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Full Length Research Paper

Views of pre-service primary school teachers regarding computer assisted environmental education

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The main aim of this study is to highlight the importance of computer assisted instruction in environmental education. Recently, the importance of environmental education in many countries has begun to increase in parallel with environmental problems. This has led to increased interest in environmental education. The fact that computers were the most important invention of the 20th century is reflected in the fact that computer assisted instruction has been put into practice in all fields of education sciences. The research was done in the Department of Primary Teacher Training, Education Faculty, Recep Tayyip Erdogan University in the 2012-2013 academic year. According to the results of the analyses, the attitudes of prospective teachers' towards computer assisted instruction in environmental education are positive. However, the female prospective teachers attached more importance to computer assisted environmental education than the males.

Key words: Computer assisted instruction, environmental education, prospective teacher, environmental citizenship.

INTRODUCTION

Human beings are involved in an intense struggle to solve environmental problems that have become highly dangerous for them recently. Having an individual conscience about solving such major problems is of great importance. This, in fact, may be possible with an effective environmental education (Alım, 2006). Environmental concerns have been on the agenda of industry and science for more than 30 years (Haytko, Matulich, 2008). The concept of environment education emerged only in the seventies which were called the decade of environmental education. During that period the world realized that environmental concerns and awareness could be spread only through a mass environmental education program. The concept of environment education emerged from the World Conference on the Environment in Rio de Janeiro organized by the United Nations in 1972 (Panth, 2010; Erol and Gezer 2006). The recommendations of the conference emphasized organization of 'formal' and 'mass' environmental education programs (Panth, 2010). Education concerning environmental problems recognized that the initial entrance of Environmental Education (EE) into the formal education systems was through natural and life science studies (Gottlieb et al., 2013). In addition to this, in December 2002, the United Nations passed Resolution 57/254, which declared a Decade of Education for Sustainable Development beginning in 2005 (Jickling and Wals 2008).

Computers in education is a general term meant to encompass all elements of educational computing. It has three major components: awareness, computer literacy, and computer-assisted education (Türkmen, 2000). Today, general-purpose, easy-to-use software such as Microsoft PowerPoint has become available. For the first time, instructors can easily modify and even create their own CAI material based on the demands of their own students. With the evolution of technology and the passing of time, the traditional techniques, in which the instructor acts as the most active role in the students'

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education, are being transformed into new techniques, which are technology-assisted and encourage learning and reasoning techniques. In pedagogical knowledge, the conception of new ideas is as important as the applications themselves. Most importantly, teaching techniques that are developed involving technological tools and applications offer great opportunities for educators and students (Morgil et al., 2004; Solem et al., 2003). At the global level, developed countries are more advanced than developing countries in terms of computer assisted learning (Munyavi, 2011). Computer assisted education is an educational method which uses computers as an environment in which learning takes place, strengthens the education period improves student's motivation, and increases learning speeds. This educational method is formed by combining computer technology and learning principles by oneself (Hançer and Tüzemen 2008). In parallel with the technological advances, technological devices, particularly computers, began to be used in educational environments to develop audio-visual materials such as animation and simulation, which resulted in the development of computer-based instruction techniques. The best example of the integration of science and technology is the Computer-Based Instruction technique. The use of computers in teaching and learning activities is defined as Computer-Based Instruction (CBI) Serin, 2011).

Preparing students for their future life requires active classrooms and successful learning (Kostova and Atasoy, 2008). It is crucially important to enhance the students' willingness to make some sacrifices for the protection of the environment by providing them with the necessary knowledge base (Alp et al., 2008). However, though the educational environment supported by computer aided presentations has positive contributions to learning activity, it does not have effects on the permanence of what has been learnt (Kose, 2009; Cotton, 2007). Different approaches embraced in applications, and the duration of applications can be effective in student's achievements in computer aided teaching (Bayrak and Bayram 2010). Clearly, since environmental education is in its infancy in Turkey (Alp et al., 2008; Tuncer et al., 2005), computer use in environmental education may not provide the necessary easiness for both teachers and students. Successful learning in environmental education (EE) is closely related to the methods used by the teachers and the learners (Kostova and Atasoy, 2008).

One of the most important concepts regarding environmental issues is environmental citizenship (EC). According to Meerah (2010), this concept recognizes the active participation of citizens in moving towards sustainability. If the goals of sustainable development are to be reached, and individuals are to engage in lifestyles that will not ultimately detract from future generations, they need to be aware of the influence of their lifestyles, consumption patterns, and so on (Sheehy, et al., 2000). Computer Assisted Environmental Instruction (CAEI) can also be used to reach this target. One of the materials on environmental courses is computer assisted instruction material. CAIM can improve students' achievement, and to some extent change misconceptions and improve cognitive levels (Cepni et al., 2004).

One section of this study was presented at the Computer and Instructional Technologies Symposium, 2010, in Konya, Turkey and it was rearranged according to the proposal of symposium participants and applied to prospective teachers in the autumn 2012-2013 semester.

The aim of this study was to bring to light the effects of computer assisted environmental education on pre-service teacher training.

In this context, the study was generated under three categories:

1. What are the general thoughts of pre service teachers regarding environmental education?
2. What are the general views of pre service teachers regarding the use of computers on courses of environmental education?
3. What are reflections on the use of Computer Assisted Environmental Instruction (CAEI) in the course?

METHODS

This study was conducted on pre-service teachers in the autumn period of the 2012-2013 academic year in the Department of Primary Teacher Teaching, Education Faculty, Recep Tayyip Erdoğan University, in Rize. The courses of computer assisted environmental education were realized over about 14 weeks (two hours per week) in this faculty by the researcher. At the time of this period, the educational presentations assisted by computers and laptops were performed in an environmental course at four different classrooms. The content of the course consisted of "basic ecological concepts and principles, ecosystems, nutriment chains, environmental pollution, environmental health, decision making about the environment, environmental sensitivity and literacy, environmental organizations in the world". Moreover, each student participating in the course prepared at least one CD on environmental education for homework or intermediate examination as multimedia or PowerPoint materials. Some of the CDs were presented during the course by students in the classroom. In the last week, a Computer Assisted Environmental Education Attitudes Questionnaire (CAIAQ) was applied to 200 prospective teachers.

Sample

The sample was selected from two hundred students registered in courses during the fall of 2012-2013 school year. 190 of these students gave responses to a questionnaire**.**

Instruments

The questionnaire questions were generated depending on the study literature and content of the environmental courses at the faculty by the researcher. In the beginning, it consisted of 40 questions and was tested on 50 pre-service teachers as a pilot application. Afterwards, the views of five academic experts regarding CAEAQ were taken to in order to finalize the final format. Finally, CAEAQ consisted of 32 (Section A 8, Section B 6, Section C 18) items in total. Five-point Likert-scale type questions with responses

Table 1. Distribution of the pre-service teachers according to gender.

Gender		N	X
Gender	Male	112	60.1
	Female	78	39.9

ranging from 'strongly disagree' (1) to 'strongly agree' (5) according to the respondent's views were included in the questionnaire.

Data analysis

To analyze and interpret the data, per cent and t tests were used to understand the differences between groups at P<0.05 significance. The results were evaluated and calculated values by means of SPSS (Statistical package for social sciences). The scale reliability coefficient (Cronbach Alpha) was 0.85.

Participants

The demographic characteristics of geography students are shown in Table 1. Participants were 190 volunteers. They consisted of 61.8% (112) male and 39.9 % (78) female.

RESULTS AND FINDINGS

Findings concerning the first sub-question

The first sub-question of the study was "What are the general thoughts of pre-service teachers regarding environmental education?" To present the answers to this question, firstly the general thoughts of students regarding environmental education were investigated (Table 2). Most of the respondents (pre-service teachers) (agree, 25.3%; strongly agree, 64.2%) stated that they were concerned for the future of the world because of environmental problems. On the other hand, respondents generally agreed that people must take compulsory education on environmental issues in high school (mean=3.73). More than half of prospective teachers (strongly disagree, 29.5%, disagree, 23.7%) did not respond to Item 4 "The Environment problems cannot be solved by means of education". According to the results of Item 5 and Item 6, Pre-service teachers emphasized that they implemented their responsibilities to the environment as a citizen (Mean= 3.16) and that they were concerned about the negative effects of environmental pollution around them (Mean= 3.21). Meanwhile, Pre-service teachers' mean scores were 3.44 about the view "I believe that I have environmental knowledge at enough level." However, as seen in Table 2, their mean score was 2.61 about the view "I am more interested in environmental education course than other courses at the faculty."

Findings concerning the second sub-question

The second sub-question of this study was concerning the general view of pre-service teachers regarding the using of computers in the environmental education course. In this context, the respondents were firstly asked if the use of visual materials with on-site computers in environmental courses had made teaching easy. Most of the respondents (agree, 35.8%; strongly agree, 35.3%) believed that the visual materials assets computer had made teaching easy (Table 3). An important part (agree, 33.2; strongly agree, 21.6 %) of the students said that the knowledge learnt on computer assisted environmental education was enough to teach to their students in the future. The great majority of them (agree, 22.1%; strongly agree, 21.6 %) mentioned that project and homework assisted computers in environmental education course were effective in enhancing environmental sensitivity. On the other hand, respondents generally agreed that they enjoyed researching environmental subjects by means of computer and internet (mean=2.78) and that the contribution of CAEI was remarkable in increasing awareness of individual responsibilities in environmental conservation (mean=2.98). In addition to these, most respondents (mean=2.79) agreed that computer assisted environmental education (CAEI) was very effective in learning environmental concepts.

Findings concerning the third sub-question

Thirdly, the effectiveness of Computer Assisted Environmental Education (CAEI) to develop ecological behaviors was researched according to students' views in the context of "reflections on the use of Computer Assisted Environmental Instruction (CAEI) in the course" (Table 4). As seen in Table 4, the students stressed that computer assisted instruction for environmental issues and problems were extremely effective. Item 2 "CAEI in understanding ecological relationships and events" (mean= 3.79, Item 3"CAEI in learning of the nutriment chain and grid" (mean=3.77)), Item 4"CAEI in terms of avoidance of the haphazard use of energy resources (mean=3.98), Item 6 "CAEI in understanding climate changes" (mean=3.73), Item 7 "CAEI for the protection of the nearly extinct species of animals" (mean=3.99), Item 8 "CAEI for the fight against environmental pollution (mean=3.84) Item 9 "CAEI for environmental literacy and awareness" (mean=3.52), Item 10 "CAEI for information on environmental health" (mean=4.00), Item 12 CAEI to understand the importance of creating protected areas" (mean= 3.60), Item 17 "CAEI in leaving a good legacy for future generations (mean=3.82) Item 18 "CAEI in learning of international actions on global environmental" concerns (mean=3.72) clearly showed this specialty.

Lastly, in this study, we investigated differences of gender attitudes towards computer assisted environmental

Table 2. The general thoughts of pre-service teachers regarding environmental education.

	I strongly disagree	I less disagree	Neutral	I agree	I strongly agree	M	Sd
1. I believe that people must take compulsory education on environmental issues in high school	3.2	8.9	17.4	52.6	17.9	3.73	.963
2. I believe that although environmental education is extremely important recently, environmental education of people is not enough.	4.7	5.8	23.7	58.9	6.8	3.57	.88
3. I am concerned for the future of the world in term of environmental problems.	3.7	6.8	25.3	28.4	35.8	3.85	1.09
4. The environmental problems cannot be solved by means of education only	29.5	23.7	23.7	15.8	7.4	2.47	1.26
5. I think that I implement my responsibilities to the environment as a citizen	6.8	30.0	18.9	27.9	16.3	3.16	1.21
6. I am concerned about the negative effects of environmental pollution around me.	7.4	27.4	20.5	25.8	18.9	3.21	1.24
7. I believe that I have environmental knowledge at enough level	5.8	17.4	26.3	27.9	22.6	3.44	1.18
8. I am more interested in the environmental education course than other courses at the faculty.	17.9	37.9	21.1	11.1	12.1	2.61	1.24

Table 3. The necessities of environmental education with assisted computer were researched in preventing environmental problems according to students' views.

	I strongly disagree	I less disagree	neutral	I agree	I strongly agree	M	sd
1. The use of visual materials in environmental courses has made teaching easy.	2.6	6.3	20.0	35.8	35.3	3.88	1.02
2. I enjoy researching environmental subjects by means of computer and internet.	13.7	31.6	25.8	13.7	15.3	2.78	1.26
3. The contribution of CAEI is considerable in raising awareness of individual responsibilities in environmental conservation	6.8	23.7	23.2	37.4	8.9	2.98	1.10
4. Projects and homework assisted by computers in environmental education courses are effective in enhancing environmental sensitivity.	5.3	17.9	33.2	22.1	21.6	3.30	1.15
5. I believe that the knowledge I learnt on computer assisted environmental education is enough to teach to my students in future.	--	6.8	38.4	33.2	21.6	3.64	.89
6. Computer assisted environmental education is remarkably effective in the learning of environmental concepts.	17.4	28.4	9.5	28.9	15.8	2.79	1.38

education depending on its issues. For this aim, Independent-Samples T test was conducted to examine the views of female and male pre-service teachers towards CAEI. Results are shown in Table 5. The table shows that there are statistically significant differences in some areas but not in others. The results show that female pre-service teachers participated more in the following items than men with a statistically meaningful difference. Item 2 "The effectiveness of the CAEI for the environmental literacy and awareness" t=-2.49 $p<0.05$, female (m = 3.96, sd = .72), male (m = 3.67, sd = 0.79). Item 4 "The effectiveness of CAEI in terms of avoidance of the haphazard use of energy resources t=-2.33, $p<0.05$, female (m = 4.16, sd = 0.71), male (m = 3.86, sd = 0.97. Item 9 "The effectiveness of the CAEI for the environmental literacy and awareness" t=-2.18, $p<0.05$, female (m = 3.75, sd = 1.13), male (m = 3.36, sd = 1.26). Item 10 "The effectiveness of CAEI for information on environmental health t=-2.13, $p<0.05$, female (m = 4.17, sd = .80), male (m = 3.88, sd = .82). Item 11 "The effectiveness CAEI for the protection of natural scenery" t=-3.05, $p<0.05$, female (m = 3.93, sd =1.06), male (m =

Table 4. The use of Computer Assisted Environmental Education (CAEI) to develop ecological behaviors in the context of environmental issues**.**

	Most ineffective	Much ineffective	Effective	Much effective	Most effective	M	sd
1. CAEI in concept learning regarding environmental education	10.5	17.9	38.9	12.1	20.5	3.14	1.23
2. CAEI in understanding ecological relationships and events.	1.1	5.3	20.5	59.5	13.7	3.79	.78
3. CAEI in learning of the nutriment chain and grid	6.8	5.8	18.4	40.5	28.4	3.77	1.12
4. CAEI in terms of avoidance of the haphazard use of energy resources	.5	4.2	23.7	38.9	32.6	3.98	.88
5. CAEI for the results of acid rain and Ozone Depletion	9.5	17.4	41.6	11.1	20.5	3.15	1.21
6. CAEI in understanding climate changes	1.6	10.0	30.5	28.9	28.9	3.73	1.03
7. CAEI for the protection of the nearly extinct species of animals	.5	4.7	23.7	26.8	34.2	3.99	.90
8. CAEI for the fight against environmental pollution	1.1	8.9	30.0	24.2	35.8	3.84	1.04
9. CAEI for environmental literacy & awareness	6.8	12.6	30.5	21.1	28.9	3.52	1.22
10. CAEI for information on environmental health	1.1	5.8	20.5	36.8	35.8	4.00	.94
11. CAEI for the protection of natural scenery	2.1	23.2	30.5	25.8	28.4	3.65	1.09
12. CAEI to understand the importance of creating protected areas	4.7	8.4	40.0	15.3	31.6	3.60	1.15
13. CAEI in learning the activities of governmental and non-governmental organizations	4.2	9.5	42.1	14.7	29.5	3.55	1.13
14. CAEI in setting environmental policies	6.3	14.7	35.8	15.3	27.9	3.43	1.21
15. CAEI in learning the importance of the laws and regulations related to the Environment	4.2	14.7	33.7	18.4	28.9	3.53	1.17
16. CAEI for the evaluation of environmental waste	3.7	7.9	26.8	61.1	.5	3.46	.80
17. CAEI in leaving a good legacy for future generations	2.6	5.8	30.5	28.4	32.6	3.82	1.03
18. CAEI in learning of international actions on global environmental concerns	2.1	11.1	34.2	17.9	34.7	3.72	1.11

3.45, sd = 1.07). Item 12 “CAEI to understand the importance of creating protected areas” t=-2.25, p<0.05, female (m = 3.76, sd = .96), male (m = 3.40, sd = 1.18). Item 14 “The effectiveness of CAEI in setting environmental policies” t=-2.31, p<0.05, female (m = 3.67, sd = 1.09), male (m = 3.26, sd = 1.27). Item 15 “The effectiveness of CAEI in learning the importance of the laws and regulations related to the Environment t=-3.12, p<0.05, female (m = 3.85, sd = 1.17), male (m = 3.34, sd = 1.12). Item 16 “CAEI for the evaluation of environmental waste) t=-3.90, p<0.05, female (m = 3.73, sd = .55), male (m = 3.60, sd = .89). Item 17 “The effectiveness of CAEI in leaving a good legacy for the future generations” t=-3.59, p<0.05 (m = 4.14, sd = .84), male (m = 3.60, sd = 1.10) Item 18 “CAEI in learning of international actions on global environmental concerns” female t=-2.40, p<0.05 (m = 3.69, sd = 1.12), male (m = 3.29, sd=1.12).

An independent-samples t test comparing the mean score of CAEI and gender found a significant difference between the means of the two groups (t= -4.31, p < .05). The mean of CAEI for females (m = 3.82, sd =1.27) was slightly higher than the mean of those for males (m = 3.50, sd = 1.09).

DISCUSSION OF FINDINGS AND CONCLUSION

Consequently, according to the results of this study, generally pre-service teachers had positive attitudes towards the computer aided education environment. This result also supports the findings of previous studies (Cepni et al., 2004, Morgil et al., 2004) which obtained the same or similar results in terms of achievement or attitude. On the other hand, there are many studies showing the positive effects of the computer aided instruction in geography, mathematics, biology, etc. (Kaygısız et al., 2011). It can be deduced that the use of computer assisted instruction enhanced the performance of both male and female students (Yusuf and Afaolobi,

Table 5. Analysis of the effectiveness of Computer Assisted Environmental Instruction (CAEI) to develop ecological behaviors in the context of environmental issues in terms of gender.

		N		S	df	T	P
1. CAEI in concept learning regarding environmental education	Male Female	112 78	3.15 3.10	1.22 1.26	188	.36	.714
2. CAEI in understanding ecological relationships and events.	Male Female	112 78	3.67 3.96	.79 .72	188	-2.49	.014
3. CAEI in learning of the nutriment chain and grid	Male Female	112 78	3.83 3.69	1.15 1.08	188	.88	.379
4. CAEI in terms of avoidance of the haphazard use of energy resources	Male Female	112 78	3.86 4.16	.97 .71	188	- 2.33	.021
5. CAEI for the results of acid rain and Ozone Depletion	Male Female	112 78	3.16 3.15	1.19 1.23	188	.03	.969
6. CAEI in understanding climate changes	Male Female	112 78	3.65 3.88	1.08 .95	188	-1.64	.101
7. CAEI for the protection of near extinct species of animals	Male Female	112 78	3.90 4.12	.95 .81	188	-1.70	.090
8. CAEI for the fight against environmental pollution	Male Female	112 78	3.72 4.02	1.09 .95	188	-1.97	.050
9. CAEI for environmental literacy and awareness	Male Female	112 78	3.36 3.75	1.26 1.13	188	-2.18	.030
10. CAEI for the information on environmental health	Male Female	112 78	3.88 4.17	.02 .80	188	-2.13	.034
11. CAEI for the protection of natural sceneries	Male Female	112 78	3.45 3.93	1.07 1.06	188	-3.05	.003
12. CAEI to understand the importance of creating protected areas	Male Female	112 78	3.40 3.76	1.18 .96	188	-2.25	.025
13. CAEI in learning the activities of governmental and non-governmental organizations	Male Female	112 78	3.41 3.69	1.19 1.13	188	-1.57	.116
14. CAEI in setting environmental policies	Male Female	112 78	3.26 3.67	1.27 1.09	188	-2.31	.022
15. CAEI in learning the importance of the laws and regulations related to the environment	Male Female	112 78	3.34 3.85	1.12 1.07	188	-3.12	.002
16. CAEI for the evaluation of environmental waste	Male Female	112 78	3.28 3.73	.89 .55	188	-3.90	.000
17. CAEI in leaving a good legacy for future generations	Male Female	112 78	3.60 4.14	1.10 .84	188	.3.59	.000

Table 5. Contd.

18. CAEI in learning of international actions on global environmental concerns.	Male Female	112 78	3.29 3.69	1.12 1.12	188	-2.40	.017
Mean score Of CAEI	Male Female	112 78	3.50 3.82	1.27 1.09	188	-4.31	.000

2010). The findings of this research also show similar results. Nevertheless, as is in this study based on the data, some researchers have also shown that female students have more positive attitudes on environment education than males (Özmen et al., 2005; Şama, 2003). Similarly, it has been found that female pre-service teachers believe more in the effectiveness of CAEI in courses than males. This finding is consistent with that of Kaplan et al. (2013) and Yıldırım and Kaban (2010).

The fact that views towards the computer assisted environmental instruction course (CAEI) by pre-service teachers in this study are positive may lead to the thought that they are satisfied with the subjects taught and the materials used in the course.

This study is consistent with that of Morgil et al. (2004), Çepni et al. (2004), Ruchter et al. (2010) and may in this aspect play an encouraging role in promoting the usage of CAI in environmental courses for lecturers. Moreover computer assisted environmental instruction (CAEI) may also increase the performance of the students in the course. The development of environmental literacy has an important place in environmental education (Stables, 2010). Kostova and Vladimirova (2010) brought to light that CAEI improved and strengthened students' environmental literacy. Pre-service teachers in this study provided similar explanations. Rickinson (2001) stated that media has an important role in environmental educa-tion according to the results of studies done regarding its effects. In this context, CAEI may be useful in bringing environmental issues and events reported in the media to the classroom. Teachers who are sensitive and conscious of the environment may improve the students' necessary awareness and responsibility (Şahin et al., 2004). For this reason, computer assisted instruction is necessary for the better teaching of environmental education. One way to rescue students from learning by rote on environment courses is to have them prepare projects by means of computer assisted instruction. We therefore need to consider afresh the utility of the current generation of hardware and software in teaching and learning and conduct research on what techniques are effective (Ranade, 2001).

Environmental citizenship concept has begun to be popular recently. This concept can be viewed as the ultimate outcome of education for sustainability (Meerah et al., 2010). This study reveals that CAEI has an important role in the teaching of environmental education. Because "A more livable Turkey" can also be realized by increasing citizen thinking on ecological or environmental issues in societies as is the case in all countries.

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Full Length Research Paper

Comparison of teachers' understanding of team work according to various variables

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People form organizations by getting together in order to realize the goals that they might not manage to realize alone. Organizations differ from one another by various distinctive characteristics. However, their success is related to the level of goal fulfillment. People working more effectively and efficiently within the organization may create the need to form a new team or group. Forming a new team and sustaining it generally requires a more active and participative approach than the existing approach. If an individual in a team feels happy and successful within the concept of "us" and has a sufficient level of job satisfaction, team work can be considered efficient. Team understanding in schools means that all employees, especially teachers, integrate around common goals and are willing to act with a feeling of "unity" in order to realize those goals. Administrators, teachers and other staff often take responsibility for the parenting of students, and the team spirit at school can be related to the other parts of the society. Particularly, teachers' team understanding is very important in terms of effectiveness of education institutions. The present study has been conducted in order to evaluate teachers' understanding of team work in terms of different variables.

Key words: Team work, forming a team, school administration, school culture, common purpose, cooperation.

INTRODUCTION

Today organizations have begun to be interdependent and job division based on specialization has become common. Now, a single person does not have the knowledge and skill to manage a task alone. Therefore, it has become a must that success is reached along with others by making use of collaborative efforts such as consulting, cooperation and team work. Cooperation and team work are considered important for reaching goals more effectively and efficiently for success at different fields of profession (Dettmer et al., 2005). In recent years, team work has taken considerable place in the literature. According to Katzenbach and Smith (1993), team is made up of a few people who are inclined towards a common purpose, performance goals and the approach that they are responsible for each other (cited. Atılgan et al., 2010; Tuna, 2003: 4; Wallace, 1998: 5). When the word team is mentioned, it is meant that the most skilled individuals at a task, who gather together to realize previously determined goals, who are faithful to each other and act together and who can form good relationships with each other, convene and select their own leaders to work in collaboration. What distinguishes the team from any group of individuals is the mutual interaction among members, collaboration and group spirit (Balcı, 2005: 177; Başaran, 1993: 62).

Today, several projects require that different individuals work as a team in a unit effectively. Within the process of forming high performance teams, it is not enough to make planning, high cost and quality calculations but it is also necessary to establish psycho-social relationships and the concept of trust. In this respect, an effective and open communication, motivation and positive employees make up the main elements of success. This shared vision in organization provided by teams helps employees

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make more effort to realize organizational goals and contributes in creating a strong corporate culture in the organization (İnce et al., 2005).

It is expected that groups gathered with the same goal and expectations become unified around a main subject, not necessarily for the whole process, but at least from the beginning until the end of the activity. Groups do not have physical structure that is different from individuals. However, it is claimed that groups are formed from the individuals who created them. As stated by Hicks (1979): "Groups are nothing more than mental abstractions" (Hicks, 1979). Results obtained via team work are always more creative and effective than individual results. Everyone has a certain level of mental structure, knowledge and experience. Team members become more productive and creative by opening their minds and sharing it with others, and through others' support, they play a role in creating results that exceed their own capacity (cited. White, 1998: 51). Above all, people gathering in a group is a sufficient reason to form integration. Without considering the factors such as the quality of process that will be experienced in the group, even the "gathering" alone can create a specific integration (Hogg, 1997, 53).

Teams are distinguished from any group or human communities by certain characteristics. These can be listed as being goal oriented, having the right members and enough time, giving team work priority, ensuring management contribution and a perfect communication, and having good level of knowledge (cited. Atılgan et al., 2010; Sümter, 2003). In his book called "The Fifth Discipline", Senge (2002) mentions five disciplines in organizational management. Mentioning the other four, he puts forward the "system" idea, which requires learning as a team and emphasizes a real "thinking together" action by suspending single assumptions of individuals. According to Senge, it is essential that these five disciplines develop together. The system idea is the discipline that combines the other disciplines together and unites them as a coherent theory.

It is apparent that organizations' formal structures and processes create results against work development. Employers should be approached not based on their roles and status but with a view that each one is an important member of team. Team spirit approaches should aim towards improving team members' level of interaction (Freeman et al., 2000). Teams being more productive with their flexible structures form one of the main elements of performance in organizations. Today, it has become almost an obligation to motivate people, increase employees' skills, ensure that they share their knowledge and emphasize team work to raise their performances (Küçük, 2008).

Simply determining the main purpose is not usually sufficient for spelling it, because team purposes have not been determined despite authorized individuals. Successful team based organizations have a main plan that indicates which responsibilities would be fulfilled with teams, and at what pace. These plans also put forth which team members will organize which responsibilities (İnce et al., 2005). Having the collective thought process formed within the team, not only can the problems be solved, but new understandings that might be a foundation for the organization can also be developed. Teams act as an organism that operates within the organization with their collective thought and effective communication system and transfer learning from the level of individual to the level of organization (Atılgan et al., 2010; Özgen, Kılıç and Karademir, 2004: 180).

Senge (2002) listed the dimensions of learning as a team as follows:

1. There is a need for insightful thinking on complex problems. Here, the teams should learn how they would benefit from the potential that several minds are more intelligent than a single mind.
2. There is a need for innovative and coordinative action; there is complementing each other and operational trust.
3. Team members have an effect on the other teams.
4. There is the skill of being a huge jazz band.

Team work is a separate requirement for organizational learning. According to Dyer (1994), in order for organizational learning to occur, it is necessary that team work culture be established within the organization. Team work culture would be a quite critical step in terms of forming a continuous learning environment. Team, in terms of organizational learning, has a larger intelligence potentially compared to an individual's intelligence (Atılgan et al., 2010; Töremen, 2001). Therefore, cooperation and team work are considered complementary in nature. The following questions can be asked for cooperation and team work (Dettmer et al., 2005):

1. What kind of an approach do we have in terms of cooperation and team work?
2. What is and what is not a cooperative organization?
3. What are the important elements of working together actively?
4. What are the differences among members in terms of cooperation?
5. What are the factors affecting team work?

Team work has a crucial impact on schools as educational organizations. The schools' reaching previously established purposes is only possible with employees who adopt these purposes as theirs, develop cooperation with other employees for realizing these purposes and who know that school success depends on the employees taking responsibility with a team spirit. The establishment of a total quality management approach has been attempted in our schools as a result of the necessity to develop team spirit and working values. Total quality management approach, which is tried to be established at our schools, results from the necessity to

develop team spirit and work. In order to convince members to adopt a team spirit approach, all employees should believe in team spirit and care for the training of new members; employees' loyalty should reflect on management, there should be a foundation for team members to know each other better, problems should be solved before they turn into disasters, healthy communication should be established within the team, team friendship and sincerity should be developed, team culture should be defined, common mission and vision values should be dominant, quality of work methods should be assessed at regular intervals, personal development should be encouraged, rivals should be identified and assessed, performance of team and individuals should be appreciated, candidates should be selected well, work should be done in a team spirit, and there should be trips, camps and conversations (Atılgan et al., 2010; Çağlayan, 2002). Implementing team work at schools would be very beneficial for schools. According to Oswald (1995: 9), results of team work at schools would be as follows (Atılgan et al., 2010):

1. A team spirit that is strengthened with a common vision and feeling of commitment may remind teachers who want to make a change that they are not alone.
2. It gives teachers the opportunity to provide interactions in more structural and productive ways.
3. A more intellectual school setting can be provided through discussing important education issues.
4. Teachers regard themselves as a source of information and as researchers with the ability to create new information.
5. Businesses, entities, and new relationships formed with higher education may create a support network for professional development founded at school.
6. Close relationships can be formed between professional development and students' needs.

The participation of employees in school management depends on interpersonal relationships. It is necessary that employees should be provided with opportunities involving important decision making processes, taking over responsibility, fulfilling responsibilities and advocating results that allow them to regard themselves as a part of school. Employees' skills and knowledge should be made sustainable (Lusena, 2010).

Until recent years, there has not been enough planned, efficient and effective communication and co-operation in school settings. Complicated structuring that has gradually increased in schools, and school development processes in response to demands have created the need for working together (Dettmer et al., 2005). To achieve this, first of all, it is requested that teachers working at school should gain team spirit and their team perceptions should be strengthened. Administrators may find the following pointers helpful for achieving this team-based working structure (Dettmer et al., 2005):

1. There is a need for cooperation as a tool to develop long term planning and coordination in education.
2. Do not expect to encounter problems for consultation, collaboration and team work.
3. Try to use collaboration in order to solve school, staff and student problems together.
4. Avoid being a "rescue helper" for your environment.
5. Give up hanging onto non-functional instructions.
6. Try to understand and share teachers' problems and troubles.
7. Organize meals and social activities that all staff would attend, both in and out of school.
8. Organize meetings regularly to listen to the needs and worries of staff.
9. When you face a problem, handle it with its humanistic aspects and ask for help when needed.
10. Do not become the person who is perceived as the one doing nothing.
11. Listen patiently to people in order to understand their ideas.
12. Encourage every member of the group to share knowledge and perceptions, and ask for their opinions directly regarding the issue.
13. Pay special attention to students with special needs.
14. Accept the fact that no one individual has all the right answers, and try to make use of different ideas.
15. Respect different beliefs and others' rights.
16. Care for others' emotions and thoughts.

In educational organizations, it is a more complicated process to form teams and to lead them in line with organizational goals, and establish common mission and vision of the organization, compared to other organizations; however it is not impossible. The most important reason is the difference between individuals' and groups' education approaches. Also, schools are not independent from other sections of society nor from political and cultural pressure groups. Education is a field that does not have a one-sided perspective but have goals, mission and vision that are a very complicated multi-dimensional sector. Therefore, establishing a team spirit in educational organizations depends on a process and skills requiring more effort and knowledge.

Schools are workplaces where mosty teachers work. Therefore, teachers' team perceptions at their organizations are important. If teachers think that they are a team member at the school organizations and they have a strong willingness for team work, this will increase the motivation of employees as well as school efficiency. In this respect, it is important that teachers' teamwork perceptions be measured.

RELEVANT LITERATURE

Among the studies conducted in Turkey with regards to team work, a study by İnce et al. (2005) titled "Effective

Leadership Qualities for Team Work in Organizations", puts forth that working with teams means accepting the strategic risk that covers both the restructuring of the organization, and supporting change and the researcher advocated the idea that team-based organization approach would be an important advantage.

In a study by Küçük (2008), namely "The Effects of Team Work at Organizations on Innovation", it was concluded that today innovation cannot be regarded as an output resulting from a single individual's skill and ability, and in order to spur innovation, all employees should be encouraged to develop such qualities. In order to achieve this, the human resources in the organization should be effectively managed. Also, it was argued that increasing employees' desires and willingness to innovate would create a synergistic effect further promoting team work.

In one of the studies conducted outside Turkey by Freeman et al. (2000), "The impact of individual philosophies of teamwork on multi-professional practice and the implications for education", the effect of team work in the field of education was examined. Based on their findings, negotiation, communication and job division were found to have a positive effective on people. Role and status factors were not found to be effective, but instead it was seen that professional knowledge and skills of team members were more important.

Lusena (2010) concluded in a study, "The Principles of Teamwork and School Personnel Participation in the Administration of Liepaja City Comprehensive Schools," that variables such as communication, trust, interpersonal relationships, school culture and participation in school management affect school staff positively, and increasing interaction among school staff would be effective in promoting the school's goals while affecting school culture positively.

Purpose

The present study was conducted in order to find out how teachers perceive team work, whether this differs between factors such as school type, branch, gender, age and professional experience, and to determine whether or not team work sub-dimensions differ among those same variables.

The following questions were asked accordingly:

1. How do teachers perceive team work?
2. Do teachers' team work perceptions differ based on sub-dimensions?
3. Do team work perceptions differ based on school type, age, gender and professional experience?

METHOD

This is a relational study conducted in order to examine teachers' team work perceptions and whether they were determined by school type, age, gender or professional experience.

Population and sample

The population of the present study composed of teachers working at elementary and middle schools in Turkey. Since the population size is large, sample selection was preferred. A total of 400 teachers working at 20 elementary and middle schools in Ankara, Istanbul and Bursa were selected randomly. Of 400 surveys distributed, 308 were returned and analyzed (a 76% returned rate). The distribution of teachers according to school type, branch, gender and professional experience are given in Table 1.

Validity and reliability of the scale

The "Team Work Scale" developed by Atılgan et al. (2010) was used in the study. Scale reliability values Cronbach Alpha and McDonald Omega coefficients were calculated by Atılgan et al. (2010) and Crobnach Alpha reliability of the combined scale was found to be 0.92; while the reliability of sub-scales was found to be 0.92 (CC), 0.81 (IC) and 0.82 (DJS). For the combined scale McDonald Omega coefficients were 0.96 and for the subscales: 0.92 (CC), 0.82 (IC) and 0.85 (DJS). Two reliability coefficients found show that reliability of the scale was good both for the sub-scales and for the combined scale.

In order to determine the reliability value of the scale over the research data, sub-factors and scale total reliability coefficients were calculated. For the 32 item total values, Cronbach Alpha: 0.95 and Alpha values of sub-factors were found as 0.90 for Commitment and Cooperation; 0.90 for Interaction and collaboration; and 0.89 for Development and Job Satisfaction. The reliability coefficients obtained showed that reliability was enough for both sub-scales and the whole scale, and the values were found to be close to those obtained by Atılgan et al. (2010).

The model established to test that the scale forms a single team perception the basic structure together with the three sub-dimensions of the scale (CC, IC and DJS) was tested with DFA. The coefficients of concordance were NNFI=0.96, CFI=0.96, IFI=0.97, and RMSEA=0.053. When the coefficients of concordance obtained were compared, the model was confirmed with the basic team perception structure besides the related sub-dimensions of scale items. The team perception obtained based on confirmatory factor analysis was hierarchically structured and composed of sub measurements/dimensions within the general structure of the single team. DJS sub-dimension has the largest effect on team perception general structure with a value of 0.85. The impact of the two other scales on team perception general structure was 0.78 for CC and 0.53 for IC. The hierarchical structure tested in this way showed that the scale has factor validity (Atılgan et al., 2010).

Data collection

The team study perception scale used in the study comprised 32 questions. There were three sub-dimensions of the scale. These are "Commitment and Cooperation" sub-dimension with 4 questions, "Interaction and Collaboration" with 8 questions, and "Development and Job Satisfaction" with 10 questions.

308 of the 400 teacher surveys in the sample group were returned and analyzed. Based on the sub-problems of the study, item averages and total average scores, factor analysis, t-test for gender, and instrument reliability test with single-way analysis of variance (ANOVA) for other variables were performed in the SPSS statistical software package (CITE).

Table 1. Teachers' team work perception score averages (X) and standard deviation (S) table.

Items and sub-factors	X	S
Commitment and Cooperation	-	-
1. Each one of us is aware of the goals to be reached.	4.07	0.65
2. Each one of us is determined to show better performance.	4.10	0.68
3. Each one of us tries to perform our job at as high a standard as is possible.	4.05	0.73
4. Enough time is devoted for each task.	3.93	0.71
5. When a problem is faced, each one of us makes an effort until it is solved.	4.07	0.77
6. Each one of us believes in the importance of the work we do.	4.24	0.69
7. Each one of us shows personal dedication for the success of our section.	4.14	0.81
8. Each one of us believes that we have the power to achieve despite obstacles.	4.07	0.71
9. When felt necessary, assistance can easily be obtained from friends in the section.	4.05	0.66
10. Everyone does whatever they can to help each other succeed.	3.90	0.82
11. When one of us has a personal problem, others help find a solution.	3.94	0.74
12. If one of us could not complete our task, others would help to finish it.	3.84	0.78
13. While acquiring new knowledge and skills, members support each other.	3.86	0.68
14. Each one of us behaves with an awareness of responsibility in our work.	4.08	0.73
Interaction and collaboration	-	-
15. No one mixes their personal feelings with their job.	3.83	0.88
16. No one gossips about other members.	3.63	0.93
17. A subject that may embarrass one of us is not told to others.	3.88	0.85
18. No one takes over another person's job.	3.96	0.94
19. No one tries to find excuses for mistakes.	3.82	0.90
20. Our members do not avoid admitting when they do not know the answer to a question.	3.75	0.81
21. Our members do not keep their knowledge hidden from others.	3.84	0.86
22. When one of our members has bad news, we do not attack him/her.	3.97	0.99
Development and Job satisfaction	-	-
23. Disagreements are resolved before they become problems.	4.01	0.71
24. Our members feel happy about performing their jobs.	4.01	0.67
25. In order to increase quality, work is analyzed.	3.99	0.72
26. The performance level of each one of us is public knowledge.	3.95	0.81
27. It is believed that our section contributes to the general success of our institution.	4.19	0.73
28. The performance of each one of us is appreciated.	3.79	0.86
29. Any kind of suggestion from our members is considered.	3.87	0.82
30. Our members try to keep common problems confidential.	3.89	0.81
31. When one of our members could not keep his promise, it is believed that there is a valid excuse for that.	3.94	0.74
32. Our members respond to questions truthfully.	4.15	0.59
Total	3.96	

RESULTS AND DISCUSSION

1. The first research question "How do teachers perceive team work?" is given in Table1:

The average teachers' team work perception score (Table 1) was X=3.96; accordingly, it can be said that teachers' team work perception is high. When individual item score averages are examined, the three items with the highest average score were items number 7 ("Each one of us believes in the importance of our work" ; X=4.24), item number 27 ("It is believed that our section contributes to the general success of our organization" ; X= 4.19), and item number 32 ("Our members respond truthfully to any questions asked" X=4.15).

In contrast, the lowest score averages were found for items number 16 ("No one gossips about other members" ; X= 3.63), number 20 ("Our members do not avoid admitting to others when they do not know have an

Table 2. Teachers' team work perception sub-dimensions score table.

Teachers' team work perception sub-dimensions	No of Items	Factor load value	Reliability coefficient (Alpha)	X. Avg.
Commitment and Cooperation	14	3.93 4.24	.902	4.03
Interaction and Collaboration	8	3.63 3.97	.896	3.83
Development and Job Satisfaction	10	3.79 4.19	.885	3.98
Total	32	3.96	.947	3.96

Table 3. Table of distribution of teachers' team work perception total scores according to gender.

Gender	N	X. Ave.	S	F	Sig
Male	183	4.0040	4.03	0,092	0.761
Female	124	3.9021	3.83		

Table 4. Table for the difference between school type and team work perception scores.

School Type	N	XAve.	S	F	Sig
Elementary School	110	4.031	.402	4.797	.003
Middle School	88	4.035	.387		
High School	105	3.824	.595		
Other	5	4.156	.151		
Total	308	3.964	.480		

answer" ; X=3.75), and number 28 ("The performance of each one of us is appreciated" ; X=3.79).

Findings with regard to the second question of the research "Do teachers' team work perceptions differ in terms of sub-dimensions?" are given in Table 2.

When Table 2 is examined, the total score average of the "Commitment and Cooperation" sub-dimension, which is one of the sub-dimensions of teachers' team work, was found to be X=4.03; total score average of the "Interaction and Collaboration" sub-dimension was X=3.83; and total score average of the "Development and Job Satisfaction" sub-dimension was X=3.96. Accordingly, organizational commitment and cooperation had the highest scores for team work perception by teachers.

Findings with regard to the third question of the research "Do team work perceptions differ in terms of school type, branch, gender, professional experience variables?" are given in Tables 3, 4, 5 and 6:

For the third sub-question of the study, findings regarding the question of whether there is a difference between teachers' team work perception scores depending on gender are as follows (Table 3).

When the table is examined, it is seen that male teachers have higher score averages than female tea-chers. However, the Independent Samples Test table shows that F= 0.092 and meaning a relationship between teachers' gender and team work perception was not statistically supported at (p>0,05) level.

In order to test the difference between school type and team work perception score averages, a one-way ANOVA test was performed, and the results are as follows (Table 4).

When the above table is examined, it is seen that the relationship between school type and team work perception score spelling was significant at p<0.05 level. When the source of the difference is searched, it is seen that team work perception scores of high school teachers are lower than elementary school and middle school teachers' scores. No significant difference could be found among the score averages of other school types.

Table 5. Table of difference between branch and team work perception scores.

Branches	N	X.Ave.	S	F	Sig
Classroom Teacher	111	4.029	.400	1.11	.356
Science	43	3.800	.567		
Maths	36	3.944	.449		
Social Sciences	30	3.982	.400		
Turkish Language and Literature	23	3.979	.513		
Foreign Language	32	3.801	.658		
Other	33	3.978	.453		
Total	308	3.964	.470		

Table 6. Table of difference between experience and team work perception scores.

Experience	N	X.Ave.	S	F	Sig
1-8 years	91	4.056	.4299	2.94	.033
9-16 years	77	4.003	.4158		
17-24 years	82	3.853	.5162		
25 and older	58	3.922	.5514		
Total	308	3.964	.4798		

One-way ANOVA test results for the difference between branch and team work perception score averages.

When Table is examined, it is seen that the relationship between teachers' branches and team work perception score averages was at $p>0.05$ level. However, the team work perception scores of classroom teachers were found to be higher than that of other teachers' team work perception score averages. It is seen that there no significant difference among branch teachers' score averages.

Results of one-way ANOVA testing for differences in team work perception score averages between experience levels:

When the above table is examined, it is seen that the relationship between team work perception score averages and teachers' experience level is significant ($p<0.05$). The source of difference was found as follows: teachers with an experience of 1 to 8 years and teachers with an experience of 9 to 16 years had close team work perception score averages, and these were higher than the other groups with 17 or more years of experience.

RESULT AND RECOMMENDATIONS

1. Teachers' beliefs about assessment of their performances are not sufficient.
2. Teachers' perception of team work is generally high. It is particularly important that each teacher believes in the significance of the work they do. Also, teachers are truthful about the contribution of the work their departments do in the organization. However, teachers experience problems in the assessment of organizational trust and performance.
3. Commitment and cooperation, which are the sub-dimensions of team work perception of teachers, are most important. On the other hand, development and job satisfaction sub-dimensions are less important.
4. Male teachers' team perception at school is slightly higher than the perception of female teachers, but this difference was not significant; meaning there is no difference between male and female teachers' team perceptions.
5. Classroom teachers' team work perception is higher than that of other teachers. The fact that classroom teachers stay at school for the full day may increase their organizational commitment and team perceptions.
6. Young teachers' team work perception score averages are higher than those of experienced teachers. It can be said that as teachers' experience increases, the willingness to work in the organization as a team member, and on the team perception decreases.

RECOMMENDATIONS

1. Teachers generally have a high level of perception for team work; however, studies on strengthening teachers' beliefs in their performance assessments should be made. Seminars and on-the-job training can be provided for performance assessment. Also, the belief that objective criteria are used in performance assessment can be reinforced.
2. Teachers should be given training and support at the level of organizational development and job satisfaction. Subject headings or training including only these subjects can be planned into teacher training. Also, in order to increase teachers' job satisfaction, purposeful activities can be organized. School administrators can be provided training on these issues. Efforts can be made particularly to increase female teachers' organizational commitment and team perceptions.
4. Activities increasing organizational commitment of branch teachers should be created. Due to the fact that branch teachers do not work full-time at a school, their

level of organizational commitment may be limited. In order to compensate for these limitations, planning could be made to allow them to spend more time at school.

5. In order to renew the professional motivations of experienced teachers, professional and social activities should be organized. Precautions should be taken to combat the high level of burn-out that experienced teachers may face.

6. It is recommended that researchers should conduct studies on team work with teachers in rural areas and particularly with teachers that have recently started working along with teachers in big cities.

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Insistence on Teaching about Photosynthesis of Plants by Their Green Colour

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***Green* has a common use among the public. Both natural and social environment have an important effect on this expression. People tend to explain the scientific concepts using well-known situations which they intensively see around the living area. In this sense, photosynthesis is one of the most important biological concepts including social and cultural connections. Therefore this study mainly investigated the importance of *green* in explaining such concept. Data obtained from the document analysis of textbooks and content analysis of Primary School Teaching Students' (PSTS) answers to open ended questions. Evaluating the writings belongs to 200 PSTS, it is understood that most of them could not explain the photosynthesis of *non-green* plants scientifically. They think that this explanation is mainly based on the *green* pigment dominance of plants. Additionally it is an expected result of intensive and haphazardous repeatings as *green plants* instead of only *plants* originated from school education and public use. In fact, *green* is not a requirement for explaining the photosynthesis reaction of plants. This unecessary use in explaining the photosynthesis function of *non-green* plants is an interesting result for identifying the connection between scientific concepts and socio-cultural issues.**

Key words: Social, Linguistic and Cultural Issues in Science Education, Misconception.

INTRODUCTION

Cultural psychologists and child development researchers and theoreticians have acknowledged that culture and society play a critical role in cognitive development of individuals. These sociocultural influences include the values, beliefs, experiences, communication patterns, teaching and learning styles, and epistemologies inherent in the students' cultural backgrounds, and the socio-economic conditions (Solano-Flores and Nelson-Barber, 2001). As units of informal learning, these contents affect children's interest in school subjects as well (Uitto et al., 2006).

Social origins of knowledge are obscured. From this perspective, the construction of knowledge can be seen as a social activity. Before children develop their first words, they can spontaneously pick up objects and present them to adults. Thereupon, communication skills, through the manipulation of objects, begin to develop long before lingiustic competence(Roth and Lawless, 2002).

One of the fundamental purposes of science education is to provide students not only with scientific information, but also with a social context in order that they make decisions about science and technology when related to spesific social problems (Choi and Cho, 2002). "Ideas and evidence in science" requires consideration of how science is affected by the contexts in which Bausor and Poole, 2003).

Culture and society play a critical role in construction of scientific concepts. Their learning and teaching ways in both informal and school settings lead to construct their knowledge, and by the way it provides them to create meanings from various experience (Guillermo and Sharon, 2001). This socio-cultural perspective on science education includes the social-interactional, the

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organizational, and the sociological; the social-developmental, the biographical, and the historical; the linguistic, the semiotic, and the cultural viewpoint (Lemke, 2001).

An increasing number of researchers have focused on the role of language in the construction of scientific cultures (Roth and Lawless, 2002). Language represents our perceptions and experiences and interactions and communicatons and exchanging information and organizing the signifiers. Spoken language has always got primarly importance among the other forms such as written and verbal and nominal language. Language is a means of conveying an idea of science, a view of the world, a model of power relationships. Therfore it should not just be a question of reflection on the part of the teacher, but it must also play an important role in educational practice and involve the gradual development of language awareness on the part of learners (Camino et al., 2009: 85).

Research efforts have revealed that, in many areas of school science, children have prior knowledge about phenomena that often differs significantly from the knowledge to be learned. This prior knowledge depends on levels of ability and, age and amount of education and gender and culture and also language (Dekkers and Thıjs, 1998). Cognitive scientist Piaget differentiated between physical, logico-mathematical and also social knowledge, and so he also gives importance to the social conventions of knowledge (Bodner, 1986). As a cognitive and communicative tool, language is a visual part of learning and teaching science. Visualizations are an essential element of teaching, and creating scientific ideas (Tversky, 2007: 40). As science and society are mutually dependent, and science and technology are highly interrelated in a contemporary perspective (Simonneaux, 2008: 179), social and cultural values influence students' cognitive developments in Science Education.

Vygotsky's most compelling contribution to science education is probably "*Thought and Language*". Science learning is a process of moving from the linguistically abstract to the concrete. For example, children learn spontaneous concepts from their everyday experiences. (Carlsen, 2007:59). Vygotsky's social and linguistic viewpoint on learning clearly points out that the roots of construction of conceptual learning mainly depends on the experiences of individuals and this inevitably includes the values of society.

There is some research supporting the idea that Science-Technology-Society curriculum helps improve student understanding of various aspects of Science-and Technology-related Societial challenges (NSES, 2010: 197). Enivronmental science with Science-Technology and Society offer a wonderful opportunity for multi-disciplinary investigation of real problems. The goal of this union is that students will understand the relevance of scientific issues to their daily life (DeBettencourt, 2000: 160). This recently accapted quarternary in Science Education leads us to the idea that both learning and teaching science are not only a knowledge but also have social and cultural combination.

Just as misconceptions identified in some areas of science, photosynthesis is one of the biological concept including alternative explanations (Stavy and Tirosh, 2000) and social interactions. Since the term echological understanding has no established definition or real recognition in everyday language, it is not enouhg to have ecological understanding if he or she knows the chemical formulas of the compounds in photosynthesis cycle. The implications of echolgogical understanding concern not only Science, Ecology and Environmental studies, but also teaching and learning in general (Carlsson, 2002). Every community, including classrooms and schools, operates with a set of norms, a culture-explicit or implicit-that influences interactions among individuals. This culture, in turn, mediates learning (NRC, 2005: 20).

As stated above, construction photosynthesis of plants is not only a logical process but also includes social and cultural backgrounds. The student expressions on such concepts have alternatives based linguistic use originated from culture and religion and history and literature etc… Therefore, this study clearly focused on to understand the insistence on teaching about photosynthesis of plants by their *green* colour.

METHODOLOGY

This qualitative study mainly based on content analysis of students' writtings and document analysis of related textbooks. Qualitative research designs in the social sciences stem from traditionas in anthropology and sociology of the people of culture under examination (Newman and Benz, 1998: 9). Denzin and Lincoln (1994) acknowledge that qualitative research means different things to different people. Qualitative data are defined by Patton (1990) as "detailed descriptions of situations, events, people, interactions, observed behaviours, direct questions from people about their experiences, attitudes, beliefs, and thoughts and excerpts or entire passages from documents, correspondence, records, and case histories (Newman and Benz, 1998: 17).

Data analysis of students' writtings include frequency of each characteristics found in the materials being studied. Thus, a content analysis is quantitative as well as qualitative. It also includes the description of the materials, definitions and descriptions of the characteristics which the researcher is looked for, the coding procedure, tabulations for each characteristic and a description of patterns that the data reflect. Qualitative researchers can often use observations, interviews, objects, written documents, audiovisual materials, electronic documents (Leedy and Ormrod, 2010: 145).

Content analysis is one of the qualitative methods which enables researchers to study human behaviour in an indirect way, through an analysis of their communications. The steps in content analysis technique are, in orderly, determining the objectives, defining the terms, specifying the unit of analysis, locating the relevant data, developing a rationale, developing a sampling plan, formulating coding categories, reliability and validity, analyzing data (Frankel and Wallen, 2006: 485).

This study therefore focused on the objective obtaining useful information dealing with photosynthesis of *non-green plants*. The sentences in the answers of the students' writtings were analyzed. The researcher found *scientific explanations* in the first open-ended

items' writings and *green* colour insistence on explaining the photosynthesis fuction of *non-green plants*. The relation between two items were discussed in accordance with the findings in terms of socio-cultural and linguistic viewpoint.

In this study, four steps were used in orderly to explain the data which includes the beliefs and thoughts of Primary School Teacher Education Students (PSTS) towards the photosynthesis reaction of *non-green plants*. First step is about the use of *green* in textbooks. To identify the place of *green* in related literature, curriculum books, student textbooks and some biology textbooks were subjected to document analysis to find out *green plants repeatings*. The biology textbooks are commonly used ones by the students who are attending at high school and higher education. The curriculum books are related to Science Curriculum which are used by Ministry of National Education officially in Turkey. Student Textbooks are widely used among the public school. These documents were subjected to document analysis to examine the misuse of green and non-green words in the process of photosynthesis of plants.

Second step is about a scientific knowledge examining whether PSTS have enough knowledge to explain the photosynthesis in *non-green plants* or not. Third step is investigating the viewpoint of participants why some of them insisted on green pigments in explaining the photosynthesis function of non-green plants. The fourth step is about group discussion. These students were selected to have a deep understanding of the written answers.

200 Primary School Teacher Education Students are the data sources of this study. They have sufficient biological background for better answering to two open-ended questions. Sample participants are the students of a state university in Turkey.

Open Enden Questions

1. Can non-green plants make photosynthesis as well as green plants? Explain why or why not? (The researcher collected the first sheet from the PSTS and began to read the following open-ended question.)

2. The right answer of privious question is based on the photosynhesis reaction. According to this chemical change, plants produce glucose, and oxygen from the water taken in, togather with the carbon dioxide absorbed from the atmosphere. During this process they use chlorophyll, which can be seen in green colour, to catch the light-energy. Though green is not a requirement for this biological cycling, some of the PSTS who answered the privious question indicated that non-green plants connot make photosynthesis. In your opinion, what are the real reasons of this insistance on green colour in glucuse production process of plants?

In the process of categorization, there are two different coding unit for each question. First question which asked the participants using only written sheet was analysed in line with "*general explanation which includes support or opposition*". Second item's code is about to understand the basics of first item's explanations. For reliability and validity, writings of 200 PSTS were categorized twice. Each PSTS' expressions were written by using codes which represents participant's number (P). The researcher agree with the first categories over one mounth period. In the meanwhile a specialist in science education checked the data and categorized the writings separately from the researcher, and he reached at the similar categories. Analyzing the data, number of the each themes' main idea under the categories was represented with frequencies. Each theme was enlarged using the expressions of participants' words which was written on the sheet. After the open-ended questions' applications, the researcher organized a group discussion for a final decision to point out the PSTS' ideas which they have written on the sheet. 20 of 200 PSTS writtings were selected to support the categories.

FINDINGS

First Step

Green Plants Emphasising on Photosynthesis in Biology Context

Photosynthesis is, scientificially, the process by which the plants and some species of bacteria and euglena manufacture complex compounds of carbon, hydrogen, and oxygen from the water taken in, togather with the carbon dioxide absorbed from the atmosphere (Whellock, 1969: 40). In addition to chlorophyll, the leaves of many plants contain one or more other pigments, including carotens which are orange, and xanthophylls, which are yellow. These other pigments absorb light of wavelengths not absorbed by clorophyll. The energy they absorb is then transferred to the chlorophyll. In this way, more of the incoming light energy can be used by the plant. In many plants the presence of the other pigments is masked by chlorophyll. In the fall, however, when chloropyll production decreases and chlorophyll breakdown contunies, the other pigments show up, giving leaves their bright autumn colors (Schraer and Stoltze, 1990: 288).

Hence, Schraer and Stoltze (1990) define the chlorophyll which are the sites of photosynthesis in the cells of *green plants*. As seen in this defination, it is easy to understand that chlorophyll is /can only be located in *green plants* which can be seen in *green* colour. Smith (1959: 271) emphasizes that *green leaves* make glucose out of carbon dioxide and water. He also added that a *green* leaf might be called a food factory. His chapter including chlorophyll contents lots of the words including *green leaves*. Campbell and Reece (2008: 178) stated that chloroplast is located in all *green parts of plants*. This definition can lead us to the idea that only the *green parts of the plants* content chloroplast and the other coloured plants can not.

Green Plants Emphasising on Photosynthesis in Educational Context

This definition is not only a concern in Biological Context, but also located in Elementary Science Textbooks and curriculum. For example, it can be clearly understood from the definition in the 8 grade in Turkish Science and Technology Curriculum (TSTC) stating that "*chlorophyll is located in the green parts of the plants*" (MEB, 2008: 186). A similar aspect can be seen in Washington State's Essential Academic Learning Requirements (WSEALR) which defines that "*green plants need light for energy*" (WSEALR, 2005: 27). Atlantic Canada Science Curriculum (ACSC) is expressing this situation stating that students should know that one of the most important roles of *green plants* have in any ecosystem is that of

Table 1. Categories and Themes and Frequencies of Written Explanations for The First Open-Ended Question.

Categories	Themes	Frequencies
Non-green Plants Make Photosynthesis	Writting Simple Explanations	12
	Making Deductions	28
	Defining Chlorophyll Rate	41
	Having Alternatives	26
Non-green Plants Do Not Make Photosynthesis	Explaining with Absence of Chlororphyll	93

being a food (energy) source for consumers and decomposers (ACSC, 1998: 20). But all these *green plant* definitions could be only represented by the term of *plant* insted of *green plants*.

Green in Turkish History and Religion Context

Green is a term which is founded on documents concernig the Gokturks (Küçük, 2010). *Green* is the adjective word of a river which has got an important place in History of Gokturks in the Middle-Asia during that era (Kafesoğlu, 1996: 110). In some Islamic viewpoints, such as mysticism, *green* has been accapted as a holy and theological colour (Yıldırım, 2006; Çoruhlu, 2002: 192). In this sense, *Green Army* with an Islamic viewpoint is an organisation founded during the term of independence war of Turkish History. The 82th ayah in Verse of Ya-sin in Koran clearly implies that God creates fire from a very *green* tree (Koran, Yasin: 82 Ayah). In this ayah, *green* and *tree* are two related words which are being used togather (Feyizli, 2007: 456).

From the mid-term in history to nowadays, *green* is a representevive colour for medicine and drug, and so it is accepted as a universal colour by most societies. In ancient times of Egypt, *green* is a sembol of Osiris, which is a myth of that era. *Geeen* has an important meaning in Ancient Egyptian, Greek period, Jewish culture, Cristian Culture, Anatolian culture, Chinese Culture and in Turkish Culture as well (Yıldıran, 2005).

Green Plants Emphasising on Photosynthesis in Turkish Literature

As an idiom, *green* has an important part in Turkish language. For example, "*yeşil*den yemek" means to consume unripe fruits which are *green* not ripe (Püsküllüoğlu, 2003: 1081). "*Yeşil* ışık yakmak" has a positive meaning. It contents to allow someone to do something. "*Yeşil* ot vardır şifa, yeşil ot vardır zehir" means that *green* grass may be both a medicine and a poison for human health (Yurtbaşı, 1994: 125).

The analysis of documents related to the *green* indicate that the use of such colour has a historical, social and linguistic background. Additionally it is not only a subject in Turkish culture but also other societies use it to explain some cultural issues. Therefore *green* can be an important obstacle to construct the related concepts in science.

Second Step

PSTS answered the first open-ended question including the answer whether *non-green plants* make photosynthesis or not. With the categorisation of the written answers for this open-ended question, two categories and five themes were identified. Categories and themes and frequencies of 200 participants' viewpoint can be seen in Table 1.

As seen in the Table 1, nearly half of the 200 PSTS stated that *non-green* plants can make photosynthesis as well as *green* plants. These participants reached at this result by the way "Writting Simple Explanations" and "Making Deductions" and "Defining Chlorophyll Rate" and "Having Alternatives". The supporter of this idea put forward four idea to get a useful knowledge including that *non-green* plants can make photosynthesis as well as *green* plants.

Category of "Non-green Plants Make Photosynthesis"

Among 107 participants which belongs to *Non-green Plants Make Photosynthesis* category, only 12 of the PSTS made *simple explanation* expressing the participation to this funtion of such plants with a little words. Students under the Theme of *Making Deductions* wrote more logically than the privious theme. They all started at their answers from the general and most common features of all plants and deduced that all the plants need to have such characteristics. For example P3 stated that:

"*Since all the plants make photosynthesis, green plants can make it as well."*

P4 adressed the living and non-living feature of plants:

"Non-green plants can make photosynthesis as well as green plants. Living feature of them is enough for reaching this opinion, and green colour is not a

Table 2. What effects the construction of photosynthesis in *non-green* plants?.

Categories	Frequencies
Natural Environment	52
Social Environment	101
Both Natural and Social Environment	47

requirement for plants to make photosynthesis."

P7 compared the *non-green* plants with some species of bacteria:

"Non-green plants, which content chlorophyll, make photosynthesis as well as some bacteria species make it using their own green colour pigment-organelles."

The third theme of *Non-green Plants Make Photosynthesis* is about *Defining Chlorophyll Rate*. Forty of the participants, emphasized the rate of chlorophyll in *green* and *non-green* plants. Induction and deduction are two of scientific knowledge and P2 explained this feature of *non-green* plants by the way of generalization of *green* colour for all plants.

P2 expreses that *green* plants reflect the *green* colour and people can see these plants in green. He added "*If a plant is seen in red, it means that such plant reflects the red colour. In this biological process, energy-level and colour-type of light have an important effect on the speed of photosyhthesis.*"

A similar viewpoint was written by the participant P20. He identified that photosynthesis reaches at the average speed in green colour. Both P18 and P19 stated the lack of chlorophyll in *non-green* plants and for this reason they have the opinion that *non-green* plants make photosynthesis partially. P19 also used deduction to explain the reason why *non-green* plants make photosynthesis. P19 compared the *non-green* plants with *blue-green* algae highlighting the blue feature and reached the opinion that even if they make photosynthesis, *non-green* plants can make it as well.

Category of *Non-green Plants Make Photosynthesis* includes a theme whom the participants explained the glucose production of non-green plants using various alternative definitions. P1 stated that plants makes photosynthesis in various colours depending on the balance in natural environment. Just as this statements implies an overloaded generalization, it contents an alternative way of understanding echology. Because colours of the plants based not only ecological conditions but also a cellular aspect. Cellular structure is more changable than the ecological effect on the plants.

P8 used nitrification instead of photosynthesis. He associated both concepts to explain the *non-green* plants' photosynthesis. For this reason, his alternative use is not a misunderstanding, but also it can be a lack of knowledge about the related concepts. Similarly P9 has an interesting example for lack of knovledge. She stated that chemosynthetic bacteria can make photosynthesis as well as *green* plants. She emphasised the product of sulfur. She absolutely is not aware of the difference between the products of photosynthesis and chemosynthesis.

Category of "Non-green Plants Do Not Make Photosynthesis"

The other half are not agree with this viewpoint since those plants have not got chlorophyll. As they grounded their opinion that *non-green* plants have no chlorophyll, in this study that only one theme is called as *Explaining with Absence of Chlororphyll*. This category's common viewpoint is based on the chlorophyll absence of *non-green* plants. P5-10-11-13-16 asserted that *non-green* plants connot make photosynthesis as they have not got chlorophyll. P14-15-17 stated similar reason but they also aded that plants can only transform sun-light into a useful energy using chlorophyll. P12 separately explained this situation by the way of *non-green* parts of *green* plants such as roots, stems, buds… etc. His explanation mainly based on the fact that if *non-green* plants can not make photosynthesis, or else the roots and stems of *green* plants can produce sugar.

As a result of both categories mentioned above, 107 of PSTS supported the idea that *non-green* plants make photosynthesis with simple explanations and deductions and defining the chlorophyll rate and using alternatives. Other 93 participants of PSTS refused the idea and put forward that *non-green* plants connot make photosynthesis as they have no chlorophyll. It is critical that nearly half of the 200 PSTS could explained the *non-green* plants' photosynthesis function scientificially.

Step Three

PSTS were given the second open-ended question after the finishing the first one. This item includes a chemical reaction meaning photosynthesis. At the end of the paragraph, the researcher asked them why some participants students insisted on the idea that *green* was a required colour during the process of photosynthesis of *non-green* plants. The researcher collect the writings to categorize the *green* colour insistance of PSTS. Here are the categories.

As seen in Table 2, PSTS explained the reason of *green* colour insistance on photosynthesis of *non-green* plants in three categories under the headline of *Natural Environment* and *Social Environment* and *Both Natural and Social Environment*. Half of the participants stated the importance of social effects on construction of photosynthesis and 52 of them explained it using natural effect. 47 of 200 participants explained it using both

social and natural conditions.

Category of Natural Environment

Viewpoints of *Natural Environment* category mainly based on the fact that dominant pigment colour of plants is *green*. P9 and P19 imply that in general people see *green* plants around the living-area in their daily life. This is gradually leads them to the idea that only the *green* plants can make photosynthesis. Similarly P10 emhasizes that *non-green* plants samples connot be found in natural world easily, and therefore people cannot give an example of *non-green* plants concretely.

P3 explains this *green* colour insistance with a comman viewpoint in puplic. In this sense, she believes that it is a general information which is a widely used information indicating that all the plants are *green* without any interrogation among the people. Additionally P13 summurised this viewpoint in his writtings:

Green pigment of plants is mainly based on the colour of chlorophyll which is seen in green. People are tend to explain the plants using with green colour. This preconception leads them to the idea that all the plants are green. As the leaves of the plants are green, people think that only these green parts make photosynthesis.

Category of Social Environment

Half of the PSTS engaged in social combinations of learning photosynthesis with *non-green* plants. This is a critical thinking for explaining the basics of photosynthesis among the society. It is evident that these 101 participants emhasizing the construction process which is mainly can be seen in society. Learning and surely school learning is an obvious viewpoint for this social aspect.

For example, P5, P6, P7, P14, P18, P20 clearly indicated the constant education using the samples of green plants for teaching photosynthesis, and this knovledge was constructed in the cognitive development. P8 and P15 addionally stated that students did not have a deep understanding for photosynthesis, and this problem is mainly based on the school learning which have not got enough content. P11 and P16 cited that even though participants knew the right function of chlorophyll in *green* plants, they could not make mistakes because PSTS thougt that only *green* parts of plants could make photosynthesis. They additionally explained that the constant emphasizing in process of learning photosynthesis resulted in a misunderstanding including that only *green* plants could make photosynthesis.

Category of Natural and Social Environment

Fifty participants in this category highlighting both natural and social effects on learning photosynthesis. In a natural viewpoint, all of 52 students accapted the natural environment effect on learning such concept. According to the *green* colour dominance in understanding the plants, people remember them *green things* at first sight or glance. One of the participant (P2) differently expressed the school textbooks role in this misunderstanding.

Fouth Step

The final technique which was used in this research is group discussion. At the beginning of the discussion the PSTS surely corrected the wrong idea about the photosynthesis function of *green* and *non-green* plants. Six selected PSTS accepted that "*plants make photosynthesis"* instead of "*non-green plants make ….*". Most of them have a parallel viewpoint with the second open-ended categories and themes after the discussion. This is a result of social viewpoint of PSTS. They believe that eventhough this is a biological topic, it has a social connections regarding culture, linguistics, religion, believes, preconceptions, preassumptions and etc.

RESULTS

This study mainly investigates the *green* colour insistance in explaining the phtosynthesis reaction of *non-green* plants. In addition to general feature of plants which identifies that all plants produce glucose, half of 200 PSTS are not aware of the fact. They all made a connection with the common belief and this situation. In accordance with this public understanding, all the plants are *green* and only *green* plants make photosynthesis.

107 of 200 participants accapted the *non-green* plants' photosynthesis function. 26 of them explained this function using alternatives, 12 of them owned this viewpoint in a preconceptive way. 28 of the PSTS could made a useful explanation by deductions. Only 41 students could explained the photosynthesis function of *non-green* plants emphasizing the various *plastides-pigments' rates* in the cellular structure. This scientific knowledge could be written on the sheet by only 41 PSTS. First open-ended questions' written answers point out that most of the PSTS are unaware of the fact that *non-green* plants make photosynthesis using chlorophyll which are very less as compared with *green* plants.

This situation is a valuable step for the second open-ended question of this study. As written answers for the second item content the real reason of why PSTS are unconscious of the photosynthesis function of *non-green* plants. Written answers of 200 PSTS imply that this unconsciousness situation mainly based on the social and natural environment effects on learning. 101 of the 200 PST emphasized the social background, and 52 participants primarly gives importance for environmental

conditions, and 47 of them engaging both natural and social situations. As a natural effect on construction of the photosynthesis function of *non-green* plants, people always and currently see the plants in *green*. This feature is gradually becoming a common sense in the public. Social environment has an important effect on learning such concept related to the *non-green* plants.

DISCUSSION

PSTS' understanding of photosynthesis (Carlsson, 2002) is a general result of this study. Although students may associate science with experimentation, science also uses observations, surveys, and other non-experimental approaches (NIH, 2005: 1). This explantion includes both cognitive-logical and social learnings. According to the Kuhn's seminal work, an increasing number of researchers have focused on the role of laanguage in the construction of scientific cultures (Roth and Lawless, 2002). Piaget's connection with social and logical process of learning (Bodner, 1986) and Vygotsky's emhasizing on language, which is one of the most important element of cultural viewpoint (Carlsen, 2007: 59), are basics to explain this studie's result which includes that most of 200 PSTS prefer to explain the photosynthesis function of *non-green* plants using non-scientific truts to scientific knowledge. Participants' ideas are focusing on social and natural environment combinations to explain the result of first open-ended question.

Green colour dominance of natural environment is another effect on construction of such concepts in logical and social processes. This intensive dual effect on learning photosynthesis and chlorophyll is not only a part of learning in general but also a biological process of the body. Since individuals' interest in an object leads to a higher degree of deep-level understanding (Uitto et al., 2006), intensive green colour of plants around the living-area have an important part in constructing such concepts in cognitive development. This idea has also got a parallelism with Deweyan perspective on learning with experience which occurs contiuously and which has a history (Wong and Pugh, 2001). Since most participants' viewpoint on *non-green* plants' photosynthesis function have connection with natural environment, their explanations regarding social and natural environments' roots is not a momentary knowledge.

Social background in this understanding of such concept is obvious that 148 of the 200 PSTS supported the idea which is mainly based on the school learning including teaching practices and textbooks. Although this is an expected result as such concepts is being learnt during the school learning processes, participants' responsibility in this non-scientific explanations belongs to *non-green* plants' photosynthesis function is an important concern. Just as preperation for their occupation, they could have reached at the top of learning level of photosynthesis in *non-green* plants.

Their recommendations to the school textbooks about the *green colour* and balming *non-green* plants' photosynthesis function problem on their teachers and Turkish Educational System are indicators for us to understant the real reasons of such misunderstanding. Even if Turkish Science and Education Textbooks contents officially used by Ministry of National Education (MEB) that chlorophyll is located in the *green* parts of the plants (MEB, 2008: 186), they can remember the functions of other cellular pigments which are chromoplast and leukoplast.

Conclusion

As a consequence result of this study, *green* is an important word for defining the photosynthesis and chlorophyll in *green* plants. But it has a massive effect on construction process in individuals' social and logical learning processes. Public understanding of *plant* is synonymous of *green* in the society (Yıldıran, 2005). This is inevitably an obstacle for differentiation of *green* and *non-green plants* in their photosynthesis function. As though both have the feature of making photosynthesis using thier different-rate chlorophyll, public understanding of plants' *green* colour is interrupting the other coloured-plants' photosynthesis function. For this reason, haphazard use of *green* and *plants* togather is a needlessly using in learning photosynthesis in *non-green* plants with logically and socialy.

Recommendation

It is clear that understanding the photosynthesis is not an ordinary situation in Science Education. Both Biology and Science Education Textbooks authors have not taken care of this ordinary use of *green* and *plant*. This related use of *green* and *plant* has gradually become an idiome. Today it is widely used as tongue twister without thinking its mis-use in a scientific viewpoint. The authors and teachers need to be careful during the use of *green* and *plants* together for the explanation photosynthesis in chlorophylls.

Implication

This study is focused on PSTS and therefore misunderstanding of photosynthesis in this study can be seen a result of 200 PSTS. For more understanding the *green* insistance on photosynthesis, it should be better for studying with little-aged groups. The researchers can study on document analysis concerning the haphazardous use of *green* and *plants* use deeply. Additionally, *green* is not only a concern at part of Turkish Culture in

learning practices for photosynthesis. Various cultural understanding of *green* and photosynthesis can give us valuable comparison data.

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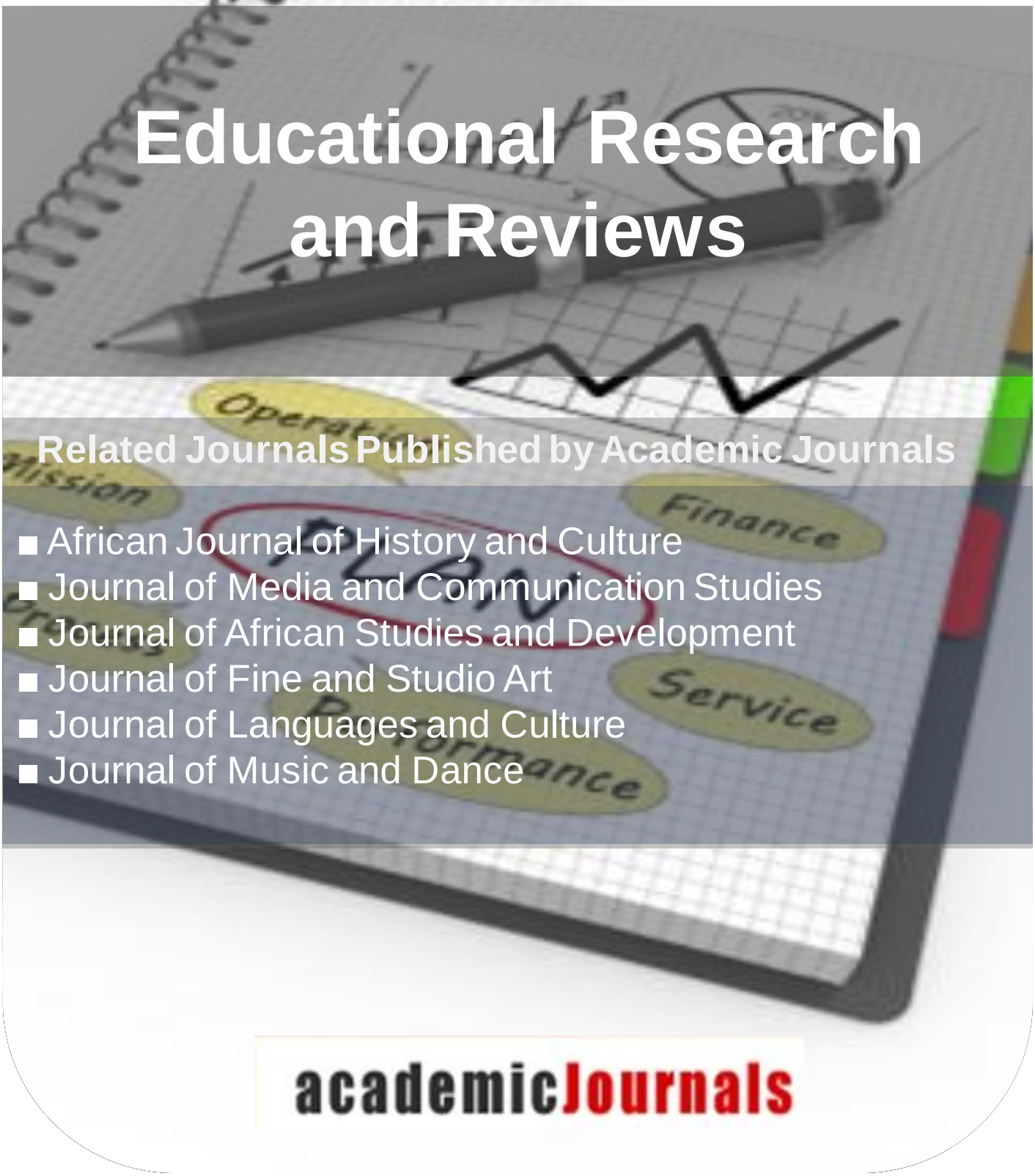

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