Preprints.org

Review

Not peer-reviewed version

Do Secondary School Graduates in Greece Recognise the Opportunities for Vocational Rehabilitation in Stem Education?

Eirini Golegou , Manolis Wallace , Kostas Pepas *

Posted Date: 11 February 2025

doi: 10.20944/preprints202502.0752.v1

Keywords: STEM universities; Greeks students' preferences; vocational rehabilitation; university departments in high demand

Preprints.org is a free multidisciplinary platform providing preprint service that is dedicated to making early versions of research outputs permanently available and citable. Preprints posted at Preprints.org appear in Web of Science, Crossref, Google Scholar, Scilit, Europe PMC.

Copyright: This open access article is published under a Creative Commons CC BY 4.0 license, which permit the free download, distribution, and reuse, provided that the author and preprint are cited in any reuse.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 11 February 2025 doi:10.20944/preprints202502.0752.v1

Disclaimer/Publisher's Note: The statements, opinions, and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions, or products referred to in the content.

Review

Do Secondary School Graduates in Greece Recognise the Opportunities for Vocational Rehabilitation in Stem Education?

Eirini Golegou *, Manolis Wallace and Kostas Peppas

University of the Peloponnese, Department of Informatics and Telecommunications, Tripoli, Greece; wallace@uop.gr (M.W.); peppas@uop.gr (K.P.)
* Correspondence: ei.golegou@go.uop.gr

Abstract: Considering that the development of STEM education in the Western world was due to the low interest of young people in working in one of the STEM fields (Altangerel , Tsolmon, & Khulan , 2022), it is interesting to study the level of interest of Greek students in finding STEM related jobs forty years after the need to stimulate it was recognized in the USA, thirty years after the appearance of the term (Breiner, Johnson, Harkness, & Koehler, 2012)and eighteen years after the introduction of the first STEM oriented study programmed (Sanders, 2009). As has been noted, 21st century skills are necessary for a competitive workforce that will be able to contribute to national and global economic growth (Mandal, 2018). And since the schools associated with STEM skills are the ones that can lead to the development of 21st century skills and that educate the future STEM professionals, it is deemed necessary to make a list of them. The article analyses the number of admissions to each higher education institution related to STEM fields and the vacancies recorded in these institutions after the introduction of the lower admissions threshold. The main conclusion of the research is that there are vacancies in science departments even in large urban centers. A fact that shows that candidates do not recognize them as STEM. There are also many vacancies in engineering departments even in smaller provincial towns.

Keywords: STEM universities; Greeks students' preferences; vocational rehabilitation; university departments in high demand

---

INTRODUCTION

The constant changes that determine the evolution of the global economy, such as climate change, globalization, technological progress and demographic issues, have led to the search for workers who can adapt to any new conditions (Abina, et al., 2024; Drymiotou, Constantinou, & Avraamidou, 2021). At the same time, the professions in which graduates can be employed are changing. STEM professions are gaining ground on the global scene (El Nagdi & Roehrig, 2022; de las Cuevas, García-Arenas, & Rico, 2022; Stelter, Kupersmidt, & Stump, 2020) and the demand for such professionals is increasing (Maiorca, Roberts, Jackson, & et al., 2021). The acquisition of knowledge in the respective disciplines is a guarantee of professional success (Stelter, Kupersmidt, & Stump, 2020; Maiorca, Roberts, Jackson, & et al., 2021) due to the many opportunities and high salaries (Stelter, Kupersmidt, & Stump, 2020), even with higher starting salaries (Habig, Gupta, & et al., 2020). The knowledge that young people acquire in STEM fields can be beneficial due to their high demand in the labor market (Lytle & Shin, 2020). However, less than 25% of graduates in OECD countries have a degree in one of the STEM fields (OECD, 2023). By 2021, however, 27% of first-year students in OECD countries will have chosen one of the STEM fields for their studies, putting this choice ahead of the others (OECD, 2023)[13, p. 217]. In particular, it is observed that interest in science declines from primary school onwards, so that it is largely gone by the time an individual enters higher education (Drymiotou, Constantinou, & Avraamidou, 2021). As adolescents are the future workforce (Zammitti, Magnano, & Santisi, 2021), it seems appropriate to examine their attitudes towards STEM university departments in order to investigate whether they recognize the career opportunities available to them through them.

© 2025 by the author(s). Distributed under a Creative Commons CC BY license.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 11 February 2025 doi:10.20944/preprints202502.0752.v1

The role of higher education institutions is considered to be of paramount importance, as individuals will have acquired specific skills at the end of their studies that will be useful in their professional careers (Abina, et al., 2024)\cite, as they offer specialization of the skills acquired by the individual (OECD, 2023; Mouton, Hartmann, & Ertl, 2023). It is these skills that will help the individual to obtain a job with higher earnings and more opportunities (Yeung, 2024). However, it is the skills that individuals acquire during their training in these occupations that can contribute to their career success. Implementing them from a young age can help to develop the 21st century skills and knowledge needed for the era (El Nagdi & Roehrig, 2022).

Throughout this research, it is accepted that all disciplines of STEM are equally valid. As studies in these fields are the means for economic development, cultural transformation and innovation and technology (Yeung, 2024). Therefore, a science degree can be considered as useful for professional rehabilitation as an engineering degree. It was chosen to study the preference of applicants for university departments because it has been observed that attending a STEM department can positively influence an individual's career in related professions by giving them more chances of employment than any other type of education (Hwang, 2024). Moreover, the constant changes brought about by technological development have made it even more difficult for young people to make the transition from university to the labor market (Felaco, Zammitti, Marcionetti, & Parola, 2023). Moreover, higher education institutions play an important role in the process of specializing individuals' knowledge and skills in order to meet and successfully respond to the jobs that will arise in the future (Abina, et al., 2024). Given the specialization that STEM workers need to have (Lytle & Shin, 2020), it is clear that attending a university department in STEM fields can offer high paid careers. Combined with the high graduation rates of Greeks compared to other OECD countries (OECD Skills Strategy 2019, skillas to shape a better future. 2019 OECD Skills Strategy: Greece, 2019), it is clear that STEM careers can be achieved through higher education in the respective professional fields.

The number of students opting for STEM subjects at the end of secondary education is also examined, as students' attitudes towards STEM careers are formed during secondary education (Yeung, 2024). Also, students' choice of orientation group is an indication of their interests, which in turn influence their career development (Mouton, Hartmann, & Ertl, 2023).

The survey is important because young people's choice of university department to study in largely reflects both their aspirations and their belief that this department will provide them with a career. Despite the increase in jobs requiring STEM skills, the number of those who manage to graduate from these types of schools is decreasing, while the gender inclusion gap is widening at the expense of women (Martínez, Segura, Andújar, & Ceada, 2023). At the same time, there is a lack of interest in STEM careers among young people. Looking at the criteria for choosing the university department that students will attend, the authors conclude that the polytechnic departments in large urban centres are in high demand, a demand that is not observed in the provincial polytechnics. There is also low demand in science and mathematics departments, as evidenced by the large number of vacancies recorded. The high number of vacancies in departments that can lead to STEM careers indicates that high school graduates are not aware of the career opportunities that these departments can offer.

The main objective is to answer the following questions:

(1) Do Greek adolescents entering university departments recognize the parity between STEM fields when it comes to future careers?
(2) Is the choice of department in which seniors wish to study influenced more by the department they will attend or by the university institution?
(3) Identify best practices to ensure that students have accurate information about the employment opportunities that STEM careers can offer.
(4) Identify best practices to motivate them to engage in STEM.

STEM Education and Professional skills

The turn to STEM education came in response to a growing need to strengthen science and mathematics education in the US, a need that has been observed since 1980, when the National Science Foundation began to make references to it in its reports (Breiner, Johnson, Harkness, & Koehler, 2012). The perceived need to adapt to a changing global economy and to maintain national competitiveness were the main drivers for this shift (Kennedy, Yi-Fen, & Ying-Shao, Asia-Pacific STEM

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 11 February 2025 doi:10.20944/preprints202502.0752.v1

Teaching Practices; Maass, Geiger, Ariza, & Goos, 2019). During this decade, there are publications from various associations/organizations stating their intention to contribute to the science education of Americans. During the 1990s, teachers' unions and primary, secondary and tertiary education associations join the trend. As a result, innovative educational practices in science, mathematics, engineering and technology (SMET) are designed and implemented (Breiner, Johnson, Harkness, & Koehler, 2012). Since 2007, STEM education has been seen as key to the acquisition of knowledge during the school years as well as professional skills required in the professions of the future (Breiner, Johnson, Harkness, & Koehler, 2012). It is believed that improved STEM education of the workforce can contribute to global economic growth (McDonald, 2016). This type of education is also expected to help young people adapt their expectations to new work standards and secure better career prospects (Tytler, Aderson , & Li, 2020), by cultivating positive attitudes towards each STEM discipline, by deepening the knowledge that can be acquired during the implementation of STEM education, and by teaching students to make connections between the disciplines. Research in Australia in 2014 claimed that in the future, 75% of jobs would require some STEM skills and that the increase in the number of people employed in STEM fields would contribute significantly to the increase in GDP (Tytler, Aderson , & Li, 2020).

By the early 21st century, research in several countries shows a decline in interest in STEM subjects among secondary school students, as well as in university enrolments in science and mathematics. More specifically, in the UK, between 1990 and 2008, participation in science courses fell by 49% and in chemistry courses by 26%. Between 1992 and 2007, enrolments in science and chemistry decreased by 26% and 22% respectively. In France, between 1995 and 2007, the number of students enrolled in university courses in these fields fell by half. In Japan, between 1999 and 2007, enrolments in science and engineering schools fell by 10% (Bøe, Henriksen, Lyons, & Schreiner, 2011). This data highlights the need to re-evaluate science and engineering curricula. It also shows that the turn to STEM education was indeed a societal need. Engineering in particular is a discipline that needs to be strengthened as it involves problem solving and innovation, skills that are in demand in the workplace and nationally (Bybee, 2010).

Acquisition of University level STEM Education in Greece

Considering that the development of STEM education in the Western world was due to the low interest of young people in working in one of the STEM fields (Altangerel , Tsolmon, & Khulan , 2022), it is interesting to study the level of interest of Greek students in finding STEM related jobs forty years after the need to stimulate it was recognized in the USA, thirty years after the appearance of the term (Breiner, Johnson, Harkness, & Koehler, 2012) and eighteen years after the introduction of the first STEM oriented study programme (Sanders, 2009).

Regarding the Greek education system, it should be explained that after the Panhellenic Examination and the publication of the results, students are asked to submit their application form. They list the schools they wish to attend in order of preference. From 2020, each orientation group will have access to schools in a specific academic field.

The 1st academic field consists of humanities, law and social sciences. The 2nd academic field is made up of schools offering science and technology programmes. The third is made up of health and life sciences schools, and the fourth is made up of economics and computer science schools. Students from the "Humanities and Social Sciences" orientation group can apply to schools in the 1st academic field, those from the "Natural Sciences" orientation group to the 2nd academic field, those from the "Health Sciences" orientation group to the 3rd academic field and finally those from the "Business and Computer Sciences" orientation group to the 4th academic field.

As mentioned above, 21st century skills are necessary for a competitive workforce that will be able to contribute to national and global economic growth (Mandal, 2018). And since the schools associated with STEM skills are the ones that can lead to the development of 21st century skills and that educate the future STEM professionals, it is deemed necessary to make a list of them.

To consider a school as STEM for the purposes of this paper, we used one of the following criteria

- The name of the school contains at least one of the STEM fields
- The graduates' professional rights give them access to a STEM profession.

The different schools can therefore be divided into four groups:

- Science (physics, chemistry, biology, geology)

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 11 February 2025 doi:10.20944/preprints202502.0752.v1

- Technology and computing
- Technology and engineering
- Mathematics

Below we group (table 1-4) the schools according to the academic field to which they correspond.

Table 1. This table shows all those University departments that are related with Science (S of STEM).

ACADEMIC FIELD : SCIENCE			
SCHOOL	CITY	UNIVERSITY	ACADEMIC FIELD
	Athens	National and Kapodistrian University of Athens	
	Heraklion	University of Crete	
	Thessaloniki	Aristotle University of Thessaloniki	
Physics	Ioannina	University of Ioannina	2nd
	Kavala	International Hellenic University	
	Lamia	University of Thessaly	
	Patras	University of Patras	
	Athens	National and Kapodistrian University of Athens	
	Heraklion	University of Crete	
Chemistry	Thessaloniki	Aristotle University of Thessaloniki	2nd and 3rd
	Ioannina	University of Ioannina	
	Kavala	International Hellenic University	
	Patras	University of Patras	
	Athens	National and Kapodistrian University of Athens	
Biology	Heraklion	University of Crete	
	Thessaloniki	Aristotle University of Thessaloniki	
	Patras	University of Patras	
Biological Applications & Technology	Ioannina	University of Ioannina	2nd and 3rd
Molecular Biology and Genetics	Alexandroupoli	Democritus University of Thrace	
Geology and Geoenvironment	Athens	National and Kapodistrian University of Athens	
Geology	Thessaloniki	Aristotle University of Thessaloniki	2nd
	Patras	University of Patras	

Table 2. This table shows all those University departments that are related with Technology and Informatic (T of STEM).

ACADEMIC FIELD: TECHNOLOGY AND INFORMATICS			
SCHOOL	CITY	UNIVERSITY	ACADEMIC FIELD
Applied Informatics- Computer Science and Technology	Thessaloniki	University of Macedonia	
Applied Informatics-Information Systems	Thessaloniki	University of Macedonia	2nd and 4th
	Athens	Athens University of Economics and Business	
	Thessaloniki	Aristotle University of Thessaloniki	
Informatics	Kavala	International Hellenic University	2nd and 4th
	Kastoria	University of Western Macedonia	
	Corfu	Ionian University	
	Piraeus	University of Piraeus	
Informatics and Telematics	Athens	Harokopio University	
	Athens	National and Kapodistrian University of Athens	
Informatics and Telecommunications	Arta	University of Ioannina	2nd and 4th
	Lamia	University of Thessaly	
	Tripoli	University of Peloponnese	

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 11 February 2025 doi:10.20944/preprints202502.0752.v1

Computer Science and Biomedical Informatics	Lamia	University of Thessaly	2nd, 3rd and 4th
Agricultural Biotechnology and Oenology	Drama	International Hellenic University	2nd and 3rd
Aerospace Science and Technology	Psachna, Evia	National and Kapodistrian University of Athens	2nd
Industrial Management and Technology	Piraeus	University of Piraeus	2nd and 4th
Biotechnology	Athens	Agricultural University of Athens	2nd and 3rd
Biochemistry and Biotechnology	Larissa	University of Thessaly	2nd and 3rd
Agriculture and Agricultural technology	Larissa	University of Thessaly	2nd and 3rd
Department of Music Technology and Acoustics Engineering	Rethymno	Hellenic Mediterranean University	2nd

Table 3. This table shows all those University departments that are related with Engineers and Mechanical Engineers (E of STEM).

ACADEMIC FIELD : ENGINEERS AND MECHANICAL ENGINEERS			
SCHOOL	CITY	UNIVERSITY	ACADEMIC FIELD
Architecture	Athens Volos Thessaloniki Ioannina Xanthi Patras Chania	National Technical University of Athens University of Thessaly Aristotle University of Thessaloniki University of Ioannina Democritus University of Thrace University of Patras Technical University of Crete	2nd
Electrical and Electronic Engineering	Egaleo	University of West Attica	2nd
Electrical and Computer Engineering	Athens Volos Heraklion Thessaloniki Kozani Xanthi Patras	National Technical University of Athens University of Thessaly Hellenic Mediterranean University Aristotle University of Thessaloniki University of Western Macedonia Democritus University of Thrace University of Peloponnese	2nd
Electrical and Computer Engineering	Patras	University of Patras	2nd
Electronic Engineering	Chania	Hellenic Mediterranean University	2nd and 4th
Computer Science and Engineering	Ioannina Patras	University of Ioannina University of Patras	2nd
Information and Electronic Engineering	Thessaloniki	International Hellenic University	2nd
Computer, Informatics and Telecommunications Engineering	Serres	International Hellenic University	2nd
Information and Communication Systems Engineering	Samos	University of the Aegean	2nd and 4th
Informatics and Computer Engineering	Egaleo	University of West Attica	2nd and 4th
Mechanical Engineering and Aeronautics	Patras	University of Patras	2nd
Mechanical engineering	Athens Egaleo Volos Heraklion Thessaloniki Kozani Patras Serres	National Technical University of Athens University of West Attica University of Thessaly Hellenic Mediterranean University Aristotle University of Thessaloniki University of Western Macedonia University of Peloponnese International Hellenic University	2nd
Naval Architecture	Egaleo	University of West Attica	2nd
Naval Architecture and Marine Engineering	Athens	National Technical University of Athens	2nd
Civil engineering	Athens Egaleo Volos Thessaloniki Xanthi Patras	National Technical University of Athens University of West Attica University of Thessaly Aristotle University of Thessaloniki Democritus University of Thrace University of Peloponnese	2nd

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 11 February 2025 doi:10.20944/preprints202502.0752.v1

Chemical engineering	Patras Serres Athens Thessaloniki Kozani Patras	University of Patras International Hellenic University National Technical University of Athens Aristotle University of Thessaloniki University of Western Macedonia University of Patras	2nd
Chemical and environmental engineering	Chania	Technical University of Crete	2nd

Table 4. This table shows all those University departments that are related with Mathematics (M of STEM).

ACADEMIC FIELD : MATHEMATICS			
DEPARTMENT	CITY	UNIVERSITY	FIELD
Applied Mathematical and Physical Sciences	Athens	National Technical University of Athens	2nd
Mathematics	Athens Thessaloniki Ioannina Kastoria Lamia Patras Samos	National and Kapodistrian University of Athens Aristotle University of Thessaloniki University of Ioannina University of Western Macedonia University of Thessaly University of Patras University of the Aegean	2nd
Mathematics and Applied Mathematics	Heraklion	University of Crete	2nd
Statistics	Athens	Athens University of Economics and Business	2nd and 4th

Table 5. This table shows the number of Universities' Departments that are related with each field of STEM Education.

STEM FIELD	NUMBER OF SCHOOLS
SCIENCE	22
TECHNOLOGY AND COMPUTER SCIENCE	21
ENGINEERING AND MECHANICAL ENGINEERING	47
MATHEMATICS	11
NUMBER OF SCHOOLS OF STEM FIELDS	101
NUMBER OF SCHOOLS AVAILABLE IN THE APPLICATION FORM	438

In the application form that students deposit, schools are classified in different academic fields, with some of them belonging to more than one. 718 options appear therein, however the total number of schools including military schools and schools for the security forces, is 458. Here we do not take into account these schools since their graduates join the forces immediately without entering the market like the rest of the graduates. We thus find ourselves with 438 schools (table 5).

From these 438 schools, 101 can be considered as STEM. These schools are in their totality accessible to students from the orientation group "Science". Some of them also belong to another academic field. More precisely, 16 schools belong also to the 3rd academic field and can thus be selected by students from the orientation group "Health Sciences". Finally, students from the orientation group "Economics and Informatics" have access to 19 out of these 101 schools.

It's quite clear that the orientation group "Science" is the one whose student have the most chances of becoming STEM professionals : out of the 215 schools they can apply for, 101 have a direct re-lation to STEM skills. It's worth reminding that students from this group are tested in Mathematics, Physics, and Chemistry, the three pillars of STEM.

The significance of the knowledge acquired through these subjects becomes apparent from the following analysis.

Firstly, the Engineering schools belong only to the 2nd academic field. Secondly, the Informatics schools are accessible through the 4th and the 2nd academic field. In the orientation group "Economics and Informatics" students are taught pseudocode as part of the subject of Informatics. The

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 11 February 2025 doi:10.20944/preprints202502.0752.v1

possibility given to students having chosen "Science" to apply for these schools reveals the strong connections between the fields. The connections have to do with mathematical thinking as well as problem-solving skills acquired through Mathematics and Science.

Students from the orientation group "Health Sciences" have access only to the schools of Chemistry and Biology, among the schools from the academic field of Science, and not to schools of Physics, despite the fact that they are taught Physics. This can be explained by the fact that Mathematics is not one the obligatory subjects for this group. Conversely, the orientation group "Health Sciences" and the orientation group "Science" can both select Biology schools. Students from the orientation group "Science" may not be tested in Biology but they are in Chemistry.

All in all, it is safe to say that the orientation group "Science" leads more than any other to studies that will prepare the future STEM professionals, followed by the orientation group "Economics and Informatics" and finally by the orientation group "Health Sciences".

Table 6. Percentage and number of students per orientation group in day High Schools. (N.B. : The total number of candidates does not equate the total number of students which includes students who only took the exam to enroll to Music schools.) (www.minedu.gov.gr, 2024; www.minedu.gov.gr, 2023; www.monedu.gov.gr, 2022; www.minedu.gov.gr, 2021).

ACADEMIC YEAR	HUMANITIES		INFORMATICS AND ECONOMICS		SCIENCE – SCIENCE		SCIENCE – HEALTH SCIENCES		NUMBER OF STUDENTS
	NUMBER OF STUDENTS	PERCENTAGE	NUMBER OF STUDENTS	PERCENTAGE	NUMBER OF STUDENTS	PERCENTAGE	NUMBER OF STUDENTS	PERCENTAGE	
2023-2024	20.141	27%	27.341	36,6%	13.585	18,2%	13.571	18,18%	74.638
2022-2023	18.857	25,8%	26.641	36,5%	13.218	18,11%	13.893	19,04%	72.961
2021- 2022	18.286	26%	25.177	35%	14.204	20%	13.680	19%	71.710
2020-2021	22.624	30,17%	24.400	32,54%	14.685	19,58%	12.810	17,09%	74.968
2019-2020	21.617	30,21%	23.394	32,69%	15.193	21,23%	11.020	15,40%	71.547

The above table (table 6) depicts the number of students per orientation group who took the panhellenic exam and the corresponding percentage since the academic year 2019-2020, year of entry into force of the current education system. The largest concentration of students is observed consistently in the orientation groups "Economics and Informatics" and "Humanities". The orientation groups "Science" and "Health Sciences" have the smallest amounts of students. From 2020-2021 to 2022-2023 the differences in numbers do not go above 2% and are thus not significant. In 2019-2020 however, the number of candidates from "Science" was significantly lower than from "Health Sciences" (15,40% and 21,23% respectively).

The percentage of students having chosen the orientation group "Science" ranges from 15,40\% to 19,04%, which is less than a quarter of the entire student population. These numbers suggest a potential ignorance of the market demand in STEM professions in the years to come. This observation is in keeping with international bibliography. It is in fact suggested that :the study of enrollments in higher education leads to the conclusion that the demand in professions relating to engineering and technology is expected to be higher than the offer.

Greeks' students preferences

From the academic year 2020-2021, a Minimum Grade of Access (M.G.A.) will be in force (FEK A25 17/12/21). The M.G.A. is set by the Senate on the basis of a proposal from the department or school. The M.G.A. refers to the average grade without taking into account the coefficient of each subject (FEK A25 17/12/21). The introduction of the M.G.A. has meant that students with a lower average have not been able to express a preference for a particular school.

The table above (table 7) shows the number of vacant places in certain schools. The M.G.A. is also mentioned in order to draw conclusions. Only schools related to STEM fields have been included.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 11 February 2025 doi:10.20944/preprints202502.0752.v1

Table 7. Number and percentage of positions that are not filled in each department from 2021 to 2023. The result was obtained by removing the column "Positions (after transfer)" with the column "Graduates" from the file of the Ministry of Education, in which the admission bases to the universities are announced. (www.minedu.gov.gr, 2023; www,minedu.gov.gr, 2022; www.minedu.gov.gr, 2021; 25-07-24 2024 Panhellenic Examinations Bases and Statistics).

SCHOOL/DEPARTMENT	POSITIONS NOT FILLED											
	2024			2023			2022			2021		
	NUMBER	**PERCENTAGE**	**E.B.E.**	**NUMBER**	**PERCENTAGE**	**E.B.E.**	**NUMBER**	**PERCENTAGE**	**E.B.E.**	**NUMBER**	**PERCENTAGE**	**E.B.E.**
Mineral Resources Engineering (Kozani)	79	85,87	9,72	88	94,78	9,87	83	92,22	9,50	182	98,38	9,58
Mathematics (Ioannina)	194	77,91	12,15	210	86,78	12,96	174	76,65	12,47			9,58
Computer Science & Engineering (Ioannina)	188	88,10	14,58	172	84,31	14,81	162	84,38	14,25			9,58
Physics (Ioannina)	133	60,73	10,94	183	83,94	12,96	148	74	12,47			9,58
Mathematics (Kastoria)	82	83,67	9,72	82	82,0	9,87	69	71,88	9,50	138	*95,83*	*9,58*
Chemical Engineering (Kozani)	99	68,28	14,58	115	79,31	14,81	42	31,11	14,25			14,38
Civil Engineering (Serres)	0		9,72	60	78,95	9,87			9,50	71	75,53	9,58
Physics (Kavala)	61	68,54	9,72	72	77,42	9,87	67	74,44	9,50	190	94,53	9,58
Geology (Patras)	28	38,89	9,72	54	75	9,87	61	80,25	10,09	167	93,82	10,18
Electrical and Computer Engineering (Heraklion)	0		9,72	160	70,48	9,87	147	68,37	9,5	151	70,56	9,58
Mathematics (Samos)	131	90,34	9,72	100	68,97	9,87	97	66,90	9,50	299	98,03	9,58
Mechanical Engineering (Serres)	0		9,72	70	64,22	9,87	18	17,48	9,50	21	20,39	9,58
Computer Engineering & Informatics (Patras)	120	62,5	14,58	118	61,46	14,81			14,25			14,38
Physics (Lamia)	47	52,22	9,72	56	60,87	9,87	47	51,09	9,50	79	81,44	9,58
Physics (Heraklion)	92	77,97	12,76	73	60,83	12,96	66	56,41	12,47	121	78,06	14,38
Physics (Patras)	124	64,25	12,15	111	57,51%	12,34	56	30,11	11,87	15	8,15	11,98
Architecture (Patras)	79	77,45	15,74	59	56,73	15,9	65	63,73	15,33	59	61,46	15,76
Mathematics (Thessaloniki)	67	58,77	14,58	64	52,46	14,81	37	33,04	14,25	44	33,59	14,38
Mechanical Engineering (Egaleo)	0		13,49	54	47,79	13,70	26	23,21	13,18	38	28,15	13,3
Geology and Geoenvironment (Athens)	0		9,72	36	46,75	11,35	34	43,59	11,28	66	56,41	11,38
Mathematics (Athens)	99	54,7	14,58	85	46,70	14,81	30	16,67	14,25			14,38
Mechanical Engineering (Heraklion)	0		9,72	40	40,40	9,87	19	19,59	9,50	58	51,79	9,58
Physics (Thessaloniki)	92	63,01	14,58	57	39,58	14,81	29	21,32	14,25	22	13,66	14,38
Electrical and Electronics Engineering (Egaleo)	0		12,15	48	33,10	12,34			11,87	120	49,38	11,98
Mathematics (Lamia)	0		9,72	15	27,27	9,87			9,50	62	65,26	9,58
Electrical and Computer Engineering (Chania)	54	28,17	14,58	53	26,50	14,81	3	1,64	14,25			14,38
Mechanical Engineering (Kozani)	64	32	14,58	45	22,96	14,81	34	18,09	14,25			14,38
Civil Engineering (Egaleo)	0		12,15	29	22,48	11,48			11,04	49	26,92	11,14
Electrical and Computer Engineering (Xanthi)	58	24,37	14,58	44	17,16	14,81	72	30,51	14,25			14,38
Computer science (Kavala)	0		11,43	35	17,16	11,47	77	39,58	11,50			11,37
Geology (Thessaloniki)	0		9,72	14	16,47	9,87	12	13,79	9,74	28	26,17	9,82
Civil Engineering (Patras)	33	21,85	9,72	21	13,91	9,87	8	5,48	14,25			14,38
Mechanical Engineering (Patras)	0		10,33	18	13,85	10,49			10,06	11	8,87	10,78
Electrical and Computer Engineering (Patras)	0		10,33	27	13,11	10,49	66	34,55	10,09	16	8,08	10,18
Informatics (Kastoria)	83	39,90	10,39	19	9,36	9,39			8,36			8,28
Physics (Athens)	64	40,76	14,58	18	6	14,81			14,25			14,38
Architecture (Xanthi)	0		10,50			13,25			10,22	108	100	14,45
Mathematics and Applied Mathematics- Applied Mathematics (Heraklion)	12	26,09	9,72			9,87			9,5	138	87,34	10,78

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 11 February 2025 doi:10.20944/preprints202502.0752.v1

Civil engineering (Xanthi)	0		10,84	11,11	10,68	98	51,04	13,18
Electrical and Computer Engineering (Kozani)	0		12,15	12,34	14,25	52	40,31	14,38
Mathematics (Patras)	0		9,72	9,87	10,68	49	27,65	10,78
Mathematics and Applied Mathematics- Mathematics (Heraklion)	2	4,35	9,72	9,87	9,5	137	81,55	10,78
Informatics and Telecommunications (Tripoli)	1	0,51	11,43					

A high number of unfilled posts can be observed in schools such as physics, geology and mathematics. It is worth noting that this observation applies not only to provincial areas, but also to the country's large urban centres, such as Athens and Thessaloniki. For example, in 2023, the Physics Department of the National and Kapodistrian University of Athens, which had set the M.G.A. grade as 14.81, had 18 vacancies. All the positions were filled in previous years when the M.G.A. was relatively lower. In 2023, the number of students who expressed a preference for this school was 1251. The fact that not all places were filled means that the rest of the candidates ended up in a school that they had ranked higher in their list of preferences. Of all the candidates who got into the school, 91 had made it their first choice.

As for the Physics school in Thessaloniki, not all positions were filled in 2023 and in the two previous years. The number of vacancies is higher in the provincial schools, despite the lower M.G.A. It is noteworthy that the Physics school in Lamia had an M.G.A. of 9.87, which means that it was not preferred even by students who did not manage to get a 10/20.

The situation is not much different for mathematics schools. These also end up with vacancies, with the school in Ioannina having the highest number of vacancies in 2023, despite the low M.G.A., which was 12.56. Schools in Lamia and Samos, whose M.G.A. was 9.78, had 56 and 100 vacancies respectively.

The number of vacancies in geology schools was also quite high throughout the period of application of the M.G.A. In 2021, despite the low M.G.A. of 10.18, the number of vacancies increased to 167. Compared to other science schools, geology schools have the highest percentage of vacancies over the last three years.

Schools or departments of electrical and computer engineering in the province present a large number of unfilled positions. The figures in 2023 were 160 for Heraklion, 53 for Chania, 44 for Xanthi and 27 for Patras. The reduction of the M.G.A. seems to have had a positive effect. For example, in the case of the school of Kozani, the reduction of the M.G.A. between 2021 and 2023 resulted in all posts being filled.

Finally, the same applies to schools such as Architecture, Electrical Engineering, Civil Engineering and Chemical Engineering.

In general, we observe a large number of unfilled posts in university schools whose graduates will be STEM professionals. Some other paradoxical trends can also be observed. For example, the Department of Electrical and Computer Engineering in Athens is in high demand and has a high MG.A., while the same schools in the province have vacancies.

The departments of Engineering and Mechanical Engineering in Athens and Thessaloniki fill all their positions, while the departments of Physics, Mathematics and Geology, even in the National and Kapodistrian University of Athens, do not. On the other hand, chemistry and biology departments are filling all their posts, including the newly established chemistry department in Kavala.

Table 8. Number of candidates who declare the school as their forst choice irrespective of place from 2019 to 2023. (www,minedu.gov.gr, 2022) (www.minedu.gov.gr, 2023) (www.minedu.gov.gr, 2021) (www.minedu.gov.gr, 2020) (www.minedu.gov.gr, 2019).

SCHOOL/DEPARTMENT	NUMBER OF CANDIDATES WHO DECLARED THE SCHOOL AS THEIR FIRST CHOICE IRRESPECTIVE OF PLACE					
	2024	2023	2022	2021	2020	2019
Electrical engineering	2.264	2.022	1.888	2.008	2.747	2.903
Electronic engineering	414	317	353	417	557	588
Mechanical engineering	1.333	1.054	1.152	1.180	2.263	2.447
Civil engineering	802	908	789	739	746	698

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 11 February 2025 doi:10.20944/preprints202502.0752.v1

Mathematics	450	507	474	607	1.022	1.308
Physics	276	315	405	502	794	848
Biology	803	787	853	797	1.186	1.625
Chemistry	1.986	1.659	1.832	1.334	1.146	1.661
Geology	79	48	51	60	131	165
Computer science	3.908	3.113	2.581	3.263	2.931	3.134

Finally, the number of students who gave physics, mathematics or geology as their first choice is an indication of the lack of interest in these fields, as can be seen in the table above (table 8). Geology schools are the least preferred first choice, followed by physics schools and then mathematics schools. Biology and chemistry schools are much more popular. The same applies to schools specializing in electrical, mechanical and electronic engineering.

Table 9. Number of candidates who declare the school irrespective of place and order of reference from 2019 to 2023. (www,minedu.gov.gr, 2022) (www.minedu.gov.gr, 2023) (www.minedu.gov.gr, 2021) (www.minedu.gov.gr, 2020) (www.minedu.gov.gr, 2019).

SCHOOL	NUMBER OF CANDIDATES WHO DECLARED THE SCHOOL IRRESPECTIVE OF PLACE AND ORDER OF PREFERENCE					
	2024	2023	2022	2021	2020	2019
Electrical engineering	15.541	13.169	13.991	14.914	30.339	52.270
Electronic engineering	6.034	6.793	7.616	7.152	18.470	29.377
Mechanical engineering	13.894	11.654	13.296	14.009	30.747	56.290
Civil engineering	11.770	11.945	13.873	12.618	24.002	38.881
Mathematics	11.944	11.614	13,171	16.207	29.381	49.244
Physics	6.399	6.128	8.641	10.721	20.071	32.533
Biology	12.955	12.783	13.496	14.397	23.428	34.968
Chemistry	25.422	22.967	28.490	30.581	5.003	7.892
Geology	2.792	2.013	2.435	2.669	6.244	11.870
Computer science	54.628	44.158	46.362	58.748	82.816	131.353

The picture seems to remain the same concerning the total number of candidates who declared a preference for each group of schools in whatever position in their application form (table 9). The large number of candidates who declared a preference for Physics schools for instance clashes with the number of positions not filled. This can be explained by the fact that a particular school was preferred by students who obtained higher grades and who listed it higher in their application form.

Discussion

Investing in the quality of higher education received by students in each country is one of the OECD's main lines of approach so that young people can adapt smoothly to the demands of the labour market (Abina, et al., 2024).

In Greece, less than one in four departments is related to one of the STEM fields of education (101 out of 438). We assume that the field of Science Studies is the one that is most related to all STEM fields, but is not in high demand compared to the other fields. The two main conclusions that can be drawn are the following. Firstly, Physics, Mathematics and Geology departments rank low in the preferences of candidates and there are vacancies not only in provincial departments but also in departments in large urban centers such as Athens and Thessaloniki. These vacancies reveal a lack of student preference for these schools, which is consistent with the decline in science graduates in America (Lytle & Shin, 2020). Future research could investigate the reasons for this. Both mathematics and physics schools are core STEM fields, and their low demand can be linked to the fact that Greece is in the bottom 20% of countries in terms of matching the skills acquired by workers with the corresponding demand in the labor market (OECD Skills Strategy 2019, skillas to shape a better future. 2019 OECD Skills Strategy: Greece, 2019). The picture is different in chemistry and biology, where there are no vacancies and admission rates remain high. On the contrary, in the Faculties of Engineering and Mechanical Engineering, there are no vacancies in large urban centers, but only in provincial towns such as Serres, Heraklion, Patras, Chania, Xanthi. Comparing the enrolment bases of the National Technical University of Athens, the technical schools of the Aristotle University of Thessaloniki and the University of Patras, it is clear that departments such as electrical engineering remain in high demand. In Xanthi, on the other hand, there are vacancies. Thus, there is an admission of high-

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 11 February 2025 doi:10.20944/preprints202502.0752.v1

achieving students to prestigious university institutions, as is the case in South Korea (Hwang, 2024).The issue of the prestige of the profession itself as a motivation for career choice is also mentioned in (Mouton, Hartmann, & Ertl, 2023). Other factors influencing the choice of a field of study are parents (Maiorca, Roberts, Jackson, & et al., 2021; Felaco, Zammitti, Marcionetti, & Parola, 2023); the environment, such as friends and teachers (Felaco, Zammitti, Marcionetti, & Parola, 2023); the career guidance students receive at school (OECD, 2023); and personal interests (Maiorca, Roberts, Jackson, & et al., 2021; Lytle & Shin, 2020) mentions the relatively low demand in the US for both jobs and STEM degrees. A similar level of interest could not be found in Greece due to the large number of vacancies in the fields already mentioned. Since some of the factors influencing the individual's career path, and therefore the type of studies to be pursued, are related to endogenous factors such as personal interests (Felaco, Zammitti, Marcionetti, & Parola, 2023). This begs the question: if candidates were aware of the horizons offered by STEM careers, would these positions still be vacant?

In (Zammitti, Magnano, & Santisi, 2021), a survey of Italian adolescents was conducted on the subject of work, the results of which show that adolescents perceive work as a means to achieve economic well-being and satisfaction of values related to respect and dignity. It is evident that STEM fields can satisfy both the need for economic empowerment and the satisfaction of young people's value system. Thus, proper information about STEM professions can be a springboard for increasing the demand for the respective university departments.

Conclusions

The ultimate goal of STEM education is, on the one hand, to produce professionals in the relevant sectors, i.e. a workforce with skills that are expected to be in high demand in the labour market (El Nagdi & Roehrig, 2022). On the other hand, to motivate students to become interested and involved in the relevant fields through their studies in adult life (El Nagdi & Roehrig, 2022). It is clear that the application of STEM education can make an important contribution both to the choice of the orientation group for scientific studies and to the choice of the corresponding university institutions by the candidates.

The authors respond to the questions raised at the beginning of the article:

1. Greek high school graduates do not seem to recognize parity between university departments in all STEM fields. Thus, even in the capital city of Athens, there are differences between the different fields. High demand in STEM departments, low demand in Physics, Mathematics, Geology departments, where even vacancies are observed. In conclusion, candidates do not seem to recognize the equality of opportunities that all STEM disciplines can offer.
2. The selection criterion for university entry seems to be the university institution rather than the department. This is reinforced by the vacancies for engineering positions observed in provincial universities. Even in physics and mathematics departments, there are disproportionately more vacancies in provincial departments than in departments in large urban centres. The main selection criterion is therefore the university institution.
3. The choice of the university department that a person will attend is the first choice regarding the professional career that he/she will pursue, and therefore it is one of the most important decisions that he/she will have to make in his/her life (Felaco, Zammitti, Marcionetti, & Parola, 2023). In addition, careers guidance and counselling helps young people to identify their vocations and to follow the appropriate processes to acquire the skills that will enable them to succeed professionally (Zammitti, Magnano, & Santisi, 2021). The limited knowledge that students may have about career opportunities from a STEM institution negatively affects their decision to pursue these careers (Drymiotou, Constantinou, & Avraamidou, 2021). Therefore, it is suggested that students should have sessions with career guidance experts during their secondary education, as interaction with knowledgeable experts can positively influence candidates. It is not considered appropriate to carry out this process during school hours. Also, as it requires special knowledge that not all teachers may have, it is suggested that the sessions should be initiated by school PTAs or recommended by teachers to be carried out on the initiative of students and their parents.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 11 February 2025 doi:10.20944/preprints202502.0752.v1

4. Increasing the amount of time that pupils spend on the respective subjects of the different areas can increase their motivation to engage in them on a professional level. It is worth noting here that it is beneficial to engage students in these subjects from as early as kindergarten (McDonald, 2016). In addition, mentoring programs in STEM subjects can make a positive contribution both to students' interest in the subjects and to their later careers in related professions (Drymiotou, Constantinou, & Avraamidou, 2021; Stelter, Kupersmidt, & Stump, 2020). The effects can be enhanced by the presence of a mentor with whom the students develop a close relationship based on trust (Stelter, Kupersmidt, & Stump, 2020). The mentor, on the other hand, should have specialized knowledge to meet the requirements of the position and mentoring should start from the early school years (Stelter, Kupersmidt, & Stump, 2020). Another good practice that can motivate students to later engage in STEM fields is participation in non-formal learning programs (Habig, Gupta, & et al., 2020). Non-formal learning opportunities can be provided to students at all levels in places such as museums, science centers, zoos and botanical gardens (Habig, Gupta, & et al., 2020), university facilities. In this sense, educational visits - excursions to such places - can be considered good practice. It is therefore important for teachers to encourage and organize such visits. Informal STEM learning experiences can also have a positive impact, for example participating in a STEM programmed during the summer (Drymiotou, Constantinou, & Avraamidou, 2021; Maiorca, Roberts, Jackson, & et al., 2021), such as the See Blue See STEM model (Maiorca, Roberts, Jackson, & et al., 2021) and robotics, engineering and science competitions (Maiorca, Roberts, Jackson, & et al., 2021; Alsalamat, 2024). Interest in STEM subjects has a strong influence on individuals' decisions about their studies and future careers (Drymiotou, Constantinou, & Avraamidou, 2021), so it seems appropriate to strengthen it.

References

1. 25-07-24 2024 Panhellenic Examinations Bases and Statistics. (n.d.). Retrieved from Ministry of Education, Relegious and Athlets: https://www.minedu.gov.gr/baseis-an/59025-25-07-24-vaseis-kai-statistika-panelladikon-etous-2024
2. Abina, A., Temeljotov Salaj, A., Cestnik, B., Karalič, A., Ogrinc, M., Kovačič Lukman, R., & Zidanšek, A. (2024). Challenging 21st-Century Competencies for STEM Students: Companies' Vision in Slovenia and Norway in the Light of Global Initiatives for Competencies Development. Sustainability, 16(1295). https://doi.org/10.3390/su16031295
3. Alsalamat, M. (2024). Secondary Stage Science Teachers' Perceptions toward STEM Education in Saudi Arabia. Sustainability, 16(3634). https://doi.org/10.3390/su16093634
4. Altangerel , B., Tsolmon, R., & Khulan , O. (2022). An Experiment in Applying Differentiated Instruction in STEAM Disciplines. Eurasian Journal of Educational Research, pp. 21-37. doi:10.14689/ejer.2022.98.02
5. Bøe, M., Henriksen, E., Lyons, T., & Schreiner, C. (2011, Aug 16). Participation in science and technology: young people's achievement-related choices in late-modern societies. Studies in Science Education, 47(1), pp. 37-72. https://doi.org/10.1080/03057267.2011.549621
6. Breiner, J. M., Johnson, C. C., Harkness, S. S., & Koehler, C. M. (2012, Jan). What Is STEM? A Discussion About Conceptions of STEM in Education and Partnerships. School Science and Mathematics. https://doi.org/10.1111/j.1949-8594.2011.00109.x
7. Bybee, R. W. (2010, Aug 27). What Is STEM Education? Science, 329(5995), p. 996. https://doi.org/10.1126/science.1194998
8. de las Cuevas, P., García-Arenas, M., & Rico, N. (2022). Why Not STEM? A Study Case on the Influence of Gender Factors on Students' Higher Education Choice. Mathematics, 10(239). https://doi.org/10.3390/math10020239
9. Drymiotou, I., Constantinou, C., & Avraamidou, L. (2021). Enhancing students' interest in science and understandings of STEM careers: the role of career-based scenarios. International Journal of Science Education, 43(5), 717-736. https://doi.org/10.1080/09500693.2021.1880664
10. El Nagdi, M., & Roehrig, G. (2022, 12). Reality vs. Expectations of Assessment in STEM Education: An Exploratory Case Study of STEM Schools in Egypt. Educ. Sci., p. 726. https://doi.org/10.3390/educsci12110762

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 11 February 2025 doi:10.20944/preprints202502.0752.v1

11. FEK A25 17/12/21. (n.d.). Introduction to Higher Education, protection of academic freedom, upgrading of the academic environment and others. A/25 17/02/2021. Retrieved from https://www.kodiko.gr/nomologia/download_fek?f=fek/2021/a/fek_a_25_2021.pdf&t=fc589f33536856b0906351381b4efb81
12. Felaco, C., Zammitti, A., Marcionetti, J., & Parola, A. (2023). Career Choices, Representation of Work and Future Planning: A Qualitative Investigation with Italian University Students. Societies, 13(225). https://doi.org/10.3390/soc13100225
13. Habig, B., Gupta, P., & et al. (2020). An Informal Science Education Program's Impact on STEM Major and STEM Career Outcomes. Res Sci Educ, 50, 1051–1074. https://doi.org/10.1007/s11165-018-9722-y
14. Hwang, S. (2024). Differences in Academic Persistence Intentions among STEM Undergraduates in South Korea: Analysis of Related and Influencing Factors. Educ. Sci., 14(577). doi: https://doi.org/10.3390/educsci14060577
15. Kennedy, K., Yi-Fen, Y., & Ying-Shao, H. (Asia-Pacific STEM Teaching Practices). A Framework for Examining Teachers' Practical Knowledge for STEM Teaching. 2019. Retrieved from https://link.springer.com/chapter/10.1007/978-981-15-0768-7_3
16. Lytle, A., & Shin, J. (2020). ncremental Beliefs, STEM Efficacy and STEM Interest Among First-Year Undergraduate Students. J Sci Educ Technol, 29, 272-281. https://doi.org/10.1007/s10956-020-09813-z
17. Maass, K., Geiger, V., Ariza, M., & Goos, M. (2019). The Role of Mathematics in interdisciplinary STEM education. ZDM Mathematics Education(51), pp. 869–884. https://doi.org/10.1007/s11858-019-01100-5
18. Maiorca, C., Roberts, T., Jackson, C., & et al. (2021). nformal Learning Environments and Impact on Interest in STEM Careers. Int J of Sci and Math Educ, 19, 45–64. https://doi.org/10.1007/s10763-019-10038-9
19. Mandal, S. (2018). The competencies of the Modern Teacher. International Journal of Research in Engineering, Science and Management, 1(10). Retrieved from https://www.ijresm.com/Vol_1_2018/Vol1_Iss10_October18/IJRESM_V1_I10_93.pdf
20. Martínez, M., Segura, F., Andújar, J., & Ceada, Y. (2023). The Gender Gap in STEM Careers: An Inter-Regional and Transgenerational Experimental Study to Identify the Low Presence of Women. Science Edu., 13(649). https://doi.org/10.3390/educsci13070649
21. McDonald, C. V. (2016). STEM Education: A Review of the Contribution of the Disciplines of Science, Technology, Engineering and Mathematics. Science Education International, 27(4), pp. 530-569. Retrieved from https://eric.ed.gov/?id=EJ1131146
22. Mouton, D., Hartmann, F., & Ertl, B. (2023). Career Profiles of University Students: How STEM Students Distinguish Regarding Interests, Prestige and Sextype. Educ. Sci., 13(324). https://doi.org/10.3390/educsci13030324
23. OECD. (2023). Education at a Glance 2023: OECD Indicators. OECD: OECD Publishing. https://doi.org/10.1787/e13bef63-en
24. (2019). OECD Skills Strategy 2019, skillas to shape a better future. 2019 OECD Skills Strategy: Greece. OECD. Retrieved from https://www.oecd.org/greece/Skills-Strategy-Greece-EN.pdf
25. Sanders, M. (2009). STEM, STEM education, STEM mania. TechnologyTeacher, 68(4). Retrieved from https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1949-8594.2011.00109.x
26. Stelter, R. L., Kupersmidt, J. B., & Stump, K. N. (2020). Establishing effective STEM mentoring relationships through mentor training. Annals of the New York Academy of Sciences, 1438(1), 224-243. https://doi.org/10.1111/nyas.14470
27. Tytler, R., Aderson , J., & Li, Y. (2020, Dec). STEM Education for the Twenty-First Century. In Integrated Approaches to STEM Education: An International Perspective (pp. 21-43). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-52229-2_3
28. www,minedu.gov.gr. (2022, Jul 28). Retrieved Jul 2024, from https://www.minedu.gov.gr/geniko-lykeio-m/anakoinwseis-gel/52948-28-07-22-sxetika-me-ta-apotelesmata-eisagogis-a-ypopsifion-ton-panelladikon-eksetaseon-etous-2022-stin-tritovathmia-ekpaidefsi-v-ypopsifion-me-sovares-pathiseis-etous-2022-stin-tritovathmia-
29. www.minedu.gov.gr. (2019, Aug 28). Retrieved Lul 2024, from https://www.minedu.gov.gr/news/42643-28-08-19-statistika-protimiseon-epityxonton-kai-ypopsifion-gia-tin-tritovathmia-ekpaidefsi-ana-katigoria-epilogis
30. www.minedu.gov.gr. (2020, Sept 02). Retrieved Jul 2024, from https://www.minedu.gov.gr/rss/46173-02-09-20-statistika-protimiseon-epityxonton-kai-ypopsifion-gia-tin-tritovathmia-ekpaidefsi-ana-katigoria-epilogis-2

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 11 February 2025 doi:10.20944/preprints202502.0752.v1

31. www.minedu.gov.gr. (2020, Jun). Retrieved Jul 2024, from https://www.minedu.gov.gr/news/45726-10-07-20-anakoinosi-vathmologion-panelladikon-eksetaseon-gel-kai-epal-2020
32. www.minedu.gov.gr. (2021, Jun). Retrieved Jul 2024, from https://www.minedu.gov.gr/news/49404-09-07-21-anakoinosi-vathmologion-panelladikon-eksetaseon-gel-kai-epal-2021
33. www.minedu.gov.gr. (2021, Aug 27). Retrieved Jul 2024, from https://www.minedu.gov.gr/news/49816-27-08-21-sxetika-me-ta-apotelesmata-eisagogis-a-ypopsifion-ton-panelladikon-eksetaseon-etous-2021-stin-tritovath-mia-ekpaidefsi-v-ypopsifion-sta-dimosia-iek-2021
34. www.minedu.gov.gr. (2023, Jun). Retrieved Jul 2024, from https://www.minedu.gov.gr/news/55832-29-06-23-anakoinosi-vathmologion-panelladikon-eksetaseon-gel-kai-epal-2023
35. www.minedu.gov.gr. (2023, Jul 27). Retrieved Jul 2024, from https://www.minedu.gov.gr/news/56075-27-07-23-a
36. www.minedu.gov.gr. (2024, Jun). Retrieved Jul 2024, from https://www.minedu.gov.gr/epal-m/anakoinwseis-epala/58752-28-06-24-anakoinosi-vathmologion-panelladikon-eksetaseon-gel-kai-epal-2024-statistika-4
37. www.minedu.gov.gr. (2024). Retrieved from https://www.minedu.gov.gr/epal-m/anakoinwseis-epala/58752-28-06-24-anakoinosi-vathmologion-panelladikon-eksetaseon-gel-kai-epal-2024-statistika-4
38. www.monedu.gov.gr. (2022, Jun). Retrieved Jul 2024, from https://www.minedu.gov.gr/news/52639-28-06-22-anakoinosi-vathmologion-panelladikon-eksetaseon-gel-kai-epal-2022
39. Yeung, J. (2024). The Dynamic Relationships between Educational Expectations and Science Learning Performance among Students in Secondary School and Their Later Completion of a STEM Degree. Behav. Sci., 14(506). https://doi.org/10.3390/bs14060506
40. Zammitti, A., Magnano, P., & Santisi, G. (2021). The Concepts of Work and Decent Work in Relationship With Self-Efficacy and Career Adaptability: Research With Quantitative and Qualitative Methods in Adolescence. Frontiers in Psychology, 12. doi:10.3389/fpsyg.2021.660721

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.