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Examination of Pre-School Teachers' Beliefs About Science Education

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Abstract: The aim of this study is to find out preschool teachers' beliefs about preschool children's ability to learn science concepts and subjects and in connection with their beliefs examine their perception of self-efficacy in science teaching. Sampling of the study is composed of 100 teachers who are working in preschool institutions. *Beliefs about Reformed Science Teaching and Learning (BARSTL)* which is developed by Sampson and Benton and adapted into Turkish by Büyüktaşkapu is used as data collection device. This scale is prepared to identify teachers' beliefs about science teaching and education. It consists of 32 questions that reflect both current science education philosophy in early childhood period and traditional science education philosophy. In addition to that The Science Teaching Efficacy Belief Inventory (STEBI) developed by Riggs and Enochs in 1990 and adapted into Turkish by Bıkmaz in 2002 is used as data collection device too. Gathered data was analyzed with frequency, percentage, arithmetic mean, standard deviation and Pearson correlation coefficient importance test. According to study results it is seen that preschool teachers' beliefs about their self efficacy in science education is average and they still adopt traditional methods instead of constructivist methods in science teaching. Teachers with high self efficacy in science teaching prefer to use traditional methods in science teaching. This result indicates that in preschool science teaching children are transferred shallow information in many subjects. On the other hand the aim of science education should be in fewer subjects children could learn in detail so children can develop their science skills and construct their own information themselves.

Key words: Science teaching in preschool period, constructivist approach, teaching efficacy belief

Introduction

Rote-learning in current education system is not creative and questioning, and also leads to bringing up passive individuals who take everything as it is. However, for children to be self-sufficient and successful individuals in their future lives and they need to have high level thinking and research skills. Children who acquire research skills can reach to a lot of information for their daily lives via scientific thinking and scientific processes.

Therefore, research activities that can develop scientific processing skills of children are to be given place in the educational programs. These activities mostly take place in science programs. Science programs can be prepared by educationalist by adopting two different approaches.

In the first approach, science education is accepted as the memorization of some facts children are required to know, in the second approach it is regarded the studying the environment by making use of processing skills (Wallace & Louden, 2002). The educationalist adopting the first approach regard science students who remembers the information transmitted to them and answer questions directed to them as successful science student (Solomon & Aikenhead, 1994). As they believe that children are to learn scientific concepts like the concepts of number, color and shape (Bereiter, 1994) they advocate that education programs should take traditional approach to the center.

In traditional science education even in times when “processing” , ”discovering” or “ putting forward an idea” methods can be applied some certain scientific information and content are emphasized, the content which is basically organized by adults is not taught (Kamii ve DeVries, 1993). Subjects, operations and activities which are taught to be the necessary part of children’s education are focused on (Howe, 1993). It is based on experimental assumption which argues that children learn things examining by means of five senses (smelling, listening, touching and tasting) and through language (as a means of explaining things) (Kamii ve DeVries, 1993) After the topic is chosen, simple experiments are carried out with explanations to make them understandable. The teacher emphasis the results of the experiment and explains them in detail (Paulu & Martin, 1992; Hildebrand, 1981; Harlan, 1976). This process only creates opportunities for scientific management and the introduction of new words. However, these long explanations can cause children to lose interest in the activity itself. According to Piaget, because of child’s difficulty in understanding the language it is not beneficial to make long explanations before an idea about a topic is formed.

The educationalists who adopt the second view believe that science education is more than memorizing or learning scientific concepts. According to the educationalists who adopt this view, science education is a process and is a way discovering physical world (Merton & Storer, 1979). These educationalists define a successful science student as individual who can think like a scientist (Staver, 1998) and adopt constructivist approach in the preparation of teaching programs.

Contary to traditional approach, in constructivst approach other than loading students with ready made information teachers try to make them acquire knowledge and skills required to reach to information. Knowledge acquisition is not a result but is a source used for the formation of new information (Brook & Brooks, 1993; Marlowe & Page, 1998).

In constructivist science education learners are enabled to grasp events in interaction with physical world, interpreting them with their own concepts (Scott, Asoko, Driver & Emberton içinde Fensham, Gunstone & White, 1994). Individual constructs knowledge instead of learning it from an authority or the teacher (Sherman, 2000; Tobin & Tippins, 1993). Individual relates new information-which s/he acquires as a result of interaction with the events and objects in the environment-with his/her existent knowledge (Bodner, 1986; Fosnot, 1996; Limon,2001; Sherman,2000).

The results of the studies aiming to reveal which one of these two approaches are more effective in science education indicate that science education programs are to be prepared based on constructivist approach to train inquisitive, researching, questioning, criticizing and producing individuals (French, 2004; Gelman &Brennenman, 2004; Aydın ve Balım, 2005; Tsai, 2007; Yanpar ve diğerleri, 2006; DeBoer, 2002; Lavonen & Laaksonen, 2009; Orhan, 2004; Roberts, 2007; Chall, 2000; Balcı, 2007).

Furthermore, it is observed that the teacher who adopt traditional approach, who teach teacher-centered courses and who leads classes by reading course books have low self-efficacies (Henson, 2001; Plourde, 2001).

According to the results of this study, it is important that pre-school teachers are to adopt constructivist approach when preparing science education programs and have higher science education self-efficiency perception levels to bring up a new generation of scientists.

The determination of the approach and self-efficacy of the teachers in science education, This study -hoping to shed light on teacher training applications- aims to determine whether teachers in pre-school science education adopt a role of guide in children's construction of information and to determine their science self-efficacy perceptions. In line with this general aim, answers to the following questions were sought:

a. What is the self-efficacy level of pre-school teachers about science education?

b. What is the approach the teachers participating the study adopt in pre-school science education?

c. Is there a relation between the approach participant teachers use in pre-school science education and their self-efficacy perceptions of science education?

Method

Sample

This study was carried on 100 teachers who are working in pre-school education institutions in 2009-2010 education year.

Measurement

As means of data collection Science Education and Teaching Belief Scale *(BARSTL)* developed by Sampson and Benton and adopted to Turkish by Büyüktaşkapu and Science Teaching Self-efficacy Belief Scale developed by Riggs and Enochs in 1990 and adopted to Turkish by Bıkmaz (2002) were used.

"Class Teachers' Science Teaching Self-efficacy Belief Scale" developed by Riggs and Enochs in 1990 is composed of 25 items and two factors, namely; Personal Science Teaching Efficacy Belief and Science Teaching Outcome Expectancy. In the scale designed in Likert type, the answers are designed in five choices (I Certainly Agree, I Agree, I am Indecisive, I disagree, I Certainly Disagree). According to validity results, the scale had two factors as in the original scale, but the number of items decreased to 20. In the scale redesigned as a result of adaptation to Turkish Science Teaching Self-efficacy belief factor is composed of 13 items. Of these items 5 are positive 8 are negative. The lowest score to be received from this factor is 13, the highest score is 65, and the Alfa value is .78. The factor named Science Teaching Outcome Expectancy is composed of 7 items, 5 of which are positive and 2 of which are negative. The lowest score to get from this factor is 7 and the highest score is 35. The Alpha value of this factor is .78. The reliability coefficient of the whole scale is .71, the highest score to be received is 100 and the lowest score is 20 (Bıkmaz, 2004).

Science Education and Teaching Belief Scale (BARSTL) developed by Sampson and Benton in 2006 is composed of 32 items to determine teachers beliefs about science education and teaching. BARSTL Scale has 16 items which reflect Constructivist Approach as science education strategy in early childhood period and 16 items which reflect traditional science education strategy. In science education, constructivist approach sub-scale includes conceptual development (4 items), planning and applying lesson (4 items), teacher and education environment (4 items) and science curriculum (4 items). The items in science education traditional approach sub-scale are conceptual development (4 items), lesson planning and application (4 items), teacher and education environment (4 item) and science curriculum (4 items). Science education constructivist approach sub-scale has four factors as in the original scale, however 3 items were omitted. Traditional Approach sub-scale had four items as in original scale, however 2 items were omitted. A total of 5 items were omitted from the two sub-scales and the number of items decreased to 27. Science education in constructivist approach sub-scale

explains 59% of total variance, traditional approach in science education sub-scale explains 61% of total variance. The Cronbach Alpha reliability coefficient is .71.

Results

In this part of the study findings and interpretations based on the data obtained in the study are given.

a. What is the science teaching self-efficacy belief level of pre-school teachers?

The direction and mean values of the questions of the scale administrated to measure science teaching self-efficacy levels of the teachers working in pre-school education institutions are given in Table 1.

Table 1. Directions and means of the questions in science self-efficacy scale

	Direction	Mean
1. If always find better teaching ways in Science teaching	+	3,70
2. Although I try hard, I cannot teach science lesson as well as I teach other lessons	-	3,64
3. I know the necessary steps to teach science concepts.	+	3,60
4. I am not very efficient in designed and controlling science experiments.	_	3,56
5. If a student is less successful than S/he can be, this is most probably because of inefficient science teaching.	+	3,36
6. Generally I cannot teach science lesson well.	-	3,68
7. Generally the reason for some students' being unsuccessful cannot be the teacher.	-	2,79
8. The reason why a child with low science success to show improvement is that his/her teacher show greater interest in this child than normally.	+	3,37
9. I know science concepts well enough to teach basic science effectively.	+	3,25
10. Teacher making more effort in Science teaching does not make a significant change in science success of some teachers.	-	3,32
11. Teachers are responsible for students' success in science class.	+	3,14
12. Students' success in science class is directly related with teachers efficiency in science teaching	+	3,97
13. If it is commented that parents are more interested in science lesson of their children, this probably stems from teachers performance.	+	3,90
14. I have difficulty in explaining students why experiments in science classes are successful.	-	3,36
15. I can answer students' questions about science at ideal standards.	+	3,68
16. I wonder whether I have necessary skills for science teaching.	+	2.91
17. I had a chance to make preference, I would not invite school director to assess my science teaching.	-	3.02
18. If a student has difficulty in learning any science concept, I cannot know how to help him/her understand it better.	-	3,04
19. When teaching science class I am pleased to answer questions of students about science.	+	4,18
20.I do not know what I can do to direct students to the field of science	-	3,58

When Table 1 is examined, it is seen that the mean self-efficacy scores of the teachers in preschool education institutions is 3.45. According to these results, it can be said that teachers' science teaching self-efficacy scores are high.

b. What is the approach participant teachers adopt in pre-school science teaching?

The mean values of the questions of the scale carried out to determine pre-school science education and teaching beliefs of teachers working in pre-school education institutions are given in Table 2.

Table 2. Mean Score Teachers Get from BARST Constructivist Approach Sub-scale and Traditional Approach Sub-scale

Constructivist Approach		Traditional Approach	
İtem	**Mean Score**	**İtem**	**Mean Score**
1	2.79	4	1.75
3	2.32	5	2.28
6	1.73	7	2.06
9	2.67	8	3.30
11	1.70	10	3.16
12	1.70	14	3.36
16	2.06	19	3.39
17	2.39	20	3.14
21	2.90	23	2.42
22	1.90	24	2.85
26	2.23	27	2.00
30	2.59	28	3.23
31	2.43	29	2.02
		32	2.87

When Table 2 is examined, it is seen that the general average of the constructivist sub-scale of Science Education and Teaching Belief Scale (BARSTL) applied to the teachers working in pre-school education institutions is 2.28 and that of traditional approach sub-scale is 2.70. According to these results, it can be concluded that teachers working in pre-school education institutions adopt traditional approach more than constructivist approach in science activities.

c. Is there a relation between the approach participant teachers use in pre-school science teaching and their self-efficacy perceptions about science teaching?

Pearson Correlation coefficient was calculated to examine the relation between the views of the teachers working in pre-school education institutions about constructivist approach and their self-efficacy beliefs about science teaching and given in the table below.

Table 3. The Correlation Coefficient Significance Test of the Scores Teachers got from BARSTL Constructivist Approach Sub-scale and Science Teaching Self-efficacy Belief Scale

		Science Teaching Self-efficacy Belief Scale
BARSTL Constructivist Approach Sub-scale	Pearson Correlation	-.32
	Sig (2-tailed)	.02*
	N	100

When the relation between pre-school teachers level of using teaching strategies based on constructivist approach in science teaching and science teaching self-efficacy beliefs is examined, there found a statistically significant ($p<0.05$) and negative relation between BARSTL Constructivist Approach Sub Scale scores and Science Teaching Self-efficacy Belief Scale scores ($r= -0.32$). In line with these findings, it can be said that while teachers' belief in constructivist approach in pre-school science activities increased, their self-efficacy perceptions in science teaching decreased.

Besides, to examine the relation between views of teachers -working in pre-school education institutions- about traditional approach and their science teaching self-efficacy belief levels Pearson Correlation coefficient was calculated and given in the table below.

Table 4. The Correlation Coefficient Significance Test of the Scores Teachers got from BARSTL Traditional Approach Sub-scale and Science Teaching Self-efficacy Belief Scale

		Science Teaching Self-efficacy Belief Scale
BARSTL Traditional Approach Sub-scale	Pearson Correlation	.20
	Sig (2-tailed)	.04*
	N	100

When the relation between pre-school teachers level of using teaching strategies based on traditional approach and science teaching self-efficacy beliefs, it was determined that there is a statistically significant ($p<0.05$) ad positive relation between BARSTL Traditional Approach Sub-scale scores and Science Teaching Self-efficacy Belief Scale ($r=0.20$). In line with these findings, it can be said that teachers who adopt traditional approach in pre-school science activities have higher self-efficacy perceptions about science teaching.

Conclusion and Suggestion

It was found out that pre-school teachers did not adopt constructivist approach which has been applied for several years in science teaching, and still adopt teaching based on traditional approach.

Besides, it was found out that pre-school teachers participating the study have high level of self-efficacy belief in pre-school science teaching. Considering that self-efficacy belief can affect teacher attitudes like making effort, giving feedback and being able to give field specific teaching (Riggs&Enochs,1990), teachers having high pre-school science teaching self-efficacy belief will affect the quality of the education they will give. However, research findings indicate that teachers with high science teaching efficacy score adopt traditional approach in preschool science teaching. On the other hand, while teachers' belief in constructivist approach in pre-school science education increases, their self-efficacy perceptions decrease.

As self-efficacy levels of teachers who adopt traditional approach in science teaching planning and application are higher than those who adopt constructivist approach, it can be concluded that teaching approach teachers adopt affects their affective characteristics.

Özden, Akdağ, Ekmekçi (2009) studied the relation between pre-school teachers pedagogical subject knowledge about science education and self-efficacy belief levels and self-efficacy belief levels. According to the result of the study, pre-school teachers (62%) prefer traditional teacher-centered teaching methods like presentation and question-answer and their science teaching self-efficacy belief levels (51%) is not at required level.

Besides, in studies on self-efficacy it is seen that teacher candidates' self-efficacy beliefs are higher than medium level (Sarıkaya, 2004; Altunçekiç, Yaman and Koray, 2005). Therefore, the results of this study are completely parallel with the results of the studies in the literature.

As teachers not being knowledgeable about new development in teaching, not attaching importance to alternative thinking ways in science activities can cause children to develop negative attitudes towards science in future years, suggestions are made to bring teachers to a better level in terms of pre-school science teaching.

As pre-school science activities are composed of research, experiment activities, they can be easily adapted into student-centered teaching. Therefore, especially constructivist education approach can be applied effectively in pre-school science activities. However, teachers who are to do education-teaching applications according to constructivist approach are to know constructivist approach very well and to have all theoretical and practical information necessary. Therefore, insufficiencies or deficiencies our teachers have are to be removed by given them in-service training by concerned institutions.

Furthermore, books in which sample science syllabi and activities based on constructivist approach are given are to be written to provide guidance for pre-school teachers.

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