*Full Length Research Paper*

# Relationship between pre- school preservice teachers' environmental literacy and science and technology literacy self efficacy beliefs

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This study examined the relationship between preschool teachers' environmental literacy and their science and technology self efficacy beliefs. 120 preschool teachers from teacher education programme at one university participated in this study. Data were collected by using Environmental Literacy Scale and Science and Technology Literacy Self Efficacy Belief Scale; quantitative data analysis was conducted for each of the scale. Results indicated that preschool preservice teachers' environmental knowledge and awareness of environmental uses were found to be somewhat satisfactory but their environmental literacy level was found insufficient. In addition their science and technology literacy self efficacy beliefs were found to be quite sufficient. Correlation analysis showed positive and significant relationship among the subdimensions of environmental literacy, but no significant realtionship between preservice teachers' attitudes towards the environment and their self efficacy beliefs and between preservice teachers' environmental uses and their self efficacy beliefs regarding science and technology literacy. However, results indicated a significant interaction between pre-service teachers' environmental concerns and their self efficacy beliefs regarding science and technology literacy.

**Key words:** Science and technology literacy, environmental literacy, pre-school preservice teachers.

## INTRODUCTION

In today's world, science and technology increasingly influence the environment, and therefore many environmental problems arise such as overpopulation, the depletion of natural resources, food shortages, pollutions, global warming, ozone depletion, waste etc. Using scientific and technological developments in a harmful way may sometimes cause such problems. These problems can be understood very well, and solutions need to be found for future generations. For this reason, citizens need to take an active and responsible role to prevent and solve these problems (Amirshokoohi, 2010). Kışoglu et al. (2010) indicated that all sections of society can make conscious decisons as a result of a qualified

environmental education in order to solve environmental problems.

The goals of environmental education are (Anemiya and Macer, 1999; Tbilisi Declaration, UNESCO, 1978; Merritt, 2008; Toyoda, 2009; Yexi, 2010),

1. to train students to develop a correct sense of morality, responsibility, values and attitudes
2. to increase students' environmental knowledge, environmental awreness and environmental literacy
3. to set up healthy communication and dialogue
4. between human beings and the natural world on a cognitive level;

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5. to foster a clear awareness and concern for economic, social, political, and ecological interdependence in urban and rural areas.

6. to provide every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment.

7. to enable people to judge environmentally responsible behaviour or to create a new pattern of behaviour on the part of individuals and groups towards the environment.

Apart from these goals, the one of the important purpose of environmental education is to construct environmentally literate people (Kışoglu et al., 2010; Merritt, 2008). In previous years, the term 'literacy' referred to the ability to read and write, but it has had an accepted plural notion in the last two decades. People have different literacies and each of them is related to ways of thinking, talking, interacting, valuing, reading and writing (Disinger and Roth, 1992). Environmental literacy generally includes students' knowledge, skills, attitudes and behaviour related to environment (Merritt, 2008). Goldman et al. (2006) defined an environmentally literate person as one who possesses the values, attitudes, and skills that enable knowledge to be converted into action, and also reflects his or her behaviour towards the environment.

Environmental education provide a strong relationship between environmental literacy and scientific literacy. Since environmental education involves numerous fields scuh as biology, geology, nature, etc. this kind of education is important not only to learn about environment but also to learn about science (Merritt, 2008). Therefore another important contribution of this course can be seen in students' scientific literacy.

It is assumed in various studies that environmental literacy is equivalent to or a subset of, scientific literacy. These assumptions are explained by two reasons; firstly, environmental education tends to be treated as an enrichment of a science programme; secondly, science educators are interested and involved in such an education compared with others (Disinger and Roth, 1992; Simmons, 1989).

In addition to these explanations to understand environmental problems and to try to solve them might be possible only with scientifically literate people with a scientific background. As UNESCO stressed, scientific and technological literacy means being able to read, understand and write about science and technology, and also being able to apply scientific and technological concepts and process skills to life, work and culture, problem solving and decision making in daily life (www.unesco.org). To achieve scientific literacy, students should be educated about complex social issues and their underlying scientific and technological principles (Amirshokoohi, 2010).

Teachers have an important role to play with regard to environmental education in the classroom. This is because  students are immensely influenced by teachers' beliefs (Rubba, 1991). Therefore it is important to prepare teachers as environmental educators. Teacher education programmes are crucial with regard to training teachers to address environmental education. These programmes are responsible for preparing pre-service teachers adequately, from pre-school through to high school in the field of environmental education to give them the ability to design and implement effective environmental education programmes (Goldman et al., 2006; Pe'er et al., 2007).

A scientific background is essential for pre-service teachers in all areas of education, especially in pre-school education. This is because the first formal knowledge of science and the environment is given to the students in pre-school. Therefore pre-service teachers' pre-school education levels of environmental literacy, and their self efficacy with regard to beliefs in science and technology literacy is important. The purpose of this study is to investigate the relationship between pre-service teachers' science and technology self efficacy beliefs and their levels of environmental literacy.

## MATERIALS AND METHODS

### Sample

This study is conducted during the Spring semester of 2011-2012 academic years. The research sample consisted of 120 preservice teachers in second and third years pre-school teacher education program at Mersin University in Turkey.

### Research instruments

Data related to preservice teachers' attitudes towards environmental literacy were collected through Environmental Literacy Scale developed by National Environmental Education Training Foundation (2005). This scale was adaptaed into Turkish by Tuncer et al. (2009). The scale consists of four dimensions as environmental kowledge (11 items), environmental attiudes (9 items), environmental uses (19 items) and environmental concerns (9 items). First dimension consists of multiple choice items and related with current environmental issues (biological diversity, pollution of streams, rivers and oceans, reneweable resources etc.) knowledge; second, third and fourth dimensions consist of Likert type scales ranging from strongly agree to strongly disagree.

Data related to preservice teahers' self efficacy beliefs towards science and technology literacy were collected through Science and Technology Literacy Self Efficacy Belief Scale developed by Caymaz (2008). This scale is 5 point Likert type and consists of 33 items related with science and technology literacy self efficacy beliefs.

### Data analysis

Quantitative data analysis was used for each of the scale. Statitical analysis of the data was carried out by means of SPSS 11 for Windows. Preschool preservice teachers' environmental literacy and science and technoogy literacy self efficacy beliefs levels were determined  with descriptive statistics. To determine the relationship

**Table 1.** Results of descriptive statistics.

|  | N | Minimum | Maximum | $\bar{X}$ | Std.D. |
|---|---|---|---|---|---|
| Environmental concern | 120 | 12.00 | 57.00 | 35.48 | 6.87 |
| Environmental attitudes | 120 | 16.00 | 43.00 | 35.25 | 4.26 |
| Environmental uses | 120 | 29.00 | 95.00 | 77.58 | 7.60 |
| STLSEB | 120 | 50.00 | 159.00 | 107.29 | 21.15 |

(STLSEB: Science and technology literacy self efficacy belief).

**Table 2.** Frequency of answers related to preservice teachers' environmental knowledge.

| Issues | Correct answer | |
|---|---|---|
|  | f | (%) |
| Biodiversity | 96 | 80 |
| Motor vehicles as main source of carbonmonoxide | 21 | 17.5 |
| Hydroelectric plants as generation of electricity | 77 | 64.2 |
| Untreated domestic, industrial and agricultural waste water as main reason of pollution in rivers and the sea | 104 | 86.7 |
| Trees as reneweable sources | 66 | 55 |
| Protective effect of ozone layer | 76 | 63.3 |
| Waste | 59 | 49.2 |
| Official institution to protect the environment | 83 | 69.2 |
| Batteries as hazardous waste | 64 | 53.3 |
| Extinction of animal species | 90 | 75 |
| Nuclear waste storage method | 28 | 23.3 |

between their environmental literacy and science and technology literacy self efficacy beliefs Pearson's Correlation analysis was utilized.

To check the distribution of the sample Kolmogorov Smirnov test was undertaken for each scale. The results of these test indicated that distributions were not significantly different from a normal distribution ($Z_{STL}$: 0.90, p>.05; $Z_{EC}$: 1.13, p>.05; $Z_{EA}$: 1.07, p>.05; $Z_{EU}$:0.92, p>.05).

The reliabilities of environmental knowledge, environmental attitudes, environmental uses, environmental concerns scales as reported by Tuncer et al. (2009) were found to be .88, .64, .80, .88, and these values,.88, .88, .70, .90 and .88, .70, .81, .88 respectively were found in other studies (Kahyaoğlu, 2011; Teksöz et al., 2010). Reability coefficients were found to be .81, .61, .81, .71 respectively in this study.

The reliability of the Science and Technology Literacy Self Efficacy Belief Scale was .95 in the study of Caymaz (2008) and was .94 in another study (Saracaloğlu, Yenice and Özden, 2013). The reliability coefficient of this scale was also .94 in this study.

## FINDINGS

The results of descriptive statistics showed that approximately half of the preservice teachers (55.8%) stated that they were interested in environmental problems and majority of them (69.2%) thought that environmental problem is one of the two or three most important problems today. In addition, half of them (51.7%) stated that they were knowledgeable enough about environmental issues.

Table 1 represents the results of descriptive analysis of environmental concern, environmental attitudes, environmental uses and science and technology literacy self efficacy belief. When we look at the mean scores, we can say that preservice teachers' uses, environmental attitude and science and technology self efficacy beliefs are satisfactory. However, their environmental concern needs to be improved.

Table 2 displays the frequency of answers related with preservice teachers' knowledge about environment. This table shows that the most correctly answer is about main reason of pollution in rivers and sea. Issues related to biodiversity and extinction of animal species are the most correctly answered questions. On the other hand, the least correctly answered questions were about main sources of carbonmonoxide and nuclear waste storage method.

Table 3 indicates preservice teacher' concerns about environmental problems. This table shows that the most concerned environmental problems by preservice teachers are poor quality drinking water and air pollution in enclosed areas. The least concerned environmental problems are automobile emissions and smoke pollution.

Table 4 displays the pearson correlation coefficient for the changes in science and technology literacy self efficacy belief and dimensions of environmental literacy. This table shows that changes between science and technology literacy self efficacy belief are positively

**Table 3.** Pre-school presrevice teahers' environmental concerns.

| Environmental problems | f | % |
|---|---|---|
| Smoke pollution | 24 | 20 |
| Noise pollution | 41 | 34.2 |
| Automobile emissions | 21 | 17.5 |
| Industrial pollution | 34 | 28.3 |
| Hazardous waste | 49 | 40.8 |
| Poor quality drinking water | 71 | 59.2 |
| Air pollution in enclosed areas | 66 | 55 |
| Ozon layer depletion | 44 | 36.7 |
| Global warming | 41 | 34.2 |

**Table 4.** Correlation between science and technology literacy self efficacy belief and dimensions of environmental literacy.

| Variables | | N | r | p |
|---|---|---|---|---|
| | Environmental concern | 120 | 0.41* | 0.0 |
| STLSEB | Environmental attitudes | 120 | 0.00 | 0.9 |
| | Environmental uses | 120 | 0.01 | 0.9 |

(STLSEB: Science and technology literacy self efficacy belief).

correlated with changes in environmental concern (r:0.41, p<.05). However, no correlation was found between science and technology literacy self efficacy belief and evironmental attitudes and also, between science and technology literacy self efficacy belief and environmenral uses.

Table 5 shows the relationship between environmental dimensions of environmental use, environmental concern and environmental attitudes. As can be seen in this table, there was a positive correlation between environmental use and environmental attitudes (r:0.61, p<.05). On the other hand, no correlation was found between environmental use and environmental concern and also betwenn environmental attitudes and environmental concern.

## RESULTS AND DISCUSSION

The assessment of the questionnaire related to environmental literacy indicated that most of the students thought that environmental problems were important in today's world. The results also showed that almost half of the pre-school pre-service teachers thought that they were interested in environmental problems and that they have enough knowledge of environmental issues and problems. It was also found that, although pre-service teachers had enough knowledge about the main cause of pollution in rivers, sea, biodiversity, extinction of animal species and official institutions to protect the environment, their knowledge about the main sources of

carbonmonoxide and nuclear waste storage methods was found to be insufficient. Since the pre-service teachers' had not attended any environmental courses in their undergraduate education, this result was to be expected.

In this study, the analysis of the subdimensions indicated that the pre-school pre-service teachers awareness of environmental uses was found to be somewhat satisfactory. Their answeres showed that issues relating to their awareness of environmental problems, the importance of plants and animals for the environment, recycling and water quality were most commonly mentioned compared with other aspects of the environment. However, they also revealed anthropocentric views. For example, they stated that poisonous snakes and insects must be killed because they pose a threat to humans, and owned land should be used as desired.

When the pre-service teachers' responses were examined, the participants' attitudes towards the environment were found to be complicated. While they thought that plants and animals have the same right to live as human beings, they also thought that being human beings should dominate nature. It can be said that while they have an ecocentric point of view, they also adopt an anthropocentric approach.

When the participants' environmental concerns were examined, the results of the frequency analysis showed that although poor quality drinking water and pollution in enclosed areas were most frequently mentioned, automobile emissions and smoke pollution were the least mentioned environmental problems. These results obtained from environmental liretacy scale showed that pre-school preservice teachers' levels of environmental literacy were insufficient. Similarly, studies indicated low levels of environmental literacy among preservice teachers (Amirshokoohi, 2010). Yavetz et al. (2009) also determined in their study that, after implementation of environmental education, students' levels of environmental literacy were found inadequate.

The results of the science technology literacy self efficacy belief scale analysis showed that pre-school pre-service teachers' science and technology literacy self efficacy levels were found to be quite adequate. This result is in line with some of the stuies in literature. While results of studies conducted with preservice science teachers indicated quite enough level of self efficacy beliefs (Caymaz, 2008; Saracaloğlu et al., 2013), this level was found moderate for primary preservice teachers related to scientific literacy (Bulut et al., 2010). However in our study, in some of the statements, preschool preservice teachers' self efficacy literacy beliefs were found to be at a low level. For example, they thought that their self efficacy beliefs were not enough to allow them to cooperate in such a way as to find a solution for environmental pollution and global warming.

Correlation analysis was performed to find the relationship between pre-school pre-service teachers'

**Table 5.** Correlation between environmental dimensions.

|  | Environmental use | Environmental attitudes | Environmental concern |
|---|---|---|---|
|  | r; p | r; p | r; p |
| Environmental use | 1 | 0.61; 0.00* | -0.05; 0.50 |
| Environmental attitudes | 0.61; 0.00* | 1 | -0.03; 0.70 |
| Environmental concern | -0.05; 0.50 | -0.03; 0.70 | 1 |

*(p<.05).

environmental literacy and their science technology literacy self efficacy beliefs. Using this analysis, it is found that when participants have a satisfactory science technology literacy self efficacy beliefs level, they also have enough environmental literacy. This means that they have favourable environmental attitudes, concern and uses. In this study, the results of the correlation analysis revealed that no significant relationships were found between pre-service teachers' attitudes towards the environment and their self efficacy beliefs regarding science and technology literacy (r: .00; p>.05) and between preservice teachers' environmental uses and their self efficacy beliefs regarding science and technology literacy (r:.01; p>.05). On the other hand, positive and significant relationships were found between pre-service teachers' environmental concerns and their self efficacy beliefs regarding science and technology literacy (r:.41; p<.05).

The results of the analysis among the subdimensions of environmental literacy revealed positive and significant relationships between pre-service teachers' environmental attitudes and their environmental uses (r:.61; p<.05). However, no relationship was found between pre-service teachers' environmental attitudes and environmental concerns, and between environmental concerns and environmental uses. Similar results were also found by Teksoz et al. (2010). In contrast however, they found a relationship between environmental uses and environmental concerns, and also between environmental attitudes and environmental concerns.

In this study it was expected to identify a positive and significant relationship between pre-service teachers' environmental attitudes and their beliefs with regard to science and technology literacy, and also between environmental uses and science and technology literacy self efficacy beliefs. This means that environmental literacy is not dependent on pre-service teachers' science and technology literacy. In the light of these results, we need to emphasize the importance of environmentally-based and science- and technology-oriented program-mes for pre-service pre-school teachers.

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