CHOICE - INCREASING YOUNG PEOPLE'S MOTIVATION TO CHOOSE STEM CAREERS THROUGH AN INNOVATIVE CROSS-DISCIPLINARY STE(A)M APPROACH TO EDUCATION

National report on local and regional initiatives, best practices, students' attitudes and teachers' approaches to STEM education

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1 Background information

1.1 Information about Greece.

Greece is the southernmost of the countries in the Balkan Peninsula. Historically the mountains of Greece have impeded communication but the access to the sea made easier internal communications. It is bordered by Albania, North Macedonia, Bulgaria, and Turkey.[1]

The population of Greece is at 10,423,054, and the largest cities in Greece are Athens and Thessaloniki.[2] The official language spoken is Modern Greek. Modern Greek generally referred to by speakers simply as Greek (Ελληνικά, *Elliniká*), refers collectively to the dialects of the Greek language spoken in the modern era, and includes Standard Modern Greek.

1.2 Statistics

Most High Schools operate from 8am to 2pm, but there are also evening schools that operate from 7pm till 10pm for students – mainly adults – who work during daytime. A variety of subjects are taught in Junior High Schools, including Modern and Ancient Greek Language, **Maths, Physics, Chemistry,** Geography, History, Physical Education, Religious Studies, Music and Art, while special emphasis is given to foreign language learning, as students are taught both English and another European language of their choice (students tend to choose between French and German). Students take exams in all subjects at the end of each school year.

Students may also pursue vocational training in Vocational High Schools, or, once they are 16, they may enrol in a Vocational Evening High School and graduate after 4 years of study. In addition, there are Vocational Training Schools; in these schools, as well as in all Vocational High Schools students attend general education courses combined with workplace courses. At the final stage of their studies, a student may work as an apprentice and gain valuable work experience.

High Schools offer a combination of General Education courses and Advanced Placement courses. Students who wish to pursue studies in Higher Education take Panhellenic exams in a specific number of Advanced Placement courses which fall into one of the following categories: Humanities, Science, Technology. This is considered to be a tough and highly competitive exam process that students go through in order to ensure education at a higher level.[3]

The **school laboratory of natural sciences (SEFE)** covers the needs of natural sciences laboratory teaching. The implementation of lab activities is an integral part of teaching natural sciences subjects. Students work in groups on a specific subject, developing their creativity in a spirit of cooperation. At the same time, they have at their disposal up-to-date instruments. The latter help them discover the

[1] https://www.britannica.com/place/Greece/Local-government#ref26469
[2] https://www.worldometers.info/demographics/greece-demographics/#pop
[3] https://www.fulbright.gr/en/study-in-greece/the-greek-educational-system

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environment and the laws that govern it. In order to offer extra support to lab teaching of natural sciences (Physics, Chemistry, Biology, Geology-Geography), **laboratory centres of natural sciences (EKFE)** operate. There can be one or more depending on the number of school units at each education directorate. Parallel to SEFE, all school units are equipped with a **school laboratory for information technology and computer applications**. Its function is to teach computer science and computer applications as defined by the curricula and the greater educational goals.

The lab operates complementary to the educational process. It offers a modern and interactive way of learning and training through the teaching of subject fields via:

1. The use of certified educational software
2. Pedagogical use of the Internet
3. The support of project-based learning in the framework of the school's activities
4. The European cooperation actions
5. The broadening of purely teaching activities (enhanced teaching, additional teaching support).[4]

- The teaching profession is highly attractive but opportunities and incentives to improve professionalism are lacking.
- Education expenditure is lower than in most EU countries and largely spent on salaries.
- Early school leaving has been further reduced, particularly in rural areas.
- Finding employment after education remains difficult, including for highly qualified people.
- Measures to tackle the brain drain of tertiary graduates are being implemented but
- internationalisation of Greek universities is underdeveloped.[5]

2 Integration of STE(A)M in schools

2.1 Good practices and ongoing national and international projects, resources, initiatives related to STE(A)M

What is relatively new regarding STEAM is the part of the Arts being embedded with Science, Technology, Engineering and Mathematics (STEM) and brings the STEM together with Arts (STEAM). Therefore, this addition is introducing students and educators a more holistic approach in the classroom that involves inquiry, innovation and critical thinking. Teachers in Greece have been trying to motivate the students in order to think of STEAM education and the connection of STEAM education and Greek ethnicity. STEAM is developed to integrate STEM scientific subject categories into various relevant disciplines for education. These constructed programs aim to teach apprentices to think critically and use engineering, technology,

[4] https://eacea.ec.europa.eu/national-policies/eurydice/content/teaching-and-learning-general-lower-secondary-education-16_en
[5] https://ec.europa.eu/education/resources-and-tools/document-library/education-and-training-monitor-2019-greece-report_en

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natural sciences in virtual designs or creative approaches to real-world problems while building on them mathematics and science base. Thus, STEAM programs add Art to STEM curriculum by depicting on design principles and enheartening and invigorating creative solutions.

In other words, it introduces students and educators to a holistic approach in classroom. STEAM removes limitations and replaces them with wonder, critique, inquiry, and innovation. Considering the importance of helping pupils understand that STEAM education is connected to everyday life, teachers in Greece need to motivate the students in order to think of the interdisciplinarity of STEAM education and more specifically, the connection that may exist between STEAM education and the Greek culture. In other words, pupils have to cooperate in an interdisciplinary way during discovery, inquiry and experiential learning activities.

STEAM rises up STEM to the next level: it provides students to network their learning in these critical areas together with arts concepts and practices, design principles, and standards in such a way to provide the whole floor of learning at their disposal[6].

"STEM or STEAM alone miss several key components that lead to the feasible holistic approach, that many employers, educators, and parents have voiced as critical for our children to thrive in the present and rapidly approaching future. STEM integrated with arts and culture could offer such miss and develop to an educational approach to learning that uses of Science, Technology, Engineering, Mathematics in Arts and Culture as access points for guiding student inquiry, intercultural dialogue, critical thinking, understanding, realization of a common language; that of STEM. The end results are students who take thoughtful risks, engage in experiential learning, persist in problem-solving, embrace collaboration, and work through the creative process, all targeted to an interesting other half; the humanities […] for example Using proper tools from STEM applied to Arts & Culture could refer to some interesting topics, here we mention some: a) teaching astronomy from astronomical significant monuments, and artefacts, deciphering and simulating myths related to cultural heritage measurements"[7]

In this chapter some of the stakeholders that are involved in STEAM education in Greece are presented. What the chapter focuses on is the initiatives taken in Greece, the best practices, and the sustainability of their actions.

2.2 National level

1. The Hellenic Education Society of STEM[8]

An example of the national level initiatives regarding the national level is the Hellenic Education Society of STEM.

[6] Watson, A.D., Watson, G. H. (2013) cited in Liritzis I. (2018) 'STEMAC (SCIENCE, TECHNOLOGY, ENGINEERING, MATHEMATICS FOR ARTS & CULTURE): the emergence of a new pedagogical discipline', DOI: 10.5281/zenodo.1214567

[7] *ibid*

[8] http://e3stem.edu.gr/wordpress/?page_id=48&lang=en

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Target group: students, parents, teachers

Aims: The aims and objectives of the E 3 STEM are to: provide best teaching and learning practices and concepts for the operative delivery of STEM in Education didactics models; provide applied teaching projects/didactic scenario and curriculum activities; provide material towards the clarification of the concepts "STEM in Education" and "STEM epistemology"; promote the implementation of "engineering pedagogy" in Education integrated in STEM Education; provide guidance through the support of STEM based laboratories; provide innovative ideas for implementation of "STEM in education" in curriculum models; create and sustain a national professional association representing the educators in STEM in Greece; preserve and deliver a representative national opinion for member associations; provide a common forum for educators in STEM education at National and International level; cooperate with other organizations and stakeholders at local, national and international levels; facilitate and provide strategies for the dissemination STEM epistemology and practices for the teaching and learning process at local, national and international level.; provide support for member associations; organize and conduct workshops, conferences and seminars; be involved in National, European and International projects; publish publications with an International focus; increase community awareness of STEM epistemology; provide a repository with "STEM in Education" learning design activities

Resource and activity: Membership provides access to material, training, advice and support. (E3STEM), can support and represent those in the foundation years of their career as teachers and it runs by providing seminars and workshops to students and schools.

Teaching strategies: The Hellenic Education Society of STEM engages in the development of STEM applications and epistemology with practices linked to the Inquiry Based teaching and learning approaches. It aims to promote the STEM epistemology, computing, computational science and computational thinking, and to advance understanding and education of the STEM methodology alongside with contemporary learning theories and didactic models. It is the only professional body for STEM education in Greece with the vision to grant chartered status to STEM in Education professionals.

Procedural information: the Hellenic Education Society of STEM was first created back in 2017 and is an independent, non-profit, registered professional body and its members work for STEM education in primary, secondary and tertiary education. It is a community of University Professors, School educators and School Advisors who share a common vision for the role of STEM epistemology in promoting education.

2. The MAthisi STEM Camp at Moraitis School[9]

Mathisi Initiative is a not-for-profit organization dedicated to introducing innovative and recognized educational programs in Greece in an open and affordable way. It is supported by foundations and private donors. For the summer 2019, it collaborated with the MIT Jameel World Education Lab (J-WEL) to establish an MIT-supported STEM Camp for the first time in Greece (and in Europe) at the Moraitis School in Athens.

[9] http://www.mathisi.org/indexeng.html

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While we haven't been able to run and expand our scheduled 2020 camp due to Covid-19, we are pursuing our work to be back with adaptative programs in the near future.

Target Group: pre-high school students (12- to 14/15 -year old children)

Aims: provide pre-high school students with local and affordable access to programs of internationally recognized excellence and relevance, to foster independent and curious learners, critical and creative thinkers, and problem-solving young adults engaged in the world.

Resource and Activity; The 2019 Mathisi Camp took place at the Moraitis School in Athens, with the participation of 60 students from 1st, 2nd and 3rd Gymnasium, coming from 20 different schools. The program cost for 2 weeks was €650 and almost a quarter of the students received financial support. Buses were provided along main routes

3. CTY Greece – Center for Talented Youth at Anatolia College

CTY Greece at Anatolia College is the culmination of the strategic partnership of three organizations with a long tradition in education and social contribution. Anatolia College, Johns Hopkins University in the US and the Stavros Niarchos Foundation, all came together to establish a center that is unique to Greece and Southeastern Europe in general.

Target Group: primary and secondary education students

Aims: The program aim offers summer programs that provide the eligible students the opportunity to engage in challenging academic work in the company of peers who share their exceptional abilities and love of learning. As part of the Older Students Summer Day Programs, students enrich their experiences inside and outside the classroom. At CTY Greece the main components of the program's educational experience are both learning and cultivating social skills, as students develop lifelong friendships. The courses are fast-paced and have high academic requirements, so that they meet the needs of the respective high academic potential children they are serving. The students come from different places and have different educational experiences. For three weeks they are invited to delve into their academic interests while being part of an extraordinary community, without distractions.

2.3 International level

1. Annual International **Symposium on the Future of STEAM (sciences, technology, engineering, arts and mathematics) Education**

The Natural & Formal Sciences and the Engineering & Architecture Research Divisions of the Athens Institute for Education and Research (ATINER) organize An Annual International Symposium on the Future of STEAM (sciences, technology, engineering, arts and mathematics) Education sponsored by the Athens Journal of Sciences and the Athens Journal of Technology & Engineering.

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Target group: educators, students

Aims: The aim of the symposium is to bring together scholars and students of sciences, technology, engineering, mathematics and arts Education. You may participate as panel organizer, presenter of one paper, chair a session or observer. Papers (in English) from all areas of mechanical engineering are welcome.

Resource and activity: The Athens Institute for Education and Research (ATINER) was established in 1995 as an independent world association of Academics and Researchers. Its mission is to act as a forum where Academics and Researchers from all over the world can meet in Athens, in order to exchange ideas on their research, and to discuss future developments in their disciplines.

The organizing and hosting of International Conferences and Symposiums, the carrying out of Research, and the production of Publications are the basic activities of ATINER. Since 1995, ATINER has organized more than 400 International Conferences and other events, and has published close to 200 books. [10]

Some European-funded projects

SMART MATHEMATICS TEACHER (SMART-MT): The project integrates innovative ICT methods in the learning process, managing to stimulate the pupil's interest towards mathematics teaching and improving their performance. More specifically, e-tools were created for teaching math as well as for developing the students' critical thinking.

Mastering Energy Supply focusing on Isolated Areas (MESfIA): The project involves the development of an MSc course specialized in Energy Supply for Isolated Areas, aimed at engineer students. The joint collaboration of academics, Engineering associations, as well as local industries, ensures the delivery of strong teaching materials and transfer of valuable skills to create a sustainable energy system for these isolated areas.

Among others, the **CIRCLE** project has promoted the social integration of migrants in the educational system, through the development of innovative pedagogies. This project aims at increasing the spread and use of state of the art, effective tools for the assessment and validation of prior learning of newly arrived migrant/refugee students in primary & secondary education. The involvement of several social actors, such as the Family and Childcare Centre from Greece and the Institute for Migration in Germany, were not only able to achieve the exchange of good practices and know-how between European partners, but were also able to influence policy making and measures dedicated for the inclusion of migrant children in the educational systems, as well as the adoption of innovative learning techniques.

[10] https://euagenda.eu/events/2019/07/22/3rd-annual-international-symposium-on-the-future-of-steam-sciences-technology-engineering-arts-and-mathematics-education-2225-july-2019-athens-greece

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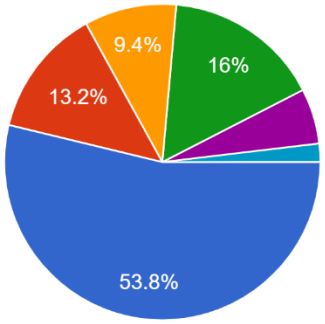
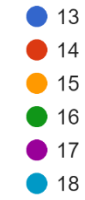
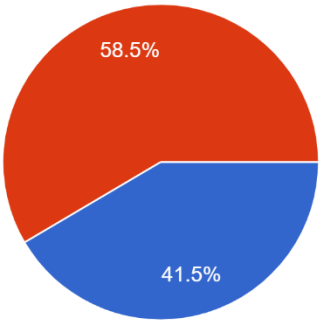
3 Analysis of students' attitudes and teachers' approaches towards STEM learning and teaching

3.1 Data collected from students' questionnaires

The questionnaire was completed by 106 students in Southern Greece. The majority of the student participants were 18 years old in the final grade of the Greek High School. As shown below, more than half of the participants were 18 years old, and all the other age groups were examined as well. The third question regarding the gender of the participants, showed that the number of participants were balanced with 58.5% being female and 41.5% being male. The third question regarding the gender of the participants, showed that the number of participants were balanced with 58.5% being female and 41.5% being male. The third question regarding the gender of the participants, showed that the number of participants were balanced with 58.5% being female and 41.5% being male.







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When it comes to questions the questionnaire consisted of closed-ended questions where the students could choose between Not confident at all, Fairly Confident and Very confident in order to assess their confidence level and attitude toward STEM subjects at school.

- The first of these questions was “5. How confident are you that you are able to ask questions about a phenomenon or define a problem that needs to be solved?”. As shown below, more than half of the participants at 66.7% have answered with Fairly Confident, only a small percentage answered Not Confident at all and 29.5% answered with Very Confident.

- The next question was “6. How confident are you that you are able to plan and carry out investigations?” and again more than half of the students replied with Fairly Confident, while 26% answered Very Confident and 17.3% answered with Not Confident at All, as shown below.

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- The following question showed similar results, in examining “7. How confident are you that you are able to analyse and interpret data?” the results are again analogous to the previous question with more than half of the participants replying with Fairly Confident at 57.1%, with 28.6% with Very Confident and 14.3% with Not Confident at all.

- Next, the following question is examining “8. How confident are you that you are able to use mathematics and computational thinking?” the responses are quite parallel to the previous ones with 49% answering with Fairly Confident, 35.6% with Very Confident, and with 15.4% with Not Confident at all.

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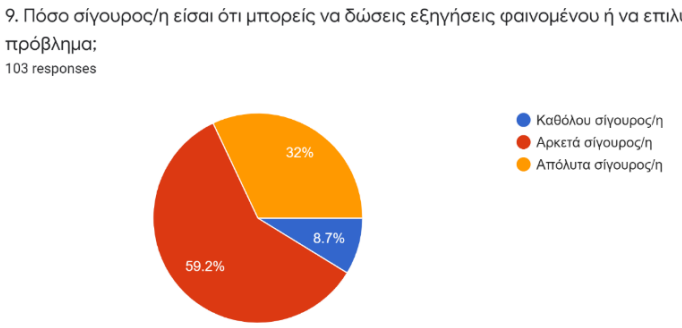
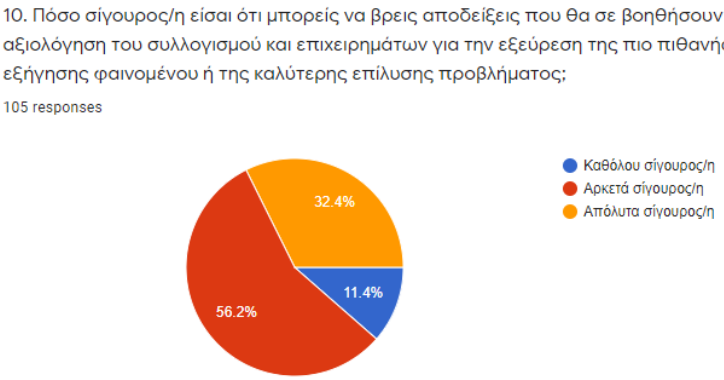
- The following question is asking “9. How confident are you that you are able to build explanations about a phenomenon or design solutions for a problem?” and the replies we got are again of the same pattern. The majority answered with Fairly Confident at 59.2%, the 32% at Very Confident and the 8.7% at Not Confident at all, as shown below:



- The next question examines “10. How confident are you that you are able to find evidences that help you to reason and argument when finding the best explanation to a phenomenon or the best solution to a problem?” and the answers gathered again the majority in Fairly Confident with 56.%, the 32.4% at Very Confident and the 11.4% at Not Confident at all, as shown in the pie chart.



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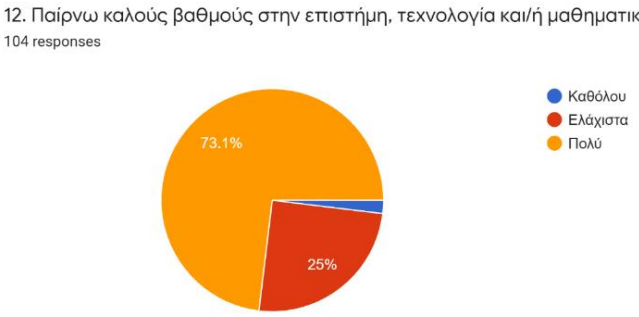
- From the following question and on, the pattern is changing. The next question is “11. How confident are you that you are able to obtain, evaluate, and communicate information?” but in this question the majority lies no longer in the answer Fairly confident, but in Very Confident with 51.9%, then in Fairly Confident with 42.3% and only at 5.8% with Not Confident at all.

- The next question is aiming to assess how the students feels about their grades, with the statement “2. I get good grades at science, technology and/or mathematics” and the possible answers being “Quite a lot” at 73.1%, Fairly with 30.4% and Not at all with 6.5%.



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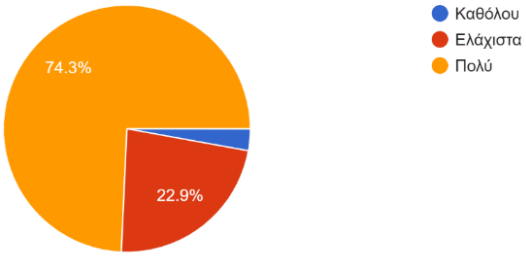
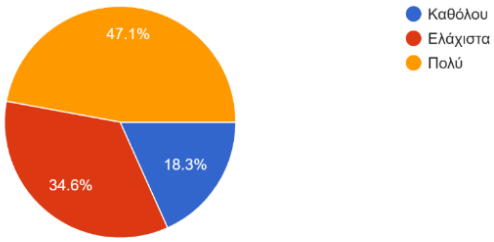
- The next question is aiming to assess how comprehensive the students find STEM courses, with the statement “13. I understand everything in my science, technology and/or mathematics lessons.” The results here follow the same pattern as the previous question, at 74.3% with Quite a lot, 25% with Fairly, and only 2.9% with Not At all.

13. Καταλαβαίνω τα πάντα στο μάθημα επιστήμης, τεχνολογίας και/ή μαθηματικών.
105 responses



- The following question is assessing if the students “14. find science, technology and/or mathematics easier than theoretical subjects” and the answers were 47.1% Quite a lot 34.6% Fairly and 18.3% Not at all, as indicated below.

14. Βρίσκω τα μαθήματα επιστήμης, τεχνολογίας και/ή μαθηματικών πιο εύκολα από τα θεωρητικά μαθήματα.
104 responses



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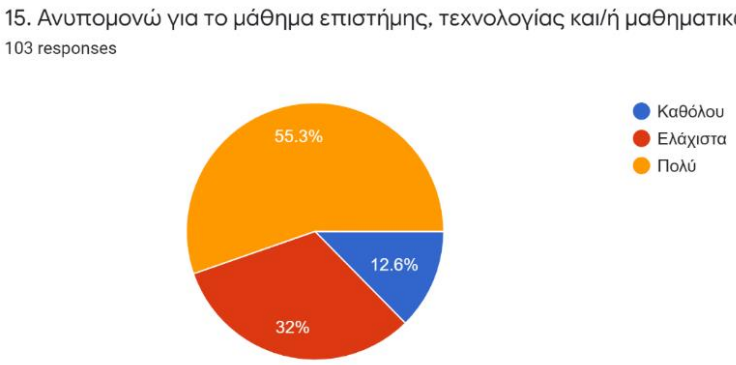
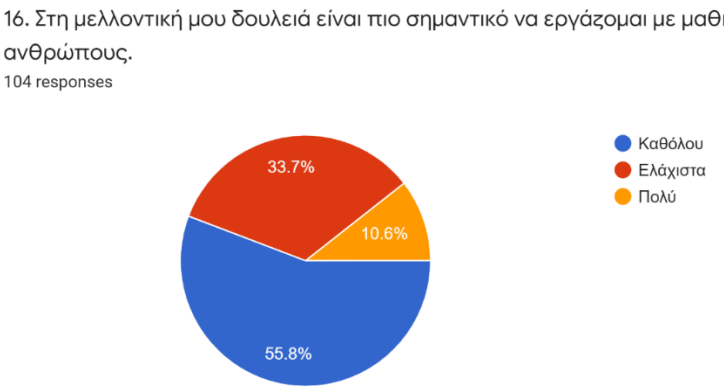
- The next question is assessing how much the students “15. Look forward to my science, technology and/or mathematics lessons” and the answers were 55.3% for Quite a lot, 32% for Fairly and12.6% for Not at all, as shown below.



- The next question is “16. For my future job it is important to me to work with mathematics rather than people” and the majority of the students replied with 55.8% with Not at all, 33.7% Fairly, and 10.6% Quite a lot as shown below:



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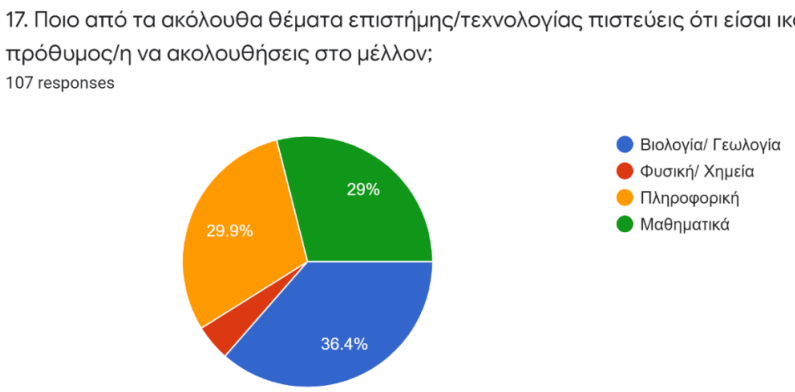
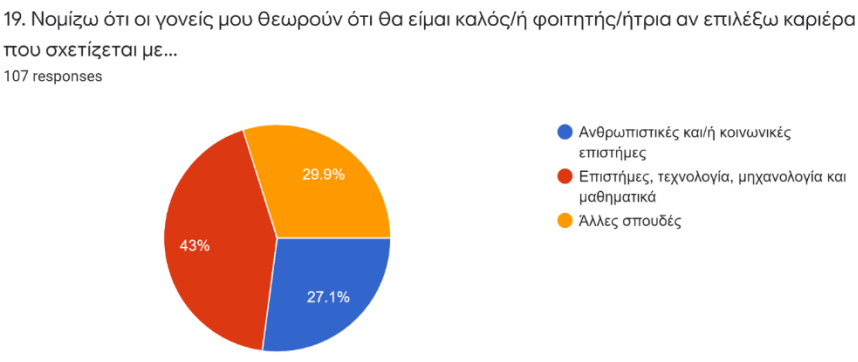
- The next question is asking the students “17. Think about science and technology subjects. Which of them do you feel you are capable and willing of studying in the future?” and the students replied with 36.4% with Physics/Chemistry, 36.4% with Biology/Geology, 29.9% with Informatics and 29% with Mathematics as shown below:



- The following questions ask the students to evaluate the opinion of their teachers and parents about their capabilities in STEM courses. In the question “18. I think that my **teachers** consider that I will be a good student of…” the 42.5% answered A Career related with science, technology, engineer and mathematics, the 29.2% answered A career related with humanities and the 28.3 selected Other studies.

  The next question is examining the same but for the students’ parents: “19. I think that my parents consider that I will be a good student of…”. As we can see below, the 43% answered A Career related with science, technology, engineer and mathematics, the 27.1% answered A career related with humanities and the 29.9% selected Other studies.



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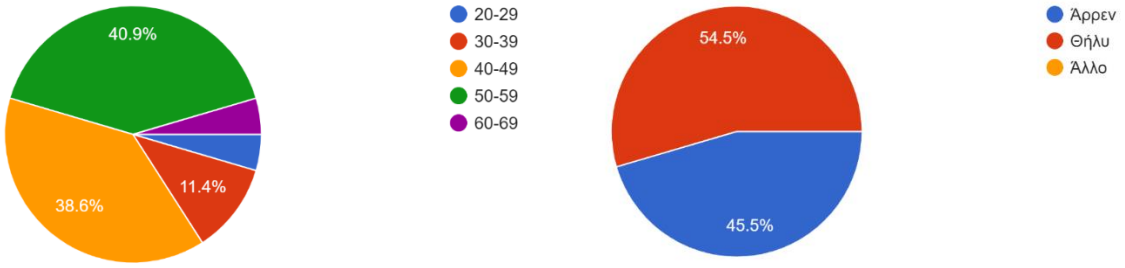
3.2 Data collected from teachers' questionnaires

The second questionnaire that was developed in CHOICE project was distributed among participant teachers aiming to assess the attitude of educators regarding STEAM.

- The first question was about the age group of the educators that took the questionnaire and we can see that the majority of the participants were middle-aged, from ages 40-49 and 50-59. However, we managed to have participants from all age groups as shown below in the pie chart. The number of participants was balanced in terms of gender with 54.5% being female and 45.5% being male, as shown below:



- The next question was "5. How confident are you that you are able to ask questions a phenomenon or define a problem that needs to be solved?" and the answers we received were mostly Quite Confident at 54.5%, Very Confident at 38.6% and only a small percentage at Not Confident at all as shown below:

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- The same pattern is followed in the next questions: a high percentage answers with Quite Confident, then the second highest percentage answers with Very Confident, and only a small percentage with Not Confident At All. Below we can see the answers to the question “6. How confident are you that you are able to plan and carry out investigations?” where the answers were 58.1% for Quite Confident, 30.2% for Very Confident and 11.6% Not Confident At All.

- The next question is “7. How confident are you that you are able to analyse and interpret data?” and the answers we received were 72.7% Quite Confident, 22.7% Very Confident and a small fraction at Not Confident At All as shown in the pie chart.

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- The following question is examining “8. How confident are you that you are able to use mathematics and computational thinking?” and follows the same pattern. The majority has replied with Quite Confident at 52.3%, Very Confident at 31.8% and 15.9% at Not Confident At All as shown below in the pie chart:

- The next questioned asked in the questionnaire is “9. How confident are you that you are able to build explanations about a phenomenon or design solutions for a problem?” where the majority answered with 68.2% Quite Confident, 22.7% Very Confident and 9.1% Not Confident At All as shown below:

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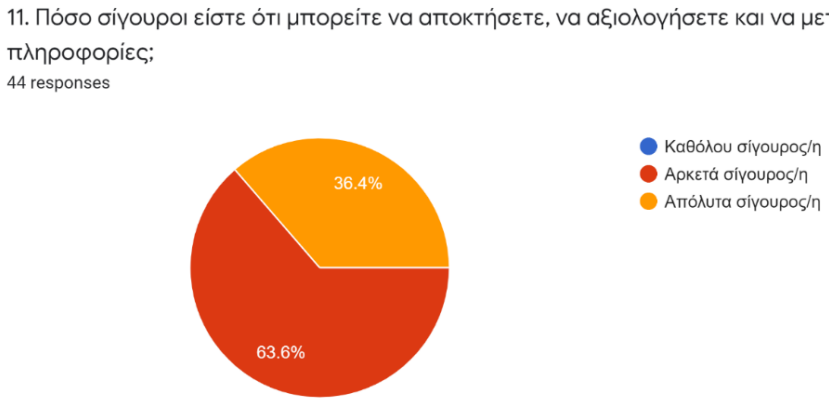
- Following the previous question, the next question asks “10. How confident are you that you are able to find evidences that helps you to reason and argument when finding the best explanation to a phenomenon or the best solution to a problem?” and the answers gathered were 75% at Quite Confident, 11.4% at Very Confident and 13.6% at Not Confident At All as we can see in the following pie chart:

- The next question is “11. How confident are you that you are able to obtain, evaluate, and communicate information?” and the answers received were only Quite Confident at 63.6% and Very Confident 36.4% as shown below:



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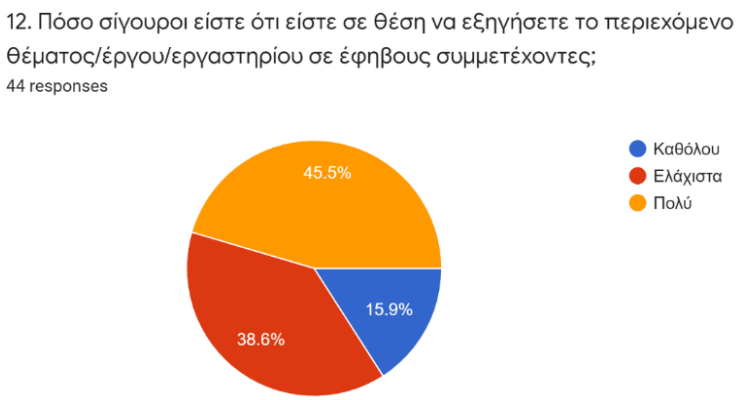
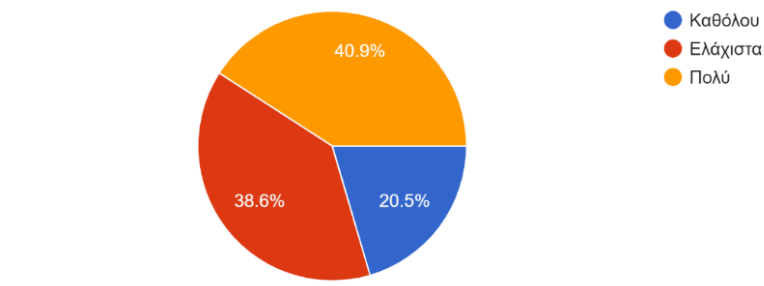
- The following question is “12. How confident are you that you are able to explain the STEM content of the subject/ project/ workshop to participant teens?” and the majority answered with Quite A Lot at 45.5%, Fairly at 38.6% and 15.9% Not At All as we can see below:



- The following question is asking “13. How confident are you that you have sufficient knowledge of STEM subjects to answer participant teens’ questions during your lesson/workshop?” and the answers received were Quite A Lot at 40.9%, Fairly at 38.6% and 20.5% at Not At All as shown in the pie chart below:



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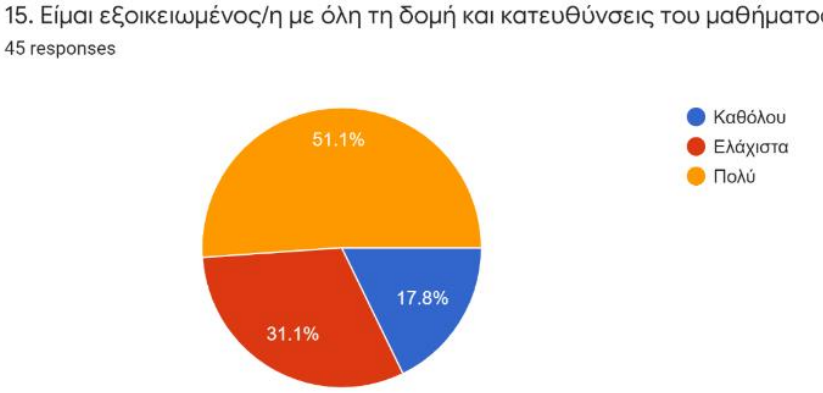
- Next, the following question is examining “14. How confident are you that you are able to use a variety of teaching approaches or strategies to develop your cognition of mathematics/ science/ technology concepts?” and the answers gathered were Quite A Lot at 54.5%, Fairly at 36.4% and 9.1% at Not At All as we can see below:

- More than half of the teachers 51.1% are very familiar with the whole structure and directions of their lesson and projects, 31.1% are fairly familiar, and 17.8% are not familiar at all.



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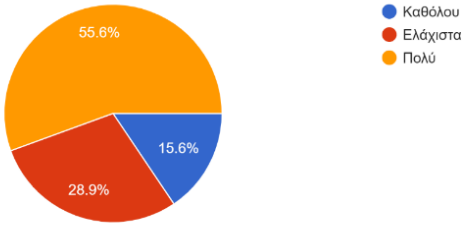
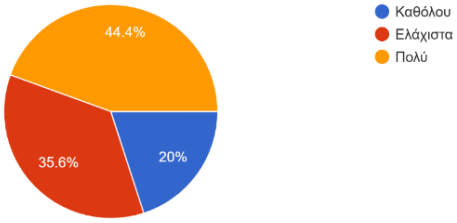
- Regarding selecting effective teaching approaches to guide student/teens thinking and learning in mathematics/science/technology, 55.6% feel very capable, 28.9% feel fairly capable and 15.6% do not feel capable at all.
- Furthermore, less than half of the teachers (44.4%) use teaching approaches or strategies to raise teens' confidence in their capacities to perform successfully STEAM activities quite a lot. 35.6% fairly use such approaches, whereas 20% do not use them at all.

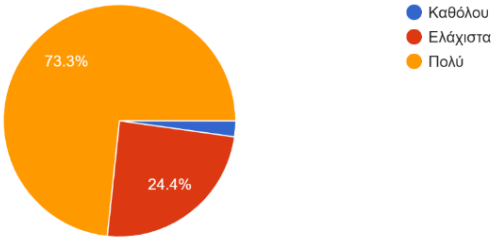
16. Μπορώ να επιλέξω αποτελεσματικές προσεγγίσεις διδασκαλίας για την καθοδήγηση των μαθητών/εφήβων και την μάθηση των μαθηματικών/επιστημών/τεχνολογίας.
45 responses



17. Χρησιμοποιώ ποικιλία διδακτικών προσεγγίσεων ή στρατηγικών για την ενίσχυση της αυτοπεποίθησης και της εμπιστοσύνης των εφήβων...κτελούν με επιτυχία τις STEM δραστηριότητες.
45 responses



18. Γνωρίζω πώς να επιλέγω αποτελεσματικές προσεγγίσεις διδασκαλίες για να καθοδηγώ τη μάθηση και της σκέψη των μαθητών.
45 responses



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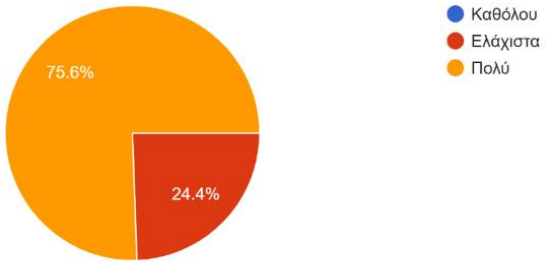
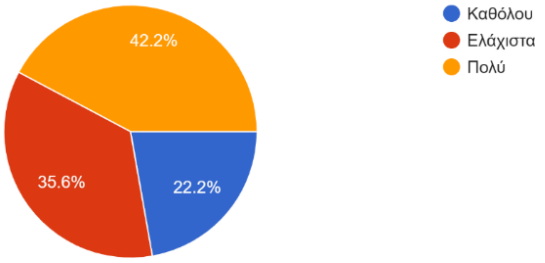
- More than half though (73.3%) believe that they know very well how to choose effective teaching approaches to guide student's learning and thinking, while the remaining teachers believe that they know fairly well how to choose such approaches.

19. Μπορώ να προσαρμόσω τον τρόπο διδασκαλίας μου σε διαφορετικούς μαθητές.
45 responses



- The majority of the teachers 42.2% believe that they are very familiar with common student understanding and misconceptions of the STEM content that they are teaching, while 35.6% believe that they are very familiar with these and 22.2% believe that they are not familiar at all.

20. Είμαι εξοικειωμένος/η με τις κοινές κατανοήσεις και εσφαλμένων αντιλήψεων των μαθητών για το STEM περιεχόμενο που διδάσκω.
45 responses



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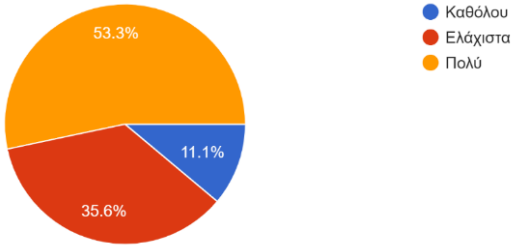
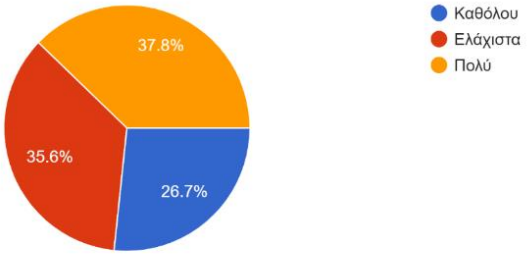
- More than half of the teachers (53.3%) believe that they are fairly capable in creating a classroom setting to promote students' interest for learning STEM concepts. About 35.6% believe that they are very capable and 11.1% believe they are not capable at all. Additionally, 37.8% have quite a lot of knowledge in the necessary steps to teach STEM concepts effectively, 35.6% have a fair amount of knowledge and 26.7% do not know the steps at all.

21. Πιστεύω ότι μπορώ να προωθήσω το ενδιαφέρον των μαθητών για τη μάθηση STEM εννοιών στην τάξη.
45 responses



22. Γνωρίζω τα απαραίτητα βήματα για να διδάξω αποτελεσματικά τις STEM έννοιες.
45 responses



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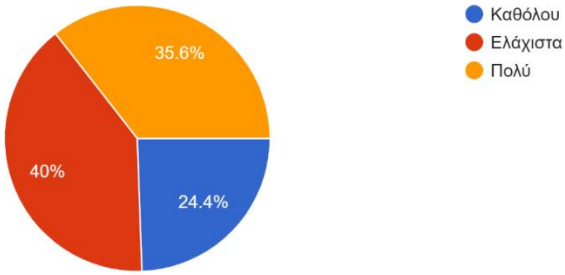
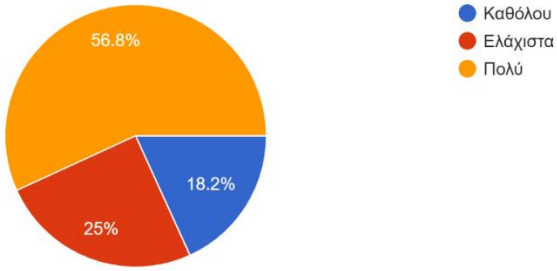
- Approximately 35.6% of teachers find it very easy to explain why STEM experiments work to students, while 40% find it fairly easy and 24.4% do not find easy at all. When teaching STEM, 56.8% of teachers encourage students/teens to ask questions quite a lot, while 25% only fairly encourage them and 18.2% do not encourage them at all.

23. Θεωρώ εύκολο να εξηγήσω τους μαθητές τους λόγους που τα STEM πειράματα δουλεύουν.
45 responses



24. Κατά τη διδασκαλία STEM μαθημάτων, καλωσορίζω τις ερωτήσεις των μαθητών/εφήβων.
44 responses



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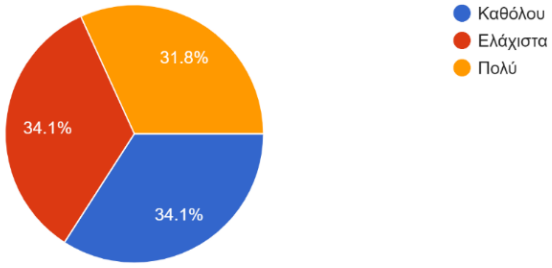
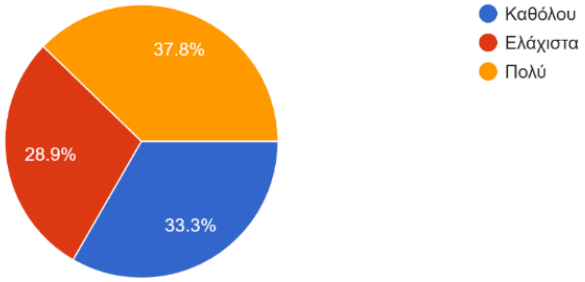
- Less than half of the teachers (31.8%) are very capable in effectively teaching STEM content to teens/students whose first language is not English. Approximately 34.8% feel fairly capable and 34.1% do not feel confident at all.

25. Μπορώ να διδάξω αποτελεσματικά το STEM περιεχόμενο σε έφηβους/φοιτητές των οποίων η πρώτη γλώσσα δεν είναι Ελληνικά.
44 responses



- As teachers, 37,8% can do quite a lot to increase the achievement of STEM subjects of children who do not speak the national language as their first language, 28,9% can do fairly and 33.3% cannot do much. Additionally, 48.9% of teachers feel they have quite a lot of ability to help teens from low socioeconomic backgrounds to be successful in STEM subjects.

26. Μπορώ ως καθηγητής/ήτρια να κάνω πολλά για να ενισχύσω την επιτυχία των παιδιών στα STEM μαθήματα, των οποίων τα Ελληνικά δεν είναι η μητρική τους γλώσσα.
45 responses



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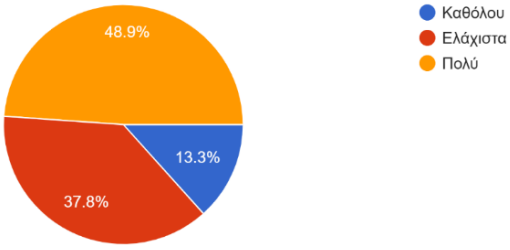
27. Έχω την ικανότητα να βοηθήσω μαθητές που προέρχονται από χαμηλό κοινωνικο-οικονομικό υπόβαθρο να πετύχουν στα STEM μαθήματα.
45 responses



Conclusions

Overall, the answers from the students have been more than encouraging in the local context of Greece. The majority of the students answered that they are either fairly confident or very confident in asking questions about a phenomenon, or that they are able to define problems that need to be solved, and that they can carry out investigations, they can use mathematics and computational thinking, and obtain, evaluate and communicate information.

Regarding their self-assessment in their achievements at school regarding STE(A)M, the majority above 70% of students said they get good grades in science, technology and/or mathematics, they understand everything in their STEM lessons, and look forward to their STEM classes. However, for their future job it is not important for half of the students to work with mathematics rather than people.

After examining the answers from the teachers, the results are also very encouraging in terms of the attitudes and approaches of the educators regarding STEM subjects. The majority of the teachers replied that they are either fairly confident or very confident in asking questions about a phenomenon, in planning and carrying out investigations, in using math and computational thinking, and in building explanations about a phenomenon or design solutions for a problem. Regarding their approaches in teaching STEM subjects, again the majority has replied positively in most questions, for example they are either fairly confident or very confident that they have sufficient knowledge of STEM subject to answer questions in their lesson, they can use a variety of teaching approaches to develop their cognition of mathematics, and know very well how to choose effective teaching approaches to guide students' learning and thinking. However, only almost half of the teachers use teaching approaches or strategies to raise teens' confidence in their capacities to perform successfully STEAM activities. Lastly, one third of the teachers feels that they cannot do much to increase the achievement of STEM subjects of children who do not speak the national language as their first language, but the majority feels that they have quite a lot of ability to help teens from low socioeconomic backgrounds to be successful in STEM subjects.

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