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Education of students from Greek schools regarding natural disasters through STEAM

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Abstract

The goal of our research is to educate students at primary schools in Greece on rapid ongoing natural disasters through the holistic-interdisciplinary science, technology, engineering, art, and mathematics (STEAM)-based method. As a learning tool, an integrated program was designed with a variety of actions and activities aiming to experientially educate students in a holistic-interdisciplinary STEAM-based way. These are based on science, technology, engineering, art, and mathematics. This three-month program was chosen to be conducted in a private school of Attica, Greece, for the course "skill laboratories". It was conducted to students of the second (seven years old) and the fifth grade of primary school (10 years old). In the beginning and the end of the program, the 133 participating students were given questionnaires, in order for the program to be assessed as to whether it managed to accomplish the initial goals. A total of 266 digital questionnaires were collected through ArcGIS survey123 application (part of geospatial cloud by Esri), which is an integrated solution for the creation, distribution and analysis of survey data. From the statistical analysis of their answers, the conclusion was that the vast majority of the students felt stress, confusion, depression and shock when they saw a forest fire. Most kids stated that they have thought of the consequences of extended wildfires and the flood events that follow.

Keywords: rapid ongoing natural disasters, primary education in Greece through STEAM, questionnaires

INTRODUCTION

In the last years, several studies about STEM have been conducted. Science, technology, engineering, art, and mathematics (STEAM) is a new educational approach, which interests the societies globally. STEAM took its name from the initial letters of the fields: science, technology, engineering, art, and mathematics (Psycharis, 2018; Psycharis et al., 2020). One of the versions of STEM approach is E-STEM (environmental education, science, technology, engineering, and mathematic), that is an interdisciplinary collaboration of STEM with environmental education/education for the environment and sustainability (Gupta et al., 2018), which follows the needs of the 21st century and therefore includes the environment in STEM field. By studying STEM approach, we can see that it is mainly based on the spotting of the future needs and the fact that it can meet them, creating hopes for an environmental consciousness (Helvaci & Helvaci, 2019).

There are studies for students of primary and secondary education that use interdisciplinary STEM-based activities (Akkaya & Benzer, 2020; Cho & Lee, 2013; Evelpidou et al., 2021b; Gottfried, 2015; Guven et al., 2018; Karabulut, 2017; Kim & Chae, 2015; Kurt & Benzer, 2020; Yildirim & Selvi, 2017), whereas there is an increase in the number of studies that assess the experiences of potential educators so that they are properly used in education (Adams et al., 2014; Blackley et al., 2017; Corlu et al., 2015).

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Contribution to the literature

- This research aims to contribute to the education through STEM of students attending primary schools in Greece about sudden natural disasters.
- This research aims to highlight the positive contribution of holistic interdisciplinary STEM education in the education of minors on environmental issues, as it achieves more consistent learning outcomes.
- This research presents the knowledge of children in Greece about sudden natural disasters and highlight the undeniable need for further education.

According to Balka (2001) and Psycharis et al. (2020), STEM literacy is the ability to recognize, apply and incorporate terms of science, technology, engineering, and mathematics into the process of analyzing and solving complex problems. Pitt (2009) states that STEM-based education can encourage students to study in the fields of science and mathematics, but especially in professions regarding technology and mechanics. In many countries of the world, the interest of STEM education is increasing, so that social problems can be solved, economic needs for the national safety can be met and personal needs for the integration of experienced citizens can be satisfied (Corlu et al., 2014). The same goes for our country as well, where the overall feeling of Greek educators and students was studied, revealing their desire for edification programs regarding rapid ongoing natural disasters to a percentage of 95% and 87% respectively (Mereli et al., 2022).

Green et al. (2019) emphasize the ultimate need for environmental education, as the problems of earth increase. Focusing on environmental issues dates many years back, but in 2017, in the 40th anniversary of the Declaration of the United Nations for Tbilisi, the ultimate need for the cultivation of environmental consciousness for the future of the planet, humanity and the biosphere became obvious.

According to the same authors, the environmental consciousness is developed through the geographical and natural sciences. The curriculum of natural sciences is ideal for the proper awareness of students regarding how the natural world works and the difficulties that arise from the modern-day way of living. The students' curiosity is increased and so is their enthusiasm for the natural phenomena. Given that the school area is a basic means of introducing youngsters to the overall problems of the world, as well as preparing them for surviving in it, it would be a neglection not to take a of the many-sided opportunity that is given by the environmental curriculum (Green et al., 2019).

As stated by Falk et al. (2016), the recent STEM movement was intent on introducing youngsters to scientific issues through their visits to non-typical educational methods, such as nature clubs, science camping, aquaria, museums and zoos and therefore aims to provide them with experiential. Educationally, learning experiences can promote the active learning and the development of interest for science, technology, engineering and mathematics, simultaneously increasing the extent of understanding of the environmental issues (Garst et al., 2011). Studies about the impact of non-typical education on the youngsters' interest and attraction by STEM fields (through non-typical learning methods and long-lasting educational experiences) is limited (Fields, 2009).

Mufit et al. (2020) conducted a research in Indonesia about the need of the modern-day society for the new method of educating students as a literacy skill. The new literacy includes data literacy, technological literacy, human literacy and disaster literacy, because Indonesia is very susceptible to disasters. Literacy is an important tool for students, as it allows them to recognize, understand and apply the knowledge they obtained during the learning process (Brown & Haun, 2014; Chung & Cherng, 2016; Sampurno et al., 2015). Additionally, it is the secret of their success in the daily routine, both at home and in the environment. Disaster literacy is the students' ability to process, understand and utilize knowledge (Brown & Haun, 2014; Chung & Cherng, 2016; Sampurno et al., 2015). What is more, it includes the alertness needed during disasters-emergencies during, as well as after its occurrence, with a view to minimize their impacts.

The learning process, when it is based on the combination of informatics and experiential learning, is capable of creating the conditions for the development of superior learning skills to the students, including problem solving, passing the knowledge decision making. The enrichment of education regarding all levels of the science of the environment is necessary and can be ach via the development and inclusion of pioneering and efficient learning tools, based on the use of informatics. Given the individuality of the educational process and curricula, the use of educational tools that are based on informatics must emphasize specific knowledge skills, such as the combination of many representations, the visualization, the use of repetitious processes and critical thinking (Herbert, 2003).

Nguyen et al. (2020) consider that, through STEM-based education, that is approaches based on the real world, students can reconsider their attitude towards the protection of the environment. Through an educational approach that includes solving real problems, students develop skills, such as critical thinking, practical application of theory, communication, concern and team

working. By cultivating cooperation skills at the school environment, students have a positive attitude and behavior, so that they are able to cooperate with other people outside school, thus achieving sustainable development in their community and country in general (Nguyen et al., 2020). However, despite highlighting the place and role of STEM in the student-centered education system, Georgousis et al. (2020) point out that the contribution of STEM to the formation of environmentally and socially sensitive citizens is not clear. For the formation of environmentally and socially aware citizens, the contribution of HASS (humanities, arts, and social sciences) is deemed necessary (Spoehr et al., 2010). The benefit of moving from STEM subjects to HASS subjects is important because it allows approaching ideas and problems from different perspectives and helps to understand the cultural, social and ethical context of environmental problems (Georgousis et al., 2021; Savelides et al., 2020).

In the last years, in the United States of America, several statutes have been enacted for the improvement of STEM education (Kuenzi, 2008). In America, after investments of millions of dollars since 1990, STEM education has encouragingly proceeded, thanks to the cooperation of public and private sector (Labov et al., 2009). Suchman (2014) states that the inclusion of STEM education in its current curricula is a demanding project whose condition is a change in its culture. When it comes to Turkey, Corlu et al. (2014) state that, in order for the ability of Turkey to pioneer, educated stuff is needed, experienced in science, technology, engineering and mathematics, whereas Sarier (2010) accepts that students are barren of knowledge about science and mathematics. As it is intent on increasing its global competitiveness and expertise in STEM fields, Turkey has to include all educational fields in education and edifice its educators (Corlu et al., 2014).

Situation of the Problem

In the last years, our country is continuously being struck by rapid ongoing natural disasters. We can recall the devastating wildfire in Mati, Attica in summer 2018 (Efthimiou et al., 2020; Garlichs et al., 2021; Kovács, 2019; Lagouvardos et al., 2019; Lekkas et al., 2018; Vallianou et al., 2020; Zabaniotou et al., 2021), the overflowing of the torrents in Mandra, Attica in autumn 2017 (Andreadakis et al., 2018; Diakakis et al., 2019, 2020a, 2020b; Kanellopoulos et al., 2020; Speis et al., 2019; Varlas et al., 2019) and in Politika, Psachna, and Vasilika, Euboea in summer 2020 (Karkani et al., 2021; Lekkas et al., 2020a), the frequent intense rainfall events, the devastating typhoon in Lefkas in August 2020, the earthquake and the consequent tsunami in Samos in October 2020 (Evelpidou et al., 2021a; Lekkas et al., 2020b; Papadimitriou et al., 2020), the major earthquake in Elassona in March 2021 (Lekkas et al. 2021; Mavroulis et al., 2021), the devastating wildfires in Attica and Euboea in summer (Evelpidou et al., 2022) and many others. During their occurrence, many problems, as well as losses are provoked. The Earth's climate is changing, and Greeks will keep facing the force of nature. Therefore, it would be best for them to be properly educated regarding natural disasters and the consequent problems. These could either refer to physical damages and losses or psychological and emotional harm. The most suitable place for edification is school and the best receptors and transmitters of knowledge are students.

The intense desire of citizens for STEM education, obtaining knowledge on social, scientific and technical correlations and their application to the solution of existent problems of the real world minimizes the apathy shown by the experts. The citizens of the modern-day society must be ready to face development challenges including environment pollution, unpredictable weather phenomena, the depletion of natural resources (water and energy), using knowledge on science and technology obtained at their school environment. STEM education offers students skills and especially the skill of pioneering, whose importance is increasing, as its conquest can alter the future. Through the aforementioned skills, citizens will be able to follow a sustainable way of living, promoting human rights (Nguyen et al., 2020)

Aim of the Study

The aim of the researchers is for students at Greek schools of general education to be educated on rapid ongoing natural disasters. What are natural disasters, when how and why they happen, are they a treat to humans and how the latter can be protected? This will be achieved through an experiential, pleasant and playful educational method. Initially, the motive will be tales we have prepared, referring to natural disasters that actually occurred in Greece and were possibly faced by the students. The aim will be for memories to be arose, for previous knowledge to be used and for students to be concerned about the possible solutions. Consequently, students will spend time on activities designed to make use of STEAM. Students are summoned to dramatize, create posters and board games, play at the school yard, as well as digital gaming, participate in educational excursions and experiential laboratories, express their emotions through drawing and music and create their own natural disaster ID, as well as maps of the potential escape route.

A further goal is to assess the initial state of the children before the beginning of the program, as well as after the completion of the STEAM-based education program regarding rapid ongoing natural disasters. The assessment is conducted via questionnaires and via the general feeling of the educators participating in the program.

METHODS

The research combines many ways to transfer the knowledge and collect data. Initially, we assessed the current situation of students regarding the knowledge and feelings about natural disasters. The research is conducted screening model (descriptive research). The screening model aims to describe a situation of the past or present as is. The researchers created a questionnaire consisting of seven questions on natural disasters and, more specifically forest fires. The same questionnaire was physically distributed to both age groups (children seven and 10 years old) in the course "skills workshops", in thematic cycle: caring for the environment. The method of questionnaires including multiple choice questions was chosen for the children, because it is a quick and safe way to estimate present knowledge and beliefs of children who we aimed to use as a sample and educate on natural disasters. After the questionnaires were written we asked for advice and help from a school psychologist, who pointed out the correct wording so as to minimize the possibility of creating stress and unpleasant feelings to students. Next, the questionnaires were approved by the Ethics Committee, which assesses research conducted at the National and Kapodistrian University of Athens. The results of the questionnaires that were collected, were afterwards imported into the digital platform ArcGis σε in two bases depending on the age group students belong to, so that the results can be comparatively studied. The aim of the digitization was the better analysis of the results. From this distribution, 68 questionnaires were collected from seven year old students and 65 from 10 year old students. The sample of the survey consists of seven and ten year old students of primary education because the school curriculum of our country state that students of these ages should be taught about topics related to the environment and in particular natural disasters, within the "skills workshops" course. The participants were chosen because they were students at the private school selected to conduct the research. Additionally, they were selected because in the previous summer, devastating wildfires had struck Attica Prefecture, where the school is located, which conflagrated a very high land surface and many houses. Therefore, we considered that some of the children will have experienced wildfires and we wish to assess their knowledge, as well as feelings.

For the data analysis, we used ArcGIS survey123 software, which enables the smart geographical data analysis and management. As part of the geospatial cloud by Esri, the ArcGIS survey123 software, it is an integrated solution to the creation, distribution and analysis of survey data. Its functionality focuses on the creation of smart forms that adopt the business logic and the rules for the right importing of data for the conduction of surveys. Through these forms, one can achieve the collection of valid data through internet applications, the latter being executed in the portable system environment. A descriptive statistical analysis was conducted on the students' answers. Students had to answer close type questions, i.e., select between the positive answer (yes) or the negative one (no). Additionally, they had to choose through a series of predetermined answers. Yet, in two questions of the questionnaire, students had the opportunity to record some of their thoughts if they wished so.

Afterwards, a three-month educational program followed with aimed actions and activities through which students were summoned to dramatize a scenario, design posters to inform the local community, design and play with board and digital games, take part in photography and drawing competitions within their school environment, create their own natural disaster ID, participate in educational excursions and experiential laboratories, play music and take part in a virtual wildfire extinguishing. Among these actions the students got involved with the disciplines of science, technology, arts, and mathematics.

In the end, a second questionnaire was distributed for the assessment of the program. It was given and answered by the same student sample.

The children participated with interest and managed to be educated. These were some limits though, such as the limited abilities of some children, the difficulties for field research, lack of funds, the school absences of students and possible misconceptions of the wording used in questionnaires, that could affect the outcoming results.

RESULTS

From the first questionnaires collected in the beginning of the program, the following answers were recorded, which are presented in detail in **Table 1**.

The first two questions regard the location of the permanent or temporary residence of the children and whether they are in danger of a potential wildlife due to the surrounding vegetation within or close to their residence. From the first question, we get that older children, at a percentage of almost 5%, live in a house with a garden or close to a forest. On the contrary, younger children, at a percentage of almost 67%, answered that their home does not include vegetation and it is far from forests. However, these four out of ten children answer that they do have a cottage house with these features. This is what interests us because if they do have, it is even more possible that they have experienced a wildfire of flood event, thus their education is even more important.

The following two questions regard the potential experience of the children in wildfires in their area of residence. A high percentage of the students answered negatively. Almost 7.8 out of the 10 younger kids and 6.5 out of the 10 older ones answered negatively. When it

Table 1. Percent frequencies of the students' answers to each question-1

Question	Answer	7 years old	10 years old
1. Is your house located close to a forest or does it have a garden with tall trees?	Yes	33.82%	64.62%
	No	66.18%	35.38%
2. In case you have a cottage house, is it located close to a forest, or does it have a garden with tall trees?	Yes	58.82%	64.62%
	No	41.18%	35.38%
3. Have you ever found yourself close to a wildfire?	Yes	22.06%	35.38%
	No	77.94%	64.62%
4. If so, did you have to leave the area you were in after the message by 112?	Yes	19.12%	27.69%
	No	80.88%	72.31%
5. What could you have felt as you would be watching a wildfire through the media (television, radio, & the Internet)?	Discomfort	23.53%	35.38%
	Pressure	17.65%	9.23%
	Bewilderment	33.82%	33.85%
	Disquiet	35.29%	50.77%
	Depression	47.06%	50.77%
	Joy	5.88%	4.62%
	Confusion	57.35%	46.15%
	Stress	69.12%	64.62%
6. Did you know what you had to do to remain safe?	Yes	33.82%	64.62%
	No	66.18%	35.38%
7. Have you thought about what can follow a wildfire, either immediately after it or later? Name some following events here: ……	Yes	64.71%	81.54%
	No	35.29%	18.46%

comes to whether they received a message for house evacuation by 112, less than two out of the 10 younger children and 2.8 out of the 10 older ones experienced something like this. Therefore, only a few children actually have experience in wildfires.

The fifth question aims to describe the emotional world of the children and what they felt while experiencing or watching the evolution of a wildfire through the media. The results from the answers are particularly interesting, as the majority of the kids answered that they felt anxiety and confusion. This is very impressive, as the majority answered that their area was not in danger of wildfire. Yet, they were stressed to a high level. Fewer kids stated that they felt depression, followed by the feeling of disquiet and bewilderment. Even fewer felt disappointment or loneliness. The majority of the older children answered that they felt stress. The next feeling, but not highly supported, was depression, disquiet and confusion. These were followed by discomfort and bewilderment.

Finally, one out of 10 felt pressure. In both age groups, there existed a minimum, negligible percentage, i.e., 0.6 and 0.5 out of 10, who answered they felt joy. This should probably concern us, as it seems that some students may need psychical support. In this question, all children were able to state whether they felt anything other than the fixed answers. Two out of 10 kids felt the need to memorize other feelings, anger and fear being the most famous. A common conclusion for the two age groups is that the majority felt stress as the most dominant feeling (**Figure 1**).

In the next question, which regarded the kids' knowledge on the safety measures that should ideally be followed by those struck by wildfires. The answers of the

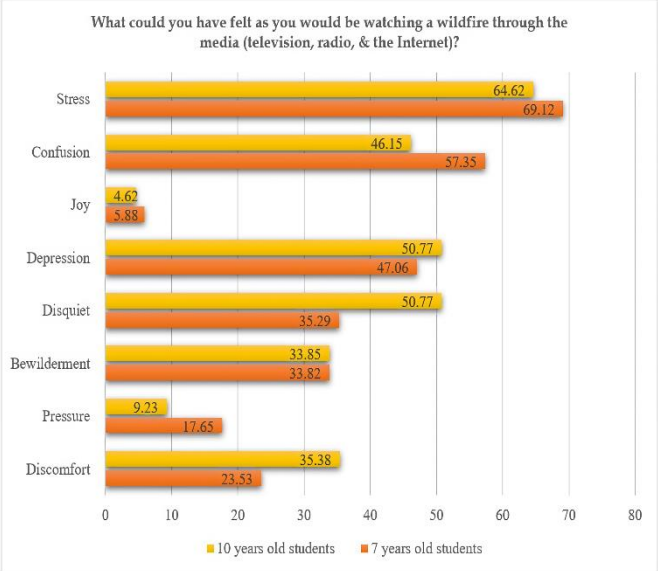

Figure 1. Answers in question 5 (Source: Authors' own elaboration)

two age groups are totally different. The majority of the younger kids stated that they are unaware of the safety measures (66%), contrary to the older ones, who stated that they are aware (6.5 out of 10). We can therefore see that some of the older students feel that they do possess knowledge that makes them feel kind of safe and prepared (**Figure 2**).

In the last question, the kids were summoned to answer whether they have thought of what the possible consequences of wildfires are. Most of the younger and older children stated that they do have. In this question too, they had the ability to memorize some of them. The majority of the young ones answered that forests were burnt, houses were devastated, animals were burnt, and

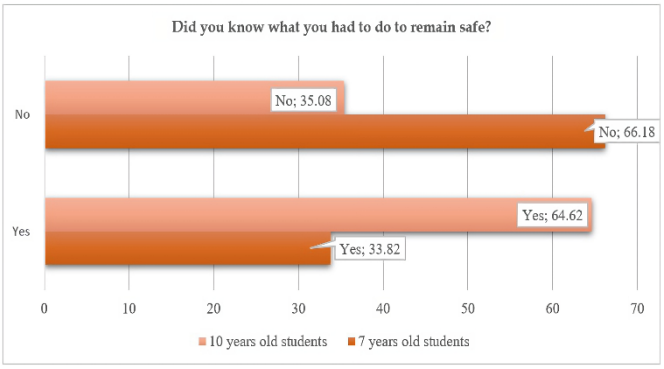

Figure 2. Answers in question 6 (Source: Authors' own elaboration)

the oxygen decreased. The older ones memorized all the above, but also made deeper thoughts. They additionally mentioned that there will be climate change-driven consequences, floods and potentially a change in the temperature.

In conclusion, even though some kids have actually experienced a wildfire, they seemed to possess inadequate knowledge of wildfires and were thus concerned. Human and environment-friendly feelings were created to them.

In this point, it would be very interesting to mention that the total of 133 participating kids includes 36 children with learning disabilities. These compose a 27.06% of the total number of the students (**Table 2**). 69.44% of these are male students and the rest 30.55% female ones. This percent also includes some non-diagnosed students, who are yet in need of special treatment according to their teachers. This is the case in every Greek school, and it is real. It would be a great challenge for us to separately assess how one such program could function for these children.

Regarding the edification program, the produced results are of high interest. The 133 students gladly took part in the digital, board and field games, the competition for photographing the healthy or burnt forest, the creation of a poster, the discussion, the creation of an ID for the natural disaster, the experiential laboratory and the educational walk (**Figure 3**).

After the completion of the program, the distribution of the second questionnaire followed, aimed at the assessment of the results. In this way, what was intended to be known in the first place became known, i.e., to see the extent to which the studied part of the population managed to obtain and embed knowledge. The results are presented in **Table 3**.

The knowledge offered to the students is included in these four questions in many ways and through many activities. The assessment of the results seems particularly encouraging, as the knowledge seems to have been embedded by the students. A very high percentage of the students gave the right answers and selected what was to be selected. More specifically, as

Table 2. Number of students of special education that are included in the general education

Age group	Number of students	Number of students under special education	Boys (special education)	Girls (special education)
7 years old	68	20	16	4
10 years old	65	16	10	6

Figure 3. Photos from student's participation (Source: Authors' own elaboration)

Table 3. Percent frequencies of the students' answers to each question-2

Questions	Answers	7 years old	10 years old
1. What can happen after a wildfire? (You can select more than one answer)	Destruction of the environment	88.24%	96.92%
	Lose an animal	91.18%	93.85%
	Better view	7.35%	3.08%
	Building new houses into the forest	26.47%	38.46%
	Increase of the atmospheric oxygen	19.12%	9.23%
2. If a wildfire starts and is close to your house: (you can select more than one answer)	You run away without a plan	4.41%	26.15%
	You live your house safely and following instructions	92.65%	95.38%
	You talk with friends on the phone & explain to them what has happened	5.88%	1.54%
	You stay inside & do not abandon the house until you are instructed to	4.41%	9.23%
	You turn on the television or the radio to watch the news	50.00%	30.77%
	You prepare a bag with the necessary items & food, so that you can survive for a few days	91.18%	89.23%
3. What can follow a wildfire? (You can select more than one answer)	Earthquake	20.59%	16.92%
	Flood	82.35%	70.77%
	Tsunami	1.47%	21.54%
	Some animals cannot find food	66.18%	76.92%
	That there will be only a few animals from each species	70.59%	78.46%
	Poverty	63.24%	72.31%
	Life or property loss	60.29%	86.15%
	Wealth	1.47%	3.08%
	Development	2.94%	9.23%
4. What actions should be done so as not to cause a wildfire, even inadvertently? (You can select more than one answer)	Water the plants	83.82%	84.62%
	Use a fireplace guard in front of fireplace when it burns	50.00%	61.54%
	Grill with your friends in the woods during summer	11.76%	20.00%
	Through litter in natural environment	14.71%	29.23%
	Clean your yard & remove dead & leaves & prune low vegetation	77.94%	58.46%

regards the questions 1 to 3 about the impacts of wildfires both on the environment and humans, most of the older kids answered that that these include distraction of the environment, loss of animals, lives and property, ecosystem and food chain disturbances, poverty and floods in this order. The younger kids focused on these situations too, but in a different order. Their order was animal losses, distraction of the environment, floods, ecosystem and food chain disturbances, poverty, life and property loss. A total seven out of 10 children answered correctly, focusing on the right impacts. Other choices, which corresponded to wrong answers, both age gave only a few answers.

In the second question about the potential reaction during the wildfire, the kids seemed to have correctly recalled the possible scenarios they were taught in the classroom. The vast majority (93 and 95%) answered that they would abandon their house safely and under instructions and they would also prepare an emergency bag with food and medicine so that they can survive for a few days. The third option was also the same. They would turn on television or the radio to watch the news and be updated on the evolution of the fire (**Figure 4**).

The fourth and final question regarding preemption and what they should do in order to avoid starting a wildfire even inadvertently, both the young and the older kids selected watering their gardens in the summer months as the first choice. As a second choice, the older students chose to use a fireplace guard in front of the fireplace when it burns and clean their yards of dead greens and leaves and prune the low vegetation. The younger ones chose the same actions but in the opposite

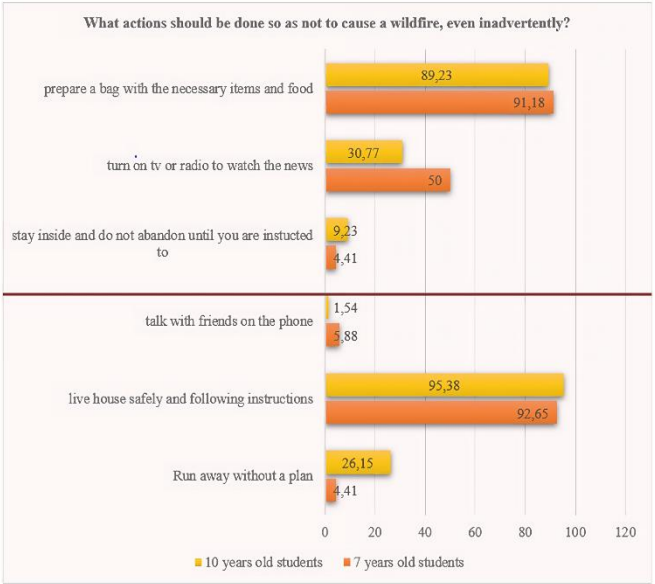

Figure 4. Answers in question 2 (Source: Authors' own elaboration)

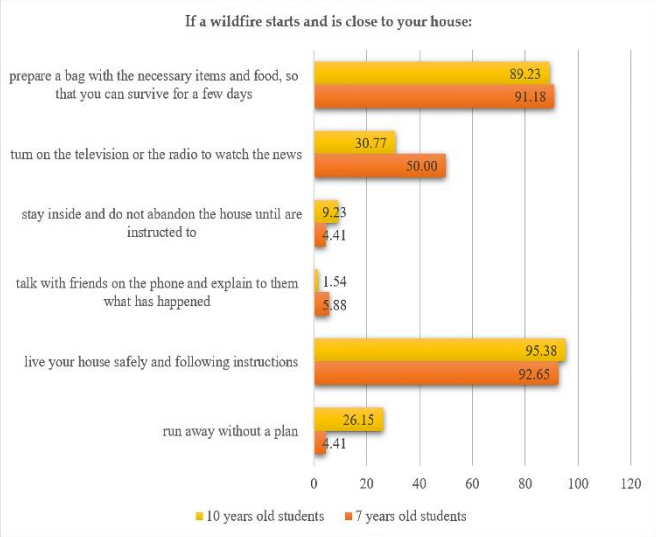

Figure 5. Answers in question 4 (Source: Authors' own elaboration)

order. Yet, all kids did choose the right answers and gave only a few wrong ones, which were still selected by a few students though (**Figure 5**).

DISCUSSION

Students participated in this training program enjoyed the process and gained knowledge and skills useful for understanding and coping with natural hazards. This belief of ours is confirmed by the results of the following surveys.

The survey by Helvaci and Helvaci (2019) for the evaluation of the effects of an E-STEM-based education on the environmental sensitization of the students and their opinion on it, did have positive results, as the participants expressed positive opinions about the environment, especially recycling, but also the usage of a variety of fields together. From the results of this survey, the need for more studies on E-STEM became obvious.

Calisici and Benzer (2021) conducted a survey on the impacts of STEM education on the students' attitude towards environmental issues, scientific creativity and problem solving skills and their results were positive. Additionally, STEM applications contributed to the increase of the academic success of the students and the development of a positive attitude towards science-related courses.

A recent research conducted by Ghadiri Khanaposhtani et al. (2018) on a four-day summer accommodation whose center was the study of the sonic field and whose participants included middle school age students aimed at the development of the students' interest in science. Three issues seemed to be necessary for the knowledge and emotional development of the participants, namely the direct relation to the nature, the access to technology and the activities that promote teamwork. The interaction with STEM issues in a real environment, through the creation of a fascinating, attractive and entertaining experience, as the participants themselves mentioned, is indeed capable of facilitating the development of their interest. The increasing contact of the participants with the natural environment during the conduction of the research activities, resulted in an increase in their independence. The combination of field exploration and scientific research was the main factor for stimulating the participants and making them independent. Furthermore, the teamwork and the social interact between the participants had a positive impact on the students' understanding, as well as interest in the field survey. As confirmed by Dohn (2013), students spending time in interpersonal communication and cooperation develop motives for learning about new issues. Palmer (2009), on the other hand, suggests that one of the basic reasons why a survey that is based on exploration seems that interesting for the participants is no other than the social participation through communication and cooperation. What was concluded through this research was that outdoor activities, as they offer a physical interaction with the natural environment, is an aid in the scientific research, especially when it comes to ecological issues. The creation of a cooperative environment, so that there is interaction with coevals, helps participants support each other and improve their self-esteem and personal ID.

The conclusion of the research of Mufit et al. (2020) was that the teaching at school is traditional and teacher-centered, thus creating a cooperative and communicating vacuity between the students. In addition, experiments are only rarely conducted, thus resulting in a lack of knowledge on data collection and processing. Students are not involved in activities based on information and communication technology, thus excluded from education on the new literacy skills the 21st century demands from them. Manuals and the learning process regarding the embedding of the new literacy (especially when it comes to natural disasters) is still of low level. The consequence of this reality in Indonesia is the lack of successes in learning, the daily routine and the future of the students. The need for technological education in Indonesia is obvious and does not only demand knowledge on computers, but instead aims at the obtaining of skills such as the use of the right technological means safely, responsibly, creatively and efficiently. What is more, the suggested solution to the existent problems is the creation of a teaching material with a variety of activities for improving the new literacy and disaster literacy.

One of the reasons of the failure of STEM in the educational process is relevant to the lack of strategies in the STEM education (Seymour & Hewett, 1997). In another research, Sumen and Calisici (2016) state that educators of primary schools consider STEM education

effective, entertaining and easy and that they will incorporate it into their courses in the near future. Colbeck et al. (2008) emphasize that educators of primary schools were characterized by high sensitization levels to STEM education, which is very important for the evolution of STEM. The expected result of this situation is the knowledge of effective teaching methods through STEM, so that STEM education is improved for the students as well. Corlu et al. (2014) support that educators do not possess the necessary knowledge to teach and offer an integrated STEM education. Tezel and Yaman (2017) mention that there exists the need to increase the sensitization to the STEM approach, not only by educators, but all citizens in general. For a successful STEM education, strong foundations are needed during the first school years (Sumen & Calisici, 2016). According to their research, Bakirci and Karisan (2018) conclude that for the achievement of the goals of the 21st century, governments, operations and educators must cooperate harmonically, as STEM education is considered to be the best solution to the prosperity of the world, which is based on knowledge. More specifically, the educational community is the main key of success for STEM.

CONCLUSIONS

In conclusion, the students' education on sudden natural disasters through STEAM is a holistic-interdisciplinary approach that can lead to positive and secure results to a high extent. Through a pleasant and constructive way and many approaches, students can obtain knowledge and skills regarding natural disasters, which could potentially be of particular help for their lives. They gladly took part in the cross- thematic activities and the educational program. The assessment of the results of their edification was particularly satisfying. This allows us to accept that a larger diffusion of the program could be applied to more Greek schools and can actually lead to the intended results regarding preemption, facing and rehabilitation from a wildfire or flood.

The holistic interdisciplinary steam approach chosen to be used helped to deliver the knowledge to more students, as it was done through alternative and diverse ways and thus helped to engage all children inclusively. Each student depending on their interests and abilities was also helped by a different activity and received the information through experiential, enjoyable and playful ways. In particular, they managed to express their emotions, create, draw, take pictures, make musical instruments, play, reflect on consequences and through them prepare themselves for something sudden that may happen.

STEAM interdisciplinary approach, which is attracting worldwide interest not without reason, can contribute to the approach to knowledge more effectively than any other. This is because it offers multiple and diverse possibilities for engagement and thus reduces the risk that a child will not find something familiar and endearing that he or she is interested in engaging in. This was also the case in our research as children with learning and/or behavioral difficulties as indicated by the classroom teachers participated in alternative activities and also mastered knowledge. All children were able to engage and give the correct answers to the questionnaires given in a high percentage.

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