Does Climate Change Matter to Us? Knowledge, Attitudes, and Environmental Behavior among College Students

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<https://fohs.bgu.ac.il/research/profileBrief.aspx?id=dtVtriji>

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**Abstract:** Climate change is one of the greatest global threats to humanity in the 21st century, and it is mostly caused by human activity. In a cross-sectional study 704 students were asked about their knowledge, attitudes, and behavior related to climate change. We found that students have a medium level of knowledge about the impact of climate change and that their attitudes are moderately pro-environmental, yet they are not strict about pro-environmental behavior. Students with higher levels of environmental knowledge demonstrated more pro-environmental attitudes and behavior, and attitudes mediate the relationship between level of knowledge and behavior. Women demonstrated more pro-environmental behavior. Our results highlight the importance of raising awareness of the effects of climate change and increasing knowledge about how climate change can be mitigated. Further research is needed in order to understand the factors associated with pro-environmental behavior and how to promote it.

**Keywords:** environmental education, climate change, pro-environmental behavior, knowledge and environmental attitudes

1. Literature Review

1.1. Introduction

Climate change is one of the greatest global threats to humanity in the 21st century. The United Nations Framework Convention on Climate Change (UNFCCC) defines it as “direct or indirect climate change as a result of human activity that creates atmospheric composition, in addition to the natural climate variability observed at different times” [1]. All evidence, including air temperature, ocean temperature, snow mass, and sea level rise, indicates an increase in average global temperature over time. Although there are many processes in nature that affect average global temperature, human activity continues to be the main factor contributing to the acceleration of climate change through processes such as greenhouse gas emissions, increases in aerosols and changes to land cover [2]. Similarly, a recent NASA report [3] claims that the likelihood that the current global warming trend is man-made is over 95%. The report shows warming in the last century at a rate unprecedented throughout Earth's history. This has many implications for life on Earth.

1.2. Impact of Global Warming and Climate Change

Climate change can have direct effects associated with weather events, including heat loads, droughts, floods, and storms. In addition, there are indirect effects, such as displacement of families from their homes, the development of mental or psychological stress, air pollution, the spread of disease, food insecurity, and even malnutrition [4]. In 2018, the Intergovernmental Panel on Climate Change (IPCC) published a large and comprehensive report, drawing on over 6,000 studies and authored by over 90 researchers. The aim was to present the severe effects of global warming at a 1.5 °C increase and to compare it with the effects of a 2 °C increase, in order to emphasize the critical and devastating effects of global warming even if the change in temperature degrees seems minor. According to the report, if global warming continues at the current rate, it is estimated that the Earth’s temperature will rise by about 0.2 °C in every decade. Thus, between 2030 to 2052, global temperatures may have reached an increase of around 1.5 °C. As a result, temperatures may increase even further and become more extreme relative to the global mean surface temperature (GMST). Extreme heat days will warm by about 3 °C with global warming of 1.5 °C and warm by about 4 °C with global warming of 2 °C. The number of warm days is expected to rise in most inland areas, with a particularly high rise in tropical areas [5].

By the year 2100, with a global warming of 1.5 °C, the average sea level is expected to rise by 0.26–0.77 m, which is 0.1 m less than the expected rise in the level relative to global warming of 2 °C. Increased saltwater infiltration, flooding, and damage to infrastructure are just some of the expected consequences in that situation [6]. On land, according to the IPCC [5], there will be an impact on biodiversity and ecosystems, including loss or extinction of species. For example, due to rising temperatures in the Arctic, rain is falling instead of snow, resulting in a hard ice layer on the ground instead of a soft layer of snow. As a result, reindeer find it difficult to dig for food, which has resulted in the deaths of over 80,000 northern reindeer over the past decade. Ocean temperatures and acidity are expected to rise, and oxygen levels in ocean waters are expected to drop. As a result, marine biodiversity, fisheries, and ecosystems are at risk.

The ecological and biological spheres are the most widely covered in the literature as the implications of climate change are explored. However, other areas are affected by those changes and will be further damaged. In a large study, Ciscar and others [7] offer an assessment of the physical and economic implications of global climate change, suggesting mainly five areas of influence: agriculture, river basins, coastal systems, tourism, and human health. It is estimated that climate change will reduce crop yields by about 10% and farmland area by about 25% by 2080. As a result, many countries will have to rely on imports of agricultural crops, which may cause food shortages in some poor economies, and there may even be an increase in morbidity rates associated with nutritional deficiencies. As one of the most common types of natural disasters in Europe, floods in stream basins and rivers can cause great economic losses and damage to infrastructure, property, and agricultural land. Damage to coastal areas, where populations are concentrated and are characterized by rapid population increases and urbanization processes, is a major concern as well. Climate change will result in rising sea level, which is a direct threat to infrastructure, heritage, nature, and residential areas. Another economic concern involves tourism, which is a major industry in many countries; global climate change could result in damage to tourism around the world. All above have major health consequences, thus turning climate change into a major concern for the health sector.

The World Health Organization (WHO) has defined three types of health outcomes that may result from climate change: first, direct results that usually occur due to extreme weather, such as harm to vulnerable groups such as the elderly populations and an increase in morbidity among workers exposed to heat; second, environmental and ecological changes that result from climate change affecting transmission of zoonotic diseases. Extreme climatic events can increase the breeding rates and distribution patterns of various pests, such as mosquitoes, that transmit a variety of diseases. Diseases whose spread has been affected by climate change include West Nile fever, malaria, leishmaniasis, dengue fever, and more; and third, outcomes resulting from trauma, infections, or dietary and psychological effects in disadvantaged and migrant populations forced into economic migration by climate change [8]. Indeed, one of the significant consequences of climate change may be the migration of populations in search of food and water sources, and that may result in the spread of various diseases [9].

Thus, public health is expected to be significantly affected by climate change—both directly through physiological effects (the intensity and frequency of heat and cold waves) and indirectly through chronic and contagious diseases, as well as through mortality and morbidity rates as a result of other factors, such as road accidents, fires, undernourishment, and others. Other climatic factors, such as the level of ultraviolet radiation, affect the incidence of certain diseases, such as skin cancer and cataracts. Those will all place burdens on health care systems, hospitals, and welfare systems that serve disadvantaged and migrant populations [10,11].

In view of the effects of climate change, it is important to examine the level of knowledge, attitudes, and behavior of the public. A better understanding of these variables should improve the current debate on the impact of human behavior on environment and health.

1.3. Relationship between Knowledge, Attitudes, and Pro-environmental Behavior

Knowledge, as a cognitive component, is indeed critical, but alone it cannot adequately predict pro-environmental behavior. The emotional component, which is related to attitudes and values, is essential for driving the transformation of knowledge to responsible environmental behavior [12]. Despite the complex relationship between the components, researchers have shown that expanding knowledge via environmental studies and educational activities leads to more positive attitudes toward the environment and more responsible environmental behavior.

Pe’er and others [13] examined the level of environmental literacy of 765 students studying teaching at three teachers’ colleges in Israel. It was found that the students had low ecological-environmental knowledge but that most of them expressed positive attitudes. Pearson correlation coefficients showed a high correlation between attitudes and behavior (r = 0.49, p < 0.001) and a low correlation between knowledge and behavior (r = 0.23, p < 0.01).

Tuncer and others [14] examined the relationship between knowledge, attitudes, and concern for the environment among 684 teachers in Turkey. Half of the respondents (51%) defined themselves as “quite concerned,” and only 11% reported a high level of concern for environmental problems. The participants did not express high confidence in their level of environmental knowledge, with less than 4% reporting that they were “quite proficient” on environmental issues and 55% of them having “some kind of environmental knowledge.” Despite the lack of knowledge, the teachers’ attitudes, on average, were positive toward the environment, and their view was considered to be an ecological worldview. The researchers found positive relationships between the level of knowledge and the level of concern for the environment (r = 0.13, p < 0.01) and between environmental attitude and level of concern (r = 0.20, p < 0.01).

Dopelt, Radon, and Davidovitch [12] examined the relationship between knowledge, attitudes, and behavior among 361 college students regarding the impact of the livestock industry on the environment. They found that the students had almost no knowledge about the environmental impact of the food they consume; their attitudes were moderately pro-environmental, yet they were not strict about pro-environmental behavior. Students with higher levels of environmental knowledge demonstrated more pro-environmental attitudes and behavior. Their attitudes mediated the relationship between the level of knowledge and behavior with respect to environmental pollution caused by the livestock industry. In addition, women demonstrated more pro-environmental attitudes and behavior than did men.

Yang and others [4] examined the level of knowledge and perceptions about climate change and its effects of 1,387 medical, nursing, and public health students at five universities in China, as well as the relationships between knowledge and various perceptions. Most respondents believed that climate change is generally "bad" (83%) and bad for human health (88%), and 67% believed that climate change is controllable. The vast majority of participants acknowledged morbidity situations resulting from poor air quality (95%), heat stress (93%), and extreme weather events (91%) as potential impacts of climate change. However, only 39% recognized the morbidity resulting from dietary deficiencies as a potential consequence of climate change. About 58% of respondents could correctly identify the causes of climate change. The level of knowledge predicts an increase in awareness of the adverse effects of climate change among medical and nursing students, but it was not so significant for their public health colleagues. The researchers concluded that students were able to identify the direct links between weather events and health but were less likely to understand the implications of the complex and long-term processes posed by climate change.

That shortcoming can be explained by research findings by Lombardi and Sinatra [15], who evaluated the effectiveness of taking a course on environmental issues on improving student attitudes about human impact on climate change. A total of 83 students from a university in the southwestern United States enrolled in a semester-long course on the anthropogenic impact on climate change. The researchers found that no major investment was needed to raise the level of knowledge and to improve student attitudes about climate change. However, most students only understood and remembered short-term consequences, while long-term consequences tended to be forgotten. Therefore, it is particularly difficult to change environmental behavior that affects climate change and global warming in the long term. Furthermore, no gender differences were found in any of the study components (66% of respondents were female). Long-term consequences may disappear from consciousness if the danger is imminent, as seen in a similar study in North Carolina, USA [16], which examines the relationship between climate change knowledge and the acceptance of anthropogenic effects on global warming. The study was conducted among 387 high school students, who answered questionnaires. The findings of the study indicated that students who reported a low acceptance of anthropogenic effects on global warming and were skeptical of the effects of long-term climate change were most likely to have a spiritual worldview and to show a low level of credibility toward empirical scientific data.

Further research shows that most students understand that climate change is real. In addition, most students know that climate change occurs primarily due to man-made factors. Although most students express concern about climate change, many of them hold misconceptions about the effects of long-term climate change and still do not fully understand the individual's responsibility and potential impact [17,18]. At the same time, other studies show a strong relationship between attitudes and concerns about climate change and environmental behavior among students, and even show that positive attitudes and concerns about climate change can mediate and affect the relationship between knowledge level and environmental behavior [12,19,20].

In summary, increasing knowledge, skills, approaches, and values among individuals with respect to the environment may reinforce the individual’s sense of responsibility and capability to make pro-environmental changes in his/her behavior. Nevertheless, studies show that, even when people pride themselves on particular values, in many cases they do not act to implement them. That is the gap between declared values and actual decisions [21]. In particular, there is a gap in the environmental field between the social and environmental values that a person holds and his/her consumer behavior; this is known as the value-action gap [22]. An example of this was found in a survey conducted in the U.S., which found that 40% of consumers hold positive opinions about “green” products, but in practice they do not purchase them for several reasons such as cost, accessibility, or convenience [23].

The literature review shows that climate change and global warming pose a real threat to the future of the earth. Researchers are warning that the climate we are now experiencing is coming to an end. Climate change has a decisive impact on all areas of life, including water, public health, agriculture, energy, biodiversity, economics, migration, natural damage insurance, and more. The aim of this current study is to examine the level of knowledge and awareness of students in Israel on topics related to climate change. Similarly, the study aspires to examine the behavior of participants with respect to this issue and to determine whether there is a relationship between knowledge, attitudes, and behavior. The research hypothesis is that positive relationships will be found between the level of knowledge, attitudes, and behavior on topics related to climate change, whereby attitudes mediate the relationship between the level of knowledge and behavior.

2. Materials and Methods

2.1. Study Population and Sample

The study was conducted among students enrolled in Ashkelon Academic College in 2019. According to data from the Students Administration Office, 3707 students studied at the college in the academic track during that year, 70% of whom were women. The sample was comprised of 704 students who answered at least 80% of the questions on the questionnaire and who comprised 19% of the total number of students at the college. Responding to the questionnaire indicated informed consent to participate in the survey. As an exclusion criterion, pre-academic students were not included in the study.

2.2. Research Tools

We used an anonymous, closed, self-completion questionnaire for the study. We did not find questionnaires in Hebrew that measured the research variables, so English-language questionnaires were translated by the researchers. Selected questions were from validated existing surveys [24,25], while adding more questions to adapt the questionnaire to the Israeli context.

In the first phase, the relevant questions were translated from English to Hebrew, then from Hebrew to English, and back again to Hebrew; then the versions were compared to verify the reliability of the translation. In the second phase, the questionnaire was validated by health and environmental experts using a content validation method. A pilot study was conducted subsequently among ten students who did not study at Ashkelon Academic College, and four unclear questions were edited.

Description of questionnaire sections:

The questionnaire was comprised of 49 closed questions, as follows:

1. Demographic information—Six questions were included about gender, age, relationship status, city of residence, academic department, and nutritional lifestyle (omnivore/vegetarian/vegan).
2. Knowledge—Participants were asked whether they had heard of "climate change" and whether they understand what it means. In addition to those questions, the knowledge section included a thirteen-item knowledge questionnaire. Subjects were asked to indicate whether they thought the statement was true or not true. For the purpose of constructing the variable, the correct answers for each participant were counted. For example: *Do you think climate change can increase the amount of natural disasters, such as hurricanes, floods and earthquakes?* The questionnaire reliability was Cronbach’s α = 0.85.
3. Attitudes—Participants were asked how they felt about climate change (scared, worried, sad, indifferent, etc.). In addition, there were eighteen questions relating to attitudes toward climate change, in which respondents were asked to indicate to what extent they agree with the statement on a Likert scale of 1 (strongly disagree) to 5 (strongly agree). For example, *Climate change is occurring,* or *Human activity is responsible for climate change.* The questionnaire reliability was Cronbach’s α = 0.90.
4. Behavior—Participants were asked nine questions to rate the extent to which each of the statements describes their behavior on a Likert scale ranging from 1 (not at all) to 5 (to a large extent). For example, *I am willing to do everything I can to protect the environment.* or *I usually buy eco-friendly products.* The questionnaire reliability was Cronbach’s α = 0.78.

2.3. Research Process

This study was a cross-sectional study. In the first stage, the questionnaire was translated and validated as described in the "research tools" section. After approval from the ethics committee of the college, the questionnaires were programmed using Qualtrics and distributed to the students on 5 December 2019, and they were given until 22 December 2019 to complete it. The time required to complete the questionnaire was five minutes on average. There were 822 entries to the questionnaire, and 704 students completed at least 80% of the questions (85% of those entering the questionnaire); thus, 118 participants were omitted from the analysis.

The introductory page of the questionnaire contained an explanation of the essence and aim of the questionnaire. Completion of the questionnaire indicated informed consent to participate in the survey, and the students could stop responding to it at any stage or choose not to answer some of the questions. No questions were presented as compulsory.

2.4. Data Analysis

The data were analyzed using SPSS 26 (IBM, Armonk, NY, USA). The relationships between the variables were examined by calculating Pearson correlations. Mediation was examined using linear regressions according to Baron and Kenny [26]. Differences between groups were examined by using independent t-tests or one-way ANOVA. Finally, hierarchical (multiple) linear regression models were compiled to predict pro-environmental behavior. The models included variables that were found to be significantly related to behavior in the univariate analyses.

3. Results

3.1. Description of Sample Characteristics

The study participants included 704 students aged 19 to 55; the average age was 26.5 (SD = 9.5). The sample characteristics are presented in Table 1.

**Table 1.**

3.2. Level of Knowledge

Most participants (80%) had heard of the term "climate change." Nearly half (42%) answered that they very much understand what is meant by "climate change," 32% understood moderately, and 26% did not understand what climate change is.

The distribution of responses to the statements that examined the level of knowledge with respect to the damages caused by climate change is presented in Table 2.

**Table 2.**

To construct the variable “level of knowledge about the damages caused to the environment by the livestock industry,” we counted the number of correct answers provided by each participant. The variable ranged from 0 to 13. The mean value of the knowledge variable was 9.63 (SD = 3.56).

3.3. Attitudes

The distribution of responses to statements that examined attitudes is presented below in Table 3, after categories were combined as follows: Answers 1 and 2 were combined into the category “weakly agree,” answer 3 remained “moderately agree,” and answers 4 and 5 were combined into the category “strongly agree.”

**Table 3.**

To construct the attitudes variable, we calculated the mean response of each after inverting the scale for the three negative items as marked in the table. The mean value of the variable was 3.84 (SD = 0.72).

In addition, participants were asked about their feelings about climate change from a given list of sentiments (more than one answer could be marked). About one-fifth (18%) of respondents felt hopeful and that change can be made. In contrast, only 3% of respondents reported that they did not believe that climate change existed, 16% of respondents reported feeling fear in the context of climate change, and 15% reported feeling helpless in the face of the threat of climate change. Moreover, on one hand, 14% of respondents reported feeling sad, and, on the other, the same percentage of respondents reported indifference. A sense of confusion was reported by 12% of respondents, and only 8% reported feeling angry.

3.4. Behavior

The distribution of responses to the statements, after combining categories, is presented below in Table 4.

**Table 4.**

For the purpose of constructing the variable, we calculated the mean response for each participant after inverting the scale for the negative item (as marked in the table). The mean value of the behavior variable was 2.41 (SD = 0.64).

3.5. Relationships between Knowledge, Attitudes, and Behavior

We found positive and strongly significant relationships between level of knowledge and attitude (*r* = 0.42, *p* < 0.001) and between attitude and behavior (*r* = 0.37, *p* < 0.001) and a weak significant relationship between level of knowledge and behavior (*r* = 0.10, *p* < 0.05). In other words, the higher the level of knowledge, the more pro-environmental were the attitudes and behavior. More pro-environmental attitudes were related to more pro-environmental behavior. Therefore, the hypothesis is confirmed.

3.6. Attitudes Mediating the Relationship between Knowledge and Behavior

Three linear regressions were performed according to the method of Baron and Kenny [26] (Figure 1). Firstly, we examined the predictive effect of knowledge on behavior (A). Secondly, we examined the predictive effect of knowledge on attitudes (B). Thirdly, knowledge and attitudes were included as independent variables, with behavior as the dependent variable (C). In the first regression (path A), we found that the knowledge variable predicted behavior (*β* = 0.10, *p* < 0.05), explaining 1% of variance in behavior. In the second regression (path B), we found that the knowledge variable predicted attitude (*β* = 0.42, *p* < 0.001), explaining 17% of variance in attitudes. In the third regression (path C), we found that the knowledge and attitude variables explained 15% of variance in the behavior variable. When we added the attitude variable, the amount of variance explained increased to 15%, and the power of the corrected regression coefficient (*β*) of the knowledge variable decreased (*β* = 0.08, *p* < 0.05). The attitude variable was found to significantly predict behavior (*β* = 0.40, *p* < 0.001), Thus we can conclude, according to Baron and Kenny, that the attitude variable partly mediates the relationship between knowledge and behavior. In other words, if we controlled for the effect of attitude, there was still a relationship between knowledge and behavior, but it was weaker. Similarly, the change in the variance percentage was significant (R2 change = 0.14, *p* < 0.001), thereby confirming our hypothesis.

**Figure 1.**

3.7. Differences between Genders

No differences were found between genders in the level of knowledge and attitudes, but significant differences were found between genders with respect to behavior on topics related to climate change (*t*(694) = 2.28, *p* < 0.05). Women exhibited more pro-environmental behavior than did men (mean 2.45 vs. 2.33, respectively).

3.8. Differences between Disciplines

Significant differences were found between disciplines in the level of knowledge (*F*(668) = 4.18, *p* < 0.05), attitudes (*F*(670) = 4.27, *p* < 0.05), and behavior (*F*(665) = 5.23, *p* < 0.01) on issues related to climate change. Computer science and management students had the highest level of knowledge, followed by health sciences and humanities and social sciences (averages 10.22, 10.10, and 9.36, respectively). Health sciences students held the most positive attitudes, followed by computer science and management, and humanities and social sciences (average 3.98, 3.82, and 3.79, respectively). Students from health sciences reported more pro-environmental behavior, followed by humanities and social sciences, and finally by computer science and management (mean 2.53, 2.39, and 2.28, respectively). Scheffe follow-up test results show that health sciences students hold significantly more positive attitudes toward the environment than those of humanities and social sciences, and more pro-environmental behavior than that of computer and management students.

3.9. Linear Regression Model to Predict Pro-environmental Behavior

The results of the hierarchical (multiple) linear regression models to predict pro-environmental behavior are presented below in Table 5. The models included variables that were significantly related to behavior in the univariate analyses.

**Table 5.**

The ability of all variables to predict pro-environmental behavior was maintained, with the exceptions of gender and indifference, in the final model, which included all the variables that were significant in the previous models. Attitudes were the best predictor of behavior (*β* = 0.31, *p* < 0.001). They were followed by age (*β* = 0.15, *p* < 0.001) and being hopeful about possible change (*β* = 0.14, *p* < 0.001). The integrated model also indicated that not being in relationship and having feelings of confusion and anger predict behavior (*β* = 0.12, *p* < 0.01; *β* = 0.12, *p* < 0.01; *β* = 0.11, and *p* < 0.01, respectively). The variance explained by the final model was approximately 22% (*p* < 0.001).

4. Discussion

The present study examined the level of knowledge, attitudes, and behavior of college students on topics related to climate change. The participants’ knowledge level about the potential damage due to climate change is high (average of 9.53 correct answers out of 13 questions), and their attitudes are mostly positive (average of 3.84 on a 1–5 scale), while their pro-environmental behavior is low (2.41 on a 1–5 scale). These findings are in line with a number of studies showing that people have a high level of knowledge and positive attitudes, along with poor pro-environmental behavior [4,15,27,28].

While the average level of knowledge is generally high, inspection of the various responses shows gaps in the level of knowledge. For example, only about half of the respondents (52%) knew that climate change could cause mass migration, despite publications stating that there will be 200 million "climate migrants" by 2050 [29]. On the other hand, 85% of the students responded positively when asked whether they felt that climate change could cause desertification. About one-fifth of the participants did not associate the natural disasters reported in the media (hurricanes, earthquakes, fires) with climate change. One-third of the respondents also lacked the understanding that effects of climate change will also result in increased morbidity.

The behavioral questionnaire results show a dissonance. On the one hand, the participants declared that they are willing to do everything they can to protect the environment (average 3.38), but they displayed hardly any pro-environmental behavior. Example responses were *do not participate in environmental protests* (average 1.30), *do not recycle* (average 2.76), *do not buy eco-friendly products* (average 2.41), and *do not reduce fuel consumption* (average 2.37). Janmaimool and Khajohnmanee [30] had similar findings, which showed that a high level of knowledge along with positive attitudes did not necessarily provide a basis for positive environmental behavior. Pieters et al. [31] argue that sometimes people are biased in favor of the present and underestimate the future, so they may prefer a small profit today over a larger profit in the future. The preference for the present over the future is a classic problem of sustainability, because sustainability requires long-term thinking and preferences for the future rather than benefits in the present [32].

The greatest strengths in relationships were found between level of knowledge and attitudes, followed by the relationship between attitudes and behavior, and finally that between level of knowledge and behavior. In recent years, environmental issues have attained increasingly significant places on media agendas. Studies in environmental education have found a clear relationship between acquiring knowledge and an increase in positive attitudes toward the environment [33,34]. Many studies have strengthened that finding and have shown that environmental knowledge is needed to drive responsible environmental behavior and that it is a prerequisite for action [14,19,20]. The survey conducted by Rickinson [35] also showed that environmental knowledge is indeed an important component in the prevalence of supportive environmental behavior and is a prerequisite for formulating attitudes toward environmental problems. Knowledge, however, is not the central component affecting behavior [13]; indeed, the findings of the present study show that the strength of the relationship between attitudes and behavior is greater than the strength of the relationship between knowledge and behavior. That finding can be supported by the study of Varoglu and others [36], which reported a moderate relationship between environmental knowledge and attitudes of students at the secondary school level in North Cyprus and found a weak relationship between environmental knowledge and pro-environmental behavior.

The weak relationship between knowledge and behavior can be explained by Sobel's article on ecophobia in the context of climate change [37]. According to Sobel, a high level of knowledge about climate change and the dangers inherent in it can result in particularly poor environmental behavior. There are two main types of environmental knowledge; the first is based on natural disasters seen in the media, and the second comes from personal experiences, activism, and environmental curiosity. A surfeit of knowledge of natural disasters makes one feel as though they are environmental recurrences, along with a sense that there is nothing that can be done about them, so the individual does not make a change, and the high level of knowledge ultimately leads to low environmental behavior.

It was also found that attitudes partially mediate the relationship between the level of knowledge and behavior. In other words, if we account for the effect of attitudes, there is still a relationship between knowledge and behavior, but it is weaker. Geiger and others [38] found that although people had a high level of environmental knowledge, their engagement in pro-environmental behavior was merely average. Oreg and Katz-Gerro [39] stated that environmental knowledge potentially fosters an environmental attitude, which, in turn, influences environmental behaviors. According to Pe'er, Goldman and Yavetz [13], knowledge is indeed critical, but knowledge alone cannot adequately predict responsible environmental behavior. The emotional component, which is related to attitudes and values, is necessary to drive the transformation of knowledge into responsible environmental behavior. In other words, environmental behavior by an individual may change due to changes in values, beliefs, and pro-environmental norms. The theory of reasoned action (TRA) of Fishbein and Ajzen [21], which connects beliefs, attitudes, intentions, and behavior, can provide an explanation for that finding. Fishbein and Ajzen claimed that the intention to conduct behavior is the best predictor of its occurrence and that the occurrence depends upon the attitudes and norms of the individual. The individual’s knowledge and positive attitudes, alongside social norms that call for environmental conservation, create a socialization process that strengthens environmental values. Those factors will create motivation and intentions to act to reduce climate change.

We did not find differences between genders in the level of knowledge or attitudes; nevertheless, significant differences between genders were found for behavior. Women had more positive attitudes and pro-environmental behavior than did men. Similar findings were found in some other studies [15,40–43]. Researchers offer some possible reasons for this, including the arguments that due to women’s socialization into traditional roles in the home they are primarily responsible for the use of plastic items, recycling, and other concerns, or perhaps their role as mothers causes them to worry more about future generations [43].

We also found that computer science and management students have the highest level of knowledge, while health sciences students hold the most positive positions and pro-environmental behavior. Students in the Health Sciences Department participate in a course devoted to health and environmental as part of their curriculum. The findings are consistent with the results of Janmaimool and Khajohnmanee [30] that revealed significant differences in environmental attitudes and the engagement in pro-environmental behavior between students participating in the environmental course and students not participating in the course. Heeren and others [44] also indicated that environmental knowledge is important to encourage American students in pro-environmental behavior engagement, but that it is not as important as attitudes toward the environment. Formal environmental education can bring positive change to students’ environmental attitudes and influence them to adapt pro-environmental behavior.

Finally, a hierarchical (multiple)linear regression model was constructed to predict pro-environmental behavior. The model included variables that were found to be significantly related to behavior in the univariate analyses. In the final model, it was found that gender, age, marital status, knowledge, attitudes, and feelings about climate change predicted pro-environmental behavior. The explained variance of the final model was 22%. Thus, pro-environmental behavior is a function of knowledge, attitudes, and feelings. Heyl and others [45] also revealed the potential of positive environmental attitudes for predicting the pro-environmental behavior of engineering students in a Chilean university. Despite the positive correlation between knowledge and attitudes and pro-environmental behavior, there seems to be a cognitive dissonance that prevents those with a high level of knowledge and positive attitudes from behaving pro-environmentally. The theory of cognitive dissonance centers around the idea that, if a person knows various things that are not psychologically consistent with one another, he/she will, in a variety of ways, try to make them more consistent [46]. The person will change his/her behavior or adopt a new attitude to reduce the dissonance. Therefore, failure to take proactive action to change the behavior of the population toward the environment may result in people with positive attitudes but minimal pro-environmental behavior adopting more negative attitudes in order to reduce this dissonance (instead of changing their behavior).

To create pro-environmental behavior, a positive attitude is necessary for two reasons. First, we presented the positive relationship between positive attitudes and pro-environmental behavior—a finding that is consistent with many studies [36,47–50]. Second, because attitudes are partially mediated by knowledge level and pro-environmental behavior and because a high level of knowledge is not necessarily enough to predict pro-environmental behavior, we are led to conclude that positive attitudes improve behavior. Moreover, raising the level of knowledge is easier and more practical than affecting attitudes, so it is important not to abandon education [30]. It is likely that a significant proportion of the population does not know how to adopt pro-environmental behavior or is lacking the element of personal interest in environmental behavior. In addition, pro-environmental behavior involves understanding the implications of long-term climate change, a challenge that is a barrier for the population in the process of changing attitudes and adopting pro-environmental behavior [51].

We can summarize by saying that environmental behavior is a function of increasing knowledge, sensitivity, skills, approaches, and values held by the individual toward the environment. Nevertheless, there is sometimes a gap between the social and environmental values that a person aspires to believe in and his/her behavior, as was also shown in the study. Possible reasons for that could be that many people do not know how to behave in a pro-environmental way or that pro-environmental behavior involves a conflict between the individual’s immediate need and the long-term environmental interest. Preferring the present over the future is a classic sustainability problem, as intentional sustainable behavior necessitates long-term thinking and gives precedence to future benefits.

4.1. Limitations of the Study

The present study was conducted only at Ashkelon Academic College and may not be a representative sample. The study is a cross-sectional study, and, due to a lack of means, other factors linked to pro-environmental behavior were not examined. Another limitation of the study may be the social desirability bias of the participants—meaning that participants may have marked answers they thought the researchers wanted to receive. Finally, the study used an online questionnaire, and it may be that the subject was of concern for those who participated, creating a selection bias. We assume that, because the average knowledge, attitudes, and behavior were relatively low, the last two limitations did not lead to significant bias in the results, if any.

4.2. Recommendations

Students do not have sufficient knowledge about the effects of climate change on almost all areas of human life, indicating that campaigns to raise awareness of the issue are likely to be effective, especially since we found that knowledge is positively related to attitudes and behavior. We recommend including an introductory course in environmental studies (from the perspective of climate change and the relationship between health and the environment) in the study programs of all departments, with an emphasis on health subjects. Moreover, this issue is not adequately emphasized in public health programs in Israel. Indeed, discussion of climate change is of fundamental importance, due to the many forms of damage caused by climate change and to the responsibilities of individuals, as described in this study.

Future research to examine the level of knowledge, attitudes, and behavior needs to be conducted on representative samples of other populations, such as school children, adults, health and medical professionals, and more. A more in-depth study could include focus groups and interviews to better examine the awareness and behavior of policy makers with respect to global warming and climate change.

5. Conclusions

In this study, we found that students have a moderate level of knowledge about the impact of climate change, and their attitudes are moderately pro-environmental, yet they are not strict about pro-environmental behavior. Students with higher levels of environmental knowledge demonstrated more pro-environmental attitudes and behavior, and attitudes mediate the relationship between level of knowledge and behavior with respect to the effects of climate change. In addition, women demonstrated more pro-environmental behavior than did men. Computer science and management students had the highest level of knowledge, but health sciences students held the most positive attitudes and demonstrated more pro-environmental behavior.

Future environmental education campaigns should emphasize the individual’s contribution to environmental impact in the context of climate change, as well as environmentally relevant consumption habits, including the environmental and health benefits of organic food consumption. Burning fossil fuels, use of plastics, agriculture, and especially animal husbandry produce significant pollution. People will be able to slow climate change through recycling, reducing fuel consumption, and reducing the consumption of animal products.

Various initiatives are now being promoted around the world, such as encouraging carpooling, reducing flights, recycling competitions, promoting meatless Mondays, and increasing awareness of the impacts of climate change through education. All those practices should be evaluated in order to promote the best practices to tackle this pressing issue.

**Funding:** This research received no external funding.

**Acknowledgments:** We would like to thank all students who participated in the study.

**Conflicts of Interest:** The authors declare no conflict of interest.

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**Table 1.** Description of sample characteristics (*n* = 704)

|  |  |  |
| --- | --- | --- |
| **Characteristic** | ***n*** | **%** |
| Male | 230 | 33 |
| In a relationship | 428 | 61 |
| OmnivoreVegetarian/vegan | 64262 | 919 |
| Discipline:Humanities and Social SciencesHealth SciencesComputer Science and Management | 415169120 | 592417 |
| Home District:Ashkelon DistrictSouthern DistrictCentral DistrictJerusalem DistrictUnspecified | 392144743361 | 56211059 |

**Table 2.** Distribution of responses to the knowledge questionnaire

|  |  |  |  |
| --- | --- | --- | --- |
| **As far as you know, can climate change cause...?** | **Correct** **(%)** | **Incorrect (%)** | **Don’t Know (%)** |
| Aggravation of air pollution | 88 | 4 | 8 |
| Increase in air temperatures | 87 | 5 | 8 |
| Desertification | 85 | 5 | 10 |
| Agricultural damage (loss of crops and loss of farming land) | 85 | 6 | 9 |
| Increase in the amount of natural disasters, such as hurricanes, floods and earthquakes  | 82 | 6 | 12 |
| Decrease in the variety of plant and animal species | 81 | 7 | 12 |
| Decrease in rainfall | 74 | 11 | 15 |
| Less fish in the sea/ocean | 72 | 10 | 18 |
| Rising sea levels | 71 | 10 | 19 |
| Increase in morbidity | 68 | 9 | 23 |
| Increase in ocean temperature | 65 | 8 | 27 |
| Decrease in air temperatures | 58 | 24 | 18 |
| Migration of people due to displacement from their homes | 52 | 19 | 29 |

**Table 3.** Distribution of responses to the attitude questionnaire

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Statement** | **Weakly (%)** | **Moderately (%)** | **Strongly (%)** | **Mean ± SD** |
| It is important to recycle plastic, glass, etc. | 5 | 10 | 85 | 4.37 ± 0.90 |
| Public awareness of climate change must increase | 6 | 15 | 79 | 4.25 ± 1.00 |
| Deforestation should be reduced | 8 | 14 | 78 | 4.19 ± 1.06 |
| People should be encouraged to save water and reuse items | 9 | 15 | 76 | 4.13 ± 1.06 |
| Climate change may adversely affect the quality of life of future generations | 14 | 11 | 75 | 4.03 ± 1.28 |
| Climate change is happening | 10 | 15 | 75 | 4.01 ± 1.00 |
| It is important to conserve energy and natural resources | 11 | 20 | 69 | 3.98 ± 1.12 |
| Anyone can do something to reduce climate change | 16 | 17 | 67 | 3.91 ± 1.23 |
| Addressing climate change in Israel should be a higher priority than it is today | 15 | 18 | 67 | 3.87 ± 1.18 |
| Human activity is responsible for climate change | 15 | 13 | 72 | 3.85 ± 1.16 |
| I am concerned about climate change | 25 | 25 | 50 | 3.44 ± 1.24 |
| Israel is too small a country to do anything about climate change\* | 7 | 14 | 79 | 3.18 ± 1.15 |
| Climate change does not affect us in Israel\* | 13 | 12 | 75 | 3.13 ± 1.23 |
| People who deal with climate change are making a big deal out of nothing\* | 22 | 12 | 66 | 3.10 ± 1.18 |
| It is better not to buy a house near the coast for fear of rising seawater in the future | 34 | 29 | 37 | 3.09 ± 1.33 |
| I would agree to pay more for more environmentally friendly products | 36 | 25 | 39 | 3.03 ± 1.42 |
| It is more important to think about immediate concerns than worry about the effects that climate change will have in 50 years\* | 14 | 16 | 70 | 2.86 ± 1.25 |
| A course on environmental issues should be required for all students during their studies | 49 | 20 | 31 | 2.72 ± 1.43 |

\* Opposite items; the data are presented after inversion of scales.

**Table 4.** Distribution of responses to the behavior questionnaire

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Statement** | **Rarely (%)** | **Sometimes (%)** | **Often (%)** | **Mean ± SD** |
| I'm willing to do everything I can to protect the environment | 20 | 33 | 47 | 3.38 ± 1.04 |
| I recycle waste, like plastic containers | 46 | 22 | 32 | 2.76 ± 1.40 |
| I use energy-efficient appliances | 54 | 23 | 23 | 2.43 ± 1.32 |
| I usually buy eco-friendly products | 55 | 26 | 19 | 2.41 ± 1.21 |
| I reduce fuel consumption (by using public transportation, carpool, etc.) | 57 | 22 | 21 | 2.37 ± 1.34 |
| I reduce my consumption of animal food products (e.g. meat, chicken...) | 76 | 12 | 12 | 1.84 ± 1.22 |
| I use disposable plastic products\* | 39 | 27 | 34 | 1.80 ± 1.27 |
| I am considering cutting back on flying due to the environmental footprint | 83 | 11 | 6 | 1.63 ± 1.07 |
| I attend environmental protests/demonstrations  | 92 | 4 | 4 | 1.30 ± 0.78 |

\* Opposite items; the data are presented after inversion of scales.

**Table 5.** Results of hierarchical linear regression models to predict pro-environmental behavior

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variable** | **Background Variables** | **Knowledge and Attitudes** | **Feelings** | **Combined Model** |
|  | *β* | *β* | *β* | *β* |
| Gender (0—male, 1—female)In relationship (0—in relationship)Age |  0.10\* 0.09\* 0.19\*\*\* |  |  |  0.06  0.12\*\* 0.15\*\*\* |
| KnowledgeAttitudes |  | 0.08\* 0.40\*\* |  |  0.08\*\* 0.31\*\* |
| Afraid (0—yes) Sad (0—yes)Helpless (0—yes)Confused (0—yes)Angry (0—no)Indifferent (0—yes)Hopeful (0—no) |  |  |  0.02 0.01 0.010.14\*\*\* 0.13\*\*0.16\*\*\*0.20\*\*\* | 0.12\*\*0.11\*\* 0.04 0.14\*\*\* |
| Adjusted R Square*N* | 0.04\*\*\* 682 | 0.15\*\*\* 695 | 0.13\*\*\* 696 |  0.22\*\*\* 682 |

\* *p* < 0.05, \*\* *p* < 0.01, \*\*\* *p* < 0.001

**Figure 1.** Attitudes mediate the relationship between knowledge and behavior

\* *p* < 0.05, \*\* *p* < 0.01, \*\*\* *p* < 0.001

\*\*\* 0.42= β /\*\*\*0.37 =r

\*\*\* 0.33= r

\*\*\* 0.08= β /\*\*\*0.10 = r

Knowledge

Attitudes

Behavior

A

C

B