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Pre- and In-service Preschool Teachers' Science Teaching Efficacy Beliefs

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In this study, pre- and in-service preschool teachers' science teaching efficacy beliefs were investigated. The sample included 100 pre-service (50 first grades and 50 last grades) and 73 in-service preschool teachers. As a data collection tool "Science Teaching Efficacy Belief Instrument" was used. Findings indicated that in-service teachers had higher science teaching efficacy belief score than pre-service teachers. Also, last grade pre-service teachers had higher science teaching efficacy belief score than first grade pre-service teachers. Moreover, pre-service teachers who graduated from mathematics and science departments at high school had more science teaching efficacy belief score than those who graduated from literature and mathematics department. Finally, teachers who have teaching experience of more than 10 years had higher level of science teaching efficacy beliefs than those who have less teaching experience.

Key words: Preschool education, teacher, science teaching efficacy belief.

INTRODUCTION

Children are born with the sense of wonder and they vary their exploration through their sense of taste, touch, sight, hearing and smell at early ages. The daily life experiences provide them many opportunities at perceiving and understanding the world (Balat, 2010). In enhancing children's daily life experiences, early childhood education has a significant role (Aktaş et al., 2012).

Science education in early childhood provides children an appropriate setting by supporting their curiosity. In addition, it forms a basis for exploration of similarities and differences by observing objects and events. Children can gain many skills needed in daily life through science education (Kandır et al., 2011). Science education given at early ages help to improve observation skills, to be aware of the surrounding events, to develop positive attitudes towards their own body and to feel confident (Aktaş Arnas, 2003). On the other hand, science education consists of many abstract concepts that children can have difficulty in understanding. It is not easy to make science more understandable for children (Küçükturan, 2003). Teacher should prepare appropriate settings for children's observation and exploration rather than transferring knowledge to them directly. Teacher should support active involvement of children and he/she should not leave their questions unanswered (MEGEP [Development of Vocational Education Project], 2007).

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Teacher should involve science activities as a guide, responder, facilitator and an observer (Worthman, 2006). Teacher should integrate science activities with other activities and take into account children's individual differences and developmental levels while preparing education programs (Genç Kumtepe, 2008).

Teachers should also be a model to children in gaining scientific attitude and concepts. Therefore, they should have sufficient pedagogical information (Davies and Home, 2003) and positive attitude towards science education (Genç Kumtepe, 2008). Their knowledge on science obtained from their past experiences influences not only their beliefs about science teaching efficacy and their attitudes toward science but also their practices (Özkan et al., 2002; Çakmak, 2006).

When studies related to teacher self-efficacy are investigated, it is seen that the psychological and educational studies are based on Bandura's social cognitive learning theory (Guo et al., 2010). Social cognitive learning theory explains the relationship between internal process such as beliefs, expectations and emotions and human behaviors (Jackson, 2002). According to this theory, individuals behave with the influence of both internal and external stimuli. External stimuli occur from environmental factors whereas internal stimuli include beliefs and emotions such as self-efficacy, dependency and success (Zengin, 2003).

Self-efficacy is identified as people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives (Bandura, 1994). In other words self-efficacy, the conviction that one is or is not capable of successfully performing the behavior required to produce a certain outcome, affects whether or not a person will attempt a certain behavior and determines the effort expended and persistence levels (Bandura, 2006; Craft and Hogan, 1985). Self-efficacy beliefs can be defined as a person's beliefs on his own capacity of determined success (Akbulut, 2006). In other words, self-efficacy beliefs can be identified as being aware of own abilities for doing a task and believing on this (Zusho and Pientrich, 2003). Self-efficacy beliefs determine how people feel, think, motivate themselves and behave. Such beliefs produce several diverse effects through cognitive, motivational, affective and selection processes (Bandura, 1994).

According to social cognitive learning theory, people with a high sense of efficacy remain in the course in the face of difficulties and remain resilient to adversity. Conversely, people with a low sense of efficacy are easily convinced of the futility of effort in the face of difficulties. They quickly give up trying (Bandura, 2006). With reference to Bandura (1994), self-efficacy can be developed through mastery experiences. For instance, if people experience only easy successes they come to expect quick results and are easily discouraged by failure.

School is the place where children develop the cognitive competencies and acquire the knowledge and problem-solving skills essential for participating effectively in the larger society. Classroom structures affect the development of intellectual self-efficacy (Bandura, 1994). The task of creating productive learning environments rests heavily on the talents and efficacy of teachers. Teachers' beliefs in their instructional efficacy affect students' academic development and judgment of their intellectual capabilities and partly determine how they structure academic activities in their classrooms (Bandura, 2006). Teachers who have a high sense of efficacy about their teaching capabilities can motivate their students and enhance their cognitive development. Concordantly, those who have a low sense of efficacy favor a custodial orientation that relies heavily on negative sanctions to get students to study (Bandura, 1994). Some researchers (Schriver and Czerniak, 1999; Ashton and Webb, 1986; Harris, 2010) have reported that teachers' efficacy beliefs affect their practice in classroom. Schriver and Czerniak (1999) emphasized that teachers with high efficacy have more positive teacher behaviors like using more various teaching strategies.

Similar to Bandura (2006), previous studies have documented that there is a positive relationship between teachers' self-efficacy and students' academic performance (Anderson et al., 1988; Ross, 1994; Allinder, 1995; Goddard et al., 2000; Caprara et al., 2006; Tschannen-Moran and Barr, 2010). Anderson et al. (1988) who investigated the relationships among teachers' and students' sense of efficacy, thinking skills and student achievement, found significant relationship between teachers' sense of efficacy and students' achievement. Likewise, Goddard et al. (2000) reported that collective teacher efficacy is positively associated with students' math achievement in urban elementary schools. In another study conducted by Allinder (1995), it was shown that special education teachers with high personal and teaching efficacy increase their students' achievement. In addition, Ross (1994) highlighted positive effect of teacher efficacy on student achievement in middle school.

In the light of the definitions of self-efficacy, science teaching efficacy beliefs can be explained as teachers' judgments and beliefs about giving an effective and productive science education, being impressive on children's making a great success (Özkan et al., 2002). There have been increasing numbers of studies related with teachers' science self efficacy beliefs. These studies have investigated the science self efficacy beliefs of the preservice and inservice elementary (Enochs and Riggs, 1990; Velthuis et al., 2014), science (Önen and Muşlu Kaygısız, 2013) and preschool teachers (Ekinci Vural and Hamurcu, 2008). Recent evidence suggests that early childhood education professionals have low level of science efficacy beliefs in Turkey. Ayvacı et al. (2002) determined that preschool teachers had difficulties in

understanding science and natural events. In the same study, teachers believed that they could not conduct productive science activities.

Walan et al. (2014) investigated preschool and primary school teachers' self-efficacy and needs in relation to science teaching. Research indicated that even though the teachers had high self-efficacy, the needs of further education were expressed by the teachers to a large extent. In particular, the group of preschool teachers addressed the need for more content knowledge (CK) in physics and chemistry (>41%).

Similarly, Parlakyıldız and Aydın (2004) demonstrated that preschool teachers feel incompetent in having prerequisite knowledge about science. Karaer and Kösterelioğlu (2005) found that preschool teachers feel inadequate about science teaching.

Roehring et al. (2011) claimed that science is often avoided during early childhood education and as a result of preschool teachers' feelings of science anxiety, low self-efficacy with respect to teaching science, lack of experience participating in science activities as students, or the notion that literacy and language are more important during the early years. Leon (2014) found that science is an often neglected and misunderstood domain within early childhood education, many preschool teachers avoid and/or miss science opportunities and have low self-efficacy in teaching science, and college level child development courses place little emphasis on the subject.

Recent studies conducted with pre-service preschool teachers have shown that the level of science teaching efficacy beliefs is increasing in parallel with their grade. Alabay (2006) for instance, found that the level of science teaching efficacy beliefs of first grade students was lower than the other graders. Similarly, Vural and Hamurcu (2008) detected that third graders had more level of science teaching efficacy beliefs than the first grade students.

In the literature review process, it was recognized that few writers have dealt with pre- and in-service teachers' science teaching efficacy beliefs. Wenner (2001) examined the differences between pre-service and in-service teachers' science and mathematics teaching efficacy. He found that 58% of pre-service and 71% of in-service teachers felt as though they could effectively teach science within their classrooms. Wenner (2001) also found that 93% of pre-service teachers welcomed science questions from students, but only 32% felt like they could answer them. In contrast, only 83% of in-service teachers welcomed students' questions about science, but 69% of them felt they could answer those questions correctly for their students. Azar (2010) conducted a study to compare the levels of pre-service and in-service secondary science teachers' efficacy beliefs relating to science teaching and to analyze the change of these beliefs according to their demographic characteristics such as gender, the graduate school type, teaching experience and major. According to the research results, there was no significant difference between in-service and pre-service secondary science teachers' personal self efficacy beliefs. Moreover, he found that the self efficacy beliefs did not change relating to their gender, teaching experience, but they changed relating to their graduate school type and major.

In line with these findings, this study was conducted to investigate pre- and in-service preschool teachers' science teaching efficacy belief.

METHODOLOGY

Participants

The sample in this study included three groups: preschool teachers (n=73), first grade pre-service preschool teachers (n=50), last grade pre-service preschool teachers (n=50). Participants were selected via random sampling method. While the pre-service preschool teachers are having the preschool teachers program in Çukurova University, Adana, the in-service teachers are working in public preschools in Adana, Turkey.

Data collection tools

Data were collected using "Science Teaching Efficacy Belief Instrument" which was developed by Riggs and Enochs (1990) and adapted to Turkish by Hazır Bıkmaz (2002).

Science Teaching Efficacy Belief Instrument consists of 21 items including positive and negative statements. These items are pointed through a five-point Likert scale: 1 (strongly disagree), 2 (disagree), 3 (neither agree nor disagree), 4 (agree), 5 (strongly agree). Respondents obtained a score between 21 (the lowest) and 105 (the highest).

Hazır Bıkmaz (2002) adapted the original instrument which has 23 items. Two items were removed and the equivalence coefficient was 0.68. Turkish form of the instrument was applied to 279 preservice elementary teachers studied at three different universities in Turkey. According to the result of factor analysis, a form with two factors structure similar to the original factor structure was obtained. After these procedures, Personal Science Teaching Self Efficacy Belief sub-scale consisted of 13 items (5 positive, 8 negative) while Science Teaching Outcome Expectancy sub-scale consisted of 8 items (7 positive, 1 negative). She reported that the reliability coefficients were 0.89 and 0.69 for the sub-scales, respectively. The reliability coefficient was found to be 0.85 for the whole instrument.

In the current study, Cronbach's Alpha value was calculated in order to determine the reliability of the assessment tool. Cronbach's Alpha value was 0.79 for Science Teaching Efficacy Belief Instrument.

Data collection

Data were collected in the second term of 2012-2013 academic year. Data collection tools were applied to pre-service preschool teachers in their university and to in-service teachers in the preschools that they worked.

Data analysis

Total scores that the participants obtained from "Science Teaching

Table 1. The results of variance analysis on first and last grade pre-service and in-service teachers' scores in the science teaching efficacy belief instrument.

Source	Sum of squares	df	Mean Square	F	P
Between Groups	2342.18	2	1171.09	16.71	0.001
Within Groups	11907.95	170	70.04		
Total	14250.13	172			

Table 2. The results of Tukey analysis on first and last grade pre-service and in-service teachers' scores in the science teaching efficacy belief instrument.

Group	No.	In-service teachers	First grade pre-service teachers	Last grade pre-service teachers
In-service teachers	73	-	8.81*	4.61*
First grade pre-service teachers	50	-8.81*	-	-4.20*
Last grade pre-service teachers	50	-4.61*	4.20*	-

* p<.05, ** p<0.01.

Table 3. Mean science teaching efficacy belief scores for pre-service teachers who graduated from mathematics, science and literature, mathematics departments.

Task	Groups		T	df
	Mathematics and Science Department	Literature and Mathematics Department		
Science teaching efficacy	74.3	68.84	2.94*	94
	(10.1)	(8.01)		

* = $p < .05$, ** = $p < .001$. Standard deviations appear in parentheses below means.

Efficacy Belief Instrument" were calculated and analysis of variance (ANOVA) was conducted in order to determine whether there was a significant difference among groups. When a significant difference was found, Tukey's Post Hoc analysis was used to specify the source of the difference. Also, t-test was used to determine whether the differences between two groups were significant or not.

RESULTS

Table 1 shows the results of variance analysis of the scores that the pre-and in-service teachers obtained from the Science Teaching Efficacy Belief Instrument.

It was found out that there was a statistically significant difference among the first and last grade pre-service and in-service teachers' scores in the Science Teaching Efficacy Belief Instrument ($F(2.170)=16.71$, $p=0.001$). The effect size for this analysis ($d = 0.16$) was found to exceed Cohen's (1988) convention for a small effect ($d = 0.14$).

The results of Tukey analysis conducted in order to define the source of the difference are shown in Table 2. The results suggested that there was a statistically significant difference among in-service teachers and first and last grade pre-service teachers in favour of in-service teachers. These results indicate that in-service teachers had higher scores (M=76.71, SD=7.73) in the Science Teaching Efficacy Belief Instrument than first grade (M=67.9, SD=8.55) and last grade pre-service teachers (M=72.1, SD=9.04). Also, last grade pre-service teachers had significantly higher scores than first grade pre-service teachers in the Science Teaching Efficacy Belief Instrument.

Table 3 shows the t-test results for the scores and the pre-service teachers obtained on the Science Teaching Efficacy Belief Instrument according to the branch that they graduated from at high school. There was a statistically significant difference between the scores obtained on the Science Teaching Efficacy Belief Instrument ($t(94)= 2.94$, $p <0.05$). The effect size for this analysis was small ($d=0.08$). The scores of the pre-service teachers who graduated from Mathematics and Science department (M=74.3, SD=10.1) is higher than the scores of the pre-service teachers who graduated from Literature and Mathematics department (M=68.84, SD=8.01).

An independent-samples t-test was conducted to compare the scores on the Science Teaching Efficacy Belief Instrument between the in-service teachers who

Table 4. Mean science teaching efficacy belief scores for in-service teachers who have teaching experience of 10 years and more and less than 10 years.

Task	Groups		T	df
	10 years and more	Less than 10 years		
Science teaching efficacy	78.73	74.51	2.39*	71
	(7.38)	(7.61)		

* = $p < 0.05$, ** = $p < 0.001$. Standard deviations appear in parentheses below means.

than 10 years. The results of independent-samples t-test shown in Table 4 revealed a statistically significant difference $t(71)= 2.39$, $p < 0.05$. The effect size for this analysis was small (d=0.07). These results indicate that the in-service teachers who had teaching experience of 10 years and more had higher scores on the Science Teaching Efficacy Instrument (M=74.51, SD=7.61) than the in-service teachers who had teaching experience less than 10 years (M=78.73, SD=7.38).

DISCUSSION

This study was conducted to investigate pre-service and in-service preschool teachers' science teaching efficacy beliefs. The results showed that in-service teachers had higher science teaching efficacy belief than pre-service teachers. This result may be explained by the fact that teachers had more experiences on science teaching than pre-services. Bandura (1994) indicated that mastery experience is one of the most important factors that affect the self efficacy perception (Özerkan, 2007). Wenner (2001) found that in-service teachers feel more competent in science teaching than pre-service teachers. On the other hand, the result of the current study differs from that of Azar (2010) study that supported no significant difference between pre- and in-service teachers' science teaching efficacy beliefs. This situation may result from the grade of sample teachers' service. Also, last grade pre-service teachers had higher science teaching efficacy belief than first grade pre-service teachers. In contrast to the last graders, first grade pre-service teachers did not take 'Science Teaching' course. The difference between the levels of knowledge about science teaching may create difference on teachers' science teaching efficacy beliefs. In the study of Rubek and Enochs (1990), they stated that the self efficacy beliefs of teachers with low field information is lower than those with high field information (Küçükyılmaz and Budan, 2006). The findings of the current study are consistent with the studies which found that increasing the level of science teaching efficacy beliefs of pre-service teachers is in parallel with their grades (Alabay, 2006; Vural and Hamurcu, 2008; Duban, Gökçakan, 2012; Kaya, 2013; Okur, 2015). Moreover, the current study found that pre-service teachers who graduated from mathematics and science department at high school had more science teaching efficacy belief than those who graduated from literature and mathematics department. Those who graduated from mathematics and science department took more science courses. This may be a possible explanation of the difference in science teaching efficacy beliefs. Vural and Hamurcu (2008) carried out a study on preservice preschool teachers and determined that most of the self efficient preservice teachers thought that their efficacy arised from their graduation from mathematics and science department at high school.

Lastly, teachers who had experience in the field for 10 years and more had higher level of science teaching efficacy beliefs than those who had less teaching experience. This result may be derived from teachers' having more science teaching experience and more field experience. Cheung (2006) indicated that there are positive significant relationship between years of teaching experience and self efficacy perception. On the other hand, some researchers (Ekici, 2006; Saracaloğlu and Yenice, 2009) suggested that teaching experience is not effective on the level of efficacy beliefs. Moreover, another group of studies (Küçük et al., 2013) proposed that teachers who had less teaching experience had more science teaching efficacy beliefs. In fact, the studies which obtained these findings were conducted with primary, secondary and high school teachers. The difference between the present findings may result from the feature of the sample.

Conclusıon

The present study was designed to investigate the science teaching efficacy beliefs of pre- and in-service preschool teachers. As a result of the study, it was found that in-service teachers had higher level of science teaching efficacy beliefs than pre-service teachers. Furthermore, pre-service teachers at last grade had more science teaching efficacy beliefs than first graders. Besides, the level of science teaching efficacy beliefs of pre-services teachers who had mathematics and science background at high school is higher than pre-services' who had literature and mathematics background level. Lastly, teachers who had teaching experience of more than ten years had more science teaching efficacy belief

score than the others.

In line with these results, supporting pre-service preschool teachers and in-service teachers who have less teaching experience will be beneficial. It can provide more opportunities on teaching experience to pre-service teachers in teacher education programs in Turkey. In this study, the science teaching efficacy beliefs of pre- and in-service teachers were investigated. Further research might explore the effectiveness of teachers' science teaching efficacy beliefs on children's science achievement in preschool.

Conflict of Interests

The authors have not declared any conflict of interests.

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