**Annals of the Institute of Biology - University of Sarajevo**
AIBUS: 46: 34-49
Original Article
UDC: 551.583:001.101-057.875
(497.6 Sarajevo)"2022/2023"

ISSN: 0350-2163 (Print)
ISSN: 2831-0705 (Online)
http://aibus.pmf.unsa.ba/
DOI: 10.35666/2831-0705.2024.46.34

02 December 2024

# Research on Climate Change Knowledge among Students of the Department of Biology

*Ibrahimi, L.[1*], Gajević, M.[1]*

*[1] University of Sarajevo - Faculty of Science, Department of Biology, Zmaja od Bosne 33-35, 71000 Sarajevo, Bosnia and Herzegovina*

**lekiibrahimi1997@gmail.com*

## Abstract

Climate change is a term used to describe changes in overall weather patterns and an increase in global temperatures worldwide. The phenomenon of climate change is one of the biggest problems facing the majority of the world's population. Today, the popularization of this topic is more and more expressed in non-scientific circles (media), which requires a multidimensional approach in measuring knowledge about the mentioned topic at the academic level. This research gives us an insight into the knowledge of the students of the Department of Biology at the Faculty of Science in Sarajevo about the causes, consequences, and measures to mitigate the negative effects of climate change. In the academic year 2022/2023, a total of 45 respondents filled out the survey, which for practical reasons was divided into six cognitive levels. Descriptive statistics and multiple regression analysis were used for data analysis. The research showed that biology students are familiar with the basic processes associated with climate change (especially younger students). Also, the respondents are aware of the consequences of climate change and can relate them to the causes. As for mitigation knowledge, students are familiar with measures to mitigate the consequences of climate change but are uninformed about climate-friendly activities. Multiple regression analysis indicated the existence of a statistically significant difference in the knowledge of the respondents. In our case, students of

lower years of study and younger age showed better procedural knowledge than older colleagues. With regards to influence of gender on the respondents' knowledge, women are more familiar with the causes of climate change than men.

**Keywords:** climate change knowledge, biology students, education.

Received 03 March 2024; revision received 09 September 2024; accepted 1 November 2024. Editor in Chief: prof. dr. Samir Đug.

## 1. Introduction

Climate change refers to a change in overall weather phenomena and an increase in global temperatures. It is generally understood as a long-term change in average weather patterns around the world. The expansion of the industrial production at the end of the 19th century led to an increase in the concentration of greenhouse gases (CFC12, HCFC22, SF6, CH4) in the atmosphere, which was the first sign of anthropogenic influence on the climate (Dhal, 2021). Most of the Sun's radiation (about 70%) is reflected, and greenhouse gases absorb it and thus heat the atmosphere. This means that the increased concentration of greenhouse gases in the atmosphere (especially $CO_2$) causes an increase in air temperature on a global level (Dakić, 2020). Human activity contributes to greenhouse gas emissions through the transformation of chemical energy from fossil fuels into different types of energy-usable resources (electricity, heat and cold). Natural sources contribute to adverse emissions through changes in nature that include: water vapor, volcanic eruptions and biomass decay, and biological processes in the oceans (Perić & Šverko-Grdić, 2017). According to the Intergovernmental Panel on Climate Change (IPCC), it is estimated that Bosnia and Herzegovina will be affected by global warming with an average temperature increase of 0.7°C-1.6°C. The general trend in B&H shows an average increase in temperature and an average decrease in precipitation volume, which results in drier summers and reduced precipitation volume during winter. A surplus in the amount of rainfall was recorded in the last decade in the central mountain zone, while a deficit in the amount of precipitation was registered in the southwestern parts of the country (Knežević & Suljić, 2012). The lack of snow cover in the winter period causes a disturbance in the ecological factors of the subalpine and alpine belt, which leads to a change in the habitat and ecological niches of plants and animals (Barudanović et al., 2015). An extreme drought was recorded in 2012 in the territory of Herzegovina, while strong floods in May 2014 threatened the existence of numerous towns in the local area. All the above had a very negative impact on agriculture and the supply of food to the population (Čustović et al., 2015).

There is very little interest in climate change research in B&H. Nevertheless, the impact of climate change on public health and complete ecosystems is often the subject of debate in scientific and non-scientific circles- media (Jug, 2016). This research provides an insight into the knowledge of climate change phenomena among students of the Department of Biology at Faculty of Science Sarajevo.

#### 1.1. Dimensioning knowledge about climate change - trend or need?

Learning how to live with climate change represents an ontological-existential problem, for the solution of which it is necessary to apply a special pedagogical approach to teaching (Verlie, 2019). For this reason, a completely new scientific subdiscipline - climate change pedagogy has developed as part of conventional pedagogy. The task of climate change pedagogy is to shape the individual's personality in such a way as to understand the causes, consequences, and the role of man in the occurrence of climate change. Applying climate change pedagogy means encouraging people to adopt an ecocentric attitude towards nature and its resources (Hadžiselimović, 2015). This implies the application of certain socially and professionally acceptable procedures, which will have a favorable effect on the climate of an area. Some of these practices include: waste disposal according to regulations, reducing the use of fossil fuels, preserving wetlands, climate-friendly actions such as reforestation (Bašić, 2001).

Knowledge about climate change can be acquired through formal education (higher education institutions and schools), and through the influence of certain informal outlets of information such as media, museums visits, bookstores and zoos. Considering the increasingly evident consequences of climate change, the need for a new type of literacy has arisen, namely climate literacy (Miléř & Sládek, 2011). Climate literacy is part of the United Nation’s program for Sustainable Development, which serves as a "tool" for climate literacy of students of natural and related science profiles. This program integrates four thematic frameworks for Education about Sustainable Development: a) Science and knowledge about climate, b) Education about climate change, c) Climate change, cultural and biological diversity, and preservation of cultural heritage, and d) Ethical and social aspects of climate change (Reimers, 2021). According to previous research, the most comprehensive concept for measuring climate change knowledge was applied in the survey (Taddicken et al., 2018). The original concept represents a five-dimensional approach to the knowledge of climate change phenomena. For practical reasons, the described

concept has been modified with an additional dimension that includes knowledge about readiness for mitigation, which is explained in (Table 1.).

Table 1. A conceptual approach to measuring climate change knowledge

| | |
|---|---|
| Basic knowledge | It includes some basic scientific knowledge about $C0_2$, the greenhouse effect, and their connection with the occurrence of climate change. It doesn't include knowledge about specific climate models, which makes it acceptable to respondents who are not part of any of the sectors dealing with climate change. |
| Causal knowledge | It refers to knowing the most common causes of climate change. For this level of knowledge, the respondent should distinguish the causes and consequences of climate change and be aware that climate change is mostly caused by the irresponsible attitude of human towards nature. |
| Effects knowledge | A specific level of knowledge in which it is desirable that the respondent not only knows the facts about the increase in the global average air temperature, but also needs to understand the consequences that this increase has on an international level. For the respondent to know whether it is possible to expect the same amount of precipitation everywhere in the world (e.g., in the Philippines and in Bosnia and Herzegovina); it is necessary to continue his formal education in an appropriate higher education institution. |
| Procedural knowledge | The level of knowledge implies that the respondent is aware of the multidisciplinary of climate science. This level of knowledge allows the examinee to understand that the prognostic character of climate science is limited, and that we can't fully rely on just one source to monitor climate models. |
| Action-related knowledge | This level of knowledge implies understanding which of our actions have a positive/negative effect on the climate (primarily on increasing CO2 concentration), and how to revise them if they are not climate acceptable. 6. Mitigation knowledge. The level of knowledge is designed for the needs of this research. The task of this level of knowledge is to prepare respondents for a responsible professional and social contribution to solving and mitigating the consequences of climate change. |
| Mitigation knowledge | The level of knowledge is designed for the needs of this research. The task of this level of knowledge is to prepare respondents for a responsible professional and social contribution to solving and mitigating the consequences of climate change. |

## 2. Material and Methods

### *2.1. Survey and sample*

The interest group for researching knowledge about climate change were undergraduate students of the Department of Biology at the Faculty of Science. An online questionnaire was used as a research instrument. The survey contains a total of 50 items, and for the sake of easier data processing, it is divided into two parts. Questionnaire used as a research instrument was created by Tadicken et al. (2018) for similar investigation conducted in Germany. The questions in the general part of the questionnaire were related to the socio-demographic characteristics of the

respondents, namely: year of study, field of study, gender and age of the respondents.

From March to May 2023, a total of 45 students completed the survey. Students of the first year of study (16 respondents) and students of the second year of study (20 respondents) had the greatest interest in participating in the research. The lowest response to the research was among students in the third (five respondents) and fourth year of study (four respondents). The schedule of responses according to socio-demographics is shown in (Table 2.).

Table 2. Socio-demographic structure of the sample

| Year of study | Respondents (N) | Frequencies (%) |
|---|---|---|
| First year | 16 | 36% |
| Second year | 20 | 44% |
| Third year | 5 | 11% |
| Fourth year | 4 | 9% |
| Field of study | | |
| Genetics | 17 | 38% |
| Microbiology | 13 | 29% |
| Biochemistry and physiology | 8 | 18% |
| Ecology | 5 | 11% |
| Teaching major | 2 | 4% |
| Gender | | |
| Female | 39 | 87% |
| Male | 6 | 13% |
| Age | | |
| 19-20 | 27 | 60% |
| 21-22 | 15 | 33% |
| 23 | 3 | 7% |

The main part of the questionnaire contains a total of 46 items concerning the knowledge of biology students about climate change. In this part of the survey, respondents' knowledge is grouped into six different dimensions, described above (Table 1). The statements in the main part were evaluated by students using a Likert scale, according to the previously established numerical-categorical pattern: 1-Absolutely disagree, 2-Partially disagree, 3-Neutral, 4-Partially agree, 5-Absolutely agree.

### *2.2. Research hypotheses*

Based on data from literature sources, and by analyzing the available theoretical knowledge on this topic, the following hypotheses were set:

1. Biology undergraduate students have basic knowledge about climate change.

2. Students are familiar with the causes of climate change, are aware of its consequences, and have knowledge about the possibilities for mitigating the negative impact of climate change.

3. Students of the first and second year of biology studies show a weaker knowledge of climate change phenomena than students of the third and fourth year.

4. Students of the third and fourth year show a better acquired knowledge about climate change.

### *2.3. Data analysis*

At the beginning we measured the Cronbach's α of the entire questionnaire, as well as individual cognitive dimensions. Cronbach's α for the entire survey was 0.74 which makes this research instrument sufficiently reliable and appropriate for use (Cohen et al., 2007).

All data were analyzed using Microsoft Excel 2013. As the first step in the data analysis, descriptive statistics were applied, and for the purposes of this research, we defined the following individual and overall mean values: 1-1.80-Absolutely disagree; 1.81-2.70-Partially disagree; 2.71-3.40-Neutral; 3.41-4.10-Partially agree; 4.11-5.00- Absolutely agree.

The undergraduate study of biology lasts four years, so the application of exclusively descriptive statistics in the evaluation of students' knowledge is not sufficient. This was the indicator for the application of multiple regression analysis test (with significance level at 0.05), to determine whether differences in level of knowledge can be explained with selected socio-demographics such as: year of study, gender, and respondents' age (Petz, 2007).

## 3. Results

In the following chapter we present our findings on climate change knowledge among biology students. Descriptive statistics for all cognitive dimensions are presented in (Table 3.).

Table 3. Descriptive statistics for six cognitive dimensions

| Cognitive dimension | Overall mean (M) | Overall standard deviation (SD) | Cronbach's α |
|---|---|---|---|
| Basic knowledge | 3.41 | 1.34 | 0.09 |
| Causal knowledge | 3.63 | 1.26 | 0.11 |
| Effects knowledge | 3.51 | 1.39 | 0.31 |
| Procedural knowledge | 4.09 | 0.98 | 0.76 |
| Action-related knowledge | 3.40 | 1.11 | 0.43 |
| Mitigation knowledge | 4.06 | 1.14 | 0.76 |

### 3.1. Basic knowledge

Biology students showed very good basic knowledge. Respondents partially agree that $CO_2$ is a greenhouse gas, and they are completely sure that burning oil increases

its atmospheric concentration. The majority of respondents are familiar with the role of greenhouse gases in retaining the Earth's heat radiation and show a tendency to partially agree with this statement. Students have a pronounced misconception about the connection between ozone holes and the greenhouse effect, so they are sure that statement is correct. The respondents are not sure whether $CO_2$ is more harmful for the climate than CH4, so they are neutral about this item. As we can see in (Table 3.) all respondents tend to partially agree with all statements. Response frequencies for basic knowledge are available in (Figure 1.).

### 3.2. Causal knowledge

Our respondents seem to be aware that the concentration of $CO_2$ has increased in the last 250 years, and that this has led to an increase in the average air temperature. Students are almost certain that climate change cannot be explained by changes in nature, and they are convinced that the human factor has the most influence on the mentioned phenomenon. Most respondents are uninformed that the 1990s were the warmest decade of the last century, and they declare themselves neutral. Overall mean indicates that most respondents partially agreed with all statements. Response frequencies for causal knowledge are shown in (Figure 2.).

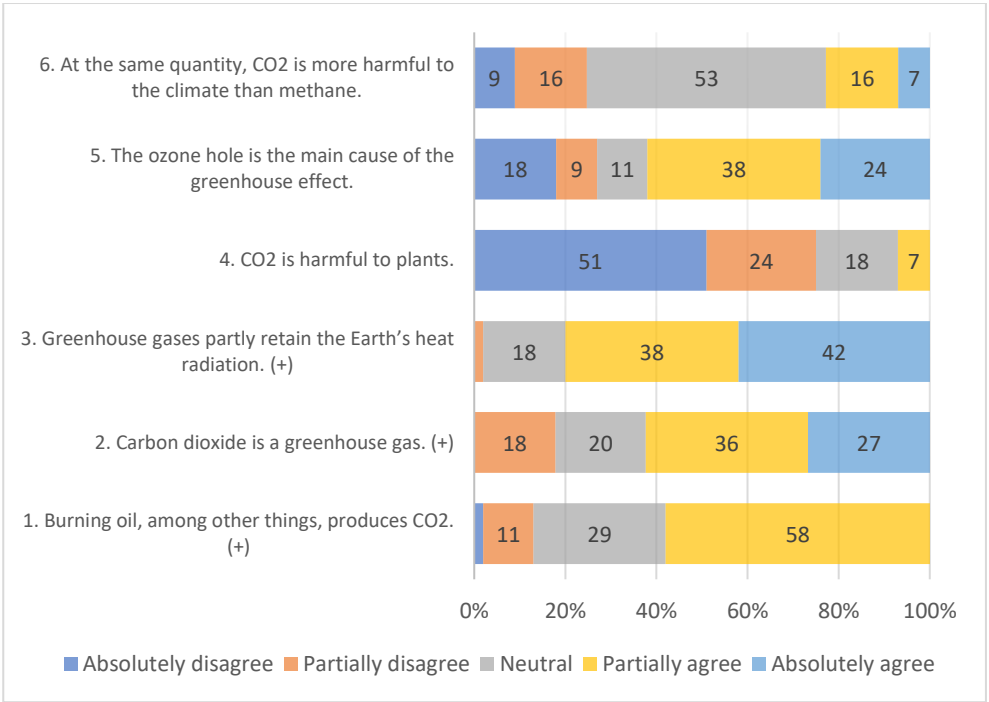


Figure 1. Response frequencies for basic knowledge ((+) - correct statement)

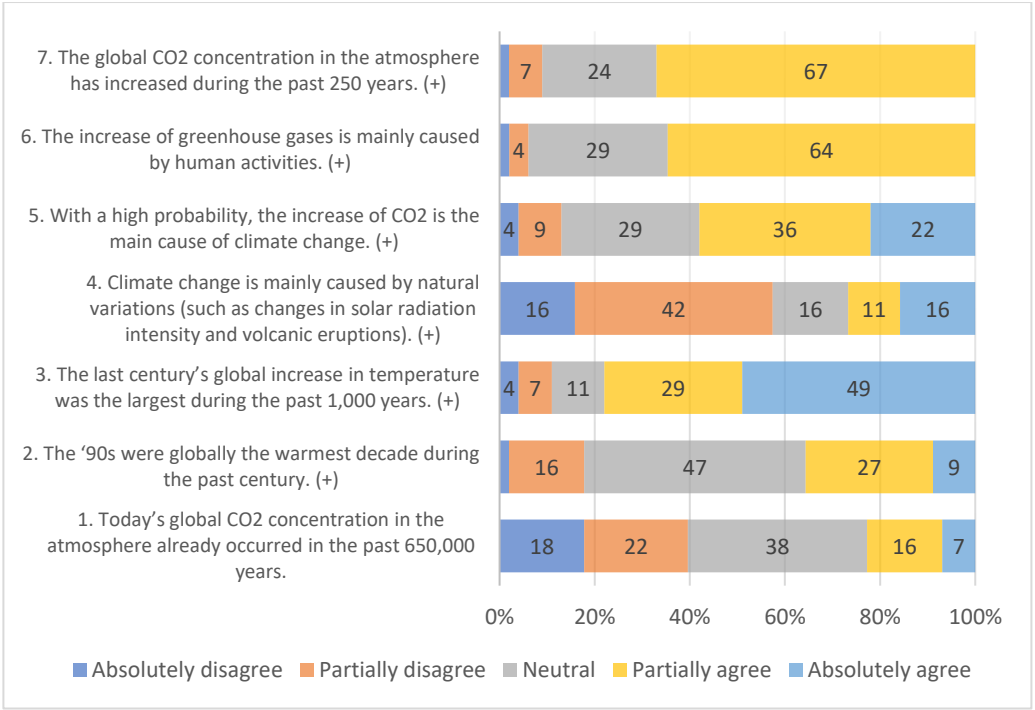


Figure 2. Response frequencies for causal knowledge ((+) - correct statement)

### 3.3. Effects knowledge

As (Figure 3.) shows, most students absolutely agree with the first two statements about the expected consequences of climate change. Respondents are neutral about whether the climate will cool down in the near future (see item 3), and whether a warmer climate can cause a decrease in sea level (see item 4). Students seem to be aware that the climate cannot change uniformly everywhere in the world, and they show a tendency to partially disagree. It is noticeable that the respondents are not familiar with the fact that we cannot expect an increase in the amount of precipitation everywhere in the world, so they are mostly neutral on this issue. The value of the overall mean indicates that the students have a solid knowledge of the consequences of climate change, with the fact that for more difficult questions they prefer to choose the neutral category, rather than really think about the accuracy of the statement.

### 3.4. Procedural knowledge

Most respondents show a tendency to absolutely agree with statements: 1, 2, 3, 5, 6 and 8. Students are not sure whether short-term climate science observations can be considered trends, as well as whether current and past climates have an impact

on the quality of climate models and declare themselves neutral (Figure 4.). The value of the overall mean indicates that the students are well informed about almost all statements related to this cognitive dimension.

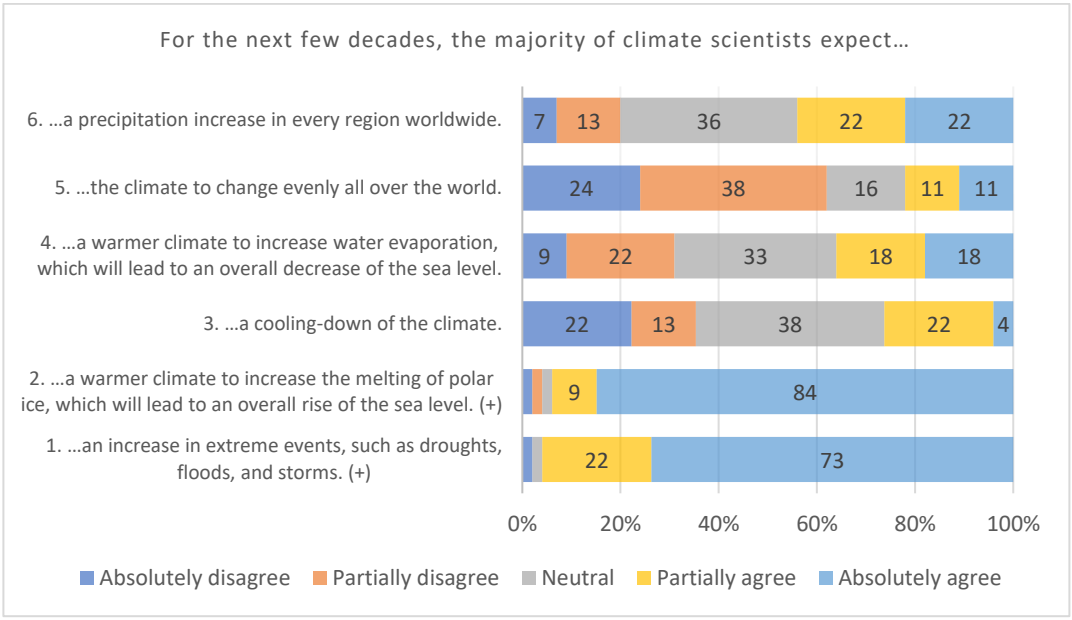


Figure 3. Response frequencies for effects knowledge ((+) - correct statement)

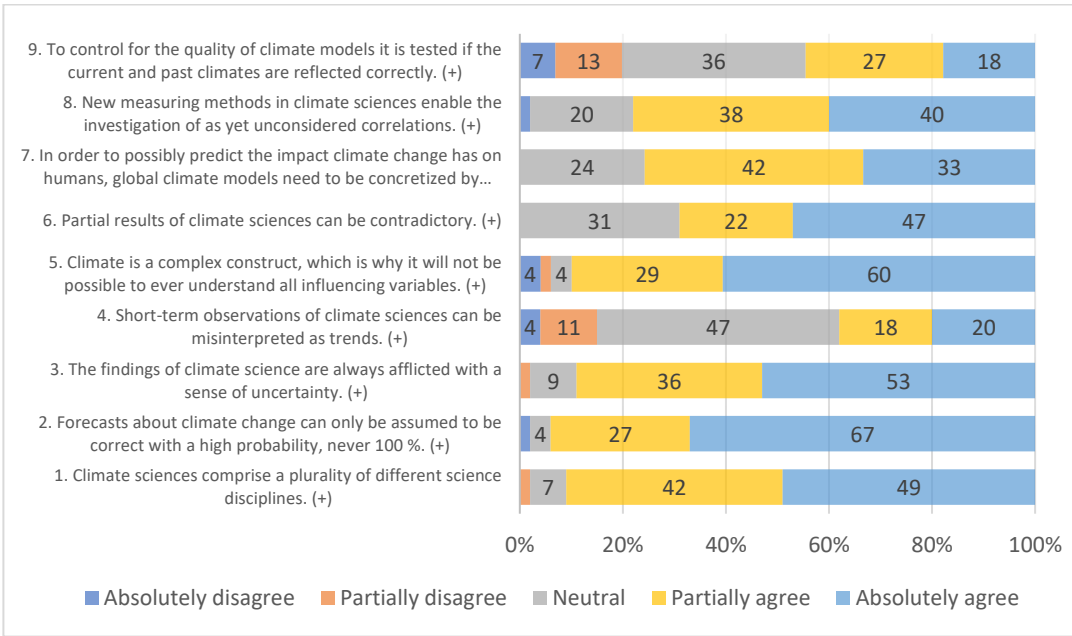


Figure 4. Response frequencies for procedural knowledge ((+) - correct statement)

### 3.5. Action-related knowledge

In contrast to the German respondents, our respondents are almost completely uninformed about climatically unacceptable activities (see statements 1, 3, 4, 6, 7, 8 and 9). Most students partly agree that the train is a more climate-friendly ways of transport than the car, and that the production of 1 kg of beef causes higher $CO_2$ emissions than the production of the same amount of wheat. The value of the overall mean indicates that the respondents were extremely uninterested in choosing grades for this level of knowledge and preferred to express themselves neutrally about almost all statements, which is shown in (Figure 5.).

### 3.6. Mitigation knowledge

Biology students have excellent knowledge about measures to mitigate the consequences of climate change and show a tendency to absolutely agree with almost all statements. The respondents showed a high level of information about energy-efficient ways of organizing private and work activities. As we can see in Figure 6, most students would use fluorescent bulbs instead of conventional ones to light the rooms. Students are also aware of the climate benefit of walking and cycling to go to the workplace. The only thing the students are neutral about is whether instead of turning on the heating, we should wear warm clothes. This was to be expected, given that the claim is partially true. Namely, we must be aware that we cannot fully rely on blankets and clothes when the temperatures are extremely low, so the accuracy of this statement also depends on the individual assessment of the respondents.

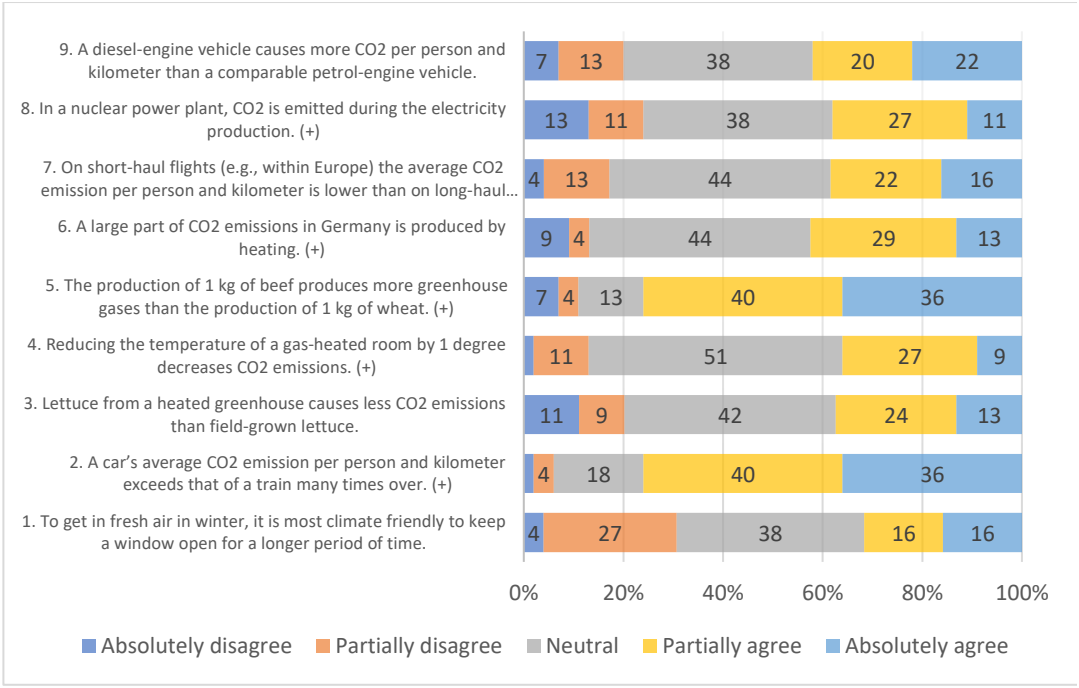


Figure 5. Response frequencies for action-related knowledge ((+) - correct statement)

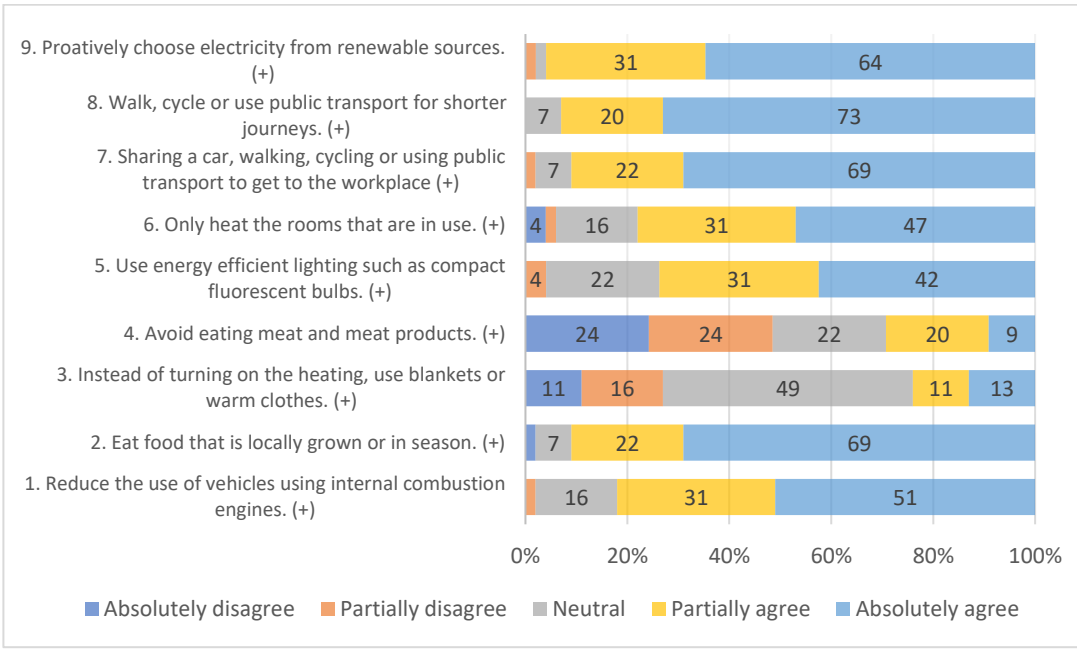


Figure 6. Response frequencies for mitigation knowledge ((+) - correct statement)

### 3.7. Multiple regression analysis in research on influence of socio-demographic variables on students' knowledge about climate change

Three regression models were included in this research. As we can see in (Table 4.) a total of 26% of the variance in students' knowledge can be attributed to the year of study. If we look at individual coefficients for knowledge levels, we can conclude that only the difference in procedural knowledge can be explained by the year of study ($p=0.01<0.05$). The year of study does not significantly affect other levels of knowledge. The second regression model refers to gender. As shown in (Table 5.), respondents' gender explains a total 23% of the variance in knowledge levels. If we look at the individual coefficients, we can conclude that the only difference in causal knowledge can be explained by gender ($p=0.04<0.05$). In the third regression model (Table 6.), we can see that 31% of the variance in students' knowledge can be explained by age. Individual coefficients make as conclude that only the differences in procedural ($p=0.04<0.05$) and basic knowledge can be explained by the age of the respondents ($p=0.01<0.05$).

Table 4. Multiple regression analysis in researching correlation between students' knowledge about climate change and year of study*

| | *Coefficients* | *P-value* |
|---|---|---|
| Year of study* | 4.90 | 0.02 |
| Basic knowledge | 0.04 | 0.46 |
| Causal knowledge | -0.05 | 0.31 |
| Effects knowledge | -0.01 | 0.73 |
| Procedural knowledge | -0.05 | 0.01 |
| Action related knowledge | -0.01 | 0.68 |
| Mitigation knowledge | 0.00 | 0.97 |
| $R^2 = 0.26$ | | |

*For this regression model we created following dummy variables: 1-First year, 2-Second year, 3-Third year, 4-Fourth year

Table 5. Multiple regression analysis in researching correlation between students' knowledge about climate change and gender*

| | Coefficients | P-value |
|---|---|---|
| Gender* | 1.41 | 0.05 |
| Basic knowledge | 0.001 | 0.95 |
| Causal knowledge | -0.039 | 0.04 |
| Effects knowledge | 0.013 | 0.45 |
| Procedural knowledge | 0.010 | 0.61 |
| Action related knowledge | -0.017 | 0.24 |
| Mitigation knowledge | 0.017 | 0.17 |
| $R^2 = 0.23$ | | |

*For this regression model we created following dummy variables: 1-Male, 2-Female

## 4. Discussion

The phenomenon of climate change is one of the biggest problems facing most of the the world's population. According to (Umegbolu, 2020), climate change is a problem that started earlier, only today we are becoming aware of its consequences for people and ecosystems. Previous research on climate change phenomena (Tobler et al., 2012) is mainly devoted to the influence of the internet and other means of information on people's knowledge about climate change. Considering very little interest in researching climate change knowledge among biologists, we decided that biology students are appropriate group for this research.

Based on overall mean values from research conducted by (Taddicken et al., 2018), we can see that biology students are similar in knowing basic facts about climate change (Table 3.). Multiple regression analysis showed that only the respondents age affects significantly on basic knowledge, so in this research the younger respondents showed better knowledge (Table 5.).

It seems that biologists showed a little better causal knowledge than the German respondents (Table 3). However, we must notice that our respondents had a certain difficulty answering correctly on statement 4 (Figure 2.). That is the indicator for existing misconception. Multiple regression analysis indicates that only the respondents' gender has an influence on this cognitive dimension (Table 5.) In our sample women are more familiar about causes of climate change than man.

Biology students are mostly aware of the consequences of climate change (Figure 3., Table 3.). Just like Tadicken et al. (2018), they showed difficulties in answering. Most interesting is the fact that students are convinced in accuracy of statement 2, but they are not sure which grade to choose for items 3 and 4. The fact is that if statements 2 is correct, we can't expect a total opposite phenomenon, which is described in statements 3 and 4. Multiple regression analysis showed that selected socio-demographics doesn't significantly affect this cognitive dimension (Tables 4., 5., 6.).

Table 6. Multiple regression analysis in researching correlation between students' knowledge about climate change and age

| | *Coefficients* | *P-value* |
|---|---|---|
| Age | 18.08 | 4.64E-11 |
| Basic knowledge | -0.17 | 0.01 |
| Causal knowledge | 0.04 | 0.45 |
| Effects knowledge | -0.06 | 0.26 |
| Procedural knowledge | 0.12 | 0.04 |
| Action related knowledge | 0.05 | 0.26 |
| Mitigation knowledge | 0.01 | 0.78 |
| $R^2$ =0,31 | | |

Based on mean values for our sample, it is noticeable that biologists showed a lot better knowledge about specific climate models than Tadicken et al. (2018) (Figure 4.; Table 3.). Considering the professional orientation of our respondents, that was expected. Multiple regression analysis for this cognitive dimension indicates that the students age and year of study affects significantly on procedural knowledge. According to the age, seems that younger students are more familiar with statements related to procedural knowledge (Table 5.). According to the year of study, first and second year students are the most knowledgeable about facts related to this cognitive dimension (Table 4.).

In contrast to Tadicken et al. (2018), it is noticeable that biologists in our research are uninformed about climate-friendly activities. Most surprising is the fact that students didn't choose grades wisely. Namely, it is impossible for respondents to be neutral about almost all statements (Figure 5.). Multiple regression analysis showed that selected socio-demographics doesn't significantly affect this cognitive dimension (Tables 4., 5., 6.).

Biology students are well informed about mitigation measures we can take to combat the consequences of climate change (Figure 6.). As we can see in (Tables 4., 5., 6.) any of selected socio-demographic variables doesn't significantly affect mitigation knowledge. This cognitive dimension was created for the needs of our research, so the results are very promising. Therefore, we recommend applying this cognitive dimension in further research with the aim of raising awareness about climate change.

Although our article is a good guide for further research on this topic, we must point out its limitations. In contrast to German sample, this research was limited to one academic year, and our respondents were more uninterested to fill the survey. In this case that affected on smaller sample size. Therefore, our Cronbach's α values for all comparable cognitive dimensions are lower than the previous research.

## 5. Conclusions

Biology students showed very good knowledge about causes, consequences and ways to mitigate negative effects of climate change. However, it is a fact that students of lower years of study are more knowledgeable about some facts related to climate change than their older colleagues. The most challenging for the respondents was to answer correctly to statements related with action-related knowledge, so we can conclude that students were uninformed about climate-acceptable activities. Devastating is the fact that students were neutral about statement 1 (Figure 5.). Respondents should remember that we are living in B&H,

and that we are facing extreme air pollution during winter. Overall mean values for causal and procedural knowledge, indicates that biologists are more knowledgeable on this cognitive dimension than the German respondents. Multiple regression analysis showed that year of study, as well as respondents age significantly affects procedural knowledge. The age of the respondents also affects significantly to basic knowledge. Respondent's gender has a significant effect on causal knowledge. In its original form this research instrument is applicable for further research on climate change knowledge among students of natural and related scientific profiles (e.g., Faculty of Forestry, Faculty of Agriculture). With some adjustments this research instrument can be used in evaluating knowledge of different groups of respondents.

## 6. References

1. Barudanović, S., Mašić, E. & Macanović, A. (2015). Biodiverzitet i ekosistemski servisi Bosne i Hercegovine. Univerzitet u Sarajevu. Prirodno-matematički fakultet.
2. Bašić, M. (2001). Metodika nastave biologije (1 izd.). Zenica, Dom štampe (pp. 44-48).
3. Cohen, L., Manion, L. & Morrison, K. (2007). Research Methods in Education (6th ed.). Routledge. https://doi.org/10.4324/9780203029053
4. Čustović, H., Ljuša, M. & Sitaula, B. K. (Ur.). (2015). Adaptacija na klimatske promjene u sektoru poljoprivrede-vrijeme je da reagujemo odmah (pp. 97-98). Univerzitet u Sarajevu. Poljoprivredno-prehrambeni fakultet.
5. Dakić, E. (2020). The impact of climate change on water resources in Bosnia and Herzegovina. Electron Collection Papers Faculty Civil Eng 19 (10), 30-38. https://doi.org/10.47960/2232-9080.2020.19.10.30
6. Dhal, P. K. (2021). Education for Climate Change, Environmental Sustainability and World Peace. Social Science Research Network. https://dx.doi.org/10.2139/ssrn.3981679
7. Hadžiselimović, Dž. (2015). Klima se mijenja, a mi… (prilozi psihologiji klimatskih promjena). Pula, Društvo psihologa Istre (pp. 107;173).
8. Jug, D. (2016). Poljoprivreda-dionik kauzalnosti klimatskih promjena. Diacovensia Journal: teološki prilozi 24 (1), 65-79.
9. Knežević, A. & Suljić, V. (2012). Adaptacija klimatskim promjenama u Bosni i Hercegovini. Proceedings No. 22 293-307. https://doi.org/10.5644/proc.bd-01.18
10. Microsoft Corporation (2018). Microsoft Excel. Retrieved from https://office.microsoft.com/excel

11. Miléř, T. & Sládek, P. (2011). International Conference on Education and Educational Psychology (ICEEPSY 2010) The climate literacy challenge. Procedia Social and Behavioral Sciences 12 (2011), 150-156. https://doi.org/10.1016/j.sbspro.2011.02.02
12. Petz, B. (2007). Osnovne statističke metode za nematematičare (7 izd). Jastrebarsko. Naklada Slap. (pp. 237)
13. Perić, J. & Šverko Grdić, Z. (2017). Klimatske promjene i turizam. Sveučilište u Rijeci. Fakultet za menadžment u turizmu i ugostiteljstvu.
14. Reimers, F. M. (2021). The role of Universities Building an Ecosystem of Climate Change Education. In: Reimers F., M., (Ed.). Education and Climate change pp. 3-14. Massachusetts: Harvard University. https://doi.org/10.1007/978-3-030-57927-2
15. Taddicken, M., Hoppe, I. & Reif, A. (2018). What do people know about climate change-and how confident are they? On Measurements and analyses of science related knowledge. Journal of Science Communication 17 (03) (2018) (A01), 1-26. https://doi.org/10.22323/2.17030201
16. Tobler, C., Visschers, V. H. M. & Siegrist, M. (2012). 'Consumers' knowledge about climate change'. Climatic Change 114 (2), pp. 189–209. https://doi.org/10.1007/s10584-011-0393-1.
17. Umegbolu, E. (2020). Awarness and Knowledge of Health Implications of Climate Change in Oji River Lga of Enugu State, Southeast Nigeria. European Journal of Pharmaceutical and Medical Research, 7 (7) 204- 210.
18. Verlie, B. (2019). Bearing Worlds: Learning to Live-with Climate Change. Environmental Education Research 25 (5), 751–766. https://doi.org/10.1080/13504622.2019.1637823