personal mathematics teaching efficacy beliefs, their mathematic teaching outcome expectancies, and their scores of MTEBI named as mathematics teaching efficacy beliefs by considering two different experimental approaches.

Non-equivalent comparison-group design always possesses a potential differential selection bias because groups are not equal, and that "pretest allows exploration of the possible size and direction of the bias on any variable measured at pretesting" (Johnson, & Christensen, 2004, p.303). In this research, a between-subjects t-test, using a two-tailed 0.005 criterion, was conducted to check the initial mathematics teaching belief levels of pre-service teachers on scores (see Table 3). As far as PMTEB scores were concerned, the mean of the pre-test scores of the group with play-generated curriculum ($M = 46.18$, $SD = 5.86$) was higher than the one of the group with curriculum-generated play ($M = 45.31$, $SD = 7.01$); however, the score change was not statistically significant ($t (70) = 0.575$, $p < 0.05$). The initial MTOE level of the pre-service teachers also did not differ significantly ($t (70) = -1.812$, $p > 0.05$) though candidates in group B ($M = 30$, $SD = 3.29$) had higher scores than those in group A ($M = 28$, $SD = 5.68$). Overall, the pre-service teachers' initial MTEB level did not change significantly ($t (70) = -0.639$, $p > 0.05$) but pre-service teachers in group B having curriculum-generated play instruction ($M = 75.31$, $SD = 7.59$) had higher scores than those in group A having play-generated curriculum instruction ($M = 74.18$, $SD = 7.33$).

Table 3. An independent samples t-test in comparison of pretest results for MTEB instrument.

	Group A (N=37) (Play-generated curriculum)		**Group B (N=35) (Curriculum-generated play)**			
	M	SD	M	SD	t	p
PMTEB	46.18	5.86	45.31	7.01	0.575	0.567
MTOE	28	5.68	30	3.29	-1.812	0.074
MTEB	74.18	7.33	75.31	7.59	-0.639	0.525

(df=70)

Inferential statistics for mathematics teaching efficacy beliefs based on play-generated curriculum instruction

According to Table 4, a paired samples t-test presented a statistically reliable increase between the pre-test scores (M = 74.18, SD = 7.33) and post-test scores (M = 83.10, SD = 7.04) for MTEB of early childhood education pre-service teachers in group A (t (36) = -5.792, $p < 0.05$). The paired samples t-test also bore out a difference between the pre-test scores (M = 46.18, SD = 5.86) and post-test scores (M = 51.7, SD = 5.02) for PMTEB of pre-school pre-service teachers, and this difference was found statistically significant (t (36) = -4.625, $p < 0.05$). A significant improvement in MTOE (t (36) = -3.003, $p < 0.05$) was also evident from the paired samples t-test between the pre-test scores (M = 28, SD = 5.68) and post-test scores (M = 31.4, SD = 3.67) of pre-school pre-service teachers.

Table 4. Paired sample t-test results for MTEB instrument.

	t	df	p
MTEB	-5.792	36	<0.0005
PMTEB	-4.625	36	<0.0005
MTOE	-3.003	36	0.005*

*p<0.05

Inferential statistics for mathematics teaching efficacy beliefs based on curriculum-generated play instruction

The paired samples t-test showed that there was a statistically significant difference between group B pre-school pre-service teachers' pre-test scores and post-test scores for MTEB (t (34) = 3.279, $p < 0.05$) and this difference warranted an increase with the mean of the pretest scores of the pre-service teachers, 75.31 with SD = 7.60 and the posttest score mean of the participants, 80.43 with SD = 7.22 (Table 5). The paired samples t-test also presented a significant difference between the pre-test scores and post-test scores for the pre-school pre-service teachers' PMTEB, t(34) = 3.019, p < 0.05. The mean of the pretest scores of the participants were 45.31 with SD = 7.01 while their mean of the posttest scores were 49.23 with SD =5.84. On the other hand, curriculum-generated play instruction did not warrant a significant difference between pre-service teachers' pretest scores and posttest scored in terms of MTOE (t (34) = 1.666, $p < 0.05$). The mean of the participants pre-test scores were 30.00 with SD = 3.299) and post-test scores were 31.20 with SD = 2.94.

Table 5. Paired-sample t-test results for MTEB instrument.

	t	df	p
MTEB	3.279	34	0.002*
PMTEB	3.019	34	0.004
MTOE	1.666	34	0.105

*p<0.05

Comparative inferential statistics for changes in mathematics teaching efficacy beliefs between curriculum-generated play and play-generated curriculum instructions

In order to compare the changes of gain between two groups in terms of their mathematics teaching beliefs after the implementation of treatments, the differences between pre-test and post-test scores within each group were compared by using an independent-samples t-test (See Table 6 for details). The difference in MTEB of group A (M = 8.91, SD = 9.36) was higher than the one of group B (M =5.11, SD = 9.22); however, the score change was not statistically significant, t (70) = 1.735, p > 0.05. The pretest-posttest score changes in MTOE of the pre-service teachers did not also differ significantly (t (70) = 1.621, p > 0.05) while the score change for group A having play-based curriculum instruction (M =3.4, SD = 6.89) was larger than the one for group B having curriculum-generated play instruction (M =1.2, SD = 4.26). Moreover, the difference in the pre-service teachers' PMTEB did not warrant a significant change between pretest and posttest (t (70) = 0.909, p > 0.05), whereas pre-service teachers in group A (M =5.51, SD = 7.25) had larger score change in positive direction than those in group B (M =3.91, SD = 7.67).

Table 6. An independent samples t test in comparison of changes in pretest-posttest results for MTEB instrument.

	Group A (N=37) (Play-generated curriculum)		**Group B (N=35) (Curriculum-generated play)**			
	M	SD	M	SD	t	p
MTEB	8.91	9.36	5.11	9.22	1.735	0.087
MTOE	3.4	6.89	1.2	4.26	1.621	0.110
PMTEB	5.51	7.25	3.91	7.67	0.909	0.366

(df = 70)

Descriptions of qualitative data on pre-service teachers' responses about implementation of play-generated curriculum and curriculum-generated play instructions

The open-ended questionnaire was conducted to both group pre-service teachers to get their opinions about their experiences during the course. *Difficulties met, advantages of the course design,* and *disadvantages of the course design* were three main themes that emerged as a result of the open-ended questionnaire data analysis. The research results showed that both the pre-service teachers who took play-generated curriculum and the ones who took curriculum-generated play found the instruction joyful and useful. One group (A) stated that the play was an important teaching method since children were eager and having fun while learning through plays. Similarly, the group B emphasized that they started to realize plays as an effective teaching method that allowed children to have a good time. Moreover, pre-service teachers from both sides of the experiment stated that they learned linking play with instruction through teaching experiences, thus acquiring information about instruction design, pedagogy, and a variety of plays for young children's education. According to the results, they improved their confidence to teach mathematics to young children. One of the pre-service teachers from the curriculum-generated play instruction stated:

> The *Play in Early Childhood* course enabled me to have more information about teaching methods, a variety of plays, and instruction design. I learned the curriculum and mathematics programme for young children.

A pre-service teacher who took play-generated curriculum instruction said:

> I learned how to extract teaching moments from children free play. And I think that using children free play as a teaching method is very beneficial since children are more eager to learn during play that they controlled.

The open-ended questionnaire results showed that the pre-service teachers from the group B had difficulty in finding sources, working with groups, doing homework on time, finding play to teach the subjects in the curriculum, and designing the instruction. Moreover, they also stated that they felt a bit stressed during the teaching since they had not designed and applied an instruction before. On the other hand, the pre-service teachers from the group A stated they experienced some difficulties during teaching, such as controlling the classroom, teaching during the play, and detecting teachable moments while children were playing. One pre-service teacher from play-generated curriculum noted:

> Kids [mentioning their classmates acting like children] were really having fun since they were playing what they wanted; however, most time they were too noisy, and some students did not want to include in the same play with the others.

The observation results were based on both group pre-service teachers' teaching experiences. There were 9 groups in a curriculum-generated play and 8 groups in a play-generated curriculum. According to the observed results, the group B pre-service teachers applied plays as both initial *learning* and *practice/consolidation* functions. Six groups from the group B benefitted from plays as *practice/consolidation* in that they first gave direct instruction and then allowed children to play. During their teaching, the other 3 groups in the group B benefitted from plays as *initial learning* in that they first allowed children to play and then gave instruction. On the other hand, the pre-service teachers, who used play-generated curriculum instruction, benefitted plays as *juxtaposition model* and *integration model*. Three groups from the group B used plays as a *juxtaposition model,* in which the pre-service teachers take ideas from free play and used them as the basis for follow-up or related activities; in contrast, five groups used plays as *integration model,* in which teachers served as spokespersons for reality during free play itself and tried to take advantage of teachable moments.

In sum, the quantitative results showed that pre-service teachers' mathematics teaching self-efficacy in both the group A and group B improved after the course. The results also showed that there was not a significant difference between both groups' pre-service teachers in terms of mathematics teaching efficacy beliefs. Moreover, the qualitative data supported the quantitative data in that both groups of pre-service teachers stated to learn how to use plays during instruction and enjoyed from the activities during the course.

Discussion and Implications

The results regarding the effects of curriculum-generated play and play-generated curriculum instructions on pre-service teachers' mathematics teaching efficacy beliefs showed that the mathematics teaching efficacy beliefs of early childhood education pre-service teachers changed positively in both groups after the pre-service teachers prepared instructions and taught mathematics to young children through play. The qualitative data supported the quantitative data since both groups of pre-service teachers had a good time during the instructions and during their teaching experiences. The qualitative data results paralleled those found in the literature in that context, and the results of actions performed affect the self-efficacy (Bandura, 1997; Incikabi, 2013, Sancar Tokmak, 2015). The pre-service teachers' self-efficacy beliefs were affected from training during their college years, according to Hoy and Spero (2005). In the current research, both groups of pre-service teachers stated that they learned linking play with instruction through teaching experiences, thus gaining information about instruction design, pedagogy, and a variety of plays for young children education, thanks to this course, *Play in Early Childhood Education*, design. Gibson and Dembo (1984) and Riggs and Enochs (1990) stated that high self-efficacy teachers are more motivated to teach, quicker to make important decisions during instruction, less stressed, more open to apply new teaching strategies and ideas, and less critical of students' mistakes. In this research, both groups of pre-service teachers stated that they had a good time during the *Play in Early Childhood Education* course and enjoyed the teaching activities. This might cause the improvement on their self-efficacy as well.

Gibson and Dembo (1984) classified the factors affecting the self-efficacy as outcome expectancy beliefs (which refer to students' learning influenced by effective teaching) and self-efficacy beliefs (which refer to being confident in her/his own teaching abilities). According to the current research results, the play-generated curriculum instruction group pre-service teachers' outcome expectancy and self-efficacy beliefs had a positive change. In contrast, the curriculum-generated play instruction group pre-service teachers' self-efficacy had a positive change but their outcome expectancy did not. The curriculum-generated group pointed out that they felt stressed because of their lack of experience constructivist instruction. According to them, they were active and the lecturer provided guidance during the course, but they got used to taking direct instruction. For that reason, they stated that they felt stressed while designing instruction and teaching in line with the instruction. Riggs and Enochs (1990) and Bursal and Paznokas (2006) stated that there is an inverse relationship between stress/anxiety and self-efficacy; when stress/anxiety increases, self-efficacy decreases. Maybe, because of stress, the curriculum-generated group's outcome expectancy was not significantly changed. Moreover, according to Ginns and Watters (1995), the pre-service teachers' self-efficacy beliefs can be affected by past experiences before entering into their profession. For that reason, a further research on pre-service teachers' past experiences is needed to be investigated in order to explain reasons for not improvement in curriculum-generated group's outcome expectancy. The play-generated curriculum group stated that they had difficulty in controlling of the classroom, teaching during the play, and detecting teachable moments while children were playing during their teaching.

Conclusions

This research aimed to present the effects of two different teaching approaches (curriculum-generated play instruction versus play-generated curriculum instruction) on the early childhood pre-service teachers' mathematics teaching efficacy beliefs. The current research had some limitations: The first one was related to the numbers of pre-service teachers in curriculum-generated play and play-generated instruction groups. Since the groups are so crowded, the pre-service teachers experienced difficulty while teaching through play. The second limitation was that pre-service teachers did not have a chance to teach in real contexts to young children; instead, they taught to their friends who took the Play in Early Childhood course.

This research provides opportunities for readers to have an insight for the effects of the play and curriculum interaction based on two different instructional design instructions on pre-service teachers' mathematics teaching efficacy beliefs. This study presents a consistence with the literature in terms of increased teaching efficacy beliefs of pre-service teachers through play-based instruction and classroom teaching. Studies conducted on teaching efficacy beliefs in mathematics were specifically limited with elementary pre-service teachers. These studies indicated that pre-service teachers participating in mathematics teaching courses presented significant gains in teaching efficacy. Similarly, this study presents evidence of the effects of play-generated curriculum and curriculum-generated play approaches on pre-service teachers' self-efficacy beliefs while teaching at pre-schools.

This research may serve as a source for future researchers who wish to investigate the effects of play and curriculum interaction approaches on the mathematics teaching beliefs of in-service teachers, who have had a chance to apply this instruction in a real teaching environment. Further analysis on the correlation between teachers' self-efficacy, model implementation and their performance in supporting the learning of mathematics in young children, would be very beneficial to the teaching profession.

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Lutfi Incikabi

PhD. in Mathematics Education, Associate Professor, Department of Mathematics Education, Faculty of Education, Kastamonu University, 37100 Kastamonu, Turkey.
E-mail: lutfiincikabi@kastamonu.edu.tr

Hatice Sancar Tokmak

PhD. in Computer and Instructional Technology, Associate Professor, Department of Computer and Instructional Technology, Faculty of Education, Mersin University, Yenişehir Kampüsü, 33160 Mersin, Turkey.
E-mail: hsancartokmak@mersin.edu.tr