

Analyzing literacy on weather-related hazards and risks among students of an Eastern Mediterranean region

Katerina Papagiannaki¹, Kyriaki Makri^{1,2}, Vassiliki Kotroni¹, Konstantinos Lagouvardos¹

⁽¹⁾ National Observatory of Athens, Institute for Environmental Research Greece & Sustainable Development

⁽²⁾ Ministry of Education and Religion, Directorate of Secondary Education A' Athens.

Supplementary Material

Questionnaire

Title: 'Research on student literacy about weather phenomena and associated natural hazards'

Link:

https://docs.google.com/forms/d/e/1FAIpQLSfQtsj_NB2LEgDbQzcNNiYsyETO45vqlwRr4A4NhFpHJsYdPQ/viewform

Introductory text

Do you often observe cloud formations in the sky? Are you impressed by the creation of a storm? Have you considered how weather phenomena are created and how their evolution can affect your daily life? Answer the questionnaire below to help us capture your views. The research is aimed at students in the 1st, 2nd, and 3rd middle school classes and 1st high school classes. It is carried out with the permission of the Ministry of Education No. Prot. 37560/D2. It is conducted using an anonymous questionnaire, which you will find at the following link, and the duration of its completion does not exceed 10 minutes.

Main Questionnaire [Note that only questions considered for the present analysis are shown in the following]

Attitudes (Likert-type questions, 5-level scale: 'not at all' to 'very much')

1. Are you interested in weather phenomena and the risks they hide? (personal motivation)
2. Do you enjoy activities related to weather observation? (personal motivation)
3. Do you think you can interpret a weather phenomenon's evolution through observation? (personal motivation)
4. Would you consider working professionally in Meteorology and natural disaster protection? (Instrumental motivation – student perspective)
5. To what extent do you think the following apply to these areas?

- I. They are areas where I believe I can succeed as a scientist (Instrumental motivation – student perspective)
 - II. They are areas that I consider to have a good professional perspective (Instrumental motivation – student perspective)
 - III. They are areas that my professors encourage me to pursue (Instrumental motivation – others perspective)
 - IV. They are fields that my parents encourage me to pursue (Instrumental motivation – others perspective)
6. How useful do you consider scientific knowledge about weather phenomena and associated natural hazards? (confidence in science)
 7. To what extent do you think scientific research can help protect citizens from weather-related natural hazards? (confidence in science)
 8. Do you think you can understand the concepts of meteorology? (self-belief)
 9. Do you think you understand the risks associated with severe weather? (self-belief)
 10. How easy do you think it would be to do the following yourself?
 - I. Explain the increase in extreme weather events due to climate change. (self-belief)
 - II. Identify the social impacts of severe weather events. (self-belief)
 - III. Explain how the greenhouse effect affects the occurrence of heat events. (self-belief)
 - IV. Discuss policies and measures to reduce the risk of severe weather in your area. (self-belief)

Knowledge

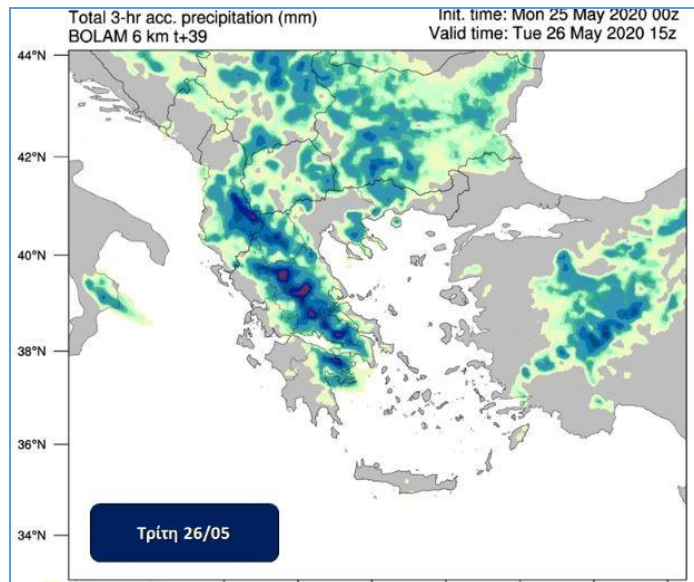
Content knowledge (dichotomous questions)

1. Choose TRUE or FALSE in each of the following sentences:
 - I. In Greece, during the summer season, the strongest winds are observed in the Ionian (true)
 - II. Lightning is not a danger to human life (false)
 - III. In Greece, the most frequent phenomena that cause damage to crops are frost and hail (true)
 - IV. The spread of forest fires is favoured by high humidity (false)
 - V. Extreme weather events cannot always be predicted accurately (true)
 - VI. Landslides are not related to weather phenomena but only to earthquakes (false)
 - VII. In Greece, most floods are caused by short-lived storms (true)

- VIII. The phenomenon of African dust transport is not associated with weather phenomena (false)
2. In which clouds are lightning formed:
- I. In the storm clouds (true)
 - II. In all the clouds that bring rain (false)
3. The greenhouse effect:
- I. It contributes to the increase in the surface temperature of the Earth (true)
 - II. It contributes to the decrease in the surface temperature of the Earth (false)
4. Occurs in storms:
- I. Lightning strikes (true)
 - II. Tornado (false)
5. The temperature differences that cause lateral and vertical air movements are called winds. This is because:
- I. Warm air tends to rise, while cooler air takes its place (true)
 - II. Warm air tends to descend, while cooler air takes its place (false)
6. It is an artificial term created by scientists to describe the weather conditions that prevail in an area, as well as their deviations over a long period of time, at least 30 years.
- I. The term "climate" (true)
 - II. The term "weather" (false)

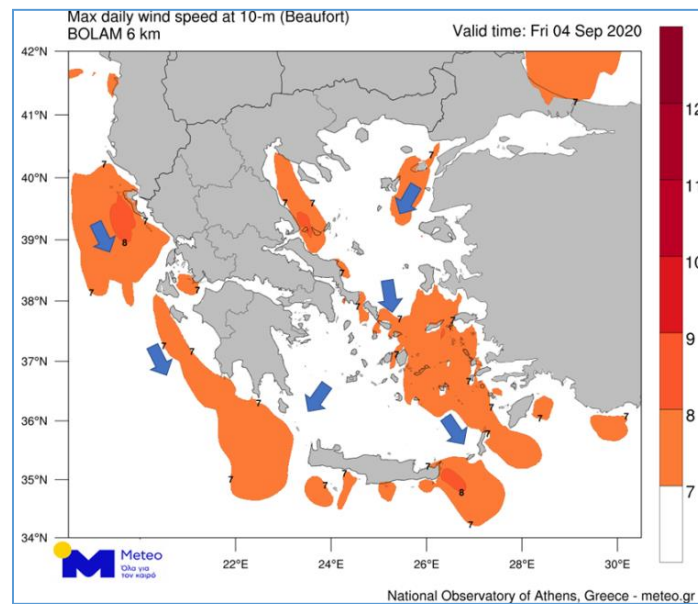
Procedural knowledge (Likert-type questions (5 levels: 'not at all' to 'very much'), which are manipulated to become dichotomous items grouping for true/false. *True* corresponds to the answers shown in parentheses in the following)

1. Based on the following weather map, note how likely heavy rainfall is to develop in the following areas:
- I. Crete (level 1)
 - II. Attica (level 3-5)
 - III. Thessaly (level 3-5)
 - IV. Western Peloponnese (level 1-2)
 - V. Cyclades (level 1)



2. Based on the following weather map, note how strong winds will likely develop in the following areas:

- I. West Macedonia(level 1)
- II. The Ionian Sea (level 3-5)
- III. Crete (level 2-3)
- IV. Eastern Aegean (level 3-5)
- V. Thrace (level 1)



Competency (Likert-type questions (5 levels: 'not at all' to 'very much'), which are manipulated to become dichotomous items grouping for true/false. *True* corresponds to the answers shown in parentheses in the following)

1. In the photo below, does the formation of Cumulonimbus clouds foreshadow hazardous weather?
[Choose TRUE or FALSE] (true)



2. In the photo below, does the formation of cirrus clouds foreshadow hazardous weather? [Choose TRUE or FALSE] (false)



3. In the photo below, does the Cirrocumulus cloud formation foreshadow hazardous weather?
[Choose TRUE or FALSE] (false)



4. For each of the following statements, indicate the degree of concern it causes you.
 - I. "The weather will be clear for most parts of the country on Monday". (level 1)
 - II. "From noon, the snowfall will gradually extend to all the mountains, the semi-mountains of the central country, as well as to the plains in the north". (level 3-5)

- III. "Intensity of rain expected from Tuesday and drop in temperature". (level 3-4)
 - IV. "Winds in the west will blow from northerly directions, 3-5 Beaufort and in the east will blow southerlies, with the same intensity". (level 1-2)
 - V. "Winds will blow from northerly directions, in the Aegean 8 and locally 9 Beaufort". (level 3-5)
5. A lightning strike can be more dangerous if: (Choose TRUE or FALSE):
- I. Holding an umbrella. (true)
 - II. You remain crouched on the ground. (false)
 - III. You stay in the car. (false)
6. During a storm: (Choose TRUE or FALSE)
- I. We can take shelter under a tree. (false)
 - II. We must get out of the sea. (true)
 - III. We can take shelter under metal structures. (false)
7. How can we better protect ourselves if we find ourselves in a car in front of a flooded road? (Choose TRUE or FALSE)
- I. To cross him at very low speed. (false)
 - II. Let's follow the example of the front driver. (false)
 - III. Turn back and leave. (true)
8. In case of heatwave: (Choose TRUE or FALSE for each answer)
- I. We eat more salty foods. (true)
 - II. Drink plenty of fluids to hydrate. (true)
 - III. We intensify our physical activities. (false)

Sociodemographics

- 1. Gender (female/male)
- 2. School class: middle -1st year / middle -2nd year / middle -3rd year / high -1st year
- 3. Urbanization (rural / semi-urban / urban al)
- 4. Municipality of permanent residence
- 5. Level of education of each parent (primary, high school, technical, bachelor, master, PhD)