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Analysis of Geography and Biology Teachers' Self-Efficacy in Environmental Education*

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Abstract

Teachers have an important role in raising environmental awareness in individuals through environmental education and thus preventing environmental problems. For this reason, the self-efficacy level of teachers in environmental education is crucial. This study aims at determining the self-efficacy levels of geography and biology teachers and analyzing these levels according to different variables (gender, subject field, years of service, and participation in scientific events related to environmental education). The study was conducted through the survey model, and the study group consisted of 91 geography and biology teachers (41 female, 50 male) employed at high schools in Aksaray Province city center. The "Environmental Education Self-Efficacy Scale" was used in the study as data collection tool. The scale consisted of 2 dimensions, namely subject knowledge and teaching strategy, and 24 items in total. Items in the survey were scaled between 0-100 points (with 10 points distance). Data collected was analyzed through Mann-Whitney-U and Kruskal Wallis tests, which are both nonparametric tests. Findings of the study suggest that the geography and biology teachers have a high level of self-efficacy in environmental education. Furthermore, no significant difference based on gender, subject, or years of service was found between the points the teachers obtained overall and from sub-dimensions. However,

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it was determined that the overall and sub-dimension points of the teachers who participated in scientific events related to environmental education were statistically higher than of those who did not participate in such events. Lastly, the study proposes different suggestions in the light of these findings.

Keywords

Environmental Education, Teacher Self-Efficacy, High School

According to Nwankwoala (2015, p.225), "environment is made up of all the physical visible and microscopic matters that affect the existence of organisms positively or negatively and an organism does not exist in isolation." Destruction of the environment by humans through various activities leads to many environmental problems that threaten living beings since humans have the power to affect ecosystems directly (Dobson and Bell, 2006). Especially environmental problems caused by industrialization in many areas (air, water and soil pollution, global climate change, extinction of species etc.) have a direct impact on the entire humanity. These issues affecting the living beings and the future of the world have become the most important problems of today's world (Erten, 2004). It is for this reason that studies have proliferated in recent years to prevent environmental problems and to solve the current issues (Yıldız, Sipahioğlu and Yılmaz, 2000).

In this context, the most effective solution seems to be preventing environmental problems before they even emerge, and the most effective way of doing this is environmental education. The aim of environmental education is to benefit individuals, society, as well as all factors constituting the environment (West, 2015). In other words, environmental education targets developing positive behaviours in individuals through processes of protecting, improving, informing, and raising awareness. Furthermore, it is also targeted towards ensuring that individuals can recognize and distinguish the values, attitudes and concepts concerning their physical and social environment (Güler, 2009). Environmental education is based upon influencing human behavior rather than providing information. The goal is to protect nature and natural resources by making positive and permanent behavioural changes in individuals, and ensuring the active participation of individuals in finding solutions to problems (Şimşekli, 2004). It should be noted that environmental education which can permanently change human behavior is more important than legal provisions towards environmental protection that are decided by governments in a political framework. Proper environmental education will ensure that individuals use natural resources more carefully and gain environmental awareness, by making positive changes in the knowledge, attitude and behavior of these individuals in connection with the environment (Lieflander and Bogner, 2018).

Teachers have important responsibilities in raising environmental awareness in individuals through environmental education and thus preventing environmental problems. From this viewpoint, teachers' self-efficacy level in environmental education is crucial in terms of environmental education reaching its goals and teachers fulfilling their responsibility in a dedicated and confident manner (Özlü, Özer Keskin and Gül, 2013). Bandura (1997) defines self-efficacy as one's belief in one's ability to accomplish a task. People with high self-efficacy perception are determined, patient and insistent;

they strive to find a solution in the face of hardships, and make an effort to solve difficulties instead of running away from them (Aşkar and Umay, 2001). Teachers who have high self-efficacy act in a planned, determined and confident way to provide an effective teaching environment at schools and to ensure that students gain relevant learning outcomes from outputs (Guskey and Passaro, 1994; Tschannen- Moran and Hoy, 2001; Milner and Hoy, 2003; Dilekli and Tezci, 2016). Having studied the relevant literature, one can argue that teachers' self-efficacy beliefs are affected by such variables as gender (Ekici, 2006; Korkut and Babaoğlan, 2012), subject (Saracaloğlu and Yenice, 2009; Gençtürk and Memiş, 2010), professional seniority (Çapri and Kan, 2007; Benzer, 2011; Gençtürk and Memiş, 2010), in-service trainings and seminars (Benzer, 2011).

Environmental education is necessary at every stage of education, from primary education to higher education, to solve environmental problems and raise individuals that possess environmental awareness (Yılmaz and Gültekin, 2012). An analysis of secondary school curricula reveals that skills, learning outcomes, and topics related to environmental education are predominantly covered by geography and biology modules. Hence, teachers of these modules must have high self-efficacy in environmental education so that environmental education reaches its goals. However, after an analysis of the literature, no study was found that investigates the environmental education self-efficacy of both geography and biology teachers who are to conduct environmental education at secondary school level according to their course curriculum. It is, therefore, important to analyze the self-efficacy of geography and biology teachers' in environmental education, and to come up with suggestions in the light of findings. It can be stated that this study, which was carried out within this framework, will thus contribute to the relevant literature and to environmental education.

Purpose of the Study

This study aims at analyzing the geography and biology teachers' self-efficacy in environmental education according to different variables, and seeks answers to the questions below:

- What is the level of geography and biology teachers' self-efficacy in environmental education?
- Does the self-efficacy in environmental education of geography and biology teachers vary according to gender?
- Does the self-efficacy in environmental education of geography and biology teachers vary according to subject?
- Does the self-efficacy in environmental education of geography and biology teachers vary according to years of service?
- Does the self-efficacy in environmental education of geography and biology teachers vary according to their participation in scientific events related to environmental education?

Methodology

Research Design

This study was conducted through the survey model (Karasar, 2011), which is employed to describe a past or present situation in its existing form without any intervention.

Study Group

The study was conducted during the spring term of 2016-2017 school year, and the study group consisted of 91 geography and biology teachers employed at high schools in Aksaray Province (Turkey) city center that are linked to the National Ministry of Education (MEB). The study group consists of geography and biology teachers since relevant lessons are taught within geography and biology curricula of high schools (MEB, 2011; MEB, 2013). Demographic data of the study group is summarized in Table 1 below.

Table 1
Demographic characteristics of the teachers in the study group

Demographic Characteristics		Frequency (f)	Percentage (%)
Subject	Biology	46	50.5
	Geography	45	49.5
Gender	Female	41	45.1
	Male	50	54.9
Years of Service	0-10 years	17	18.7
	11-20 years	41	45.1
	21 and above	33	36.2
Participation in educational activities related to environmental education	Participated	32	35.2
	Not participated	59	64.8
	Total	91	100

Data Collection Tool

Study data was collected through a form consisting of two parts. The first part of the form contained questions aiming at finding out personal information about the teachers in the study group. In this part, the teachers were asked questions regarding their gender, subject, years of service, and their participation in educational activities related to environmental education. The second part of the form employed the "Environmental Education Self-Efficacy Scale" developed by Özlü, Özer Keskin and Gül (2013). The scale, which consists of 2 sub-dimensions, namely subject knowledge (10 items) and teaching strategies (14 items), contains 24 items in total. The items in the scale are scaled between 0-100 points (with 10 points distance). Highest and lowest points that could be obtained overall and from the sub-dimensions of the scale according to this scoring method are shown in Table 2 below.

Table 2
Highest and Lowest Possible Points Overall and From the Sub-Dimensions of the Scale

Scale/Sub-dimension	Lowest Point	Highest Point
Subject Knowledge	0	1000
Teaching Strategies	0	1400
Overall Scale	0	2400

Following statistical analyses, the Cronbach Alpha coefficients of the scale, which indicated to explain 67.04% of the total variation, was calculated as 0.93 for the subject knowledge sub-dimension, 0.96 for the teaching strategies sub-dimension, and 0.97 for the overall scale (Özlü, Özer Keskin and Gül, 2013). The Cronbach Alpha coefficient for this present study was 0.92 for the subject sub-dimension, 0.94 for the teaching strategies sub-dimension, and 0.97 for the overall scale. According to these values, it can be argued that the reliability of the scale is high (McMillan and Schumacher, 2006).

The data collection tool was employed on geography and biology teachers at high schools in the city center after required permissions had been obtained. The teachers provided the personal information requested in the first part (gender, subject, years of service, and participation in educational activities related to environmental education), and then stated how efficacious they find themselves in environmental education, by grading themselves between 0-100 points on the items on the "Environmental Education Self-Efficacy Scale". The teachers were given 30 minutes to fill out the data collection tool.

Data Analysis

Skewness and kurtosis values were calculated to determine whether the study data were normally distributed or not. Furthermore, Kolmogorov-Smirnov (K-S) test was conducted since the size of the study group was over 50 (Büyüköztürk, 2007). Table 3 shows the skewness and kurtosis values obtained for the overall scale and the sub-dimensions.

Table 3
Skewness and kurtosis values for the overall scale, and the subject knowledge and teaching strategies sub-dimensions

Scale/Sub-dimension	Skewness	Kurtosis
Subject Knowledge	-1.267	1.936
Teaching Strategies	-1.161	1.214
Overall Scale	-1.214	1.424

An analysis of Table 3 reveals that the skewness and kurtosis values for overall scale as well as for the subject knowledge and teaching strategies of the scale are outside the range between -1 and +1. In the light of these findings, it was determined that the data were not normally distributed (Büyüköztürk, 2007). In addition, the fact that the significance values for the overall scale ($P_{.001}<0.05$) as well as for the subject knowledge (($P_{.001}<0.05$) and teaching strategies ($P_{.000}<0.05$) sub-dimensions were below 0.05

according to the Kolmogorov-Smirnov (K-S) test as summarized below (Table 4), indicate that the data were not evenly normally distributed (Büyüköztürk, 2007).

Table 4
Kolmogorov-Smirnov (K-S) Test Results for the Overall Scale, and Subject Knowledge and Teaching Strategies Sub-Dimensions

	Kolmogorov-Smirnov (K-S)		
	Statistic	**df**	**Sig.**
Subject Knowledge Sub-dimension	.130	91	.001*
Teaching Strategies Sub-dimension	.143	91	.000*
Overall Scale	.156	91	.000*

*p<0.05

In the light of these findings, analysis of the points the teachers obtained overall and from the sub-dimensions of the scale according to subject, gender, years of service, and participation in activities related to environmental education was conducted through non-parametric tests. Mann-Whitney U test was employed to determine whether the points the teachers obtained overall and from the sub-dimensions of the scale varied according to two independent variables such as subject, gender, and participation in activities related to environmental education. To determine whether the points varied according to years of service (three independent variables), Kruskal Wallis was used. Statistical calculations were based on a significance level of 0.05.

Findings

Distribution of the points the teachers obtained overall and from the subject knowledge and teaching strategies sub-dimensions of the scale is summarized in Table 5.

Table 5
Statistics Regarding the Distribution of the Points the Teachers Obtained Overall and From the Subject Knowledge and Teaching Strategies Sub-Dimensions of the Scale

Scale	**Lowest Point**	**Highest Point**	**Average Point**	**Point Range**	**(f)**	**(%)**
Subject Knowledge Sub-dimension	440	1000	859.45	440-600	3	3.3
				601-800	21	23.1
				801-1000	67	73.6
Teaching Strategy Sub-dimension	650	1400	1155.49	650-1000	14	15.4
				1001-1400	77	84.6
Overall Scale	1090	2400	2014.95	1090-1500	4	4.4
				1501-1900	19	20.9
				1901-2400	68	74.7
				Total	91	100

The lowest point that can be obtained from the subject knowledge sub-dimension of the scale, which consists of 10 items, is 0, whereas the highest point is 1000. Findings indicate that the average point the teachers who participated in the study obtained from the subject knowledge sub-dimension was 859.45, with the lowest point 400 and highest

point 1000. Furthermore, the number of teachers who were in the 801-1000 points range for the subject sub-dimension was 67 (73.6%). In the light of these findings, it can be argued that the self-efficacy of the teachers in the subject knowledge sub-dimension is high.

The lowest point that can be obtained from the teaching strategies sub-dimension of the scale, which consists of 14 items, is 0, whereas the highest point is 1400. Findings indicate that the average point the teachers who participated in the study obtained from the teaching strategies sub-dimension was 1155.49, with the lowest point at 650 and highest point 1400. In addition, the number of teachers who were in the 1001-1400 points range for the teaching strategies sub-dimension was 77 (84.6%). These findings indicate that the self-efficacy of the teachers in the teaching strategies sub-dimension is high.

Lastly, the lowest point that can be obtained from the overall scale, which consists of 24 questions, is 0, whereas the highest point is 2400. Overall findings indicate that the lowest point the teachers obtained was 1090 and the highest point was 2400. The average point the teachers who participated in the study obtained overall was 2014.95. 74.7% of the teachers (68 teachers) are in the highest point range of the scale, namely between 1901-2400. Therefore, it can be argued that across the scale the self-efficacy of the teachers in environmental education is high.

Table 6 contains the results of the Mann Whitney U test which was employed to determine whether the points the geography and biology teachers participating in the study obtained overall and from the subject knowledge and teaching strategies sub-dimensions of the environmental education self-efficacy scale varied according to gender.

Table 6

Results of the Mann Whitney U Test Employed to Determine the Difference of Points Teachers Obtained Overall and From the Subject Knowledge and Teaching Strategies Sub-Dimensions of the Scale According To Gender

	Gender	**N**	**Mean Rank**	**Sum of Ranks**	**Z**	**p**
Subject Knowledge Dimension	Female	41	42.83	1756.00	-1.038	0.299
	Male	50	48.60	2430.00		
Teaching Strategy Dimension	Female	41	46.82	1919.50	-0.267	0.789
	Male	50	45.33	2266.50		
Overall Scale	Female	41	45.37	1860.00	-0.207	0.836
	Male	50	46.52	2326.00		

The data in Table 6 indicates that there is no significant difference between the points male and female teachers obtained overall ($Z=-0.207$; $p=0.836$; $p>0.05$) as well as from the subject knowledge ($Z=-1.038$; $p=0.299$; $p>0.05$) and teaching strategies ($Z=-0.267$; $p=0.789$; $p>0.05$) sub-dimensions of the environmental education self-efficacy scale.

Table 7 summarizes the results of the Mann Whitney U test which was employed to determine whether the points the geography and biology teachers participating in the study obtained overall and from the subject knowledge and teaching strategies sub-

dimensions of the environmental education self-efficacy scale varied according to the subject the teachers taught.

Table 7

Results of the Mann Whitney U Test Employed To Determine the Difference of Points Teachers Obtained Overall and From the Subject Knowledge and Teaching Strategies Sub-Dimensions of the Scale According To Subject

	Subject	**N**	**Mean Rank**	**Sum of Ranks**	**Z**	**p**
Subject Knowledge Dimension	Biology	46	45.86	2109.50	-0.052	0.959
	Geography	45	46.14	2076.50		
Teaching Strategy Dimension	Biology	46	48.12	2213.50	-0.774	0.439
	Geography	45	43.83	1972.50		
Overall Scale	Biology	46	47.43	2182.00	-0.524	0.600
	Geography	45	44.53	2004.00		

The subject analysis results for the teachers participating in the study indicates that the points the teachers obtained overall (Z=-0.524; p=0.600; p>0.05) as well as from the subject knowledge (Z=-0.052; p=0.959; p>0.05) and teaching strategies (Z=-0.774; p=0.439; p>0.05) sub-dimensions of the environmental education self-efficacy scale did not vary according to the subject the teachers teach.

Table 8 contains the results of the Kruskal Wallis test which was employed to determine whether the points the teachers obtained overall and from the subject knowledge and teaching strategies sub-dimensions of the environmental education self-efficacy scale varied according to years of service.

Table 8

Results Of The Kruskal Wallis Test Employed To Determine The Difference Of Points The Teachers Obtained Overall And From The Subject Knowledge And Teaching Strategies Sub-Dimensions Of The Scale According To Years Of Service

	Years of service	**N**	**Mean Rank**	**SD**	**Chi-Square**	**p**
Subject Knowledge Dimension	0-10 years	17	45.82	2	0.966	0.617
	11-20 years	41	48.74			
	21 and above	33	42.68			
Teaching Strategy Dimension	0-10 years	17	44.29	2	4.074	0.130
	11-20 years	41	51.89			
	21 and above	33	39.56			
Overall Scale	0-10 years	17	44.71	2	2.745	0.253
	11-20 years	41	50.82			
	21 and above	33	40.68			

Upon an analysis of the results, it was determined that the points the teachers obtained overall [$X^2(2) = 2.745$; p=0.253; p>0.05] as well as from the subject knowledge [$X^2(2) =0.966$; p=0.617; p>0.05] and teaching strategies [$X^2(2) =4.074$; p=0.130; p>0.05] sub-

dimensions of the environmental education self-efficacy scale did not vary according to years of service.

Table 9 contains the results of the Mann Whitney U test which was employed to determine whether the points the geography and biology teachers obtained overall and from the subject knowledge and teaching strategies sub-dimensions of the environmental education self-efficacy scale varied according to participation in scientific events related to environmental education.

Table 9
Results Of The Mann-Whitney U Test Employed To Determine The Difference Of Points The Teachers Obtained Overall And From The Subject Knowledge And Teaching Strategies Sub-Dimensions Of The Scale According To Participation In Scientific Events Related To Environmental Education

	Participation	**N**	**Mean Rank**	**Sum of Rank**	**Z**	**p**
Subject Knowledge Dimension	Participated	32	56.47	1807.00	-2.788	0.005*
	Not participated	59	40.32	2379.00		
Teaching Strategy Dimension	Participated	32	55.88	1788.00	-2.628	0.009*
	Not participated	59	40.64	2398.00		
Overall Scale	Participated	32	56.45	1806.50	-2.782	0.005*
	Not participated	59	40.33	2379.50		

*$p<0.05$

An analysis of Table 9 reveals that there is a statistically significant difference between the points the teachers obtained overall ($Z=-2.782$; $p=0.005$; $p<0.05$) as well as from the subject knowledge ($Z=-2.788$; $p=0.005$; $p<0.05$) and teaching strategies ($Z=-2.628$; $p=0.009$; $p<0.05$) sub-dimensions of the environmental education self-efficacy scale according to whether or not they participated in scientific events related to environmental education. Based on the mean ranks, the difference in the overall scale and the sub-dimensions is in favour of those who participated in scientific events related to environmental education.

Discussion and Conclusions

Findings of this present study, which aims at analyzing the self- efficacy of geography and biology teachers according to different variables indicate that the points the teachers obtained from the overall as well as the sub-dimensions of the environmental education self-efficacy scale are high (Table 5). This finding is similar to the results of the study conducted by Özlü, Özer Keskin and Gül (2013) to improve the scale employed in this present study which showed that the environmental education self-efficacy of 105 biology and science and technology teachers' participating in the study was high. Furthermore, the study carried out by Erkol, Erbasan, Aydoğdu and Kıvrak (2017) with 371 classroom teachers also indicated that the environmental education self-efficacy of the teachers was high. It is assumed, in the light of the findings, that years of service and courses the

teachers attended during their bachelors study that are directly or indirectly related to environment play a role in this result. A majority of the teachers participating in this study have 11 or longer teaching experience (74 teachers, 81.3%). According to Bandura (1995), direct experience is an individual's most important source of self-efficacy belief. Therefore, it can be argued that having taught for many years, in other words, being an experienced teacher and giving lessons on environment and environmental problems for a long time increases the self-efficacy of teachers in environmental education. Üstüner, Demirtaş, Cömert and Öner (2009) concluded in the study they conducted with 292 teachers working at high schools to determine the self-efficacy perceptions of teachers that the self-efficacy of the teachers did not vary significantly according to years of service; however upon assessments based on arithmetic means, it was determined that the self-efficacy of the teachers indeed increased with increasing teaching experience. In addition to this remark, it can be argued that the environment related courses the teachers attended during their bachelor study also increased their self-efficacy in environmental education. This also explains why there was no statistically significant difference between the points the teachers obtained from the overall and sub-dimensions of the environmental education self-efficacy scale according to the subjects the teachers teach (Table 7). Since both geography and biology teachers had attended courses that directly or indirectly relate to environment. The subject knowledge the teachers acquired in these courses prior to their teaching experience could have increased their self-efficacy. According to Sönmez and Kılınç (2012), the strongest predictor of self-efficacy is subject knowledge. In the study conducted by Özmen and Özdemir (2016) to determine the conceptions of science and technology teachers about the environment courses they had taken, the teachers have stated that they found themselves efficacious in giving environmental education as a result of the courses they had attended. Furthermore, Karademir (2016) investigated the environmental awareness and self-efficacy of teachers in the study he conducted with science, primary school mathematics and classroom teaching departments, and found out that the environment self-efficacy of science and classroom teacher candidates was higher than of mathematics teacher candidates since the former had courses about environmental education in their curriculum. The study also concluded that there was no significant difference between the environment self-efficacy point averages of science and classroom teacher candidates, which both had environmental education courses in their curriculum.

According to the assessment based on gender, it was concluded that the points the teachers obtained from the overall scale as well as from the subject knowledge and teaching strategy sub-dimensions of the environmental education self-efficacy scale did not vary according to the teachers' gender (Table 6). This finding is in line with the findings of the studies conducted by Çimen, Gökmen, Altunsoy, Ekici and Yılmaz (2011), Kahyaoğlu (2011), and Zayimoğlu Öztürk, Öztürk and Şahin (2015) to determine the self-efficacy of teachers in environmental education which concluded that the environmental education self-efficacy of the teacher candidates did not vary according to gender. This conclusion can be explained by the relationship between self-efficacy and, undertaken duty and responsibility consciousness (Bandura, 1997). In other words, the relationship between both the female and male teachers' self-efficacy in environmental education and

their undertaken responsibility to train environmentally sensitive people may be the reason why there was no significant difference in their self-efficacy based on their gender. Akkuzu and Akçay (2012) concluded in their study on the self-efficacy beliefs of chemistry teacher candidates that neither the self-efficacy beliefs nor the outcome expectations of the candidates varied according to gender, and that the self-efficacy feeling the individuals who are responsible in their jobs acquire while making an effort to display behaviours which would enable them to meet their responsibilities influenced the result of the study.

The results of the analysis of geography and biology teachers' self-efficacy in environmental education based on years of service suggested that there was no statistically significant difference according to years of service between the points the teachers obtained from the overall scale as well as from the subject knowledge and teaching strategy sub-dimensions of the environmental education self-efficacy scale (Table 8). This finding is in line with those of the study conducted by Korkut and Babaoğlan (2012), which concluded that the self-efficacy of classroom teachers did not vary according to years of service. The fact that beginning teachers are influenced by more experienced teachers and consider themselves equally efficacious may have been a factor in this finding (Korkut and Babaoğlan, 2012). According to Bandura (1995), one of the four sources of self-efficacy belief is indeed indirect experiences an individual gains through people who have similarities to the individual and act as a model for him/her. The individual observes the behaviours that people who are similar to him/her undertake to realize a certain goal, and this increases his/her belief that he/she can also realize this goal by displaying the same behaviours under similar circumstances (Bandura, 1995).

The results of the analysis based on the teachers' participation in scientific events related to environmental education suggested that there was statistically significant difference between the points the teachers obtained from the overall scale as well as from the subject knowledge and teaching strategy sub-dimensions of the environmental education self-efficacy scale, according to their participation in scientific events related to environmental education (Table 9). This difference was in favour of those who had participated in scientific events related to environmental education, and it is in line with the findings of the study conducted by Güler (2009) with 24 teachers who had participated in a 12-day ecology-based environment training and concluded that at the end of the training the teachers' conceptions about environmental protection changed positively and their level of efficacy in environmental education increased. It is assumed that the training which covered environment, environmental education and pedagogical applications of environmental education (such as preparation and implementation of activities aimed at raising environmental awareness) played a role in this result. Theoretical information and practical applications towards environmental education which were covered in these events may have therefore increased the teachers' self-efficacy in environmental education.

Suggestions

The following suggestions are proposed in the light of the findings of the study:

- It must be ensured that senior teachers transfer their knowledge and experience about environmental education to beginning teachers. For this purpose, seminars can be offered by senior teachers for beginning teachers especially during the seminar periods.
- Scientific events on environmental education must be organised especially for teachers teaching courses related to environmental education, and participation of teachers in these events must be encouraged.
- In pre-service period of the teachers, the number of courses about environment and environmental education should be increased.
- All in service period, teachers' self-efficacy in environmental education should be surveyed. In this way, factors that negavitevely affect the teachers' self-efficacy can be identified and it can be make provisions against these factors.
- For further researches, studies that aim to explore the effect of courses, project, seminars e.t.c. on teachers' self-efficacy in environmental education can be conducted.

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