

University students' behaviors pertaining to sustainability: A structural equation model with sustainability-related attributes

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The purpose of this study is to construct a structural equation model to examine the links among attitudes, values, and behaviors pertaining to sustainability, participation in outdoor recreation as well as gender and tendency to follow mass media for university students. The data were collected by on-line administration of a survey to 958 students at Middle East Technical University during February-June of 2008. It needs to be stressed that gender emerged as a strong factor explaining sustainability-related attributes. It was reflected that female students having higher tendency to follow media held more favorable attitudes and behaviors toward sustainable life styles, and more ecocentric values. Furthermore, attitudes and values were found to be significant determinants of university students' behaviors pertaining to sustainability. It was also reported that higher tendency to follow media yielded more favorable attitudes, higher levels of ecocentric values, and engagement in outdoor recreational activities such as walking in nature, bird watching, and camping. These results implied that the university campus should be well equipped with the necessary infrastructures that will satisfy the needs and encourage female students as well as male students to motivate them take appreciative outdoor activities. A gender perspective should be integrated into existing mainstream institutions and all programmatic areas or sectors, including education in order to hinder gender inequality. In addition, during the rehabilitation of sustainability issues in higher education institutions, favorable attitudes and values of university students should be regarded as an auxiliary agent.

Key Words: education for sustainable development, attitudes, values, behaviors, university students

Introduction

To overcome problems emerging with unsustainability, education and educational cooperation has been viewed as an important factor. A worldwide action plan, namely Agenda 21 accepted at the Earth Summit in 1992 proposed that education is critical for promoting sustainable development and improving the capacity of human beings to address sustainability issues (UNCED, 1992). A later document, the World Summit on Sustainable Development (WSSD) in Johannesburg also points out the importance of education to meet the basic needs of all including the future generations (WSSD, 2002). These declarations highlighting the crucial role of education as a key element for sustainability also recommended reorientation of education towards the require-

ments of sustainable development. In this aspect, it has been advocated that considering sustainability issues in higher education sector is a necessity to build sustainable societies (Fien, 2002; Boyle, 2004).

Due to the complex nature of sustainability, the task of infusing sustainability within education sector however, has been viewed as a great challenge (Murray & Murray, 2004). The core idea behind the fulfillment of this task lies under the proposed definition of 'education for sustainable development'. Education for sustainable development has been portrayed as an agent that enables people to develop knowledge, values, and skills in order to engage in activities that will improve the quality of life now and without damaging the planet for the future (Council for Environmental Education, 1998). In the light of this point of view, Dyer and Selby (2004) indicated that an individual should possess the knowledge, skills, attitudes, and values required for living and working in a sustainable manner. It has been argued that these attributes that form the basis of education for sustainable development could aid academics create a framework to infuse sustainability consistently within the educational institutions (Murray, Goodhew & Turpin-Brooks, 2006).

Highlighted by literature review, the present study could be regarded as an attempt to clarify the complex nature of university students' behaviors pertaining to sustainability and to examine a number of variables associated with these behaviors based on a social psychological approach. In other words, this paper focuses on demonstrating the range of factors effecting behaviors pertaining to sustainability and provides empirical evidence from a data set collected from a public university in a developing country. Thus, this study shed light to some major concerns that will guide infusion of sustainability into higher education sector.

Values and Attitudes as Significant Predictors of Behaviors

The nature of university students' behaviors pertaining to sustainability change with a number of variables associated with these behaviors based on a social psychological approach. There are number of factors having some roles on behaviors pertaining to sustainability and constructing empirical evidence through a data set may shed light to some major concerns which will guide infusion of sustainability into higher education sector. The authors highlighted the research associated with behavioral changes toward sustainability were Gross (2005, p.350) and Rokeach (1976, p.112) stating that, a 'value' is "conceptualized as a sense of what is essentially important, good or valuable to individuals". It has been advocated that 'values' as a cognitive element accompanied by 'beliefs' and 'attitudes' are associated with 'behaviors'. As pointed out by Barr (2003), 'values' and 'attitudes' have been used interchangeably in constitution of the same psychological construct. However, 'attitude' has been viewed as "manners of acting, feeling, or thinking that show one's disposition or opinion" (Philipp, 2007) which differs from the concept of 'value' in meaning.

In order to clarify the conceptualizations of these psychological constructs, Murray and Murray (2007) used the following exemplification. Racist attitudes, for instance may be originated from the value of 'superiority' accompanied with a belief that one particular race is superior to any other. In this way, these attributes may result in a predisposition to behave in a racist manner. Consequently, Murray and Murray (2007) argued that it is compulsory to alter racists' attitudes by facilitating them challenge their own values and attitudes.

One of the simplistic behavioral models examining the relationships among values, attitudes, and behaviors was figured out by Oskamp (1991) (Figure 1). However, further questions were formulized about the connections of the three components. Gross (2005, p. 351) asked "*Are values the central influence on behavior or do values and beliefs blend together to form the attitudes that contribute to behavior?*". Consecutively, Murray and Murray questioned "*Is the sys-*

tem closed, or can external intervention at any point (like legislation) adjust values and beliefs sufficiently to alter behavior?". It is a very complex task to reach answers of such questions, but the critical point is that values and attitudes play crucial roles in shaping behaviors.

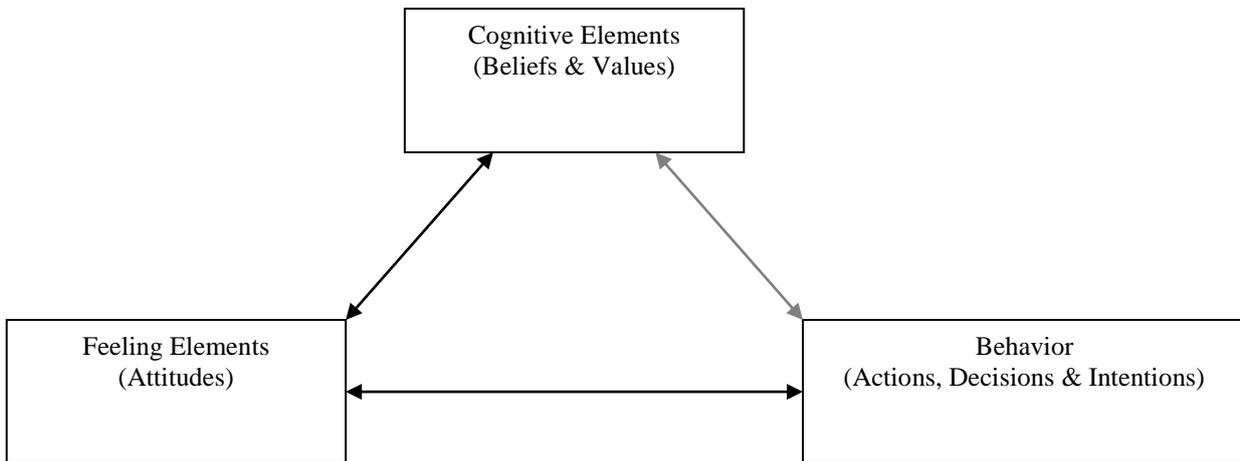


Figure 1. Tri-component Model of Behavior (Oskamp, 1991, p. 8)

A Closer Look into Values

To better grasp the interrelationships among these psychological constructs, we could carry on with a closer look into categorizations of values and their association with human behavior. Considering the basic definition of ‘values’, the literature review has shown three different continua of values examined to explain the process of engagement in a pro-environmental action. Usefulness of two value categorizations proposed by Schwartz and Blisky (1987) and Schwartz (1992) have been supported by a number of researchers (e.g Stern, Dietz & Guagnano, 1995; Corraliza & Berenguer, 2000) in the field of environmental psychology. It was advocated that fundamental values could be placed on a continuum varying from ‘conservative’ to ‘openness to change’ and from ‘egoism’ to ‘altruism’. Some research studies (Stern, Dietz & Guagnano, 1995; Corraliza & Berenguer, 2000) indicated that individuals who held altruistic orientation and were open to change had higher tendency to demonstrate a pro-environmental action. As supported by Barr (2003), these arguments could facilitate conceptualization of the connection between social value dimensions and pro-environmental behaviors.

Another value continuum ranging from ‘biocentrism’ to ‘anthropocentrism’ was identified by Dunlap and Van Liere (1978), Dunlap, Van Liere, Mertig, and Jones (2000), and Schwartz (1992). Concisely, anthropocentrism can be portrayed as the dominance of human beings over nature, and supports a belief that nature is obviously for human use and has no intrinsic value. On the other hand, biospherism characterizes human-nature interaction as egalitarian and attributes intrinsic value to nature. The evidence provided by Steel (1996) implied that those individuals with biospheric value orientation were more likely to take part in pro-environmental behaviors.

In the context of environmentalism, belief driven values were also used to explain human behaviors. Technocentrism, also stated as anthropocentric mode, was that unlimited human

progress could be achieved through the exploitation of nature's infinite resources (Merchant, 1980). In addition, it has been advocated that environmental problems emerge as a result of a lack of technological development and modern world with a progress in technology will resolve environmental conflicts. On contrary, ecocentrism or nature-centered views support the idea that non-human nature has intrinsic value apart from its contributions to human development (Devall and Sessions, 1985). Furthermore, in line with this view, the integrity of natural ecosystems should be saved while resolving the conflicts between society and nature in a process of human development (Egri and Pinfield, 1996). The impact of belief driven values was reported by Gagnon Thompson and Barton (1994) in such a way that *"because the values underlying anthropocentric's support of the environment are human-centred and basically utilitarian, they will be less likely to act to protect the environment if other human-centred values such as material quality of life or the accumulation of wealth interfere. Ecocentric individuals, however, will act to support the environment even if these actions involve discomfort, inconvenience, and expense that may reduce their material quality of life"* (p. 150).

Interrelations among these three different categorizations of human values were also summarized by Gagnon Thompson and Barton (1994) and it was reported that anthropocentric values are similar to Stern et al.'s (1993) egoistic and social-altruistic values, whereas ecocentric values are similar to biospheric values.

In the context of sustainability, Leiserowitz, Kates and Parris (2005) linked environmental values in a continuum ranging from anthropocentrism to ecocentrism with the process of sustainable development in that whether global values support this process or not. Considering the relationship between values and behaviors, researchers (Steel, 1996) have shown that favorable values toward the environment have positive influence on environmental activism. More specifically, an individual that believes intrinsic value of nature is likely to be more pro-environmental. In line with these studies, Barr (2003) concluded that there is little doubt on the role of values in behaviors supporting environmental sustainability. However, he added that there is still a question on how values could shape these actions; directly or indirectly.

The Role of Attitudes in the Context of Behavioral Theories

To grasp the nature of behaviors pertaining to sustainability, attitudes have been studied by a number of researchers (Tarrant & Green, 1999; Van Liere & Noe, 1981). To fully comprehend the complex mechanism of a particular behavior, and to have individuals demonstrate behaviors toward sustainable life styles, theories of attitude-behavior connection have been applied widely in education for sustainable development and environmental education research. Although high levels of attitudes were recorded, some research studies failed to demonstrate translation of attitudes into more favorable behaviors. Consistently, Kollmuss and Agyeman (2002) proposed that individuals' attitudes toward the environment have been demonstrated to have a varying and usually very small association with their pro-environmental behaviors. These authors also added that this situation was unforeseen since researchers were more likely to assume that people make their life choices according to their attitudes, beliefs, and values. Early simplistic linear models of pro-environmental behaviors were portrayed based on this basic assumption. More specifically, it was pointed out that enhancing knowledge would directly lead to an increase of awareness or attitudes, which would also result in more favorable environmental behaviors (Figure 2). However, research conducted over the past 30 years proves this model to be wrong.

Taking a closer look at the theories of attitude-behavior connection, Ajzen and Fishbein (1980) in their Theory of Planned Behavior propose that attitudes are not direct predictors of behaviors, but they impact behavioral intentions, and this construct together with perceptions of behavioral control could explain a significant amount of variance in actual behaviors. It was also

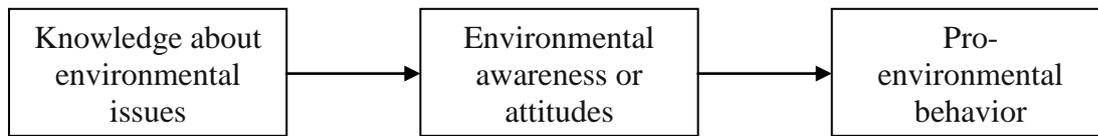


Figure 2. Traditional Assumption on Pro-environmental Behavior

maintained that intentions to perform behaviors are not solely determined by attitudes toward the behavior, but subjective norms and perceived behavioral control are shown to be related to intentions. In line with Ajzen and Fishbein's theory of planned behavior, Hines, Hungerford and Tomera (1987) asserted their Model of Responsible Environmental Behavior. Regarding the attitude-behavior association, these researchers concluded that individuals with favorable attitudes toward the environment had a higher tendency to engage in pro-environmental behavior based on their meta-analysis of 128 responsible pro-environmental behavior research studies. However, the strength of the relationship between these constructs was found to be weak.

Outdoor Recreational Activities Acting on Attitude-Behavior Association

Considering the theories on attitude-behavior connection, Tarrant and Green (1999) discussed basic reasons why attitudes may not influence behaviors and also attributed poor attitude-behavior association to a group of agents including the impact of external factors on behavioral explanation. In this aspect, there has been a shift in attitude-behavior research toward investigation of external factors acting on attitude-behavior association. Participation in outdoor recreation has emerged as an attribute which plays impressive roles in mediating the linkage between attitude and behavior. Hendee (1969), on the other hand advocated a clear distinction between 'appreciative' and 'consumptive' recreation. Appreciative recreation such as hiking or bird watching does not disturb the natural setting whereas consumptive recreation such as hunting or fishing uses resources from the environment. Research studies (Dunlap & Hefferman, 1975; Van Liere & Noe, 1981) reported that appreciative outdoor activities were significantly associated with pro-environmental attitudes. In the light of literature review, we believe that it is worth studying the interrelationships among sustainability-related variables, namely attitudes, behaviors, and participation in appreciative outdoor recreation.

The Role of Situational Factors on Individuals' Behaviors

In addition to values and attitudes, there is a group of variables associated with behaviors which could be viewed as situational factors. This study focused on two variables which fall into this category in order to see their impact on behaviors. The first one, namely tendency to follow mass media has been considered as an important part of informal education sector. Moreover, Leiserowitz, Kates and Parris (2005) advocated that mass media is an impersonal force that drives the long term changes in individuals' attitudes, values, and behaviors toward sustainable life styles. In this aspect, the current study tends to address the role of Turkish mass media in shaping the future of a society towards sustainability.

The second situational factor, gender has been considered in a number of research studies in the context of determinants of sustainability-related variables. For instance, The Future Leaders Survey (Forum for the Future, 2006/2007) highlighted that men and women had stark differences in attitudes and behaviors toward more sustainable life styles. This report stated that women were more likely to hold feelings of concern towards survival of humanity, willingness to

change their life styles radically, and readily take the necessary actions. Similarly, a wide range of research studies confirmed that women exhibit greater concern toward problems associated with sustainability than do men regardless of the culture, age, or educational status (Worsley & Skrzypiec, 1998; Tikka, Kuitunen & Tynys, 2000; Tuncer et al., 2005). In the context of Turkey, however, the literature review could provide limited number of research studies addressing the link among sustainability-related variables and gender. Thus, it is questionable to what extent program developers, administrators, and educators should take into account the gender perspectives in sustainability issues. There is no initiation to incorporate gender perspective into all Turkish plans and programs on environment, where the development plans regard sustainable development as the issue to be considered for the future strategies (The Republic of Turkey Prime Ministry General Directorate on the Status of Women, 2008). In this aspect, the current study will provide program developers, planners, administrators, and educators some basic idea about the current state of gender inequality in Turkey pertaining to sustainable development.

Purpose

The core idea behind this study underlies the attempt to infuse education for sustainable development in higher education sector in the developing world, through a data set from Turkey. Revised programs, according to the information set by a model about how and which variables decide behavioral differences towards sustainability, should equip professionals of the future with the right knowledge, the right skills, and the right values and attitudes (Parkin et al., 2004). Thus, these attributes will lead these individuals to take right decisions in order to create sustainable future world. In this aspect, we aimed to investigate the interrelationships among the sustainability-related attributes for Turkish university students. More specifically, our goal is to construct a structural equation model to examine the links among attitudes, values, and behaviors pertaining to sustainability, participation in appreciative outdoor recreation as well as gender and tendency to follow mass media. The hypothesized structural model (Figure 3) was formalized on the basis of empirical data, theory and results from previous correlational studies (Barr, 2003; Oskamp, 1991; Tarrant & Green, 1999).

The model hypothesized that tendency to follow media and gender was significantly correlated with attitudes, values, and behaviors pertaining to sustainability as well as participation in appreciative outdoor recreation. Furthermore, behaviors could be predicted by attitudes, values, and outdoor activities. The model also hypothesized that attitudes may act as the significant predictors of values and outdoor activities.

Method

Sampling

The present study was realized at one of the largest public universities in Turkey with about 21000 students with five faculties and totally 37 departments. The sample of this study consisted of 958 university students (Middle East Technical University – METU) in Turkey, which indicated 4.8 per cent response rate of METU population. Although the response rate may reflect that the sample could not be regarded as representative for the population, it was representative in terms of faculty affiliation, gender, and grade level balance across the METU population. Characteristics of the sample with respect to demographic information were presented in Table 1. Looking at the faculty affiliation, the rate of participation was highest for The Faculty of Engineering students (N=375 (39.1%)), while minimum rate of participation belonged to the students from The Faculty of Architecture (N=69 (7.2%)). Concerning the participants' grade level, 66 (6.9%)

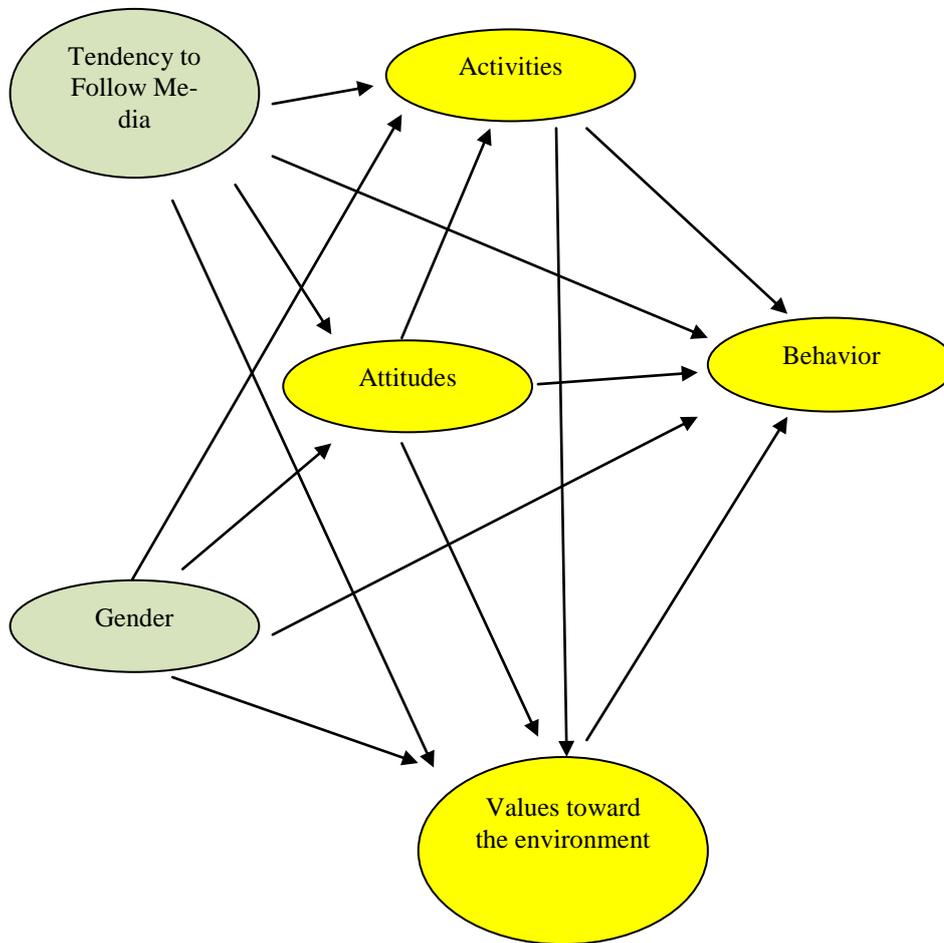


Figure 3. Hypothesized Model for Sustainability-Related Variables

students were pursuing an English Language Preparation Class while 593 (61.9%) students were enrolled in an undergraduate program, and 252 (26.3%) students were enrolled in a graduate program at METU. However, grade level was not specified by a total of 47 (4.9%) students. Regarding the participants' gender, the number of female participants was higher than that of males (479 females (50.0%); 448 males (46.8%)). On the other hand, 31 students (3.2%) did not label their gender.

Instrument

Measuring tool used in this study was comprised of 3 dimensions related to sustainability, namely, attitudes toward sustainability, behaviors pertaining to sustainability, and environmental values (Table 2). A total of 13 attitudinal items were originally developed by Kagawa (2007) and aimed to assess university students' attitudes toward economic, environmental, and social sustainability. These items were designed in 5-point Likert type (strongly disagree (1), disagree (2), undecided (3), agree (4), strongly agree (5)). University students' behaviors pertaining to sustain-

ability were evaluated through 14 items in rating scale (always, frequently, sometimes, rarely, never) which were adapted from a survey prepared by Mertig (2003) (see Appendix A). The domain on environmental values consisted of 9 items in 5-point Likert type which was originally used in World Values Survey (Inglehart et. al, 2002). These items were developed in order to assess participants' positions on a common view that nature has an intrinsic value and human being is not separate or superior to nature. In other words, values survey could help researchers make some decisions on individuals' placement in a continuum from anthropocentrism to ecocentrism/biospherism.

Table 1. Characteristics of the Sample

| | N | Percentage (%) |
|------------------------------------|-----|----------------|
| Faculty Affiliation | | |
| Engineering | 375 | 39.1 |
| Education | 166 | 17.3 |
| Economic & Administrative Sciences | 126 | 13.2 |
| Arts & Sciences | 222 | 23.2 |
| Architecture | 69 | 7.2 |
| Gender | | |
| Female | 479 | 50.0 |
| Male | 448 | 46.8 |
| <i>Unidentified</i> | 31 | 3.2 |
| Grade Level | | |
| English Preparation Class | 66 | 6.9 |
| Undergraduate | 593 | 61.9 |
| Graduate | 252 | 26.3 |
| <i>Unidentified</i> | 47 | 4.9 |

The measuring tool also included an introduction part covering some items on student characteristics (e.g gender, grade level, faculty affiliation, participation in appreciative outdoor recreation, tendency to follow mass media)

The items used in the instrument were carefully translated and adapted into Turkish by taking into account Turkey's social, educational, ecological, and cultural characteristics. Furthermore, wording of the statements in attitudinal items were examined with respect to Edward's criteria (Crocker & Algina, 1986). For content validity concerns, the original and translated items were given to two professors whose research interests cover education for sustainable development. Each sub-item was evaluated and revised utilizing the responses and reactive comments of these colleagues until 90% agreement was reached among them. This helped to eliminate ambi-

guities in items and unfamiliar terms. Additionally, two instructors from the Department of Foreign Languages checked the adaptation of the questionnaire into Turkish before the questionnaire was piloted and implemented.

To estimate the internal consistency of the questionnaire, Cronbach's alpha values were calculated for three domains. Cronbach's alpha for items on the domain of 'attitudes toward different aspects of sustainability' was calculated as 0.71, for the items on 'behaviors pertaining to sustainability' domain as 0.86, and for the items on 'environmental values' domain as 0.77.

Table 2. University Student Sustainability Survey

| Dimensions | Developed by | Item Format | Number of Items |
|------------|-------------------------|---------------------|-----------------|
| Attitudes | Kagawa (2007) | 5-point Likert type | 13 |
| Behaviors | Mertig (2003) | Rating scale | 14 |
| Values | Inglehart et. al (2002) | 5-point Likert type | 9 |

Procedure

Due to possible ethical concerns, the measuring tool was examined by some experts at human research ethics committee of the university. After their approval, this web-based survey was administered to undergraduate and graduate students of Middle East Technical University during February-June of 2008. The researchers posted an announcement on the website of this university inviting the students to complete the survey.

Data Analysis

Lisrel 8.30 for Windows (Jöreskog & Sörbom, 1999) with SIMPLIS command language was used to analyze the data. The structural equation modeling with maximum likelihood estimation was used to evaluate the degree to which the hypothesized model fits the data, and to estimate the magnitude and relationship among the variables. In order to evaluate the model fit, Standardized Root Mean Squared Residual (SRMR), Root-Mean-Square Error of Approximation (RMSEA), Goodness-of-Fit Index (GFI), Adjusted Goodness-of-Fit Index (AGFI) were used. The expected values for the good model fit interpretation were above 0.90 for GFI, and AGFI indexes; and below 0.05 for the SRMR and RMSEA indexes. However, values of .08 or less in SRMR and RMSEA indicate a reasonable error of approximation as well (Browne & Cudeck, 1993).

Variables of the Study

In this study, variables used to test the hypothesized model could be categorized as 'observed variables' and 'latent variables' (Table 3). 'Observed variables' are the directly observable or measured variables. On the other hand, 'latent variables' are defined as the variables that are not observed or measured directly. Latent variables can be indirectly measured through observable variables. In order to form latent variables for the proposed model, principal component factor analysis was run. Based on the results of this analysis, items contextually reflecting the characteristics of the related dimension more than the others were selected. In this process, latent variables

were generated by using two criteria. First, the minimum three observed variables were used and second, items with greater factor loadings were selected to define each latent variable (Kelloway, 1998; Schumacher & Lomax, 1996).

The first latent variable was related to respondents' behaviors pertaining to sustainability where *'Deliberately purchased locally produced rather than imported foods'*, *'Encouraged people involved in a destructive environmental behavior to stop that activity'*, and *'Considered politicians' positions related to environmental issues when voting or supporting'* were the items that constituted this latent variable. The second latent variable was participants' values toward the environment. The items that generated this latent variable were *'Humans have the right to alter nature to satisfy wants and desires'*, *'Humans have the right to subdue and control nature'*, and *'Humans should adapt to nature rather than modify it to suit them'*. Another latent variable was associated with university students' attitudes toward sustainability which was constituted by the items of *'The so-called 'environmental crisis' has been greatly exaggerated'*, *'We should maintain high and stable levels of economic growth regardless of costs to environmental quality'*, and *'It is imperative that we learn from cultures where people live more harmoniously with nature'*. The fourth latent variable was based on participants' tendency to follow media. The items of *'reading newspaper'*, *'watching documentary'*, and *'watching news on TV'* constituted this latent variable. The last latent variable was outdoor activities where *'camping'*, *'walking'*, and *'bird watching'* were the items that generated the latent variable.

Table 3. Variables of This Study

| Latent Variables | Observed Variables |
|--|---|
| Behaviors pertaining to sustainability | <ul style="list-style-type: none"> • Deliberately purchased locally produced rather than imported foods. • Encouraged people involved in a destructive environmental behavior to stop that activity. • Considered politicians' positions related to environmental issues when voting or supporting. |
| Values toward the environment | <ul style="list-style-type: none"> • Humans have the right to alter nature to satisfy wants and desires. • Humans have the right to subdue and control nature. • Humans should adapt to nature rather than modify it to suit them. |
| Attitudes toward sustainability | <ul style="list-style-type: none"> • The so-called 'environmental crisis' has been greatly exaggerated. • We should maintain high and stable levels of economic growth regardless of costs to environmental quality. • It is imperative that we learn from cultures where people live more harmoniously with nature. |
| Tendency to follow media | <ul style="list-style-type: none"> • reading newspaper • watching news on TV • watching documentary |
| Outdoor activities | <ul style="list-style-type: none"> • camping • walking • bird watching |

Using the selected observed variables, confirmatory factor analysis for a five-factor solution was carried out. The fit indexes of the five-factor solution was found as .96 for GFI, .95 for AGFI, .040 for SRMR, and .042 for RMSEA which indicated good fit for the five-factor model. Thus, it was concluded that these observed variables were convenient to use in structural equation modeling.

Results

The current study tested the hypothetical model explaining the causal relationships among sustainability-related components for Turkish university students. In order to find out the strength and direction of the relationships among latent variables, path coefficients were calculated. The significance of these coefficients was evaluated through t-tests. To revise the model data fit, modification indexes were also considered. The paths from *Attitudes* and from *Media* to *Values*; and from *Gender* to *Behaviors* were found to be nonsignificant. Therefore, these paths were deleted from the model. Finally, the model presented in Figure 4 was obtained with 0.96 GFI, 0.93 AGFI, 0.043 SRMR, and 0.043 RMR fit index values.

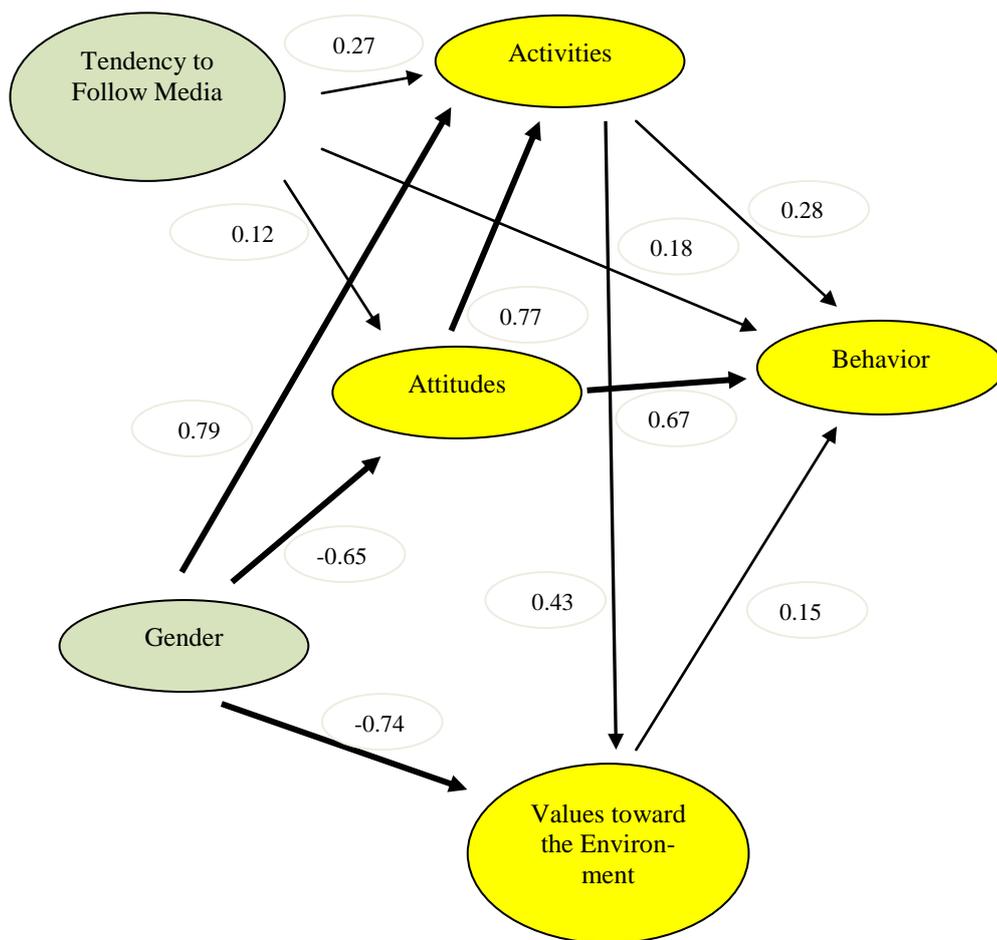


Figure 4. Structural Model for the Relationships among Sustainability-Related Variables

Regarding the relationships among the latent variables, the structure coefficients of the γ (lowercase gamma) and the β (lowercase beta) were considered. At this point, it could be appropriate to explain the terms of 'exogenous variable' and 'endogenous variable'. An exogenous variable is a variable whose variability is assumed to be determined by causes outside the causal model under consideration. On the other hand, an endogenous is one whose variation is to be explained by exogenous and other endogenous variables in the causal model (Pedhazur, 1982, pp. 178-179). The values of γ indicate the strength and direction of the relationships among the latent endogenous variables (environmental values, attitudes toward sustainability, behaviors pertaining to sustainability, and outdoor activities) and the latent exogenous variables (gender and tendency to follow media). Moreover, the values of β represent the strength and direction of the relationships among the latent endogenous variables. The t -values as well as the structure coefficients of γ and β for sustainability-related variables displayed in standardized values were presented in Table 4.

The results presented in Table 4 further displayed the direct effects for latent variables. However, LISREL output of the structural model also provided the indirect effects and the total effects for latent variables which were presented in Table 5.

Table 4. LISREL Estimates and t -values for the Model of Sustainability-Related Variables

| Latent variables | | β | γ | t |
|------------------|------------|---------|----------|-------|
| Activities & | Attitudes | 0.77 | - | 4.65 |
| Values & | Activities | 0.43 | - | 6.29 |
| | Attitudes | 0.67 | - | 6.54 |
| Behaviors & | Activities | 0.28 | - | 5.08 |
| | Values | 0.15 | - | 2.14 |
| | Attitudes | - | 0.12 | 2.50 |
| Media & | Activities | - | 0.27 | 5.16 |
| | Behavior | - | 0.18 | 4.85 |
| | Attitudes | - | -0.65 | -6.14 |
| Gender & | Activities | - | 0.79 | 4.13 |
| | Values | - | -0.74 | -7.24 |

Table 4 showed that the latent exogenous variable of gender had a significant direct effect on attitudes toward sustainability and environmental values in favor of females ($\Gamma=-0.65$; $\Gamma=-0.74$, respectively). Furthermore, it was seen that the effect of gender on participants' outdoor activities was significant in favor of males ($\Gamma=0.79$). This exogenous variable, gender had also significant indirect effect on environmental values in favor of males which was mediated by participants' outdoor activities ($\Gamma=0.11$). Moreover, there was an indirect effect of gender on behaviors pertaining to sustainability and outdoor activities in favor of females ($\Gamma=-0.26$; $\Gamma=-0.51$, respectively).

According to the results of the statistical analysis, the latent exogenous variable of media had a positive direct effect on participants' outdoor activities ($\Gamma=0.27$), attitudes toward sustainability ($\Gamma=0.12$), and behaviors pertaining to sustainability ($\Gamma=0.18$). Besides, the indirect effect of media on participants' behaviors pertaining to sustainability ($\Gamma=0.16$) and outdoor activities was statistically significant ($\Gamma=0.09$). Although there was no statistically significant direct effect of media on participants' environmental values, the results indicated indirect effect of media on this sustainability-related variable ($\Gamma=0.16$) which was mediated by participants' participation in outdoor activities.

Regarding the interrelationships among endogenous variables, the results indicated that attitudes toward sustainability had a positive direct effect ($\beta=0.67$) on behaviors pertaining to sustainability and positive indirect effect mediated by outdoor activities ($\beta=0.16$). Similarly, participants' tendency to engage in outdoor activities had a positive direct effect on behaviors ($\beta=0.28$) and indirect effect mediated by environmental values ($\beta=0.07$). Furthermore, the results reflected positive direct effect of environmental values on behaviors pertaining to sustainability ($\beta=0.15$). It was also found that the effect of attitudes on participants' tendency to engage in outdoor activities was statistically significant ($\beta= 0.77$). As it was presented in Table 4 & 5, there was an indirect positive effect of attitudes toward sustainability on environmental values ($\beta= 0.33$) although a direct effect this endogenous variable was not reported. The significant effect of outdoor activities on environmental values ($\beta= 0.18$) showed that this endogenous variable could act as a mediator between attitudes and values.

Table 5. Indirect and Total Effects for Sustainability-Related Variables

| Latent variables | | Indirect Effect | Total Effect |
|------------------|------------|-----------------|--------------|
| Values & | Media | 0.16 | 0.16 |
| | Gender | 0.12 | -0.62 |
| | Attitudes | 0.33 | 0.33 |
| Activities & | Media | 0.09 | 0.37 |
| | Gender | -0.51 | 0.28 |
| Behaviors & | Media | 0.16 | 0.34 |
| | Gender | -0.26 | -0.26 |
| | Activities | 0.07 | 0.21 |
| | Attitudes | 0.16 | 0.83 |

Cohen in 1988 (Stevens, 2002) made some interpretation on the absolute magnitudes of standardized path coefficients. Considering the Cohen's criteria, the path coefficients from *Attitudes* to *Behaviors*, which was above 0.50 indicated a large effect size. Furthermore, the path coefficients from *Attitudes* to *Outdoor Activities*, from *Gender* to *Outdoor Activities*, *Attitudes* and *Values* showed large effects for these latent variables. The other path coefficient from *Outdoor Activities* to *Values* which was 0.43 was regarded as medium effect size in the model fitted. On the other hand, the path coefficients from *Media* to *Attitudes*, *Outdoor Activities*, and *Behav-*

iors, from *Outdoor Activities* to *Behaviors*, and from *Values* to *Behaviors* which were below 0.30 indicated small effect size.

An additional fit measure, R^2 or “coefficient of determination”, could be reported as an index of overall fit (Kelloway, 1998). Coefficient of determination is also accepted as a measure of variation in latent variables that is attributed to the combination of observed variables. Path model explains 62% of variance in *Behaviors* and 62% of variance in *Values* which constituted the large amount in total variance. Furthermore, the model explains 48% of the variance in *Attitudes* and 47% of the variance in *Outdoor Activities* which are moderate amounts of total variance (Kelloway, 1998).

Discussion and Implications

Focus of the present study was to determine significant predictors of university students' behaviors toward sustainability and the interrelationships among these predictor variables. It was found, consistent with the research studies (Barr, 2003; Kaiser, Wölfling & Fuhrer, 1999; Oskamp, 1991) in the field of environmental psychology that, sustainability attitudes and values toward the environment had a significant and positive relationship with university students' behaviors pertaining to sustainability. In other words, the students with more favorable feelings toward sustainability and more ecocentric values toward the environment readily take more sustainable actions. As supported by some researchers (Thompson & Barton, 1994), this study pointed out that individuals who believe the value of nature within itself and see human beings as a part of nature have also higher tendency to support sustainability by taking the necessary actions. Furthermore, as it was also proposed by the literature review (Leiserowitz, Kates & Parris, 2005), the present study has shown that when people care for human development and hold feelings of concern toward environmental deterioration and unsustainable economies, they are more likely to engage actively with the social, environmental and economic aspects of sustainable development.

Concerning the relationships between attitudes and values as the significant predictors of behaviors, the results of the current study indicated that university students' attitudes toward sustainability played not direct but indirect roles on their values toward the environment. It could be concluded that these students' values toward the environment can be predicted by their attitudes toward sustainability not directly, but mediated by some other factors such as their tendency to engage in outdoor activities. Considering the literature review (Murray & Murray, 2007), some questions about the relationships between these components have emerged. However, the inference clearly defined by the current study and past research studies (Murray and Murray, 2007) is that attitudes accompanied with values play a crucial role in shaping behaviors toward sustainability.

Another set of variables, namely situational factors (Barr, 2003) that constituted from tendency to follow media, gender, and outdoor activities were examined in the current study with respect to their roles on university students' behaviors toward sustainable life styles and the other significant predictors of this variable. The results showed that university students having higher tendency to read newspaper, and watch news and documentaries related to sustainability more frequently engage in some activities toward pro-sustainability. At this point, it should be noted that the role of mass media providing some basic information (Berberoglu & Tosunoglu, 1995; Palmer, 1998) and enhancing university students' feelings of concern and care about sustainability issues, stimulating their values toward the nature and resulting in positive behaviors toward more sustainable life styles, could not be under estimated.

However, gender has emerged as a strong variable of this study shaping the university students' behavior toward sustainability. Results showed that gender had a significant direct relationship with university students' attitudes towards sustainable development, their values toward the environment, and activities in nature, whereas gender had a significant but indirect relationship with these students' behaviors toward sustainability. As it was supported by literature review (Hines, Hungerford & Tomera, 1987), female students exhibited greater concern toward the risk-related sustainability issues with a more favorable support for the value of nature within itself than do male students. This finding might be attributed to the fact that the concern felt by females for nature is based on the conscious of taking care of health and personal well-being, since preservation of nature is a way of welfare and survival (Worsley & Skrzypiec, 1998; Tikka, Kuitunen & Tynys, 2000). Another possible explanation on different tendency of males and females regarding their attitudes and values was suggested by Tikka, Kuitunen and Tynys (2000). These authors identified that males are more likely to master nature and derive benefits from natural resources. However, females have a tendency to hold more emotional bonding toward the nature. Interestingly, male students of this study spend more time in nature with some activities like walking or camping, but female students seem to take more sustainable actions as a result of their favorable attitudes and values toward the environment.

The finding related to gender, pertaining to the university students' behavior toward sustainability, bags a series of implications for the sustainability issues in the context of higher education. In generally speaking, there is a global lack of awareness regarding the critical interrelationship between the Earth's environment and our own human survival, and this lack of awareness is shared by men and women alike. Despite the fact that a great deal of attention has been focused on this issue in recent decades, at the local, national, and international level, many people remain confused or inadequately informed. In some countries the problem is compounded by a lack of educational materials and media coverage that are accessible to people of all education levels, thus impeding the mobilization of public action. This is also true in respect to gender differentials of human impact on the environment. Most of the indicators developed for assessing environmental damage are not gender-specific and/or sensitive, and do not allow for the differentiated evaluation of the contribution of men and women to environmental degradation. Such shortcomings undermine the potential effectiveness of rehabilitation and protection measures as well as the potential for altering consumption patterns.

In many of the developing countries, national sustainable development strategies, government intentions, and the means by which these strategies are to be implemented are not known and/or understood by the general public. To ensure voluntary compliance of the population with new regulations and norms, such as the use of water in protected zones, it is of paramount importance to carry on efforts to deepen the understanding of all social groups regarding their impact on environment and, hence, the future of generations to come. In this regard, gender mainstreaming is a comprehensive strategy aimed at achieving greater gender equality. This is attained by integrating a gender perspective into existing mainstream institutions and all programmatic areas or sectors, including education. As was defined and adopted in 1997 by the United Nations, gender mainstreaming is: "... the process of assessing the implications for women and men of any planned action, including legislation, policies or programmes, in all areas and at all levels. It is a strategy for making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring and evaluation of policies and programmes in all political, economic and societal spheres so that women and men benefit equally and inequality is not perpetuated" (UN, 1997). In operational terms, gender mainstreaming allows policy makers and practitioners not only to focus on the outcomes of gender inequality but also to identify and address the processes that cause it.

In the light of the results of the current study, we suggest that, gender inequality may result in unsustainable trends in higher education sector and gender mainstreaming should be considered. Besides, gender impact assessment (GIA), may also be suggested to be considered in such studies to seek to reveal how men as a group and women as a group may differ from each other in terms of their capacity to participate in and benefit from an implemented strategy. In this respect, GIA should have the final goal of promoting positive change in respect to gender inequality, since it has a positive role to play in determining policy opportunities to actively increase and enhance equality between men and women (UNDP RBEC, 2007). Last of all, the above mentioned implications of the current study coincide with the agenda of National action Plan of Gender Equality (2008-2013) of Turkey. As was reported in the Action Plan, it would not be incorrect to say that a gender perspective has not yet been incorporated into all Turkish plans and programmes on environment at the desired level, where the development plans regard sustainable development as the issue to be considered for the future strategies (The Republic of Turkey Prime Ministry General Directorate on the Status of Women, 2008).

Limitations of This Study

The present study has some limitations to consider in the context of generalizability of the results. First, this study is limited to public university students in an urban area located in the Central Anatolia region of Turkey. Thus, our results may be associated with the urban structure of the region. Data from geographical regions and from private universities might provide different results. Future research should examine the role of some other variables such as residence (urban vs. rural), income, and political orientations on university students' sustainability-related attributes. Second, the recommendations and implications of the present study were based on the self-reported data of these university students. Thus, this study could not provide strong evidences on the extent that these students internalized the values and attitudes, and demonstrated pro-sustainability behaviors. Subsequent research, therefore, is required to support the present results.

References

- Ajzen, I. & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall.
- Barr, S. (2003). Strategies for sustainability: citizens and responsible environmental behavior. *Area*, 35(3), 227-240.
- Berberoglu, G., & Tosunoglu C. (1995). Exploratory and confirmatory factor analyses of an environmental attitude scale (eas) for Turkish university students. *Journal of Environmental Education*, 26(3), 40-44.
- Boyle, C. (2004). Considerations on educating engineers in sustainability. *International Journal of Sustainability in Higher Education*, 5(2), 147-155.
- Browne, M. W., & Cudeck, R. (1993). *Alternative ways of assessing model fit*. In: Bollen, K. A. & Long, J. S. (Eds.) *Testing Structural Equation Models*. pp. 136-162. Beverly Hills, CA: Sage
- Copernicus (2005). *Copernicus-Guidelines for Sustainable Development in the European Higher Education Area, Copernicus-Campus*. Retrieved March 23, 2008, from <http://www.unece.org/env/esd/information/COPERNICUS%20Guidelines.pdf>

- Council for Environmental Education (1998). *Education for Sustainable Development in the Schools Sector: A Report from the Panel for Education for Sustainable Development*. Reading: Council for Environmental Education
- Crocker, L., & Algina, J. (1986). *Introduction to Classical and Modern Test Theory*. Holt, Rinehart and Winston Inc.
- Dunlap, R., & Heffernan, R. (1975). Outdoor recreation and environmental concern: An empirical examination. *Rural Sociology*, 40(1), 18-30.
- Dunlap, R. E., & Van Liere, K. D. (1978). The "new environmental paradigm". A proposed measuring instrument and preliminary results. *Journal of Environmental Education*, 9, 10-19.
- Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000) Measuring endorsement of the New Ecological Paradigm: A revised NEP scale. *Journal of Social Issues*, 56(3), 425-442.
- Dyer, A., & Selby, D. (2004). *Centre of Excellence for Teaching and Learning. Education for Sustainable Development*. Stage 2 Bid, University of Plymouth, Plymouth.
- Fien, J. (2002). Advancing sustainability in higher education. *International Journal of Sustainability in Higher Education*, 3(3), 243-253.
- Gross, R. (2005). *Psychology: The Science of Mind and Behavior*. Hodder and Stoughton, London.
- Hendee, J. C. (1969). Rural-urban differences reflected in outdoor recreation participation. *Journal of Leisure Research*, 1, 333-341.
- Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1987). Analysis and synthesis of research on responsible environmental behavior: A meta analysis. *Journal of Environmental Education*, 18, 1-8
- Inglehart, R., Basanez, M., Diez-Medrano, J., Halman, L., & Luijkx, R. (2002). *World values surveys and European values surveys, 1981-1984, 1990-1993, and 1995-1997*, Inter-university Consortium for Political and Social Research, Ann Arbor, MI: Institute for Social Research.
- Jöreskog, K.G., & Sörbom, D. (1999). *LISREL 8.30 for Windows [Computer software]*. Lincolnwood, IL: Scientific Software International, Inc.
- Kagawa, F. (2007). Dissonance in students' perceptions of sustainable development and sustainability: Implications for curriculum change. *International Journal of Sustainability in Higher Education*, 8(3), 317-338.
- Kaiser, F. G., Wölfling, S., & Fuhrer, U. (1999). Environmental attitude and ecological behavior. *Journal of Environmental Psychology*, 19, 1-19.
- Kelloway, E. K. (1998). *Using LISREL for Structural Equation Modeling*. London, New Delhi: Sage Publications.
- Leiserowitz, A. A., Kates R. W., & Parris T. M. (2005). Do global attitudes and behaviors support sustainable development? *Environment*, 47(9), 22-38.
- Mertig, A. G. (2003). *Michigan State University Environmental Survey of Freshman - Fall 2000 and Spring 2003*. Available at <http://www.ecofoot.msu.edu/documents/frosh.environmental.survey.pdf> (Accessed 24.10.2007)
- Murray, P. E., & Murray, S. A. (2007). Promoting sustainability values within career-oriented degree programs: A case study analysis. *International Journal of Sustainability in Higher Education*, 8(3), 285-300.

- Murray P., Goodhew S., & Turpin-Brooks S. (2006). Environmental Sustainability: Sustainable Construction Education – a UK Case Study. *Paper presented in International Conference on Environmental, Cultural, Economic and Social Sustainability*, Hanoi, Vietnam.
- Oskamp, S. (1991). *Attitudes and options*. Prentice Hall, Englewood Cliffs: NJ.
- Palmer, J.A. (1998). Environmental Education of the 21st century: Theory, practice, progress and promise, 267–277. London: Routledge.
- Parkin, S., Johnson, A., Buckland, H., & White, E. (2004). *Learning and skills for sustainable Development: Developing a Sustainability Literate Society, Higher Education Partnership for Sustainability (HEPS)*. London
- Pedhazur, E. J. (1982). *Multiple regression in behavioral research: Explanation and prediction*. Holt, Rinehart, Winston: New York.
- Schwartz, S. H. (1992). Universals in the content and structure of values: theoretical advances and empirical tests in 20 countries. In M. Zanna (Ed.), *Advances in Experimental Social Psychology*, 25, 1-65. New York: Academic Press.
- Steel, B. (1996). Thinking globally acting locally? Environmental attitudes, behavior and activism. *Journal of Environmental Management*, 47, 27-36.
- Stevens, J. P. (2002). *Applied multivariate statistics for the social sciences (4th ed.)*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Tarrant, M. A., Green, G. T. (1999). Outdoor recreation and the predictive validity of environmental attitudes. *Leisure Sciences*, 21, 17-30.
- The Republic of Turkey Prime Ministry, General Directorate on the Status of Women (2008). National Action Plan Gender Equality 2008–2013.
- Thompson, S. C., & Barton, M. (1994). Ecocentric and anthropocentric attitudes toward the environment. *Journal of Environmental Psychology*, 14, 149–157.
- Tikka, P. M., Kuitunen, M. T., & Tynys, S. M. (2000). Effects of educational background on students' activity levels, and knowledge concerning the environment. *The Journal of Environmental Education*, 31, 12-20.
- Tuncer, G., Ertepinar, H., Tekkaya, C., & Sungur, S. (2005). Environmental attitudes of young people in Turkey: Effects of school type and gender. *Environmental Education Research*, 11(2), 215-233.
- UN (1997). *The Report of the Economic and Social Council for 1997*.
- Van Liere, K. D., & Noe, F. P. (1981). Outdoor recreation and environmental attitudes: Further examination of the Dunlap-Heffernan Thesis. *Rural Sociology*, 46(3), 505-513.
- WSSD, Key outcomes of the summit (2002). *World Summit on Sustainable Development*. Available at <http://www.johannesburgsummit.org/html/documents/summit-docs/2009-keyoutcomes-commitments.doc> (Accessed 19.12.2006)
- Worsley, A., & Skrzypiec, G. (1998). Environmental attitudes of senior secondary school students in South Australia. *Global Environmental Change*, 8, 209-255.

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Appendix A. A Scale on University Students' Behaviors pertaining to Sustainability

Statements to assess behaviors pertaining to sustainability

- Walked or cycled instead of traveled by car for environmental reasons.
 - Deliberately purchased food produced locally rather than imported products.
 - Attended a protest march or a demonstration for environmental reasons.
 - Purchased products packaged in reusable or recyclable containers.
 - Avoided buying from a company which shows disregard for the environment.
 - Picked up litter or trash.
 - Recycled glass bottles, aluminum cans or paper.
 - Tried to use less energy (electricity, water etc.)
 - Turned off lights when I am the last to leave a room.
 - Made an effort to use less water when brushing my teeth or bathing.
 - Considered politicians' positions related to environmental issues when voting or supporting.
 - Chose to read publications that focus on environmental issues.
 - Encouraged people involved in a destructive environmental behavior to stop that activity.
 - Encouraged others to take an action on behalf of the environment.
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Üniversite öğrencilerinin sürdürülebilirlik üzerine davranışları: Sürdürülebilirlik ile ilgili değişkenlerle yapısal eşitlik modeli

Bu çalışmanın amacı üniversite öğrencilerinin medyayı takip etme eğilimleri, cinsiyet, açık hava etkinliklerine katılımları ile sürdürülebilirlikle ilgili tutum, değer ve davranışları arasındaki ilişkiyi gösteren yapısal eşitlik modelini oluşturmaktır. Toplam 958 Orta Doğu Teknik Üniversitesi öğrencisine internet üzerinden anket uygulanarak veri toplanmıştır. Cinsiyet, sürdürülebilirlikle ilgili değişkenlerin açıklanmasında önemli bir faktör olarak ortaya çıkmıştır. Medyayı daha fazla takip eden bayan öğrencilerin sürdürülebilirlik üzerine daha olumlu tutum ile davranışa ve eko-merkezli değerlere sahip olduğu tespit edilmiştir. Aynı zamanda, tutum ve değerlerin üniversite öğrencilerinin davranışları için anlamlı bir belirleyici olduğu ortaya çıkmıştır. Sonuçlara göre medyayı daha fazla takip etme eğilimi daha olumlu tutum, eko-merkezli değerler ve açık hava etkinliklerine katılım ile sonuçlanmaktadır. Bu durumda üniversite yerleşkeleri hem bayan hem de erkek öğrencilerin açık hava etkinliklerine katılımları için gerekli alt yapıya sahip olacak şekilde tasarlanmalıdır. Cinsiyet eşitsizliğini ortadan kaldırmak için cinsiyet bakış açısı kurumsal her türlü alanda program ve yapı ile bütünleşmelidir. Ek olarak, yüksek öğretim kurumlarında sürdürülebilirlik ile ilgili iyileştirme çalışmalarında öğrencilerin olumlu tutum ve değerleri göz önünde bulundurulmalıdır.