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Abstract. *As plants are vital to the survival of the planet, developing positive attitude towards them is important for protection of plants, biodiversity, and the environment. The aim of this research was to determine the predictors of ninth grade students' attitude towards plants. In the study, a descriptive correlational design was used. The data were collected from 773 upper-secondary students selected through stratified-purposive sampling. The "Plant Recognition Test" and "Plant Attitude Scale" were used as data collection tools. Multiple regression analysis was performed to determine the way different variables predicted attitude towards plants. The results of research indicated that the linear relationship between predictive variables and attitude towards plants explained 14% of the total variance in attitude towards plants at a significant level. Among the variables, gender, time spent in a garden, involvement in indoor or outdoor cultivation, experience with picking flowers, fruits, and/or vegetables, and plant recognition level had significant contributions to predicting variance in attitude towards plants, and the recognition of plants was determined to be the most important predictor relative to all the other variables.*

Keywords: *descriptive correlational design, plant recognition, secondary education*

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THE PREDICTORS OF NINTH GRADE STUDENTS' ATTITUDES TOWARDS PLANTS

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Introduction

Plants play a major role in maintaining the balance of life on earth, not only for humans but for all living things. However, despite the improvements in quality of life that have been achieved through developments in technology and industry, the need for more residential areas due to the growth in world population have threatened the number of green spaces. This reduction of green spaces in cities limits the interaction people have with nature and prevents them from knowing more about it. It has been shown that plant recognition levels have decreased today compared to those of the past (Ju & Kim, 2011). A positive correlation exists between the efforts individuals make towards protecting nature and being responsible stewards and the extent to which nature is recognized by people. The first and most important step towards achieving better recognition levels is to have people experience nature. In other words, living in harmony with nature helps individuals to know more about it.

The attitudes and perceptions individuals have about the environment have been reported to be largely shaped by their attitudes and perceptions about experience with living organisms (Tunnicliffe & Reis, 2000). Attitude is defined as "the pre-disposition of a mental, emotional and behavioural reaction organized by the individual based on their experience, knowledge, emotion and motivation towards any object, social subject or event" (Inceoğlu, 2010, p. 13). A positive attitude generally translates into positive behaviour towards the object of attitude (Aydın, 2002), as the individual who has a positive attitude towards an object will tend to behave positively towards that object, sympathize with it, support and help it (Taylor et al., 2007). Therefore, the positive attitude individuals have towards plants shapes their behaviours in a positive way and contributes to the protection of plants, biodiversity, and the environment. Current and future generations can have a better understanding of the meaning of biodiversity and its relationship to the natural environment by gaining awareness about plant species (Lindemann-Matthies, 2006), as the interest and care shown to organisms have been reported to increase as students learn more about them (Lindemann-Matthies, 2005). Prokop et al. (2016) reported that the use of live plants in botanical lessons, considering their fruits, colours and toxicity, was effective in improving students' knowledge and attitudes. It was also stated that the use of toxic plants

in botany is effective in increasing interest in plants as it creates a perception of survival in individuals (Prokop & Fančovičova, 2018), also survival-relevant information and fruit coloration enhance the retention of knowledge (Prokop & Fančovičova, 2014). Using some interesting examples of useful plants (Pany, 2014) and interesting features of plants (Strgar, 2007) can increase students' interest in plants.

Research Focus

While science education literature includes studies examining students' knowledge and understanding of plants, these studies tend to focus heavily on plant growth, development, nutrition and photosynthesis (Barman et al., 2003; Barman et al., 2006; Fančovičova & Prokop, 2010; Köse et al., 2006; Köse et al., 2009). In research conducted with students that aimed to examine their ability to name and recognize plants, students were shown to have limited knowledge and ability on this subject (Barman et al., 2003; Barman et al., 2006; Bebbington, 2005; Gatt et al., 2007; Patrick & Tunnicliffe, 2011; Tunnicliffe & Reiss, 2000; Türkmen et al., 2003). In addition, many studies have shown that children and adults are more interested in animals than in plants, and that their perceptions and attitudes towards plants are generally indifferent (Fančovičova & Prokop, 2010, 2011a; Schussler & Olzak, 2008; Strgar, 2008; Tunnicliffe, 2001; Tunnicliffe & Reis, 2000; Wandersee, 1986; Wandersee & Schussler, 1999) as "plant blindness", meaning that plants are given secondary importance, and that individuals have a lack of awareness about plants and are unable to comprehend the importance of plants on earth and to evaluate the unique biological features of life forms belonging to the world of plants. In other words, plant blindness refers to the inability of individuals to recognize plants in their daily lives and to take care of them and an overall lack of focus on plants (Wandersee et al., 2006). Parsley (2020) proposed the term "plant awareness disparity" instead of the term "plant blindness". She stated that the term plant awareness disparity is more appropriate because it is not a disability metaphor, it does not mean that people have never seen plants, and this situation can be corrected by education. Also, the concept of disparity means that people do not notice the plants around them as often as animals. It has been stated that the disparity in this term leads to individuals who do not have an interest and positive attitude towards plants and do not appreciate the importance of plants. This is especially concerning considering that "plants are vital to the survival of the planet, in terms of ecology, biodiversity and climate" (McCormick & Tijan, 2010, p.1021). The protection of plant diversity can only be achieved by loving and recognizing plants, and by developing a positive attitude towards them (Allen, 2003).

In the literature, there are a few studies examining the variables governing the students' attitudes towards plants. Lohr and Pearson-Mims (2005) found that both passive and active interactions with plants in childhood were effective factors in the positive attitudes of individuals towards trees. Krosnick et al. also (2018) stated that the experience of growing their own plants increased the students' interest in plants. Fancovicova and Prokop (2010) found that students living in garden houses had more positive attitudes towards plants, but there was no difference in terms of gender. Also, Strgar (2008) and Kaplan and Topsakal (2013), revealed that students' gender does not affect attitudes towards plants. However, Lohr and Pearson-Mims (2005) and Özel et al. (2013) concluded that female students' attitude towards plants is more positive in terms of gender. In another research (Özarslan, 2019) it was determined that the general attitude scores of gifted and talented students towards plants were significantly higher than the attitude scores of the students with normal development. By determining the dynamics of attitude towards a specific subject, it is possible to gain a better understanding of how attitudes function and to observe the attitude change processes; with this information, the behaviours of individuals can be altered through the influence of their attitudes (Baysal & Tekarslan, 1996). Therefore, it is important to determine the factors that affect the attitude towards plants. Previous studies have emphasized different variables that affect the attitude towards plants. In this research, the variables that are stated to be effective on attitudes towards plants in the literature were considered and it was examined how much these variables together predicted the attitude towards plants.

Research Aim and Research Question

The aim of research was to determine the predictors of ninth grade students' attitudes towards plants. To achieve this, present study sought the answer to the following question: Do gender, the presence of a home garden, the presence of a green field around the home, experience with indoor or outdoor cultivation, spending time in a green field and/or picking flowers, fruits, and vegetables, grades in school, and plant recognition level significantly predict ninth grade students' attitudes towards plants?



Research Methodology

General Background

A descriptive correlational design was used to identify the relation between variables affecting the attitudes towards plants. Descriptive correlational designs describe variables and investigate nature of relations between and among variables (Sousa et al., 2007). The research was carried out during the spring semester of the 2015/2016 academic year.

Sample

The research sample included 773 ninth-grade students from three different socio-economic regions of Ankara who were selected through stratified-purposeful sampling. Bujang et al. (2017) reported that "minimum sample size of 500 or more will yield reliable and valid sample estimates for the intended population" for performing multiple regression analysis. Therefore, all 9th grade students in selected schools were included in the sample, considering that there may be missing data. Prospective research participants were informed about the research before data collection. The principle of voluntary participation was taken into consideration. Participants identity was protected using anonymity and confidentiality. The distribution of the students by grade and gender is given in Table 1.

Table 1

The Students' Distribution by School and Gender

School	Gender		Total
	Female	Male	
School A (High grades)	104	81	185
School B (Average grades)	170	117	287
School C (Low grades)	154	147	301
Total	428	345	773

Instruments and Procedures

Personal Information Form

The aim behind the use of the personal information form was to collect information about the independent variables considered to be related to the attitude towards plants. Lohr and Pearson-Mims (2005) found that both passive and active interactions with plants in childhood were effective factors in the positive attitudes of individuals towards trees. As in the stated research to determine the students' passive and active interactions with plants, questions about the presence of a home garden, a green field around the home, experience with indoor or outdoor cultivation, spending time in a green field, and picking flowers, fruits and/or vegetables were included on this form. For all the questions on this form, a 4-point Likert-type scale, with response options of "Often", "Sometimes", "Rarely" and "Never", was used. For the analysis of data "Often" was coded as 4, "Sometimes" was coded as 3, "Rarely" was coded as 2 and "Never" was coded as 1.

Plant Attitude Scale

The Turkish version of the Plant Attitude Scale (PAS), originally developed by Fancovicova and Prokop (2010), with 29 items arranged under four factors, 'interest', 'importance', 'urban trees' and 'utilization', was used in this study to understand the students' attitudes towards plants. The scale was adapted by Selvi (2012) for use in the Turkish culture. The alpha internal consistency coefficients calculated for the scores obtained from the 28-item Turkish version were .76 for the interest factor, .75 for the importance factor, .58 for the urban trees factor, and .59 for the utilization factor.



The alpha internal consistency coefficients calculated for the scores obtained from this study are .81 for the interest factor of the scale, .73 for the importance factor, .78 for the urban trees factor, and .61 for the utilization factor.

Plant Recognition Test

For the plant recognition test, three faculty members who are experts in seed plants were consulted for their opinions. The plants that the students were familiar with and most likely to have encountered in their environment were selected. Rather than being interesting or having a distinctive feature, the criteria for the selected 22 plants were plants that students would regularly see in gardens, parks or streets around them. The test included two pictures of each of the first 12 plants, with one of the pictures being presented at a wide angle to allow all the parts to be seen clearly, and the other being presented with its fruit, flower and leaf. For the other ten plants, one picture was considered to be sufficient for recognition in order to increase the intelligibility of the pictures. Special attention was given to making the pictures as clear and intelligible as possible. A space was provided under each of the pictures for the names of the plants to be written. Plants included in the test are given in Table 2.

Table 2

Plants Included in Plant Recognition Test and Percentage of Plants Recognized

Latin Name	English Name	Percentage of plants recognized
<i>Rosa sp.</i>	Rose	97.5
<i>Matricaria sp.</i>	Daisy	95.8
<i>Morus alba</i>	Mulberry tree	82.6
<i>Eleagnus sp.</i>	Elaeagnus	74.1
<i>Parthenocissus tricuspidata</i>	Ivy	45.2
<i>Viola sp.</i>	Violet	43.3
<i>Taraxacum sp.</i>	Dandelion	40.8
<i>Pinus sp.</i>	Pine tree	37
<i>Populus sp.</i>	Poplar tree	35.5
<i>Salix sp.</i>	Willow tree	34.3
<i>Aesculus hippocastanum</i>	Horse chestnut	33.8
<i>Syringa vulgaris</i>	Lilac	29.8
<i>Lonicera etrusca</i>	Honeysuckle	23.8
<i>Platanus sp.</i>	Plane tree	14.6
<i>Robinia pseudoacacia</i>	Locust	10.4
<i>Cercis siliquastrum</i>	Redbud	6.7
<i>Pyracantha sp.</i>	Scarlet firethorn	4
<i>Cupressus sempervirens</i>	Cypress	2.9
<i>Ligustrum sp.</i>	Prie	1.2
<i>Cedrus pinaceae</i>	Cedar tree	0.4
<i>Senecio sp.</i>	Senecio	0.1
<i>Xanthium spinosum</i>	Cocklebur	0



The prepared test was organized in line with the opinions of expert faculty members, and a pilot study was conducted with 32 ninth-grade students to confirm the face validity of the test. In this pilot study, the students were asked about the intelligibility of the pictures, and all of them indicated that the pictures were clear and understandable.

Data Collection

The data collection tools were administered to students during their lessons, and it took approximately 25 minutes for each of the students to complete them.

Data Analysis

The extent to which the data collected about (a) gender, (b) presence of a home garden, (c) green field around the home, (d) experience with indoor or outdoor cultivation, (e) spending time in a green field, (f) picking flowers, fruits, vegetables, (g) school grades and (h) the plant recognition level predicted the attitude towards plants was analysed by multiple regression analysis. In this research, Pearson correlations between all variables were calculated to understand the structure of the correlation between variables.

Multiple regression analysis was performed to determine the degree to which each variable contributed to the attitude towards plants. For multiple regression analysis, normality was examined by measures of central tendency, Skewness-Kurtosis values and graphical interpretation, and they all showed normal distribution. Variance inflation factor (VIF) values were examined to determine whether the predictor variables had multicollinearity among themselves. The VIF values of the predictor variables should be lower than 5 (Büyüköztürk, 2012). In this research it was found that the VIF values for the predictor variables ranged between 1.05-1.81, and there was no collinearity on the regression model.

In order to provide a detailed view of the strengths of the relationships between the dependent variable (attitude towards plants) and predictors (gender, presence of a home garden, a green field around the home, experience with indoor or outdoor cultivation, spending time in a green field, experience picking flowers, fruits, and/or vegetables, plant recognition level, and school grades), the standard input procedure (enter method) was used, where independent variables are entered and evaluated as a block in one step. The analyses of data were carried out using SPSS version 22.0.

Data Management

For the multiple regression analysis, two dummy variables were created to determine the relation between attitude towards plants and the students' grades in school. In the first dummy variable, students with high school grades were encoded as 1 and the others as 0. In the second dummy variable, students with low school grades were encoded as 1 and the others as 0.

Research Results

Pearson correlations were calculated to determine whether there was a significant relationship among the variables of the study. The results of Pearson correlations are shown below in Table 3.

Table 3
Inter-Correlations for Attitudes towards Plants and Other Variables

Variables	1	2	3	4	5	6	7	8	9	10
1. Attitudes towards plants	-									
2. Gender	.084*	-								



Variables	1	2	3	4	5	6	7	8	9	10
3. Presence of home garden	.102*	.034	-							
4. Green area around the home	.084*	.103**	.278**	-						
5. Spending time in green area	.191**	.087*	.067	.141**	-					
6. Indoor or outdoor cultivation	.230**	.012	.086*	.049	.001**	-				
7. Picking flowers, vegetables and fruits	.228**	.084*	.038	.015	.212**	.386**	-			
8. Plant recognition	.268**	.106**	.085*	.125**	.083*	.099**	.088*	-		
9. High school grades compared to average and low grades-DV 1	.130**	.014	.016	.083*	.009	.039	.063	.478**	-	
10. Low school grades compared to high and average grades-DV 2	.110**	.072*	.016	.010	.020	.024	.062	.579**	.448**	-

* $p < .05$ ** $p < .01$

As shown in Table 3, the attitude towards plants is significantly correlated with gender, presence of home garden, a green field around the home, spending time in a green field, indoor or outdoor cultivation, picking flowers, fruits, and/or vegetables, plant recognition, high school grades compared to average and low grades (Dummy variable 1) and low school grades compared to high and average grades (Dummy variable 2). All of the correlation values were determined to be positive.

Results of the data analysis showed that the female students had more positive attitudes towards plants than those of the male students. Furthermore, the students who had home gardens, had a green field around their home, engaged in indoor or outdoor cultivation, spent more time in a green field, and had the experience of picking flowers, fruits and/or vegetables had attitudes towards plants that were more positive. Similarly, the attitudes of the students who could recognize the plants in their neighbourhoods were more positive, and the students with high school grades had more positive attitudes towards plants than those with average and low grades (Dummy variable 1), while the attitudes of those with high and average school grades were more positive than those with low grades (Dummy variable 2).

In Table 4 below the results of the multiple regression analysis show that the linear relationship between the predictive variables and attitude towards plants significantly explained 14% of the total variance (adjusted $R^2 = .14$), in the attitude towards plants ($F_{(9,773)} = 12.102, p < 0.05$).

Table 4

B and Beta Correlation Coefficients and Significance Levels of the Variables

	B	Standard Error	β	t	p
Gender	-2.303	.879	.100	2.621	.009
Presence of home garden	-.984	.892	.043	1.103	.270



	B	Standard Error	β	<i>t</i>	<i>p</i>
Green area around the home	-1.002	1.251	.032	.801	.423
Spending time in a green field	1.664	.561	.116	2.968	.003
Indoor or outdoor cultivation	1.461	.478	.125	3.058	.002
Picking flowers, vegetables and fruits	1.849	.559	.137	3.307	.001
Plant recognition	.679	.171	.199	3.970	.0001
High school grades compared to average and low grades -DV 1	.868	1.222	.031	.710	.478
Low school grades compared to high and average grades -DV 2	.654	1.112	.028	.588	.557

As shown in Table 4, only gender, spending time in a green field, indoor or outdoor cultivation, picking flowers, fruits, and/or vegetables, and plant recognition have a significant contribution to predicting the variance in attitude towards plants. Standard β values on Table 4 show that the recognition of plants is a relatively important predictor of attitude towards plants.

Although Pearson correlations revealed that having a home garden and a green field around home, high school grades compared to average and low grades (Dummy variable 1), and low school grades compared to high and average grades (Dummy variable 2) had significant relationships with the attitudes towards plants, when entering the other variables into the regression model, these did not significantly contribute to explaining the variance in attitude towards plants. This could have resulted from the correlations of other variables with the plant recognition level.

When the plant recognition percentages of the students given in Table 2 are examined, it is seen that their plant recognition levels are low. On average 7.6 plants recognized correctly out of 22 plants ($\bar{x} = 7.6$, $SE = .12$). Over 70% of students recognized rose, daisy, mulberry and elaeagnus. Other plants are not recognized by more than half of the students. There is no plant recognized by all students. The cocklebur was not recognized by any of the students.

Discussion

In this research, the predictors for ninth-grade students' attitudes towards plants and the degree of simultaneous relationship between attitude towards plants and other variables, including gender, the presence of a home garden, having a green field around the home, indoor or outdoor cultivation, spending time in a green field, picking flowers, fruits, and/or vegetables, plant recognition, and school grades, were examined.

The results of the research reveal that female students have more positive attitudes towards plants than those of male students. Similarly, Lohr and Pearson-Mims (2005) and Özel et al. (2013) report that females' attitudes towards plants are more positive than those of males. However, in contrast to these, Fancovicova and Prokop (2011a) and Kaplan and Topsakal (2013) and Strgar (2008) concluded that gender is not effective in students' attitudes towards plants. The result in this research that the females have more positive attitudes towards plants than males can be attributed to the interest in the plant as mentioned in some studies (Gatt et al. 2007; Schussler & Olzak 2008).

In the study, the attitudes of the students who had a home garden and a green field around their home, engaged in indoor or outdoor cultivation, spent more time in a green field, had the experience of picking flowers, fruits and/or vegetables, and knew more about the plants in their close environment, are more positive. In addi-



tion, it is observed that the students with high school grades have more positive attitudes towards plants than those with average and low grades, and that students with average and high school grades have more positive attitudes towards plants than those with low grades. Furthermore, it was determined that only gender, spending time in a green field, indoor or outdoor cultivation, picking flowers, fruits, and/or vegetables, and plant recognition level have a significant contribution to predicting variance in attitude towards plants. This finding is in line with the research results reported by Lohr and Pearson-Mims (2005), who state that individuals' first-hand experiences in the past affect their attitude towards plants. They specifically examine the effect of childhood experiences, in terms of children's active and passive relationships with nature, on attitudes towards trees in adulthood, and report that while both passive and active interactions with plants in childhood have an impact on the individuals' positive attitudes towards plants, being in an active relationship with nature through gardening or picking vegetables has a more significant effect on individuals' positive attitude towards plants during adulthood. In addition to this, the same study states that being raised in an urban environment, one with such features as skyscrapers, has a negative effect on attitudes. Similarly, Fancovicova and Prokop (2011a) reported that students with a home garden have more positive attitudes towards plants.

In the present study, it has been determined that the predictive variables explained only 14% of the total variance in attitude towards plants, with most of the variance (86%) remaining unclear, meaning that different variables must be explaining the remaining variance. As attitude has cognitive, affective, and behavioural dimensions the strength of these components differs according to the attitudes informing them. Students' attitudes towards plants could be related to their environmental attitudes, considering that a person's attitudes and perceptions about the environment are basically shaped by their attitudes, experiences and perceptions about living organisms (Tunnicliffe & Reis, 2000). On the other hand, since attitudes have not only affective but also cognitive components, it has been suggested that it would be easier for children to develop positive attitudes towards plants by teaching them meaningful ideas about the subject (Hadzigeorgiou et al., 2011).

The recognition of plants, one of the variables discussed in this study, has been found to be a more important predictor of attitude towards plants than that of other variables. This could be attributed to the fact that when children are taught about nature and how to be responsible individuals and to protect the environment, they must also, whether indirectly or directly, be informed about the common organisms in their environment (Bebbington, 2005). However, results from the students' plant recognition tests showed that the students' levels of recognizing plants were low in general. This finding is in line with those reported by research (Bebbington, 2005; Civelek, 2012; Haymana Ulucanli, 2009; Fančovičová & Prokop, 2011a; Kaasinen, 2019; Lückmann & Menzel, 2014; Mercan & Köseoğlu, 2019; Yüce & Dođru, 2018; Wyner & Doherty 2019) reveals that the level of participants' plant recognition is low. Considering the characteristics of the plants that are highly recognized by the students in the present research, it is seen that these plants have either flowers used as ornamental plants or edible fruits. Similarly, Fančovičová & Prokop (2011b) found that children recognize better about plants with edible fruit. More recognition of these plants may be due to the students' experiences and memories for them (Kaasinen, 2019) or the characteristics of the plants such as colourful flowers or outstanding fruits (Tunnicliffe, 2001). It has been reported that the characteristics of plants such as smell, colour, pattern, scale and floristic features are effective in attracting the attention of individuals (Sanders, 2007). Some plants are less recognized by students. Inability of students to recognize these plants may be due to the fact that as stated by Kaasinen (2019) they do not have distinctive features or have no special meaning for students. Lückmann and Menzel (2014) also noted, poor knowledge about plants may be derived from the lack of interest in plants among young people, since in this period, social interaction is more important. In addition, the reduction of urban green spaces limits the opportunities to experience nature and to learn more about the environment, for both adults and children (Ju & Kim 2011). The decreased contact that children and young people have with nature also affect their knowledge about nature (White, 2004). For this reason, it has been argued that children today have less information about the natural environment than that of their own parents (O'Brien, 2010). As mentioned above, both the lack of interest in plants and the limitation of their experiences with nature can be said to be effective in individuals' attitudes towards plants. Studies have shown that teachers can increase the students' interests and improve their attitudes towards plants by showing the plants from new perspectives and using appropriate methods and field knowledge (Çil, 2015, 2016; İri & Çil, 2020; Strgar, 2007). It has been further shown that students' interest in living organisms will increase and they will care about them more as they get to know the organisms (Lindemann-Matthies, 2005).



Limitations

The present research revealed that the predictive variables explained a small part of the total variance in attitude towards plants. This low explanatory power is a limitation of this research. This suggests that there are other unexplored variables that contribute to the attitude towards plants. It is known that many factors play a role in the formation and development of attitudes, such as personality, family, education, socialization, economic status and social class, mental and informational factors, physiological factors, peers, group membership, experience, living environment and place, cultural effects, profession, personal motivation, special interests, and mass media. Further research can examine other variables, in addition to those discussed in this study, that may affect attitudes towards plants.

Conclusions and Implications

In this research it was found that the active interactions individuals have with plants, such as spending time in a green field, indoor or outdoor cultivation, picking flowers, fruits, and vegetables, and plant recognition level significantly contributed to predicting the variance in attitude towards plants. It could be argued that students, from primary school to university, have not had the opportunity to gain awareness and develop positive attitudes towards plants because lessons are not designed to familiarize students with the plants around them, nor do they provide opportunities for interaction with the environment. Therefore, in order to realize the importance of the natural environment, plants and biodiversity, individuals, starting at an early age, should be provided first-hand experience with plants and educational activities should be developed to facilitate this experience.

Given that the results from this study showed the level of recognizing plants to be a relatively more important predictor of attitude towards plants, teachers should be trained in developing this skill in students, as studies have shown that teachers can generate greater engagement and interest from students by presenting plants from new perspectives and with appropriate methods.

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