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Abstract

One of the major obstacles to the continuation of life on Earth is the global climate change. The fact that our nation is experiencing a minor impact from the global climate change does not change the reality that there is no problem. It is well recognized that the polar areas are the most impacted by the global climate change, or that the triggering of the Polar Regions would have a significant influence on the whole planet. In this scenario, science teachers have a significant deal of responsibility for raising awareness of polar science subject among future generations. As a result, it is in our hands to mitigate the impacts of global climate change through increased student knowledge. The screening model was used in the study to show the knowledge and awareness levels of science teachers on polar sciences, who will supply this awareness. The "Polar Sciences Awareness Questionnaire-PSAQ" data collecting instrument, whose validity and reliability were calculated, was employed within the parameters of the study. PSAQ was created in Google Form style with web-based access. The data were collected voluntarily from 205 science teachers working in a province in the Southeastern Anatolia Region, which is the population of the study. The statistical package program SPSS 26 was used to analyze the data that had been collected. The research revealed that while science instructors were aware of the North Pole, South Pole and climate change, their awareness was not very high. It is because science instructors lack a specific education in polar sciences that they do receive explicitly. The report makes several recommendations, one of which is to include polar science learning outcomes and lessons in teacher and student education programs.

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Research Article

Polar Science Awareness of Science Teachers *

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Abstract

One of the major obstacles to the continuation of life on Earth is the global climate change. The fact that our nation is experiencing a minor impact from the global climate change does not change the reality that there is no problem. It is well recognized that the polar areas are the most impacted by the global climate change, or that the triggering of the Polar Regions would have a significant influence on the whole planet. In this scenario, science teachers have a significant deal of responsibility for raising awareness of polar science subject among future generations. As a result, it is in our hands to mitigate the impacts of global climate change through increased student knowledge. The screening model was used in the study to show the knowledge and awareness levels of science teachers on polar sciences, who will supply this awareness. The "Polar Sciences Awareness Questionnaire-PSAQ" data collecting instrument, whose validity and reliability were calculated, was employed within the parameters of the study. PSAQ was created in Google Form style with web-based access. The data were collected voluntarily from 205 science teachers working in a province in the Southeastern Anatolia Region, which is the population of the study. The statistical package program SPSS 26 was used to analyze the data that had been collected. The research revealed that while science instructors were aware of the North Pole, South Pole and climate change, their awareness was not very high. It is because science instructors lack a specific education in polar sciences that they do receive explicitly. The report makes several recommendations, one of which is to include polar science learning outcomes and lessons in teacher and student education programs.

Keywords: Polar regions, neo-climate, global climate awareness, science teacher

1. INTRODUCTION

Three of the ten items that will pose risks on a global scale in the next 10 years are climate change, unusual weather events and the decline in biodiversity, according to the National Risk Report published in 2022. Human damage to nature, which is one of the main causes of the first three items, ranks seventh. According to the sixth assessment report of the Intergovernmental Panel on Climate Change [IPCC] (2021), the 1.5-degree temperature increase projected to take place between 2030 and 2052 is now expected to be achieved between 2021 and 2040. This shows that it will lead to stronger global warming consequences. When the variables are compared with the past, it is predicted that the way to slow down human-induced warming will be to reduce carbon dioxide absorption. The poles are seen as the Earth's barometer, a fundamental building block that protects the health of the planet (Smetacek & Nicol, 2005). The change will be faster in the Polar Regions than at any other area on Earth. It is unavoidable that the Polar Regions, which are home to approximately four million people, will be the areas most affected by climate change. According to the report presented by NASA (2018), more than two-thirds of the ice cover in the Arctic ice sea has been exhausted. Since the 1970s, the Arctic has warmed by about 2 °C, three times the global average. Soil that has been frozen for thousands of years (permafrost) is beginning to thaw and release carbon dioxide into the atmosphere more rapidly. The microorganisms that are released with dramatic temperature increases cause the

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degradation of organic matter and increase the emission of greenhouse gases. Organisms living in the Polar Regions have been exposed to unfamiliar weather conditions such as strong winds, solar radiation, temperature increase, water level rise, etc. The biodiversity of polar ecosystems that cannot respond to changing weather conditions will be more deeply affected and it will not be long before they disappear (Convey et al., 2012). Due to the limited biodiversity of the Arctic, the loss of a single keystone species has the danger of causing the loss of many species (Post et al., 2009). Despite increasing efforts to conserve biodiversity worldwide, biodiversity continues to decline (Barnosky et al., 2012).

1.1. Literature of the Polar Science

There are various studies on polar sciences and climate change in national and international field. In the literature, there are studies to develop awareness in students about polar sciences (Barış, 2020; Yalçınkaya et al., 2020). Also, there are studies on special/gifted students in the literature (Arslan, 2019; Bodur, 2021). Polar sciences were gamified, and studies were carried out to raise awareness and inform students (Kepir & Toktaş, 2021).When national and international studies are examined, it is seen that the studies are on raising students' awareness, measuring the level of knowledge, the place of polar sciences in the curriculum and polar science instructional designs. However, there are no studies on polar sciences with teachers. The fourth Sustainable Development Goal is quality education. It is an undeniable fact that the first prerequisite for providing quality education is qualified teachers. Science is one of the leading disciplines in raising individuals who recognize climate change and its effects with the understanding of education for sustainable life. Science teachers have a lot of responsibility on this issue. The study group consists of science teachers due to the lack of sufficient number of studies on teachers in national and international studies and the fact that science teachers have more responsibilities on the subject.

1.2. Purpose of the Study

This study was carried out to determine the knowledge and awareness levels of science teachers about polarity issues. Accordingly, the main problem of the study was determined as "What is the level of knowledge and awareness of science teachers about pole points?". The following sub-problems were investigated within the framework of the main problem.

1- What is the level of knowledge of science teachers about the North Pole?
2- What is the level of knowledge of science teachers about the South Pole?
3- What is the level of knowledge of science teachers about the consequences of climate change?
4- What is the level of awareness of science teachers about the North Pole?
5- What is the level of awareness of science teachers about the South Pole?
6- What is the level of awareness of science teachers about the consequences of climate change?
7- Are the awareness levels of science teachers towards polar sciences affected by demographic levels?

2. METHOD

2.1. Research Design

The method in which data are collected from the universe or a sample representing the universe to determine characteristics such as abilities, opinions, attitudes, beliefs and knowledge is called survey method (Selçuk-Sezgin, 2019, p.140). The survey model is conducted with the aim of reaching a general opinion about the universe with the whole universe or a certain group of the universe (Bailey, 1982). Cross-sectional survey, which is one of the screening models, has the advantage of measuring the current situation or attitudes (Selçuk-Sezgin, 2019, p.142). In the cross-sectional survey model, data are collected once, even if the time required for data collection extends from one day to

several weeks (Fraenkel & Wallen, 2009). In this study, cross-sectional survey model was used to reveal science teachers' awareness of polarity sciences.

2.2. Research Group

The population of the study consisted of 426 science teachers working in public schools in a province in the Southeastern Anatolia region in the 2022-2023 academic years. The sample of the study consisted of 426 teachers determined by stratified sampling method among the teachers working at the secondary school level.

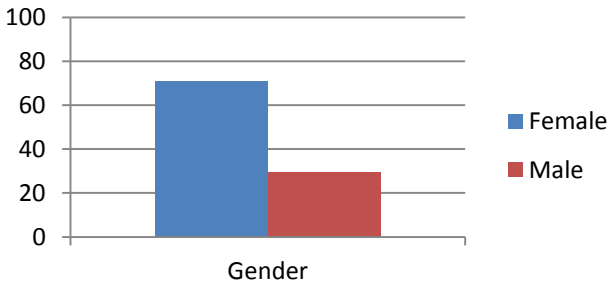

Figure 1. Gender information of the population and sample in the study

Figure 1 is shown the distribution of the population and sample of the study according to gender. The female participants of the study were 70.7%, while the male participants were 29.3%.

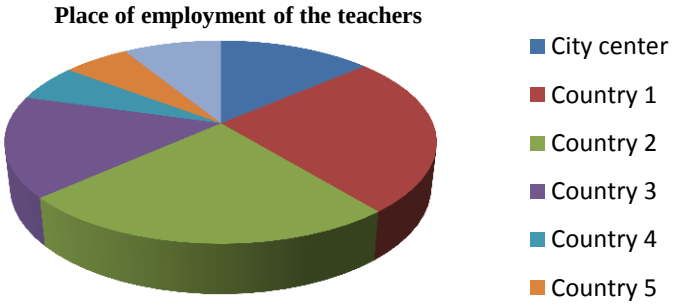

Figure 2. Place of employment of the teachers and sample of the study

Figure 2 is shown the work location of the participants of the study is shown in. The distribution of the place of employment of the teachers is as follows; 13.7% City center, 25.4% Country 1, 24.4% Country 2, 16.1% Country 3, 5.9% Country 4, 5.9% Country 5, 8.8% Country 6.

2.3. Data Collection Tools and Process

Barış (2020) "Polar Science Awareness Questionnaire" (PSAQ) was used to collect the research data together with the personal information form. The data collection tool was submitted by Barış (2020) to the expert opinion of a science teacher, a chemistry teacher and a polar science researcher. PSAQ was prepared in Google Form format and web-based access was provided. Of the data collection tools sent out, 205 (48.1%) were returned as answered. The analyses were carried out with the data collection tool of 205 science teachers.

The responses to the PSAQ were collected web-based via Google Form. In the information form of the data collection tool, teachers' gender and place of employment were included. In the first part of the questionnaire, there are twelve true-false questions aiming to measure the knowledge of the participants about polar sciences. In the second part, twelve questions of 4-point Likert type questions (not at all important, less important, important, very important) were included to determine the

knowledge and priorities of the participants about polar sciences. In the third section, there are eleven 5-point Likert type questions (I don't know at all, I know little, I know a little, I know a lot, I know completely) aiming to measure the knowledge of the participants about polar sciences. Table 1 shows information about the sections in the data collection tool and the distribution of the questions.

Table 1. Sections and distribution of questions in the data collection tool

Name of the questinnare	Part	Question Number	Question Types
PSAQ	I	12	True-False
	II	13	4-point Likert type (not at all important, less important, important, very important)
	III	11	5-point Likert type questions (I don't know at all, I know little, I know a little, I know a lot, I know completely)

The data collection tool consists of three sub-dimensions. These dimensions are North Pole, South Pole and Climate Change. The number of items and Cronbach alpha values of these subsections are given in Table 2.

Table 2. Information on the sub-dimensions of the data collection tool

Sub-dimensions	Item Number	Cronbach alpha değeri
North pole	9	,556
South pole	9	,462
Climate change	18	,703
Total	36	,801

Permission was obtained from the Provincial Directorate of National Education Research Evaluation Commission for the implementation of the data collection tool consisting of personal information form and KBFA. The data collection tool sent via Google Form was delivered to 426 science teachers. The number of returned data collection tools was 205 and the return rate was 48.1%.

2.3. Data Analysis

Descriptive statistics method was used to analyze the demographic information of the science teachers participating in the study. Frequency and percentage analyses of the data on gender and place of employment of the teachers were made. The answers given to the questionnaire applied to the science teachers participating in the study were analyzed with the help of SPSS 26 package programme.

3. FINDINGS

In this section of the study, the findings related to the sub-problems of the study are given.

3.1. Science Teachers' Level of Knowledge about the North Pole

Table 3. Descriptive statistics of Arctic knowledge level

Sub-dimensions	Min.	Max.	Mean	Standard Deviation	Skewness	Kurtosis
North Pole (Part I)	0	1	,86	,21	-1,471	1,523
North Pole (Part III)	1	5	2,98	,85	,300	-,305

When Table 3 is analyzed, the average score obtained from the questionnaire according to each item of the questions related to the North Pole, which is evaluated over 1 point in Section I, is 0.86. This shows that the participants answered the North Pole knowledge level questions very close to the "true" level. Evaluated out of 5 points, the average score obtained from the questionnaire according to each item of the North Pole questions in Section III is 2.98. This shows that the participants answered the North Pole knowledge level questions very close to the level of "A little".

Table 4. Descriptive Statistics for the questions of the North Pole section I.

Questions	True		False		
North Pole (Part I)	**n**	**%**	**n**	**%**	**Mean**
PSAQ 1	181	88,2	24	11,8	0,88
PSAQ 2	168	81,9	37	18,1	0,82
PSAQ 3	185	90,2	20	9,8	0,90

(PSAQ 1: Different groups live in the Arctic Region, PSAQ 2: The Arctic region has not been fully explored, PSAQ 3: The North polar region is also known as the "Arctic". n: Frequency, %: Percent)

Table 4 shows that 88.2% (n=181) of the science teachers who participated in the study know that different groups live in the Arctic region; 81.9% (n=168) know that the Arctic region has not been fully explored. It is seen that a large proportion of the participants (90.2%, n=185) know that the North Polar Region is the Arctic.

Table 5. Descriptive statistics for the questions in Section III of the North Pole

Questions	I don't know at all		I know little		I know a little		I know a lot		I know completely		Mean
North Pole (Part III)	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
PSAQ 28	6	2,9	57	27,8	74	36,1	52	25,4	16	7,8	3,07
PSAQ 29	26	12,7	58	28,3	68	33,2	39	19	14	6,8	2,79
PSAQ 30	4	2	59	28,8	71	34,6	56	27,3	15	7,3	3,09

(PSAQ 28: Climate and vegetation of the Arctic, PSAQ 29: Human transport to the North Pole, PSAQ 30: Animals living in the Arctic. n: Frequency, %: Percent)

When the data in Table 5 are analyzed, it is seen that only 7,8% (n=16) of the participants know the climate and vegetation of the Arctic region; 6,8% (n=14) know the transportation of people to the Arctic; 7,3% (n=15) know the animals living in the Arctic.

3.2. Science Teachers' Level of Knowledge about the South Pole

Table 6. Descriptive statistics of South Pole knowledge level

Sub-dimensions	Min.	Max.	Mean	Standard Deviation	Skewness	Kurtosis
South Pole (Part I)	0	1	,62	,27	-,247	-,541
South Pole (Part III)	1	5	2,51	,80	,663	,214

When Table 6 is analyzed, the average score obtained from the questionnaire according to each item of the questions related to the south pole evaluated over 1 point in section I is 0.62. This shows that the "correct" level of the participants is slightly higher than the "incorrect" level in the South Pole knowledge level questions. Evaluated out of 5 points, the average score obtained from the questionnaire according to each item of Section III South pole questions is 2.51. This shows that the participants expressed the levels of "I know a little" and "I know a little" a lot in the questions on the level of knowledge about the South Pole.

Table 7. Descriptive statistics for the questions of South Pole section I.

Questions	True		False		Mean
South Pole (Part I)	**n**	**%**	**n**	**%**	
PSAQ 4	87	42,4	118	57,6	0,42
PSAQ 5	157	76,6	48	23,4	0,77
PSAQ 6	139	67,8	66	32,2	0,68

(PSAQ 4: No country has territorial rights in the South Polar region. PSAQ 5: Few ethnic groups live in Antarctica. PSAQ 6: The South Polar Region is half the size of the African continent in area. n: Frequency, %: Percent)

In Table 7, 42, 4% (n=87) of the participants know that no country has territorial rights in the South Pole region; 23,5% (n=48) know that not a few ethnic groups live in Antarctica; 67,8% (n=139) know that the South Pole is half the size of the African continent in terms of area.

Table 8. Descriptive statistics for the questions of south pole section III

Questions	I don't know at all		I know little		I know a little		I know a lot		I know completely		Mean
South Pole (Part III)	n	%	n	%	n	%	n	%	n	%	
PSAQ 31	11	5,4	60	29,3	77	37,6	47	22,9	10	4,8	2,93
PSAQ 32	12	5,9	77	37,6	62	30,2	40	19,5	14	6,8	2,84
PSAQ 33	117	57,1	38	18,5	32	15,6	14	6,8	4	2	1,78

(PSAQ 31: Climate and vegetation of the South Polar Region, PSAQ 32: Animals living at the South Pole, PSAQ 33: Blood Falls at the South Pole. n: Frequency, %: Percent)

Table 8 shows that only 4.8% (n=10) of the participants know the climate and vegetation of the South Polar Region completely; 6.8% (n=14) know the animals living in the south polar region completely; 2% (n=4) know the Blood waterfall in the south pole completely.

3.3. Science Teachers' Level of Knowledge about the Consequences of Climate Change

Table 9. Descriptive statistics of climate change knowledge level

Sub-dimensions	Min.	Max.	Mean	Standard Deviation	Skewness	Kurtosis
Climate Change (Part I)	0	1	,60	,12	,238	,824
Climate Change (Part III)	1	5	3,39	,65	-,255	,411

When Table 9 is analyzed, the average score obtained from the questionnaire according to each item of the questions related to climate change evaluated over 1 point in Section I is 0.60. This shows that the "correct" level of the participants in the climate change knowledge level questions is slightly higher than the "incorrect" level. Evaluated out of 5 points, the average score obtained from the questionnaire for each item of the climate change questions in Section III is 3.39. This shows that the participants expressed "I know a little bit" and "I know quite a lot" to the climate change knowledge level questions.

Table 10. Descriptive statistics for the questions of Part I on climate change

Questions	True		False		Mean
Climate Change (Part I)	n	%	n	%	
PSAQ 7	200	97,6	5	2,4	0,98
PSAQ 8*	18	8,8	187	91,2	0,09
PSAQ 9	203	99	2	1	0,99
PSAQ 10	182	88,8	23	11,2	0,89
PSAQ 11	17	8,3	188	91,7	0,08
PSAQ 12	129	62,9	76	37,1	0,63

(PSAQ 7: Gases arising from industrial and agricultural activities cause temperatures to rise by keeping more energy in the world. PSAQ 8: Climate change does not have much negative impact on humans. PSAQ 9: As a result of the uncontrolled increase in greenhouse gases, global climate change problems have emerged. PSAQ 10: As a result of the melting of the glaciers in Antarctica, all the world's seas could rise by 60 meters as the ice reaches the ocean. PSAQ 11: Environmental problems in the Arctic region only adversely affect the animals living there. PSAQ 12: With the melting of glaciers due to global warming, sea voyages to Greenland can be organized. n: Frequency, %: Percent)

In Table 10, 97.6% (n=200) of the majority of the participants know that the gases emitted due to industrial and agricultural activities cause the temperatures to rise by keeping more energy in the world; 91.2% (n=187) know that climate change has a negative effect on humans; 99% (n=203) know

that global climate change problems arise as a result of the uncontrolled increase in greenhouse gases; 88,8% (n=182) know that all of the world's seas can rise up to 60 meters when the ice reaches the ocean as a result of the melting of the glaciers in Antarctica; 91,7% (n=188) know that environmental problems in the north polar region do not only affect the animals living there negatively; 62,9% (n=129) know that sea voyages can be organized to Greenland when the glaciers melt due to global warming.

Table 11. Descriptive statistics for the questions of Section III on climate change

Questions	I don't know at all		I know little		I know a little		I know a lot		I know completely		Mean
Climate Change (Part III)	n	%	n	%	n	%	n	%	n	%	
PSAQ 26	138	67,3	25	12,2	20	9,8	13	6,3	9	4,4	1,68
PSAQ 27	67	32,7	64	31,2	48	23,4	16	7,8	10	4,9	2,21
PSAQ 34	1	0,5	8	3,9	41	20	28	13,7	127	62	4,33
PSAQ 35	1	0,5	6	2,9	33	16,1	36	17,6	129	62,9	4,40
PSAQ 36	1	0,5	2	1	44	21,5	33	16,1	125	61	4,36

(PSAQ 26: El Nino effect, PSAQ 27: The urban heat island effect, PSAQ 34: The effect of deodorants on global warming, PSAQ 35: The extent to which the vehicles used for transport trigger global climate change, PSAQ 36: How rubbish thrown on the ground has an impact on the environment. n: Frequency, %: Percent)

Table 11 shows that only 4.4% (n=9) of the participants are fully aware of the El Nino effect; 4.9% (n=10) are fully aware of the urban heat island effect; 62% (n=127) are fully aware of the effect of the deodorants we use on global warming; 62.9% (n=129) know how much the vehicles we use for transport trigger global climate change; 61% (n=125) know exactly how a rubbish you throw on the ground affects the environment.

3.4. Awareness Level of Science Teachers about the North Pole

Table 12. Descriptive statistics of Arctic awareness level

Sub-dimensions	Min.	Max.	Mean	Standard Deviation	Skewness	Kurtosis
North Pole (Part II)	1	4	2,84	,61	-,002	-,291

When Table 12 is analyzed, the average score obtained from the questionnaire according to each item of the questions related to the north pole in Part II, which is evaluated over 4 points, is 2.84. This shows that the participants expressed "less important" and "important" levels to the questions on the level of knowledge of the North Pole.

Table 13. Descriptive statistics of items related to the level of awareness of the North Pole

Questions	Not at all important		Less important		Important		Very important		Mean
North Pole	n	%	n	%	n	%	n	%	
PSAQ 20	26	12,7	43	21	81	39,5	55	26,8	2,80
PSAQ 22	18	8,8	54	26,3	86	42	47	22,9	2,79
PSAQ 23	14	6,8	45	22	85	41,5	61	29,8	2,94

(PSAQ 20: Since there is only a thick ice mass at the North Pole, it is impossible to establish a station (research centre). PSAQ 22: Around 4 million people live in the Arctic. PSAQ 23: Frozen tundra plants are found in the Arctic. n: Frequency, %: Percent)

In Table 13, it is seen that 26,8% (n=55) of the participants find it very important that it is impossible to establish a station (research center) because there is only a thick ice mass in the Arctic; 22,9% (n=47) find it very important that approximately 4 million people live in the Arctic; 29,8% (n=61) find it very important that there are frozen tundra plants in the Arctic.

3.5 Awareness Level of Science Teachers about the South Pole

Table 14. Descriptive statistics of South Pole awareness level

Sub-dimensions	Min.	Max.	Mean	Standard Deviation	Skewness	Kurtosis
South Pole (Part II.)	1	4	2,87	,57	-,096	,052

When Table 14 is analyzed, the average score obtained from the questionnaire according to each item of the questions related to the South Pole in Section II, which is evaluated over 4 points, is 2.87. This shows that the participants expressed the level of knowledge of the South Pole at the "less important" and "important" levels.

Table 15. Descriptive statistics of items related to South Pole awareness level

Questions	Not at all important		Less important		Important		Very important		Mean
South Pole	n	%	n	%	n	%	n	%	
PSAQ 14	10	4,9	18	8,8	102	49,8	75	36,6	3,18
PSAQ 17	33	16,1	77	37,6	70	34,1	25	12,2	2,42
PSAQ 19	10	4,9	39	19	90	43,9	66	32,2	3,03

(PSAQ 14: At the South Pole, the temperature can drop to -70 degrees Celsius. PSAQ 17: The largest land animal at the South Pole is a wingless insect 1.3 cm long. PSAQ 19: 90 per cent of the glaciers and 70 per cent of the fresh water are at the South Pole. n: Frequency, %: Percent)

In Table 15, it is seen that 36,6% (n=75) of the participants find it very important that the temperature can drop to -70 degrees in the South Pole; 12,2% (n=25) find it very important that the largest land animal in the South Pole is a wingless insect 1,3 cm in length; 32,2% (n=66) find it very important that 90% of glaciers and 70% of fresh water are in the South Pole.

3.6. Awareness Level of Science Teachers about the Consequences of Climate Change

Table 16. Descriptive statistics of climate change awareness level

Sub-dimensions	Min.	Max.	Mean	Standard Deviation	Skewness	Kurtosis
Climate Change (Part II)	1	4	3,57	,40	-1,005	,773

When Table 16 is analyzed, the average score obtained from the questionnaire according to each item of the questions related to climate change in Section II, which is evaluated over 4 points, is 3.57. This shows that the participants expressed the level of knowledge about climate change at the "important" and "very important" levels.

Table 17. Descriptive statistics of items related to climate change awareness level

Questions	Not at all important		Less important		Important		Very important		Mean
Climate Change	n	%	n	%	n	%	n	%	
PSAQ 13	1	0,5	2	1	52	25,4	150	73,2	3,71
PSAQ 15	-	0	3	1,5	61	29,8	141	68,8	3,67
PSAQ 16	2	1	4	2	76	37,1	123	60	3,56
PSAQ 18	4	2	7	3,4	63	30,7	131	63,9	3,57
PSAQ 21	4	2	4	2	65	31,7	132	64,4	3,59
PSAQ 24	1	0,5	5	2,4	79	38,5	120	58,5	3,55
PSAQ 25	5	2,4	18	8,8	81	39,5	101	49,3	3,36

(PSAQ 13: Factors such as exhaust gases, factory wastes, fossil fuels increase Global Climate Change by a large amount. PSAQ 15: The polar ice caps melt rapidly due to Global Warming. PSAQ 16: Increasing the amount of micro plastics in the seas increases the amount of micro plastics accumulated in living organisms. PSAQ 18: The seas are polluted and drinking water is decreasing. PSAQ 21: Exhaust gases and deodorants deplete the ozone layer and increase global warming. PSAQ 24: Glaciers are decreasing, waters are rising and land animals living in the poles cannot find a place to live. PSAQ 25: Fresh water is getting more and more mixed with sea waters every day. n: Frequency, %: Percent)

In Table 17, 73,2% (n=150) of the participants find it very important that factors such as exhaust gases, factory wastes, fossil fuels increase global climate change in large amounts; 68,8% (n=141) find it very important that the glaciers in the poles melt rapidly due to global warming; 60%

(n=123) find it very important that the increase in the amount of micro plastics in the seas increases the amount of micro plastics accumulated in living things; 63,9% (n=131) find it very important that the seas are polluted and drinking water is decreasing; 64,4% (n=132) find it very important that the ozone layer is pierced by exhaust gases and deodorants and global warming increases; 58,5% (n=120) find it very important that the glaciers are decreasing, the waters are rising and the land animals living in the poles cannot find a place to live; 49,3% (n=101) find it very important that fresh water is mixed more and more into sea waters every day.

3.7. Awareness Levels of Science Teachers towards Polar Sciences

Table 18. Independent Sample t-Test Results of Participants' North Pole, South Pole and Climate Change Knowledge Level Scores According to Gender Variable

		N	X	SS	t	p
North Pole	Female	145	1,94	,44	,954	,341
	Male	60	1,88	,45		
South Pole	Female	145	1,58	,44	,941	,348
	Male	60	1,52	,40		
Climate Change	Female	145	2,02	,33	1,834	,068
	Male	60	1,93	,32		

Independent Group t-Test was used to investigate whether the participants' knowledge levels of the North Pole, South Pole and climate change differed effectively on gender and the results are shown in Table 18. The knowledge levels of the participants about the North Pole, South Pole and climate change did not differ statistically significantly at the $p<0.05$ level, although the scores of the female participants were higher than the male participants.

Table 19. Independent sample t-test results of participants' North Pole, South Pole and climate change awareness scores according to gender variable

		N	X	SS	t	p
North Pole	Female	145	2,82	,62	-,812	,418
	Male	60	2,90	,60		
South Pole	Female	145	2,85	,57	-1,129	,260
	Male	60	2,95	,58		
Climate Change	Female	145	3,57	,41	,016	,987
	Male	60	3,57	,38		

Whether the participants' awareness levels of the North Pole, South Pole and climate change differed effectively on gender was investigated by Independent Group t-Test and the results are shown in Table 19. The awareness levels of the participants about the North Pole, South Pole and climate change did not differ statistically significantly at $p<0.05$ level, although the scores of male participants were higher than female participants.

Table 20. Variance analysis of participants' north pole, south pole and climate change knowledge scores according to the place of duty variable

	Source	Sum of squares	ss	Mean square	F	p
North Pole	Between groups	0,426	6	0,071	0,349	0,910
	Within groups	40,310	198	0,204		
	Total	40,736	204			
South Pole	Between groups	1,119	6	0,186	1,001	0,426
	Within groups	36,875	198	0,186		
	Total	37,993	204			
Climate Change	Between groups	0,244	6	0,041	0,357	0,905
	Within groups	22,572	198	0,114		
	Total	22,816	204			

Whether the knowledge levels of the participants about the North Pole, South Pole and climate change are effective on the place of duty was investigated by analysis of variance and the results are shown in Table 20. It was not found significant in the North Pole, South Pole and Climate change sub-dimension values ($p<0.05$).

Table 21. Variance analysis of participants' north pole, south pole and climate change awareness scores by position variable

	Source	Sum of squares	ss	Mean square	F	p
North Pole	Between groups	2,714	6	0,452	0,311	0,910
	Within groups	74,950	198	0,379		
	Total	77,664	204			
South Pole	Between groups	4,365	6	0,727	0,037	0,426
	Within groups	62,890	198	0,318		
	Total	67,254	204			
Climate Change	Between groups	2,890	6	0,482	0,006	0,905
	Within groups	30,681	198	0,155		
	Total	33,571	204			

Whether the knowledge levels of the participants about the North Pole, South Pole and climate change are effective on the place of duty was investigated by analysis of variance and the results are shown in Table 17. It was not found significant in the North Pole, South Pole and Climate change sub-dimension values ($p<0.05$).

4. DISCUSSION and CONCLUSION

In this study, it was aimed to determine the knowledge and awareness levels of teachers working as science teachers in schools affiliated to the Ministry of National Education in Şırnak province and its districts towards polar sciences.

As a result of the findings obtained from the Arctic sub-dimension, it was determined that the participants had limited knowledge about the Arctic region. It was determined that the participants lacked a lot of information about the climate and vegetation of the Arctic region, the transportation of people to the Arctic, and the animals living in the Arctic. Arslan (2019) investigated the effects of pole education given to gifted students by experts on students' idea generation. The students were encouraged to participate in the webinar, which ended with a question-answer activity, in which the information that the participant of a project carried out in the Arctic region should provide and the studies carried out in the Arctic region were mentioned. At the end of the webinar, it was observed that gifted students increased their knowledge about life in the polar regions, were interested in the research carried out in the Arctic and created many research problems related to different fields. Kepir and Toktaş (2021) designed an educational game by classifying the information they obtained about the definition, borders, historical and current situation of the Arctic region with playing cards in various colors according to subject, content and question formats. Özaraz and Koç-Odabaşı (2021) In order to determine the knowledge of fine arts high school painting department students about the polar regions and to investigate the contribution of the awareness created in them by increasing the diversity of knowledge to the polar awareness studies to be carried out in the society, it was revealed with the technique of drawing and writing pictures. It was observed that the students had false information that there were indigenous people in both Polar Regions. Arslan (2020) determined the views of gifted students on polar phenomena and investigated the origin of the information sources they utilized in the process of obtaining information. It was concluded that gifted students were familiar with the phenomena in the field of physical sciences but remained distant from the phenomena in the field of earth sciences. It is recommended to carry out studies on Polar Regions for all students, including the fields of life sciences and social and human sciences, and to support teacher training in order to raise

awareness of scientists. Sasa-Fizan and Uzun (2022) examined the science curriculum in terms of polar research and climate change. It has been determined that there are no acquisitions for polar research in the science curriculum and that the curriculum is not sufficient in teaching these acquisitions despite the need for curricula designed according to the climate change education approach, which confirms the literature. Science teachers have a great responsibility in the transfer of polar sciences. It was concluded that this was since there were no acquisitions related to polar sciences in the science curriculum. It was concluded that it was not due to the fact that science teachers did not go through a certain training in which they implicitly received information about polar sciences.

As a result of the findings obtained from the South Pole sub-dimension, it was determined that the participants had limited knowledge about the South Pole region. In this direction, it was determined that the participants did not have sufficient knowledge of the climate and vegetation of the South Polar Region, the animals living in the region and the geographical names in the region. Yalçınkaya et al. (2020) investigated the contribution of Antarctic painting competition to polar science awareness activities. Antarctic painting competitions are organized every year by the Polar Research Student Team (PolSTeam) in cooperation with the Association of Polar Early Career Scientists (APECS). The paintings from all over Turkey were exhibited at two metro stations in Istanbul to reach a wider audience and raise awareness of climate change, especially in the Polar Regions, and to convey the issue to other segments of the public. Barış (2020) examined the change in students' awareness of Antarctica through online science interviews. During the implementation process, the online science interview "Science Journey in Antarctica" was shared with the students and they filled out an evaluation form after watching the video. It was concluded that the students who had no idea about Antarctica had in-depth knowledge and wanted to get information in the future in order to participate in the research to be conducted here. Ursavaş and Kandemir (2020) tried to determine the knowledge and awareness of secondary school students about Antarctica. According to the findings of the study, it was seen that students had inadequate and alternative concepts about Antarctica. To increase the awareness of students, it is recommended to carry out studies on biological, geographical and climatic characteristics. In another study of the researchers (2020), they used the Word Association Test (WAT) to reveal the cognitive structures of secondary school students about Antarctica. According to the findings obtained from the study, it was concluded that the students associated Antarctica with cold, that there were fewer words emphasizing the scientific features of Antarctica and that the students confused Antarctica with the North Pole due to the high frequencies of the features of the North Pole such as polar bear and Igloo. In the study conducted by Göktaş (2022), the contents of the 9th and 10th grade mathematics and physics curricula were examined and it was determined how much they were included in the achievements. In the study, it was found that the content of the curricula of the secondary education courses renewed in 2018 did not mention pole research and scientific studies conducted in this direction. The researcher suggested that to raise awareness of polar research, the subject should be spread to the units and acquisitions of the courses at all levels of education. It was concluded that even in the revised curriculum, there were no acquisitions related to polar sciences and teachers who were students at the time did not learn this information.

As a result of the findings obtained from the climate change sub-dimension, it was determined that the participants had high levels of knowledge about the causes and consequences of climate change. Although their level of knowledge on climate change was high, it was determined that their conceptual knowledge on climate change was at a low level. Eroğlu and Aydoğdu (2016) tried to determine the knowledge levels of pre-service science teachers about global warming. The level of knowledge of pre-service science teachers about the consequences of global warming was found to be quite high. Another result is that although pre-service science teachers' level of knowledge about global warming is above the average, their knowledge on some subjects is incomplete. When the answers given to the statements about what can be done against global warming and the precautions

that can be taken are analyzed, it is observed that the students' level of knowledge about these issues is quite high. Barak and Gönençgil (2020) conducted a comparison study of secondary school curricula in the world and Turkey according to the climate change education approach. In the study, it was found that basic information about climate change was given in the Turkey 2018 science curriculum, but there were not enough learning outcomes for a detailed teaching. Despite the need for curricula designed according to the climate change education approach, it is stated that there are no curriculum development studies that can meet this need in Turkey and there are very few examples in the world. It was concluded that science teachers have knowledge about the concepts of climate change and global warming in the light of science curriculum.

The knowledge levels of the participants about the North Pole, South Pole and climate change did not differ statistically significantly, although the scores of the female participants were higher than the male participants. The awareness levels of the participants about the North Pole, South Pole and climate change did not differ statistically significantly, although the scores of male participants were higher than those of female participants. Eroğlu and Aydoğdu (2016) did not observe any difference in the knowledge levels of pre-service science teachers about global warming according to gender and grade level. The reason why science teachers did not differ on the North Pole, South Pole and climate change on gender may be that they did not receive education on these subjects. It was concluded that they implicitly accumulated knowledge due to changing environmental conditions.

The knowledge levels of the participants about the North Pole, South Pole and climate change were not found to have a significant effect on the place of duty. The knowledge levels of the participants about the North Pole, South Pole and climate change were not found to have a significant effect on the place of duty. It was concluded that there was no difference because the undergraduate education of science teachers was similar to each other and the place of employment had the same conditions.

Based on the results of the study, the following recommendations are presented.

1-A polar sciences course can be added to the undergraduate courses.

2- Acquisitions related to the North Pole can be included in the science curriculum.

3-Gains related to the South Pole can be included in the science curriculum.

4-The number of acquisitions related to climate change can be increased in the science curriculum.

5-The diversity of concepts in the acquisitions related to climate change in the science curriculum can be increased.

6-In-service trainings for science teachers about polar sciences can be planned.

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