R1.2 Artificial Intelligence, technological innovations and soft skills in medicine, educational insight

WORK PACKAGE 1: Research on Training methods, Artificial Intelligence and soft skills in medicine studies

Artificial Intelligence, Innovation & Society, the future of medicine – AIIS

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Short Description	In this report, with the contributions of all partners working together within each country (national groups for Spain - Greece - Benelux -

	Finland), a study it is been made of the state of development of the AI and soft skills in healthcare education in each of the countries represented in the AIIS consortium, with a special attention given to the definition of the AI and its application, the need for soft skills, but also a focus on learning and teaching methods mostly used to address such skills needs. This report also includee survey and desk research results. HEIs performed an analysis of the state of the art of training of AI and soft skills in medicine curriculums in the different partner countries. Thus, R1.2 describes the educational system of each country, identifying their state of the art in terms of education with concrete examples that support the development of this sector through the training of future professionals. In addition, other partners provided information on other forms of continuous training and how professionals normally acquire those skills. The survey provides important information, giving an insight on the perception of the different target groups of the project on this issue. The survey it is annexed to this output with full results.
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Table of Contents

1 Introduction 10

2 Methodology 10

3 Comparative Analysis – The short analysis 11

3.1 Medical Studies in Belgium 16

3.2 Medical Studies in Finland 18

3.3 Medical Studies in Spain 19

3.4 Medical Studies in Greece 21

4 Data analysis 22

4.1 Teachers 23

4.1.1 AI skills 23

4.1.2 Soft skills 27

4.2 Students 31

4.2.1 AI skills 31
4.2.2 Soft skills 38
4.3 Data Analysis Per Country 41
4.3.1 Data Analysis Belgium 41
4.3.1.1 Data Analysis Belgium - Professionals 41
4.3.1.1.1 AI Skills 44
4.3.1.1.2 Soft Skills 50
4.3.1.2 Data Analysis Belgium - Students 53
4.3.1.2.1 AI Skills 54
4.3.1.2.2 Soft Skills 61
4.3.2 Data Aanalysis - Greece 65
4.3.2.1 Data Analysis Greece - Professors 66
4.3.2.1.1 AI Skills 67

4.3.2.1.2 Soft Skills 73
4.3.2.2 Data Analysis Greece - Students 76
4.3.2.2.1 AI Skills 77
4.3.2.2.2 Soft Skills 83
4.3.3 Data Analysis - Finaland 87
4.3.3.1 Data Analysis Finland - Professors 88
4.3.3.1.1 AI Skills 89
4.3.3.1.2 Soft Skills 95
4.3.3.2 Data Analysis Finland - Students 98
4.3.3.2.1 AI Skills 99
4.3.3.2.2 Soft Skills 104
4.3.4 Data Analysis - Spain 108
4.3.4.1 Data Analysis Spain - Professors 109

4.3.4.1.1 AI Skills 110

4.3.4.1.2 Soft Skills 116

4.3.4.2 Data Analysis Spain - Students 119

4.3.4.2.1 AI Skills 120

4.3.4.2.2 Soft Skills 125

5 Desk research by Country 129

5.1 Desk research of Finland 129

5.1.1 National curricula in Finland 129

5.1.1.1 Stacture 129

5.1.1.2 Courses in Finland 132

5.1.1.2.1 Courses of AI 132

5.1.1.2.2 Courses of Soft Skills 143

5.1.2 Vocational Education Training in Finland 161

5.1.3 Policy making policies in Finland 162

5.2 Desk Research of Belgium 167
5.2.1 National Curricula in Belgium 167
5.2.1.1 Structure 167
5.2.1.2 Courses 170
5.2.2 Vocational Education Training (VET) in Belgium 181
5.2.2.1 Structure 181
5.2.2.2 Courses 183
5.2.3 Policy Making Policies in Belgium 187
5.3 Desk Research of Greece 189
5.3.1 National Curricula in Greece 189
5.3.1.1 Structure 189
5.3.1.2 Courses 191
5.3.2 Vocational Education Training in Greece 196
5.3.2.1 Structure 196
5.3.2.2 Courses 198

5.3.3 Policy making policies in Greece 214

5.4 Desk Research of Spain 216

5.4.1 National Curricula in Spain 216

5.4.1.1 Structure 216

5.4.1.2 Courses (Undergraduate) 218

5.4.1.3 Courses (Postgrduate) 226

5.4.2 Vocational Education Training in Spain 237

5.4.2.1 Structure 237

5.4.2.2 Courses 238

5.4.3 Policy making policies in Spain 246

6 Conclusion 247

7 Annex 248

1 Introduction

The aim of this paper is to present the main results of the AIIS research process in the context of the first work package. The methodology used is based on the program guide and more specifically the University of Thessaly guided all partners to provide collaborative contributions from each country (national groups for Spain - Greece - Benelux - Finland), to produce this report.

This report contains the results and their analysis based on a questionnaire which was given to the Universities of the consortium and was constructed with the aim of extracting the basic needs in the field of health professionals on AI and soft skills in healthcare education, with a special attention given to the definition of the AI and its application, the need for soft skills, but also a focus on learning and teaching methods mostly used to address such skills needs.

Also, this report is including the desk research results, where each country partner has described his/her educational system, identifying their state of the art in terms of education with concrete examples that support the development of this sector through the training of future professionals.

2 Methodology

The methodology we used in the construction of the questionnaire was based on one hand on the scientific principles of research methodology and on the other hand on the broader consensus of all partners on the type and number of questions. The questionnaire and the responsibility of collecting the data was in the Universities of the consortium.

As far as desk research is concerned, its structure is starting with a focus on the skills a student should have related to AI and soft skills to better his/her performances as a professional. The University of Thessaly and the contributor partners have taken care in the vocabulary used to describe the desired skills, based on the future exploitation of the project and the need for clarity and use of EU recognized concepts.

The survey will provide important information, giving an insight on the perception of the different target groups of the project on this issue. The survey will be annexed to this output with full results. The purpose of this report is to present the results of the statistical analysis of the questionnaire. A separate analysis was carried out for the answers given by each country and specialization (professor, student, etc.). The questionnaire was answered by 408 people from 4 countries and the questions referred to the knowledge that the respondents had about artificial intelligence as well as about their soft skills.

3 Comparative Analysis – The short analysis

Analyzing the questionnaire, we came to the conclusion that in individual questions there were variations in the majority of answers, however there are common points between all four countries. This is explained by desk research since the structures of the curricula and the policies they follow in matters of artificial intelligence in health, are similar. The only exception that is observed is that in Greece where the national policy is being drafted on issues related to artificial intelligence. Analyzing the questionnaire showed very interesting results. Initially, teachers were much more conservative than students in what they thought they knew about artificial intelligence, which is common in all countries. As far as students are concerned, the students of Greece seem to have the greatest self-confidence compared to those of the 3 other countries. Let us emphasize here that this confidence does not arise from a curricula particularly oriented to AI, Greece being the only country that does not have a national policy on artificial intelligence.

We had a total of 408 answers to the questionnaire from 4 countries, Greece, Belgium, Finland and Spain. 186 men, 216 women and 6 undetermined gender.

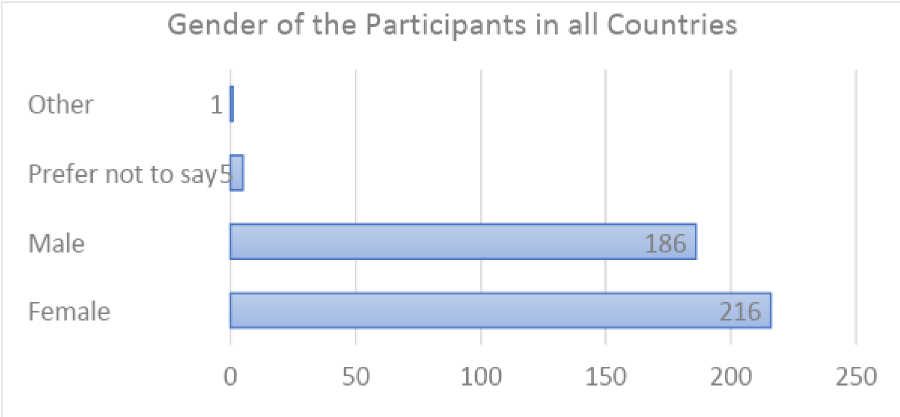


Table 1: Gender of the Participants in all Countries

We had a total of 154 responses from Spain, 71 from Finland, 118 from Greece and 65 from Belgium (French-speaking region); of these, 97 are professors and 311 students.

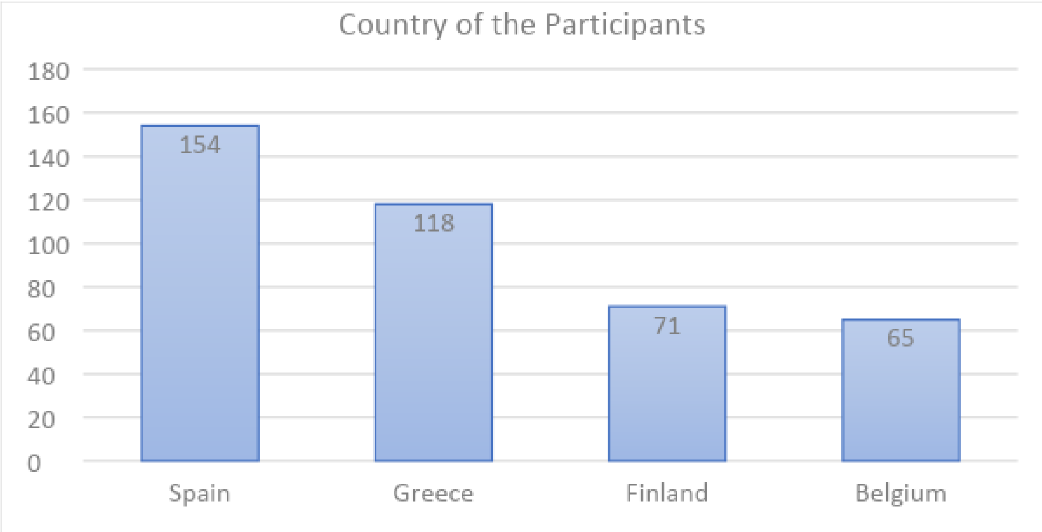


Table 1: Number of Participants per Country

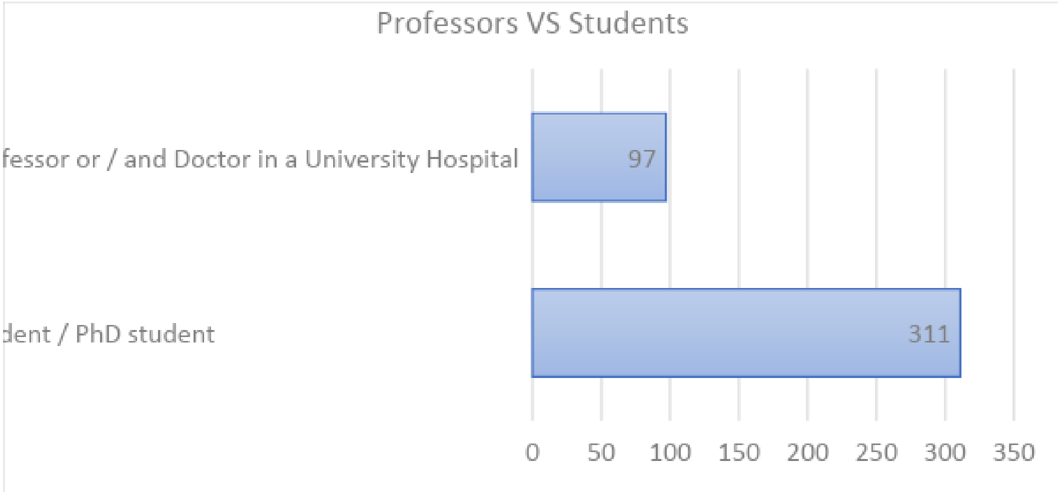


Table 2: Number of Participating Professors and Students

In the first part of the questions concerning the field of artificial intelligence and the skills that need to be developed, we managed to extract the following pattern.

For Professors:

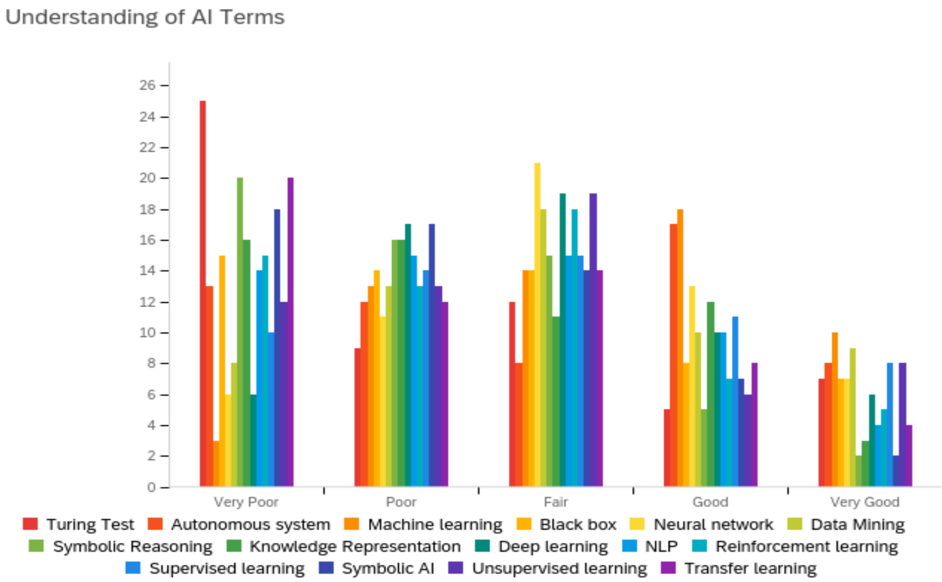


Table 4: Professors' Understanding of AI Terms

For Students:

Understanding of AI Terms

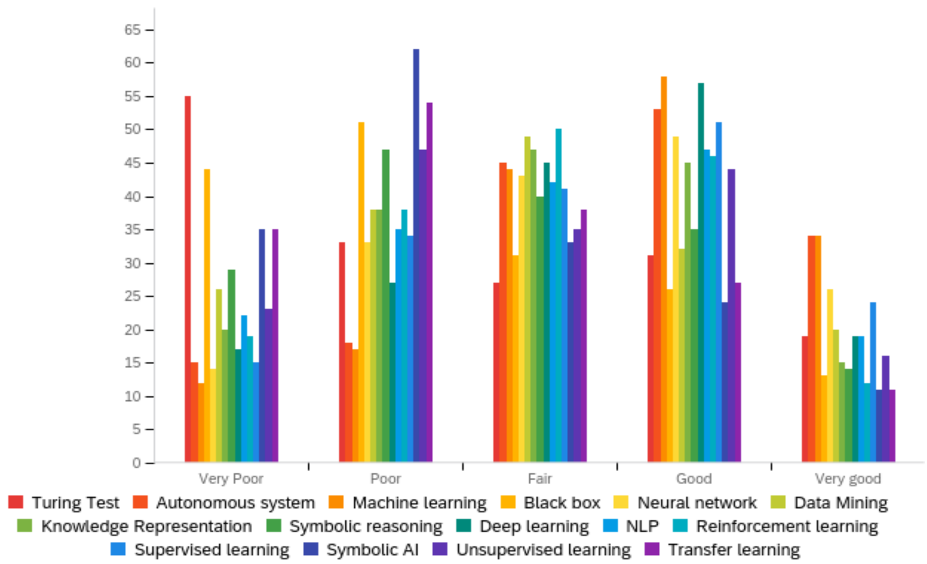


Table 5: Students' Understanding of AI Terms

The detailed results can be found on the Annex of this Report.

Regarding the comparative analysis of undergraduate and postgraduate national curriculum, we were led to the following results.

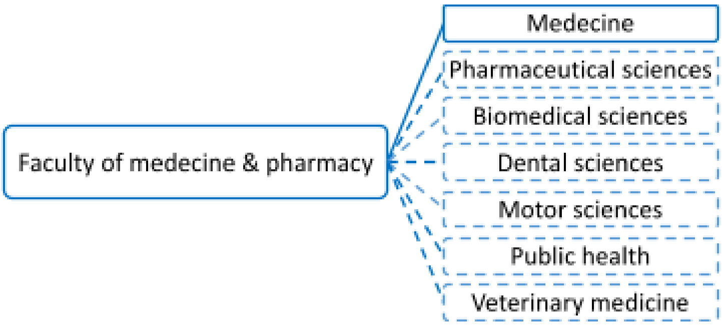


Table 3: Faculty of medecine & pharmacy

Faculties of medicine and pharmacy generally include medicine (clinical sciences), pharmaceutical sciences, dental sciences, biomedical sciences, veterinary medicine, motor sciences and public health.

3.1 Medical Studies in Belgium

Becoming a Doctor of Medicine (MD) in Belgium means following basic medical training consisting of a 180 credits bachelor's and a 180 credits master's degree. According to the

Belgian medical legal system, additional residency training in combination with an advanced master’s education is compulsory to become active as a professional physician who can and may practice medicine at his or her own responsibility within the Belgian legal and social security framework. The medical curricula in Belgium have almost no differences compared to other curricula around the world. They have the same timeframe for the whole degree program which is 6 years long (3 bachelor + 3 master) with an extra two years to become a general doctor or 3 to 6 years to become a specialist. However, the arrangement or the order of the topics that will be taught and discussed is different for every university.

The Federal Government of Belgium launched AI4Belgium the Belgian coalition for AI. Among them, a specific AI4Health working group aims to promote the implementation of AI in healthcare and AI education in medicine. The AI4Belgium coalition recommends developing a responsible data strategy where trust is the cornerstone of any transformation , while a robust and up-to-date legal framework, ethical principles and more transparency are needed. Also, the Secretary of State for Digitalization has launched "Digital Minds" to tackle the broader digital sense. Among these Digital Minds, health is included in government

competences in specialized “Councils” (each council represents a pillar - government, industry, etc.). Digital Minds and AI4Belgium work very closely together.
In the Belgian Walloon region the DigitalWallonia4.ai program has the objective of accelerating the adoption of AI in the region. The overall budget, which also includes industry 4.0 and the regional digital strategy "Digital Wallonia", is 18 million EUR per year. Since December 2020, the regional AI program includes a research project called "ARIAC by DigitalWallonia4.ai" launched in the framework of the TRAIL consortium, which brings together universities and research centers in the Wallonia-Brussels Federation. The 32 million EUR project is funded by the Walloon Region and runs from 2021 to 2026.

The Belgian Flemish Government launched the Flemish action plan to foster AI in Flanders. The Flemish AI action plan foresees an annual budget of EUR 32 million for its implementation, broken down as follows: EUR 15 million dedicated to the implementation of AI within companies, EUR 12 million allocated to basic research, and EUR 5 million to supporting measures (training, ethical and legal aspects related to AI-adoption, and outreach activities). This funding is complemented with other policy instruments of both FWO (funding for HEIs) and VLAIO (funding for enterprises). In 2020 FWO invested about EUR 15 million and VLAIO some EUR 45 million in AI related projects. The same amounts are expected for the following years. The Flemish AI policy plan also draws particular attention to the development of AI for the healthcare sector. In line with the Flemish policy plan for 2019-2024 and the framework of Flanders Care, a specific focus is given to support new cooperation models between the public health care sector and the industry. Agoria has recently launched an AI-MOOC for the health sector. For the Brussels-Capital Region, the innovation funding body Innoviris has been playing a major role in the support of AI-related research and innovation efforts in Brussels All these regional initiatives are joined up at the level of AI4Belgium.

3.2 Medical Studies in Finland

University level medical education in Finland takes place in the Medical Schools in the Faculty of Medicine (University of Turku, Helsinki and Oulu) or the Faculty of Health Sciences (Eastern Finland) or the Faculty of Medicine and Health Technologies (Tampere). Below, all these Medical School home bases are commonly referred to as “Faculty of Medicine”. In **Medicine** or **Dentistry,** the degree in Finland consists of 12 or 11 semesters, respectively. This means 6 or 5,5 years of full-time studying. The curriculum consists of preclinical (2-3 years) and clinical studies in the Universities of Turku, Helsinki, Oulu and Eastern Finland. Tampere University applies a problem-based learning pedagogy and, thus, preclinical and clinical studies are taught together. In all the Finnish Universities the curriculum of medicine consists of 360 ECTS and dentistry of 330 ECTS, similarly to other European Universities. Most of the studies are fixed and harmonized across the medical faculties, based on the core learning objectives. However, there are a few ECTS for optional (elective) studies included (about 10-30 ECTS, depending on the university). The Master's degree in Health Sciences consists of 4 semesters, which means two years of full-time studying. The curriculum for Master in Health Sciences contains 120 ECTS. Studies are offered mainly in Finnish language but in most universities, some courses are offered in English as well. Students can choose to specialize in nursing leadership and management with expertise in several clinical areas or in health education and the didactics of nursing science (teacher training). The offered programs and the options for specializing vary by different universities. The contents of the curricula for Bachelor in Health Sciences and Master in Health Sciences are different, depending on the university The courses teaching AI vary a lot depending on the University, and the particular topic. Currently, AI courses evolve rapidly, incited by the real life needs and

new technology developed for the use of health care sector and medicine &dentistry. Thus, the need for such courses is imminent, both the more general and in-depth courses.
Medical school may have other names like “Health sciences faculty”. Other health sciences grade like nutrition, biomedicine, biomedical engineering, etc., may be taught in this faculty.

The previous government (2015 – 2019) of Finland made artificial intelligence (AI) as one of its key projects. The Minister of Economic Affairs launched the Artificial Intelligence Programme in May 2017. Later in the same year, the first eight key actions were presented for making Finland one of the leaders in the application of AI. This work was later supplemented with separate analyses and recommendations for measures on the future of work, ethics and security. Finland's stability and security combined with high technology utilisation rate and education level provide an excellent platform for the creation and development of digital business. The development of data policy and data management in a way that takes the different life situations of citizens into account is a unique innovation by global standards. In addition to the policy making ministries of the central government of Finland, several universities and other research institutions have actively contributed to the discussion about the policy making principles for AI, such as the Helsinki Centre for Data

Science (HiDATA), University of Helsinki Legal Tech Lab and the Finnish Center for Artificial Intelligence (FCAI).

3.3 Medical Studies in Spain

The grade in medicine in Spain consists in a 6-years degree. The national curriculum (*link*) consists in a list of core subjects with their respective ECTS that must be included in the particular curricula of each university. This national core curriculum has a total of 160 ECTS, so each university has room to include in their curricula the subjects they may consider since the grade usually has a total of 360 ECTS. There is not a unique curriculuma concerning the post graduate studies. Each oficial master degree is designed by the university and then approved by an academic comision of the region and the Minister of Education. Regarding the masters for graduates in medicine, there are degrees related with many medical specialities, and the majority of the medical schools have a master in biomedical research, mainly oriented for future doctoral students. As for the post-graduate curricula, excepting the titles about biomedical research, we found very different curricula. Most of the masters are focused on different biomedical specialties, but some of them are more transversal with topics like healthcare systems management.

Generally, the courses are broad and not only focused on a particular topic. The courses are oriented to the teaching of a topic related to AI or soft skills and the application to the healthcare area. For example, in the 1.2.1 course, there are contents about R programming, but they are oriented and combined with the analysis of omics data.

Estrategia Española de Ciencia, Tecnología e Innovación 2021-2027: Among the strategic lines we can find “precision medicine” and the following sublines, “artificial intelligence” and “digital health in personalized medicine”. “Artificial intelligence and robotics” is also a strategic line on its own, including “computer vision” and “digital health” as sublines. Estrategia Española de I+D+i en Inteligencia Artificial: Describes primary care as a sector which will benefit from AI, and the focus in cost savings through improvements prevention, early diagnosis and treatment of child obesity, cardiovascular diseases, neurogenerative diseases and breast cancer, among other subjects. It states the need for an AI able to explain its decision to health professionals and improving the interaction human-computer. “P4 medicine” (predictive, personalized, preventive and participative) will be based on AI, big data, machine learning and computer vision. “Estrategia Nacional en Inteligencia Artificial”: Identifies the sinergy between the health sector and AI as a strategic field for research. It states that AI will drive strategic projects like simplification of algorithms in healthcare, such as patient triage, and improve the efficiency of the healthcare system.

3.4 Medical Studies in Greece

Faculties of Health Science in Greece include the following departments: a) medical, public health, biochemistry and biotechnology, and veterinary medicine. Becoming a Doctor of Medicine (MD) in Greece means following basic medical training consisting of a 364 credits (ECTS). The grade in medicine in Greece consists in a 6-year degree. Each academic year is divided into teaching periods called semesters, the winter and spring semesters. Curriculum courses are divided into twelve independent semesters of study and has a total of 364 ECTS.

Regarding the degree of medicine, students in all Departments of Medicine in Greece must complete 6 years of basic university education. After obtaining their degree, they are obliged to carry out the training program entitled "Rural General Practicioners" lasting 12 months, where the first month concerns training in a hospital and the remaining 11 months of training in a rural health center. After the entire training, the doctors state the medical specialty in which they want to specialize in a specific sector such as cardiology, pediatrics, surgery, etc. Each specialization program has a different training time and duration.

The medical curricula in Greece have almost no differences compared to other curricula around the world. There is the basic university education which lasts 6 years. After the end of the university education there is the specialization program which lasts from 3-7 years in some specialties such as pediatric surgery, thoracic surgery, neurosurgery and vascular surgery to last 7 years.

The national strategy will set a framework for a holistic policy on the future development and implementation of artificial intelligence in Greece, which will be structured in a set of coordinated and interrelated actions, with the clear aim of maximizing potential benefits and minimizing potential costs. for the economy and society. The national strategy will be a coherent policy text of the country regarding the development of artificial intelligence, which:

- It will determine the conditions for the development of artificial intelligence, including the skills and trust framework, the data policy and the ethical principles for its safe development and use.
- It will outline national priorities and areas for maximizing the benefits of artificial intelligence to meet societal challenges and economic growth.

- It will analyze the necessary actions related to the above priorities and will propose horizontal interventions as well as at least one pilot application per policy area.

The implementation of the National Strategy for Artificial Intelligence, through which the mechanisms for planning and implementation of artificial intelligence actions under the new NSRF, the ways of attracting investments and the required interventions for the adoption of Artificial Intelligence (AI) in decided the government. In particular, the Ministry of Digital Governance is proceeding with the announcement of an Open Electronic Tender for the Promotion of a Contractor in the framework of the project "Study of project maturity for the implementation of the National Strategy for Artificial Intelligence"

4 Data analysis

We had a total of 408 answers to the questionnaire from 4 countries, Greece, Belgium, Finland and Spain. 186 men, 216 women and 6 answered us not to determine their gender. We had a total of 154 responses from Spain, 71 from Finland, 118 from Greece and 65 from Belgium, of these, 97 are professors and 311 students. Only 6 professors had experience of less than 5 years and 4 professors of 5 to 10 years, all the rest had professional experience of more than 10 years.

Distribution of understanding

4.1 Teachers

4.1.1 AI skills

The table below concerns the distribution of the understanding of concepts of artificial intelligence, which inclinates that **most medical professors do not consider themselves to have a full understanding of the fundamental concepts of artificial intelligence**.

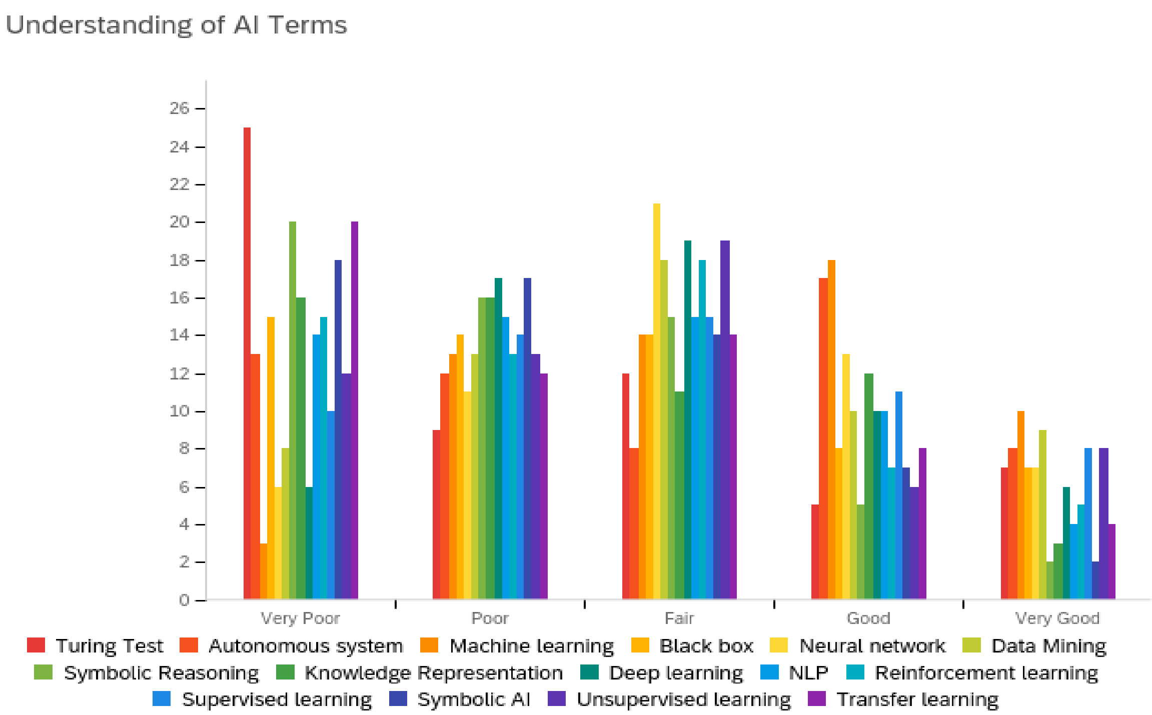


Table 8 : Understanding of AI Terms

It is important to mention that in the next question more than 50% of professionals ask their students to know Application level of understanding on how to use AI in their careers as medical professionals and 30% High-level comprehension of the AI that will be used in their careers as medical professionals. While only 14% ask for a deep understanding of the concepts of artificial intelligence.

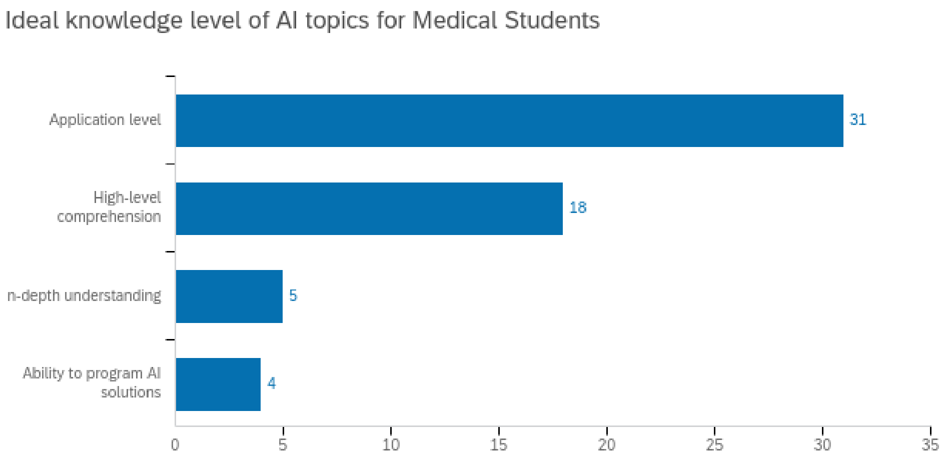


Table 9 : Ideal knowledge level of AI topics for Medical Students

The most important finding comes in the question of how to teach.

Most effective way to teach AI

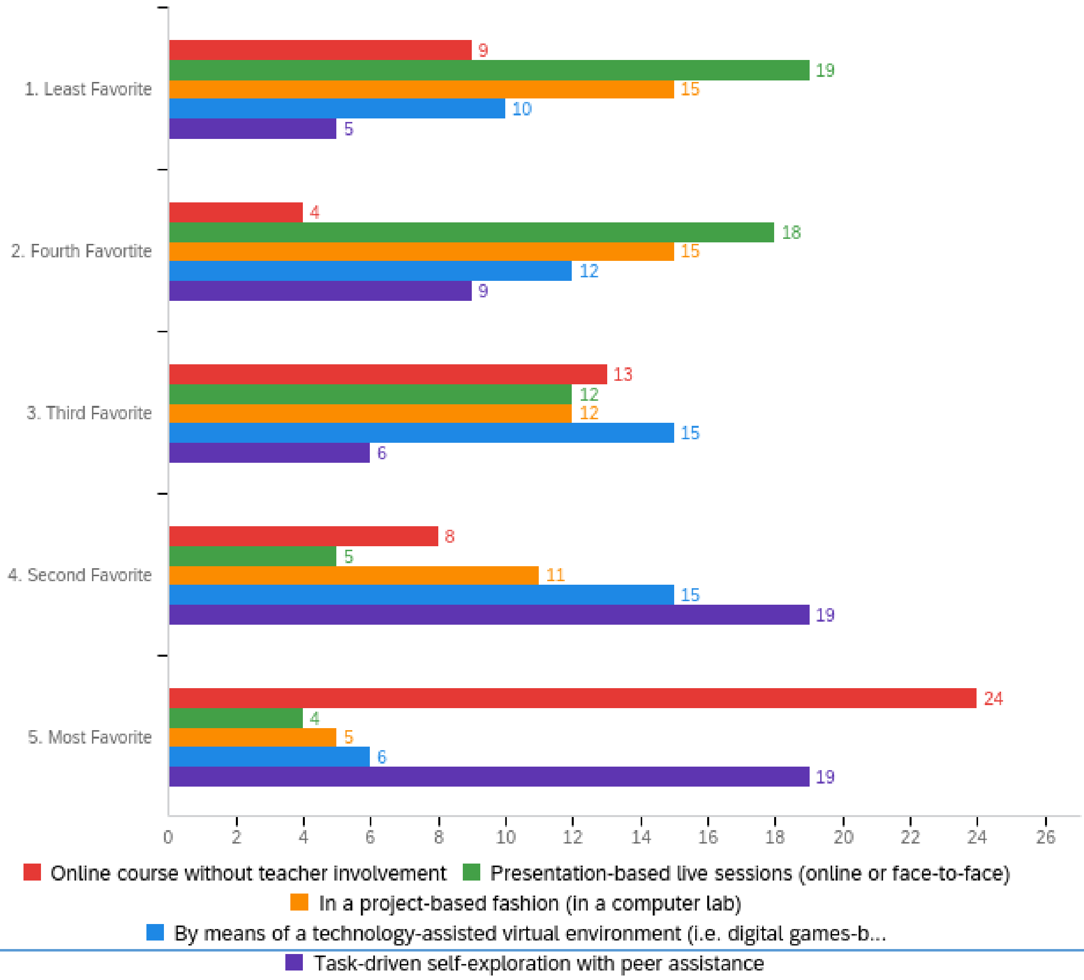


Table 8 : Most effective way to teach AI

It is clear that **professors prefer distance learning and task-driven self-exploration with peer assistance**.

In addition, **98% of teachers somehow request the introduction of an AI course in the curriculum.**

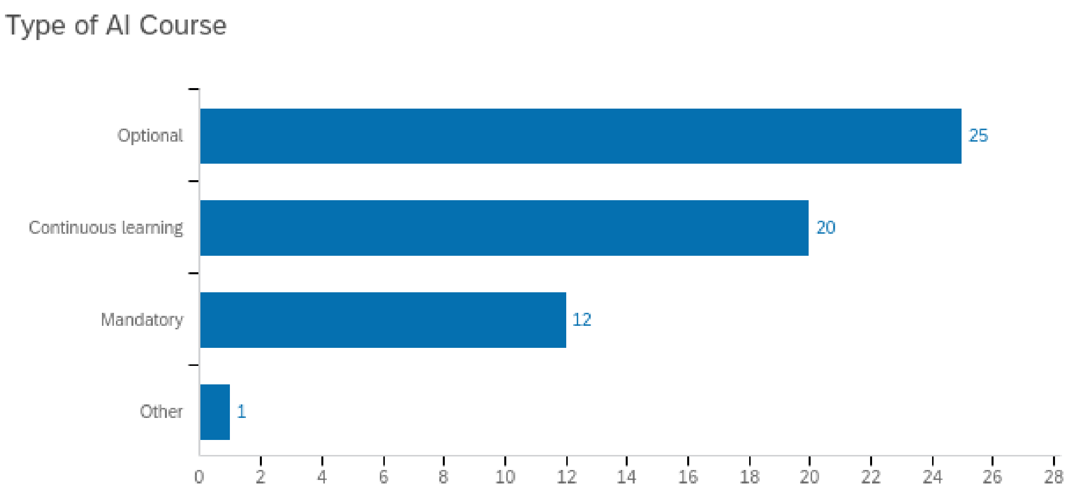


Table 11 : Type of AI Course

Finally in the Query of **how many hours are needed, we have a maximum of replies for 2 ECTS**

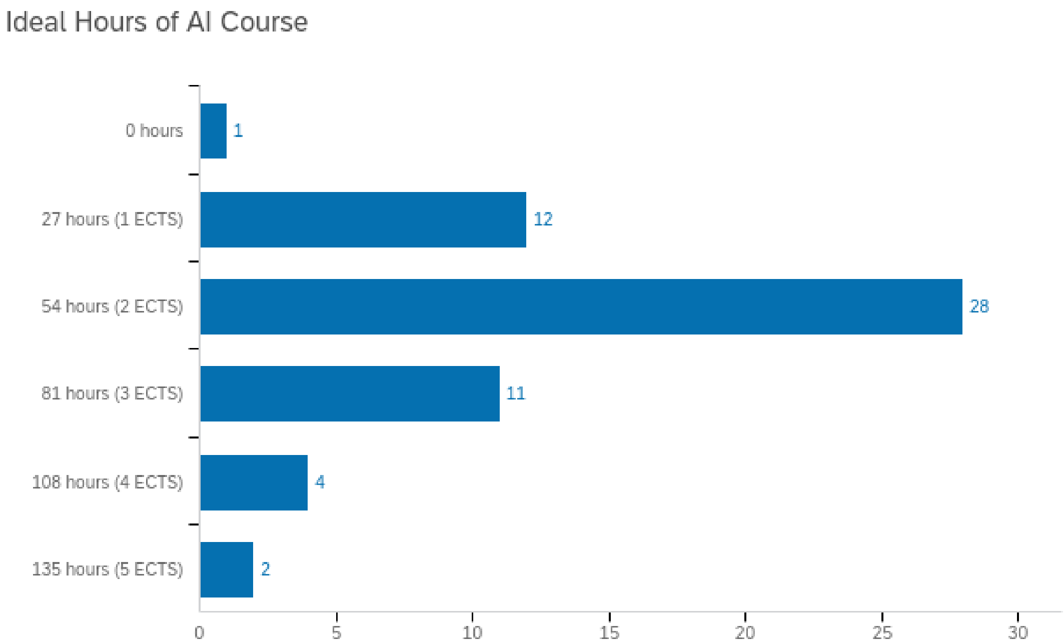


Table 12 : Ideal Hours of AI Course

4.1.2 Soft skills

In the matter of soft skills, the results are completely different, **90% answer ALL the questions that these skills are either important or very important**.

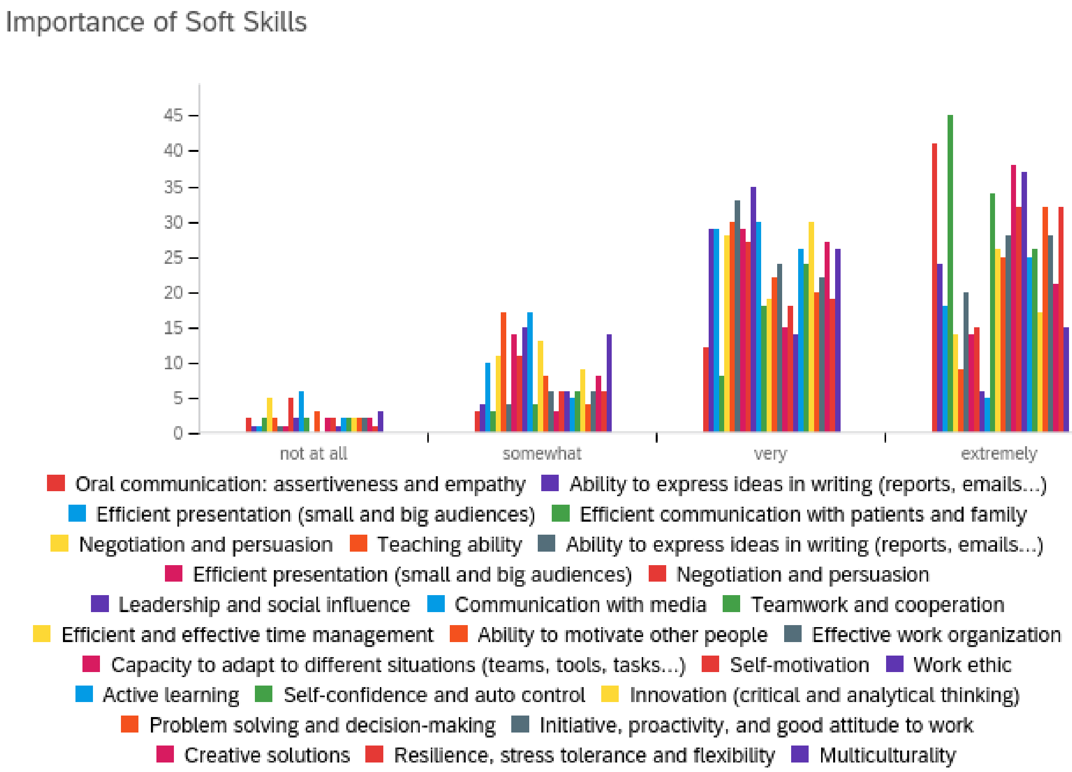


Table 13 : Importnace of Soft Skills

More detailed results for each Soft Skill can be found on the Annex of this Report.

Here in the answer for the way of teaching we have an important difference because, **it is clear that they prefer distance learning and task-driven self-exploitation with peer assistance; while they avoid presential classes, they opt for a technology-assisted virtual environment.**

Most Effective way for teaching Soft Skills

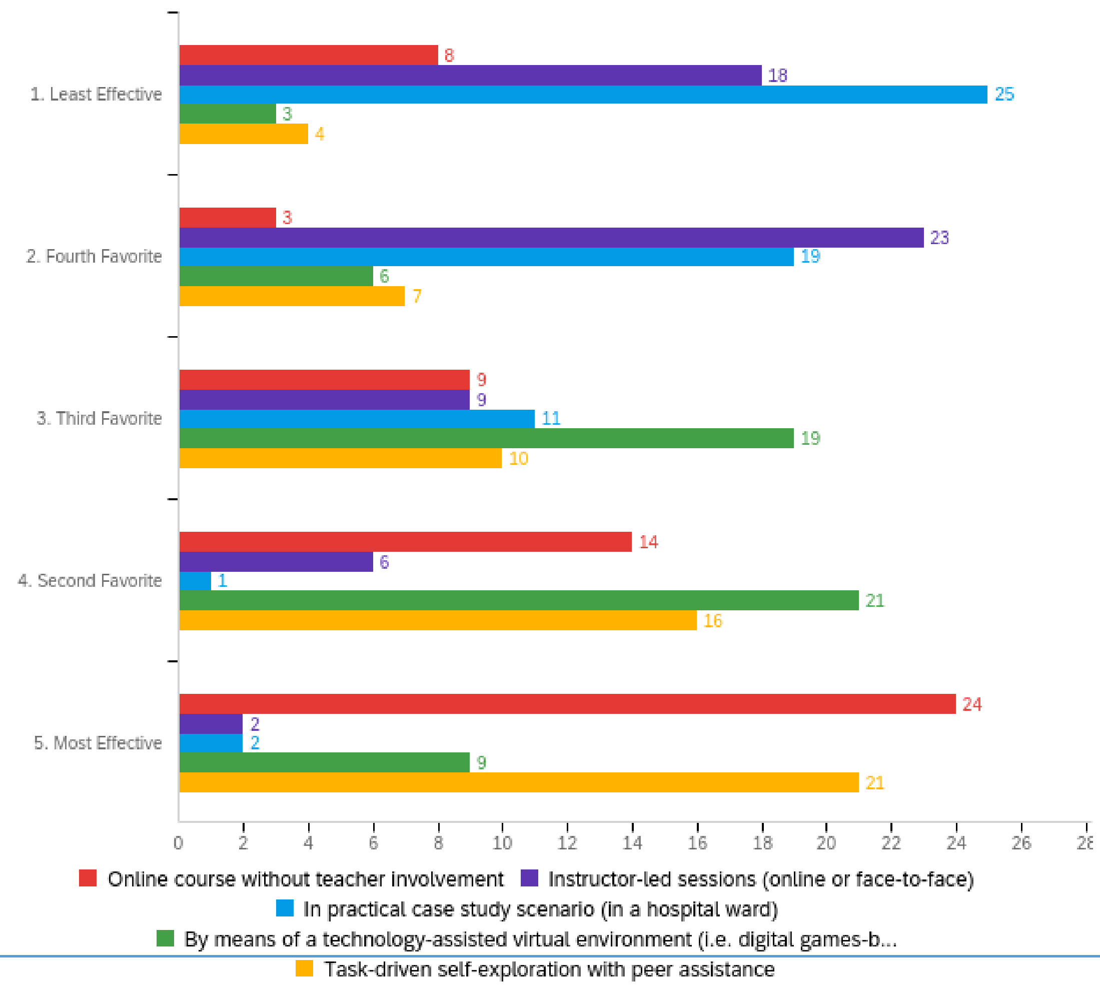


Table 14 : Most Effective way for teaching Soft Skills

In addition, 40% of the teachers request the introduction of a Soft Skills course in the curriculum as a Mandatory course, while 26% and 31% think that it is better to be included as an optional or continuous learning course, respectively.

Table 15: Type of Soft Skills Subject

Here in the matter of hours the distribution is bimodal. **The majority thinks that 1 ECTS are enough.**

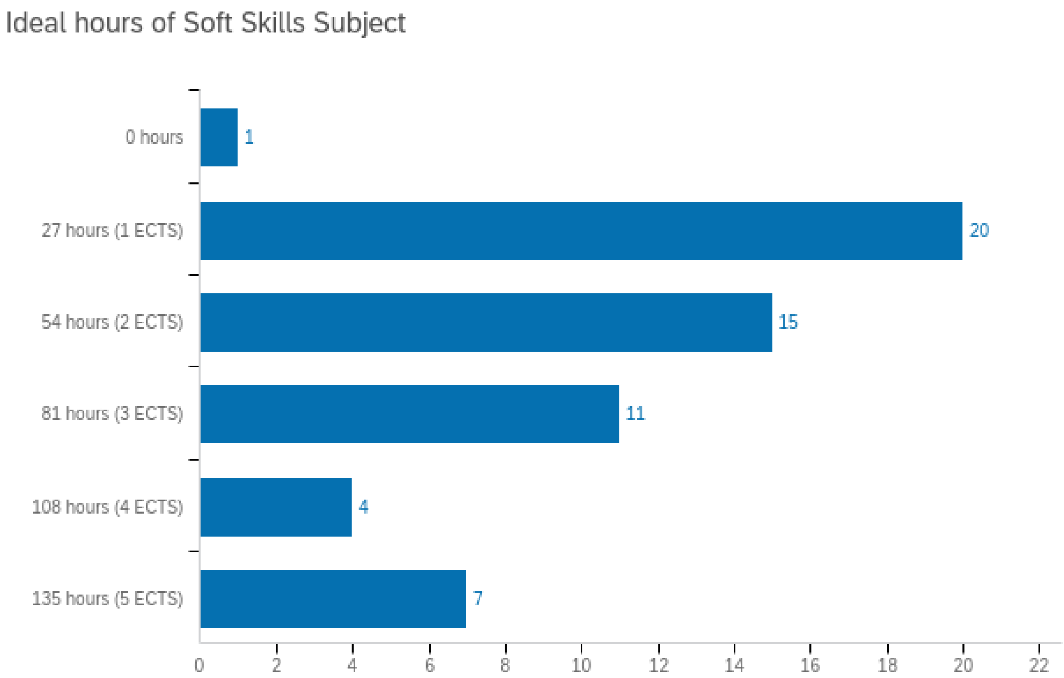


Table 16 : Ideal hours of Soft Skills Subject

4.2 Students

4.2.1 AI skills

Of the students, 146 are undergraduate and postgraduate and 19 are doctoral candidates.

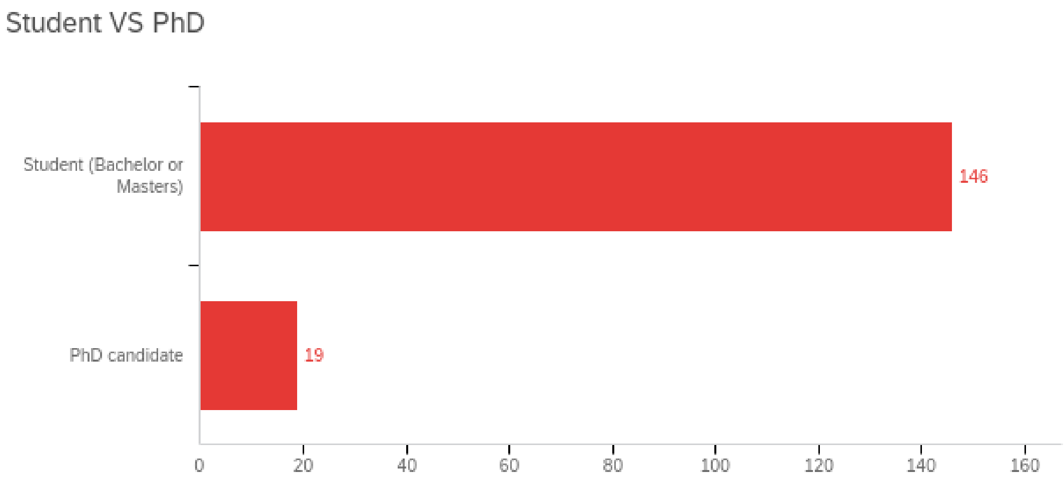


Table 17 : Student VS PhD

The following graph and table show the first significant difference in relation to the teacher population:

Understanding of AI Terms

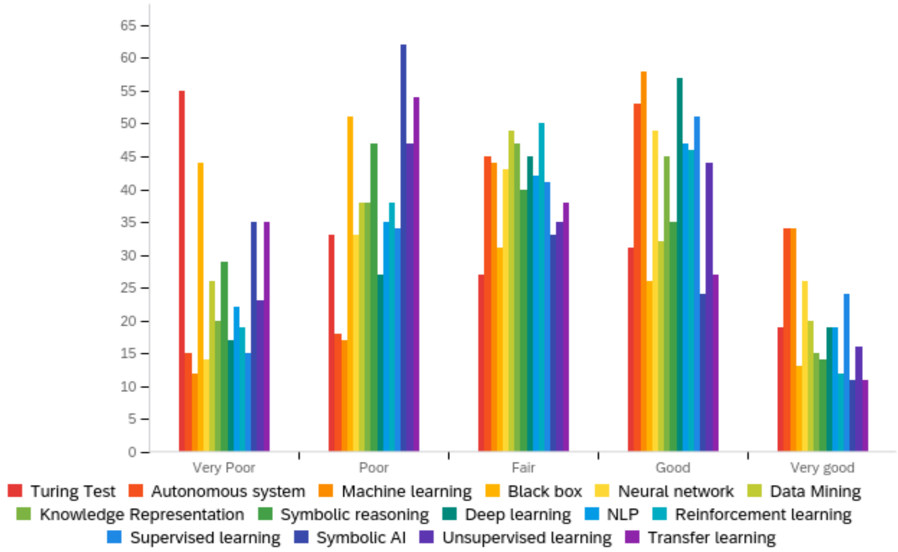


Table 18 : Understanding AI Terms

Question	Very Poor		Poor		Fair		Good		Very good		Total
Turing Test	33%	55	20%	33	16%	27	19%	31	12%	19	165
Black box	27%	44	31%	51	19%	31	16%	26	8%	13	165
Symbolic AI	21%	35	38%	62	20%	33	15%	24	7%	11	165
Transfer learning	21%	35	33%	54	23%	38	16%	27	7%	11	165
Symbolic reasoning	18%	29	28%	47	24%	40	21%	35	8%	14	165
Data Mining	16%	26	23%	38	30%	49	19%	32	12%	20	165

Unsupervised learning	14%	23	28%	47	21%	35	27%	44	10%	16	165
Natural language processing	13%	22	21%	35	25%	42	28%	47	12%	19	165
Reinforcement learning	12%	19	23%	38	30%	50	28%	46	7%	12	165
Knowledge Representation	12%	20	23%	38	28%	47	27%	45	9%	15	165
Deep learning	10%	17	16%	27	27%	45	35%	57	12%	19	165
Autonomous system	9%	15	11%	18	27%	45	32%	53	21%	34	165
Supervised learning	9%	15	21%	34	25%	41	31%	51	15%	24	165
Neural network	8%	14	20%	33	26%	43	30%	49	16%	26	165
Machine learning	7%	12	10%	17	27%	44	35%	58	21%	34	165

The students are more confident than teachers in their belief to know about AI, **event though, as shown in the literature search below, there are practically no AI course in their curricula.**

In the matter of academic courses the findings are impressive, the distribution is uniform, **there is no clear superiority for any subfield of artificial intelligence.**

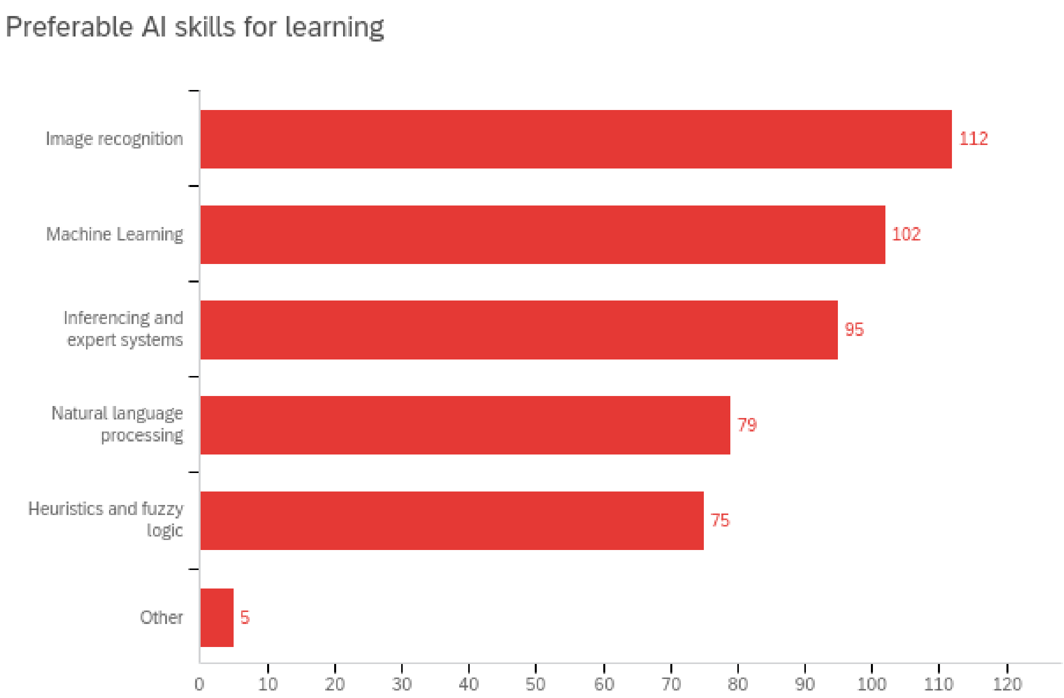


Table 19 : Preferable AI skills for learning

When asked at **what level they would like to know AI, the distribution of answers agrees with that of teachers, 38% of high-level comprehension and 44 % of application level comprehension.**

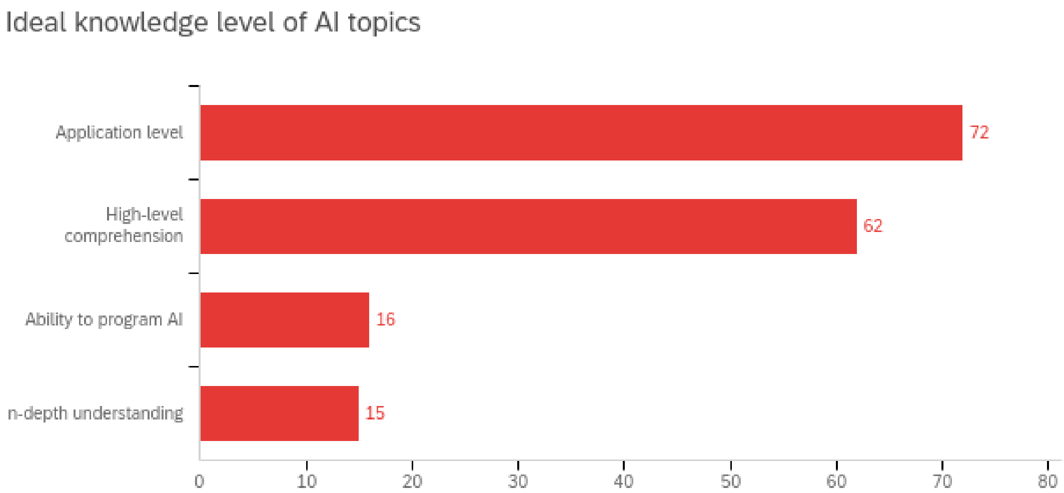


Table 20 : Ideal knowledge level of AI topics

As it is shown from the graphc bellow **it is clear that they prefer distance learning and task-driven self-exploration with peer assistance while avoiding lifelong learning.**

Most effective way to learn AI

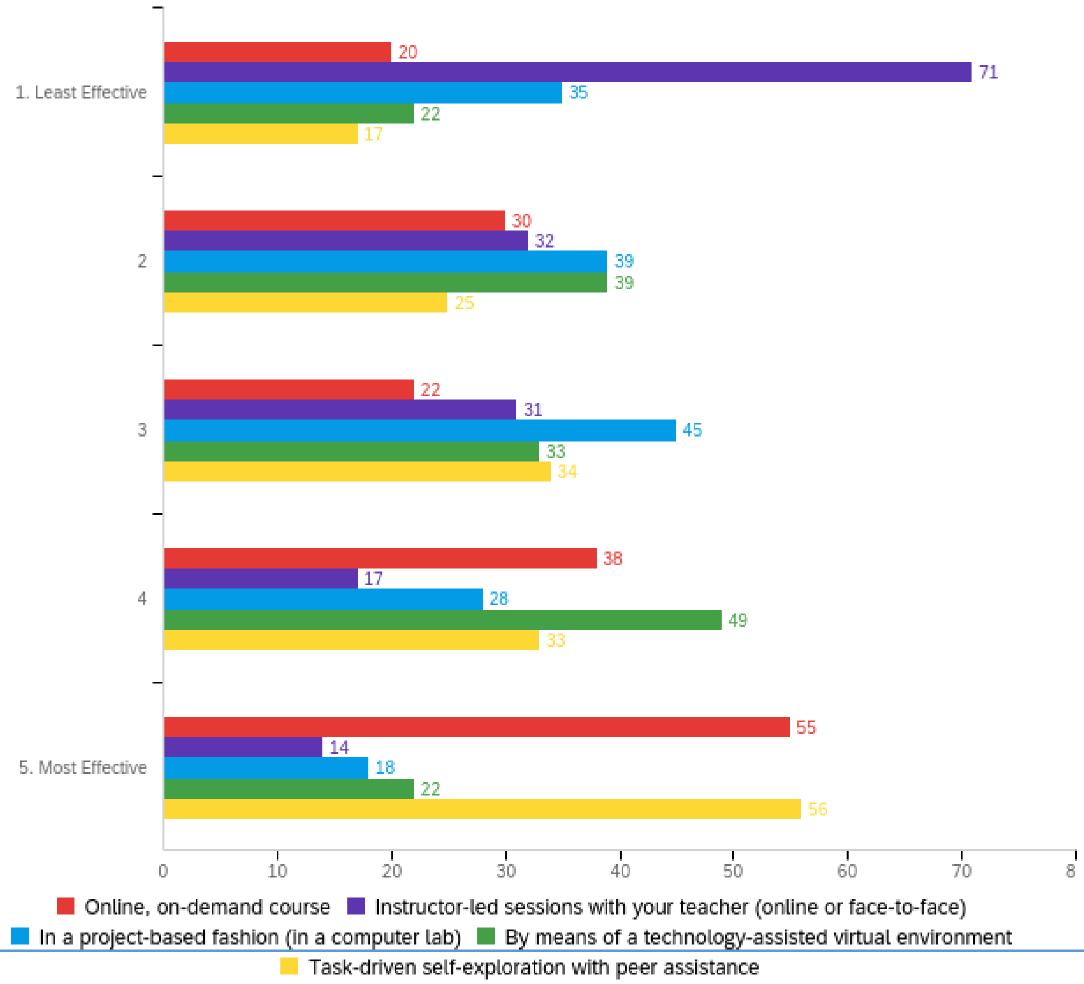


Table 21 : Most effective way to learn AI

Concerining the type of AI Skills Course the results are form as shown in the graphc bellow, which indicates that **the majority of them, with 47%, they prefer to be an optional course.**

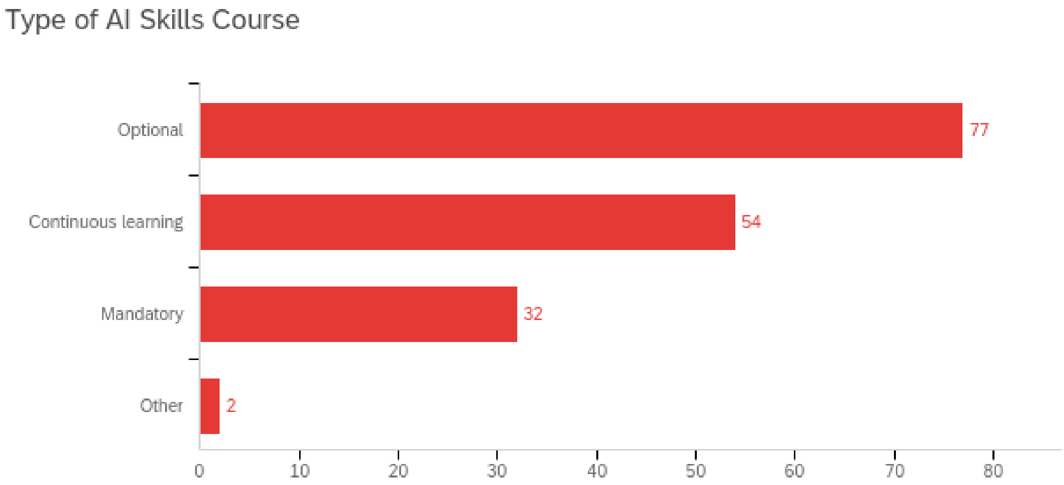


Table 22 : Type of AI Skills Course

Lastly about the ideal hours of the AI course **the majority of students (34%) voted for 3 ECTS** as shown in the graph bellow.

Ideal hours of AI Course

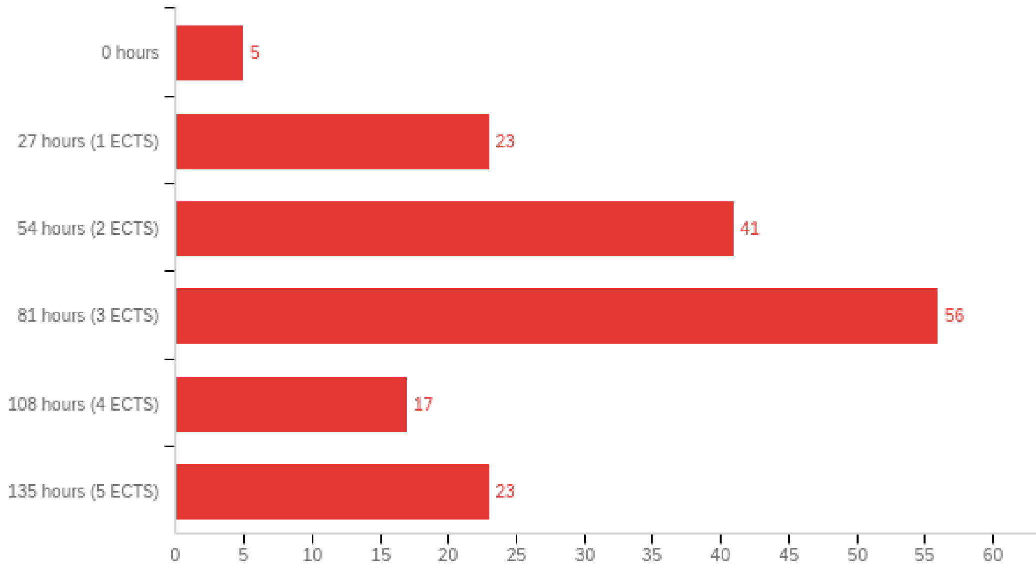


Table 23 : Ideal hours of AI Course

4.2.2 Soft skills

In question *"Please rate how important do you consider the training of these competencies (soft skills) for doctors in their profession?"*, the answers follow a distribution with a right slant, **they consider all the characteristics related to soft skills very and extremely important**. (The full results with votes per Soft Skill can be found in the Annex of this Report)

Importance of Soft Skills

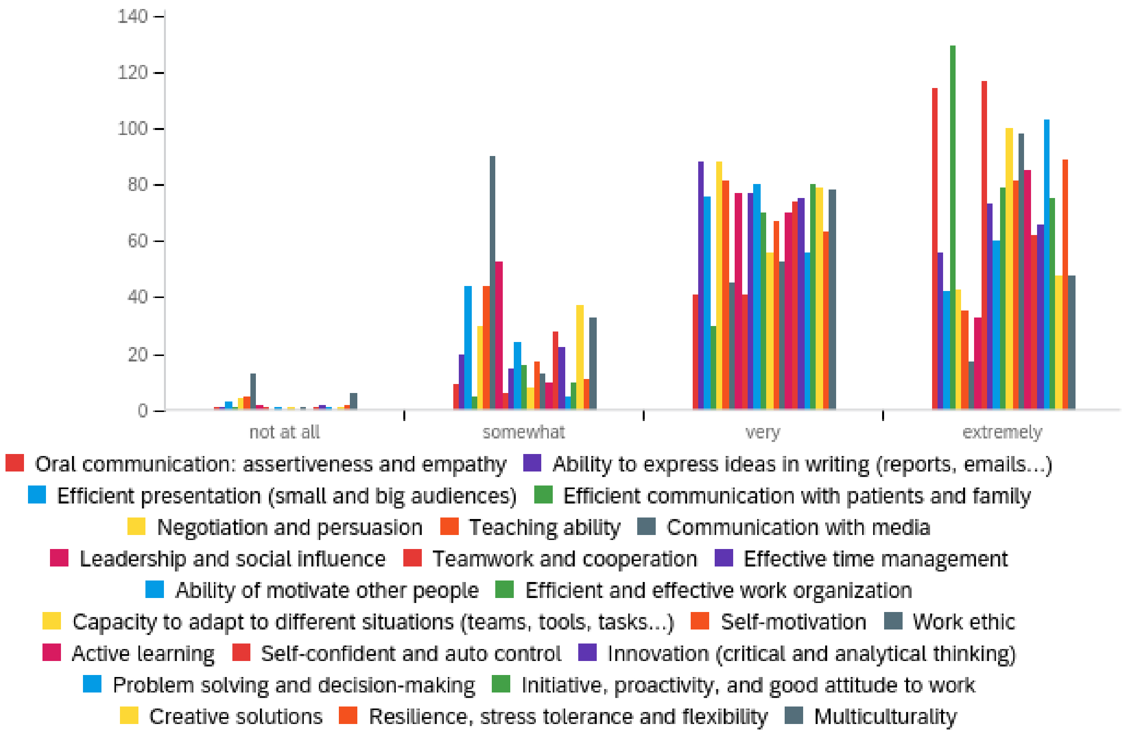


Table 24 : Importance of Soft Skills

In the matter of soft skills **the results are completely similar to the professors**, but in the answer for **the way of teaching we have a significant difference because it is clear that they prefer distance learning and task-driven self-exploration with peer assistance while avoiding the face-to-face lesson and the technology-assisted virtual environment**.

Most effective way of learning Soft Skills

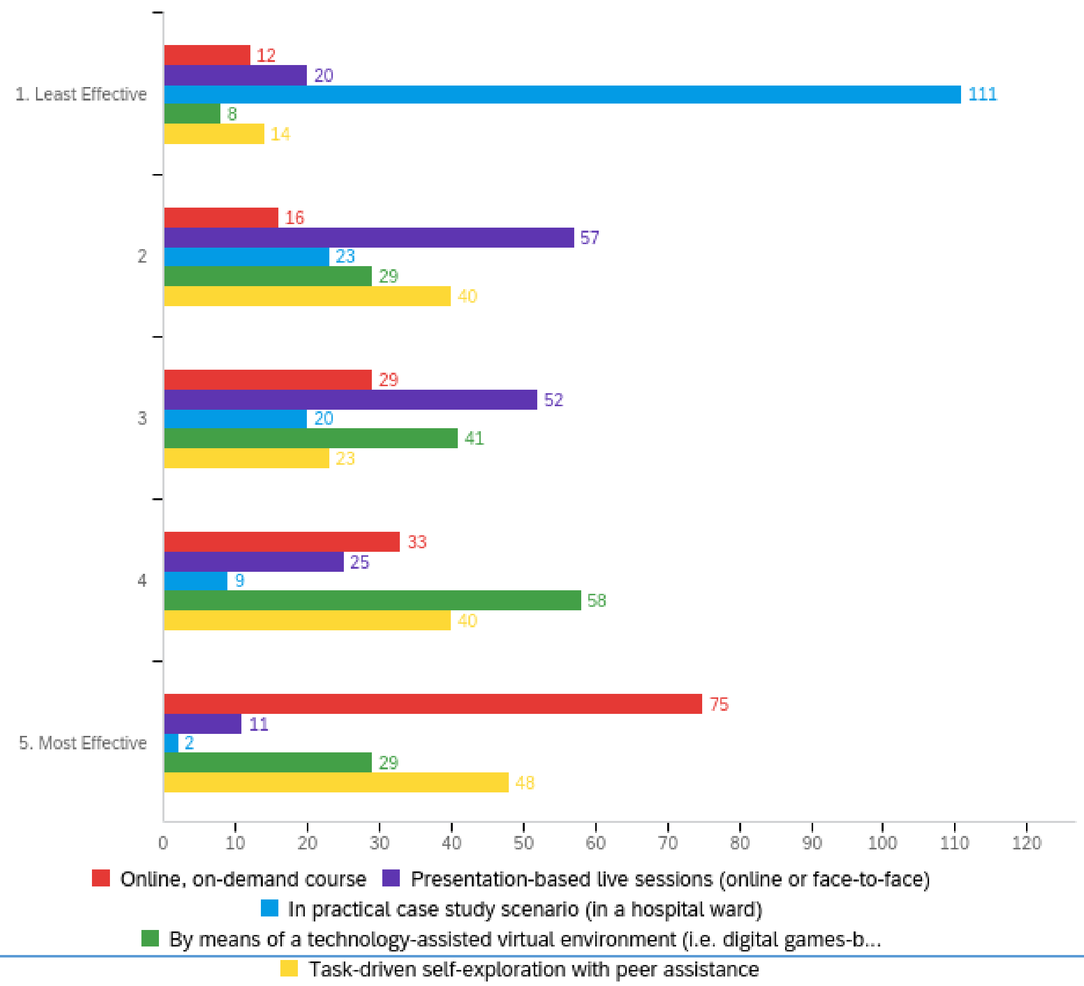


Table 25 : Most effective way of learning Soft Skills

In addition, **the 39% of the students request the introduction of a skills course in the curriculum in a mandatory way**, while 37% and the 24% prefered the Countinious Learning or Optional way of admission as shown in the graphc bellow.

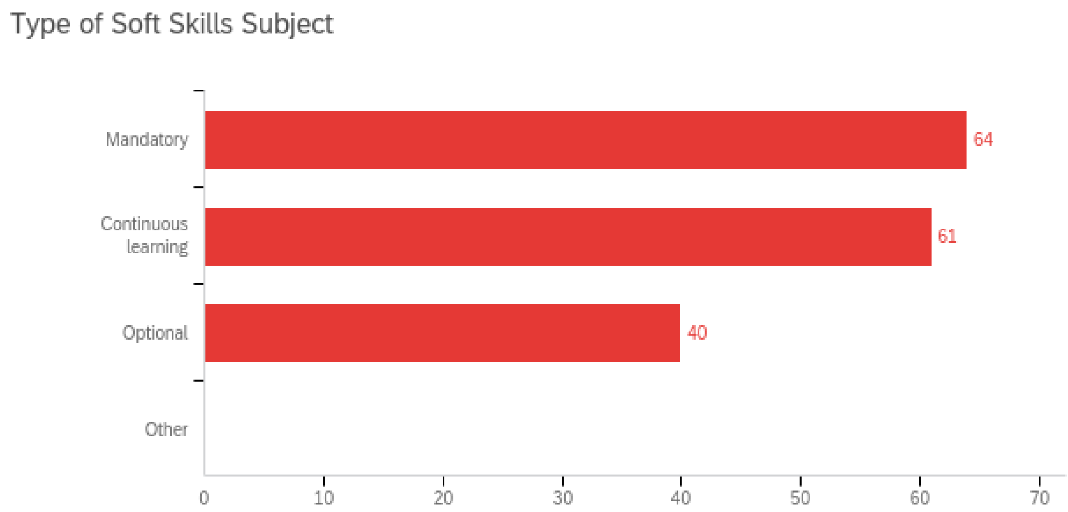


Table 26 : Type of Soft Skills Subject

And here **in the matter of hours the distribution is two-peak, the majority of them (33%) prefer a 3 ECTS course while we have also a strong vote for 2 ECTS course with 21%.**

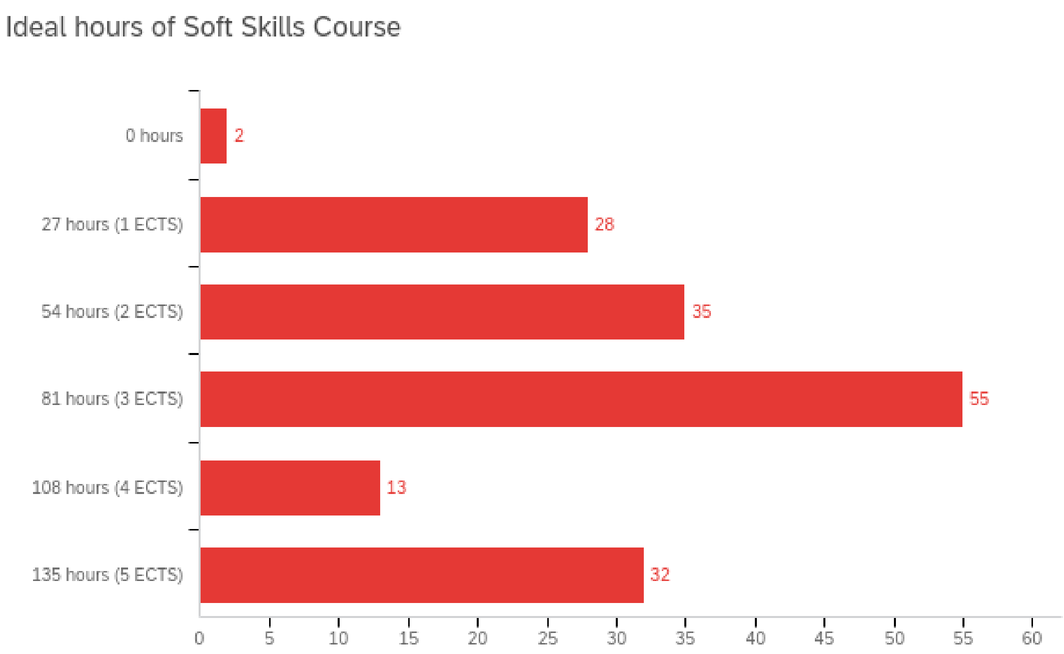


Table 27 : Ideal hours of Soft Skills Course

4.3 Data Analysis Per Country

A research was carried out in the context of the European programme “Artificial Intelligence, Innovation & Society, the future of medicine (AIIS)” in the form of a questionnaire, for which answers were drawn from 4 countries, Spain, Finland, Belgium and Greece.

4.3.1 Data Analysis Belgium

4.3.1.1 Data Analysis Belgium - Professionals

Regarding the comparative analysis of undergraduate and master national curricula for Belgium, 65 total questionnaires were filled, 72% (47) of which were filled by university students (bachelor, master’s or phd candidates) of the School of Medicine and 28% (18) from professors or medicine expert (Doctors) from university hospitals.

Professors VS Students

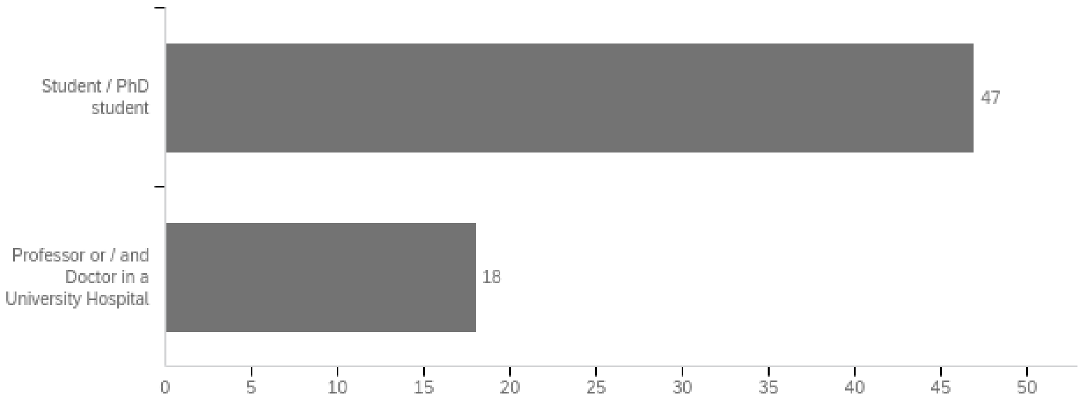


Table 28 : Professors VS Students

Specifically, for the question "*What is your position in the organization?*", 33% (5) were professors, also 33% (5) had the position of professor and manager, 20% (3) were practicing physicians and professors and 7% (1) were practicing physicians, and the rest 7% (1) practicing physician and manager, as shown in the graph bellow:

Position in the Organization

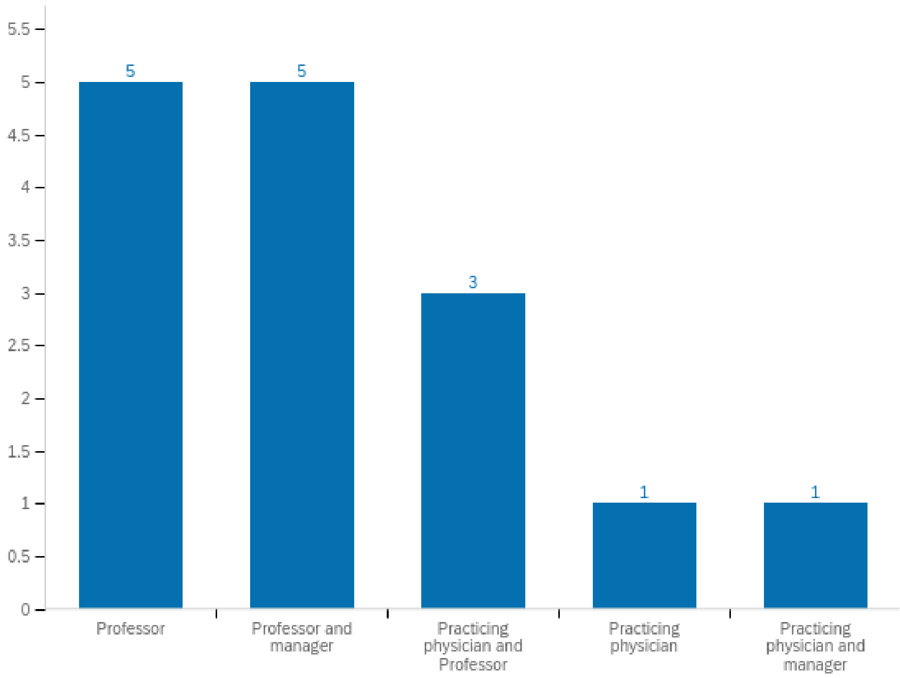


Table 29 : Position in the Organization

From the respondents, at the question "*How long have you been qualified as a medical professional*", 67% (10) answered that they have more than 10 years of experience, 20% (3) have between 5 to 10 years, while 13% (2) have less than 5 years.

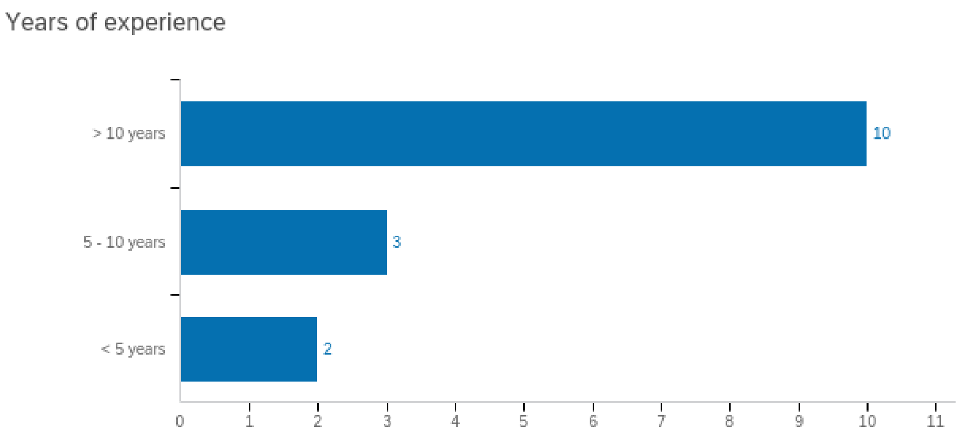


Table 30 : Years of experience

4.3.1.1.1 AI Skills

The first question for the Professros from Belgium had to do with the understanding of AI terms. More speciffically the question "*How would you rate your understanding of the following terms?*" had the following answers:

Understanding of AI Terms

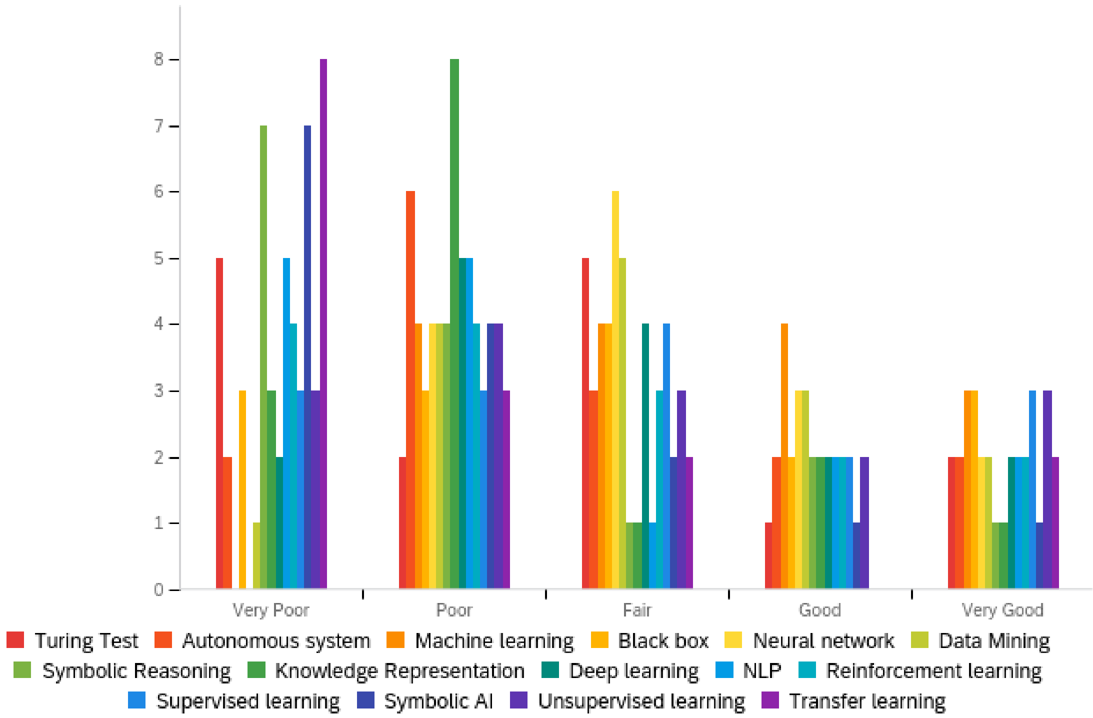


Table 31 : Understanding of AI Terms

From the answers given on the graph, it is concluded that most averages are close to «Very Poor» to «Poor» and «Fair». This means that **most professionals think that they do not have a good understanding of the basic Artificial Intelligence terms.**

The next question had to do with professional knowledge that the respondent would expect a medical doctor to have in the area of AI. Therefore, at the question "*In the context of medical studies, what AI topics would you like your medical graduates to enter the job market with?*" *29*% (13) answered *Machine learning*, *27% (12) Image recognition, 20% (9)* answered *Inferencing and expert systems,* 11 % (5) *Natural language processing, 9%* (2) *Heuristics and fuzzy logic,* and *4% (2) more answers where about data mining and Measuring of accuracy and outcomes of algorithms in clinical practice.*

AI Topics that Medical Students should know

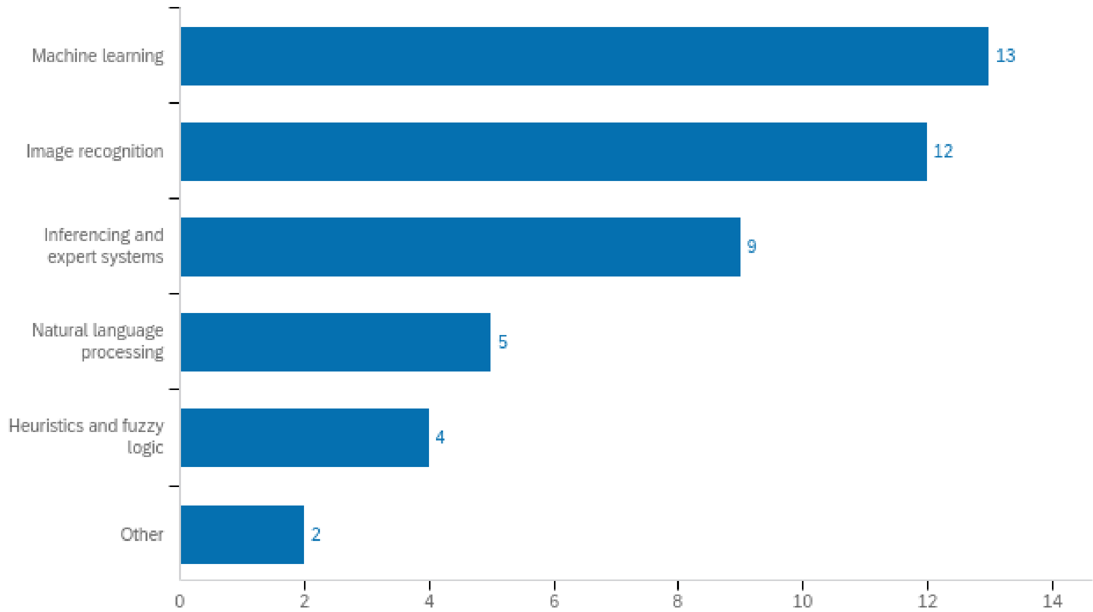


Table 32 : AI Topics that Medical Students should know

At the question " What level of knowledge about applicable AI would you like medical graduates to have?", the results are formed as the following table and graph indicates:

Answer	%	Count
High-level comprehension of the AI that will be used in their careers as medical professionals	47%	7
Application level of comprehension on how to use AI in their careers as medical professionals	33%	5
In-depth understanding of the mechanics of AI	20%	3
Ability to program AI solutions	0%	0
Total	**100%**	**15**

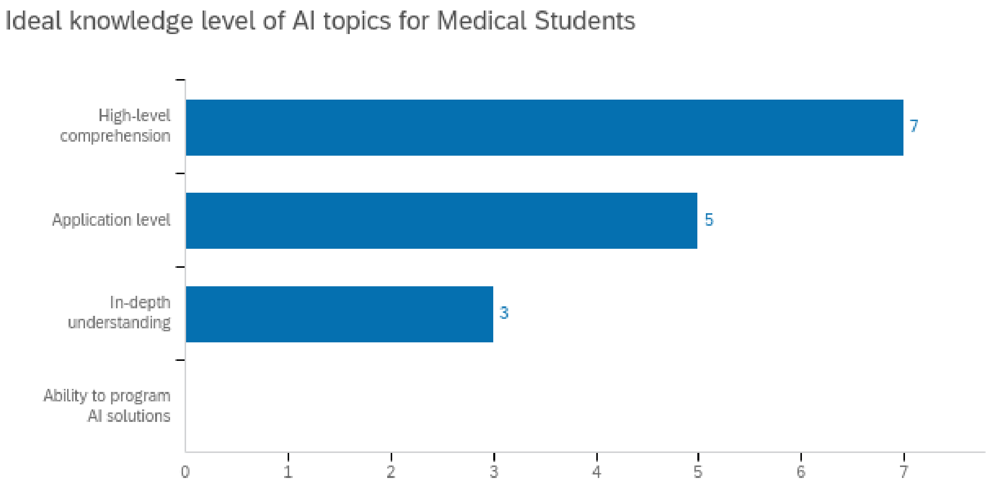


Table 33 : Ideal knowledge level of AI topics for Medical Students

Regarding **the way of teaching of AI related subjects**, at the question "*What do you think would be the most effective way to teach the applicable AI?*"

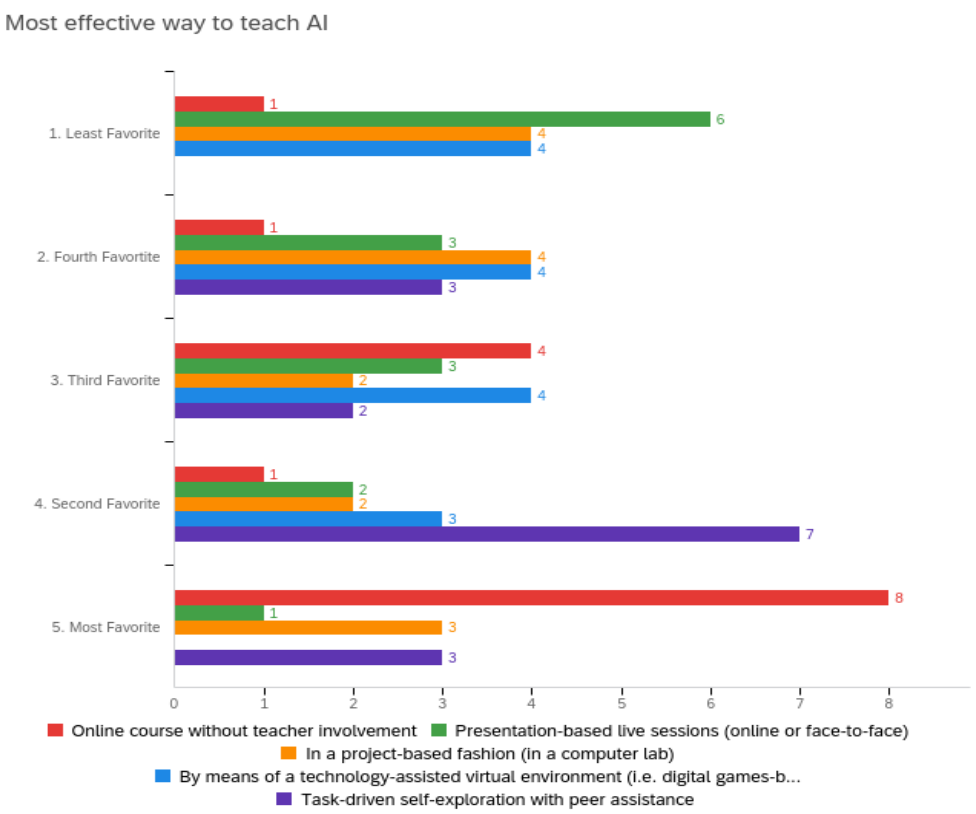


Table 34 : Most effective way to teach AI

As shown on the graph above, it is obvious that **distant learning is preferred, then task-driven self-exploration with peer assistance is chosen while close contact tutoring is chosen last.**

Concerning the **introduction of AI subject in the university curriculum**, at the question "*Under what condition would you like to include AI skills content in your current curriculum?*" they answered it **seems that the professors think equally that AI must be taught in a mandatory, optional and continually way.**

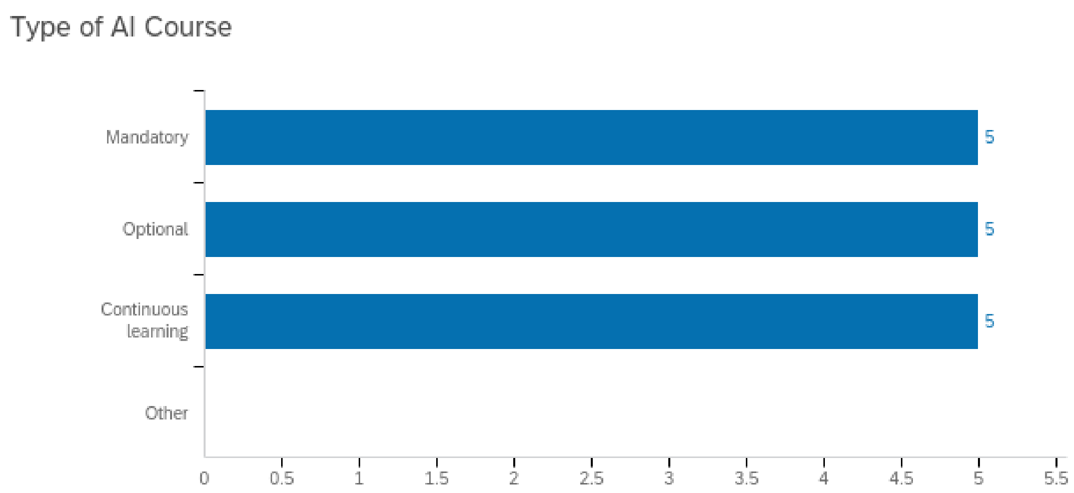


Table 35 : Type of AI Course

The next question had to do with how many teaching hours of AI should be included formed as "*According to you, how many course hours would be conceivable for students to spend on learning applicable AI skills?"*. The 27% (4) answered 1 ECTS, 60% (9) 2 ECTS and 13% (2) answered 3 ECTS. As it shown from the graph bellow **the 60% of Professors in Belgium beleive that 2 ECTS are ideal for AI training**.

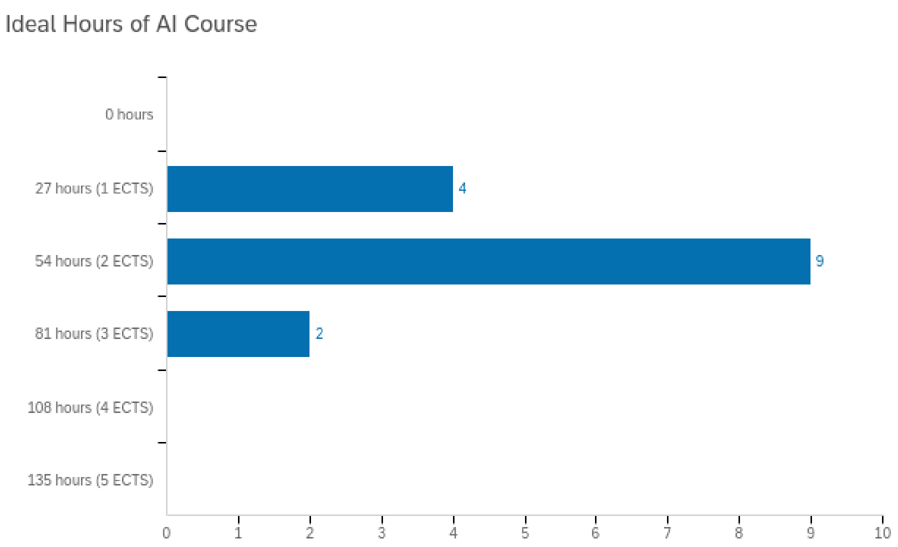


Table 36: Ideal of AI Course

4.3.1.1.2 Soft Skills

The following table sums up the answers regarding the question "*Please rate how important you consider the training of these competencies (soft skills) for doctors in their profession?*"

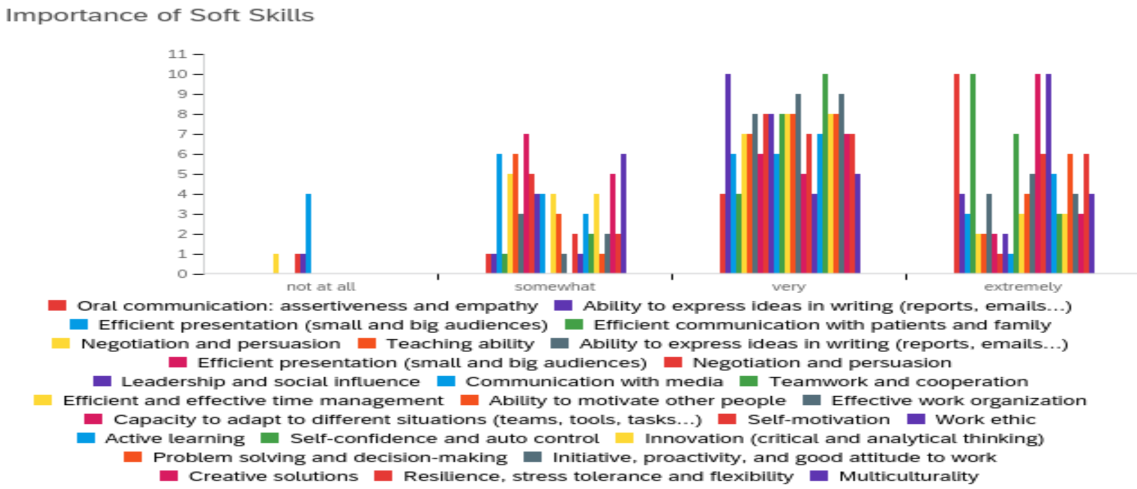
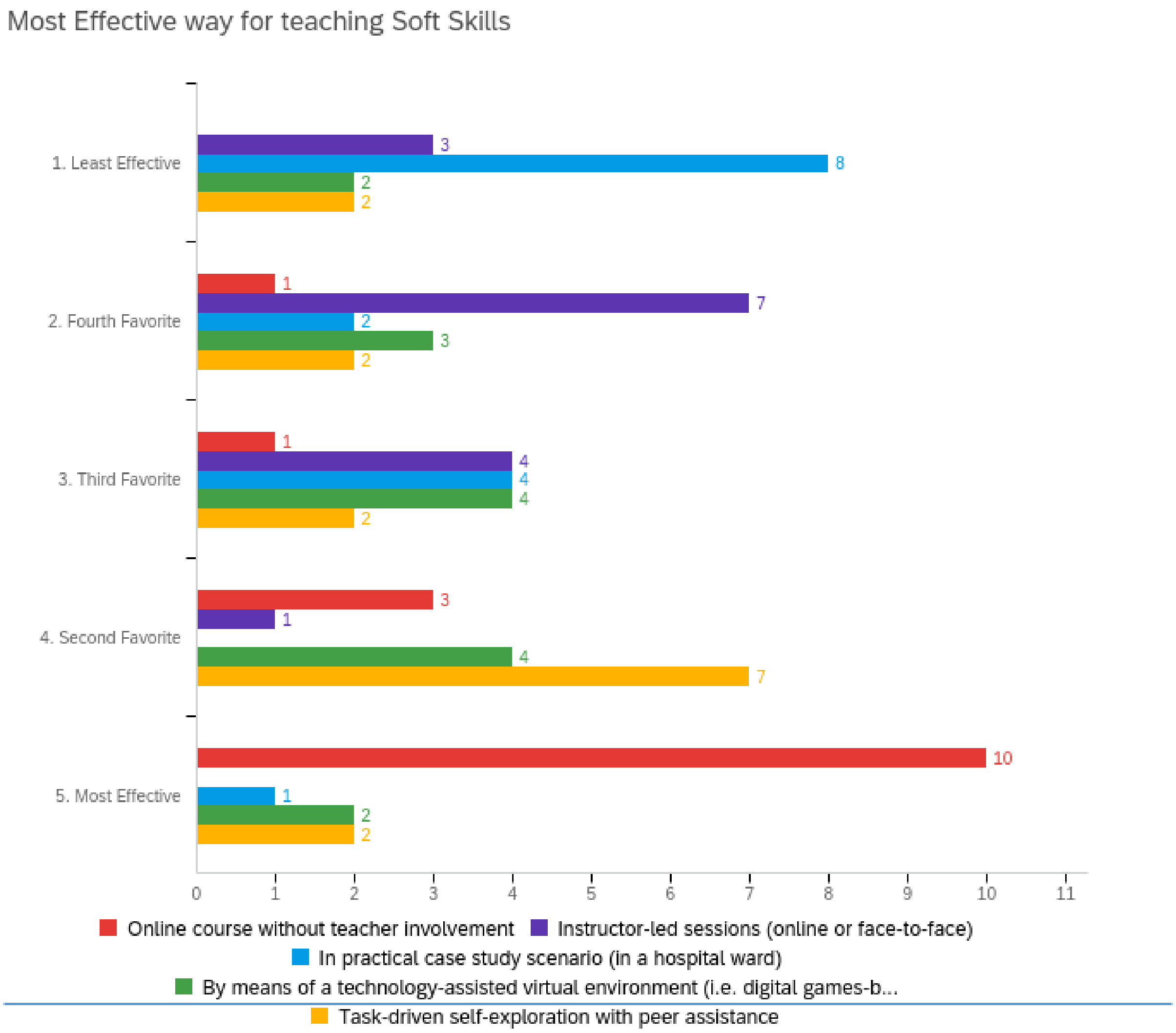


Table 37 : Importance of Soft Skills

As we can see from the graph above, **the majority of the professors in Belgium think that Soft Skills are "Very" important in the training of medical students**.

The next question was "*What do you think would be the most effective way to teach the applicable soft skills?*".


Most Effective way for teaching Soft Skills
1. Least Effective
2. Fourth Favorite
3. Third Favorite
4. Second Favorite
5. Most Effective
3
8
2
2
1
7
2
3
2
1
4
4
4
2
3
1
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11
Online course without teacher involvement
Instructor-led sessions (online or face-to-face)
In practical case study scenario (in a hospital ward)
By means of a technology-assisted virtual environment (i.e. digital games-b...
Task-driven self-exploration with peer assistance

Table 38 : Most effective way for teaching Soft Skills

As noticed, **the Online course without teacher involvement it is once again chosen as the teaching method by Professors in Belgium concerning Soft Skills as the best way of training**.

At the question "*Under what condition would you like to include soft skills content in your current curriculum?*", **60% (9) answered mandatory subject, from 20% (3) as an optional and as continuous learning.**

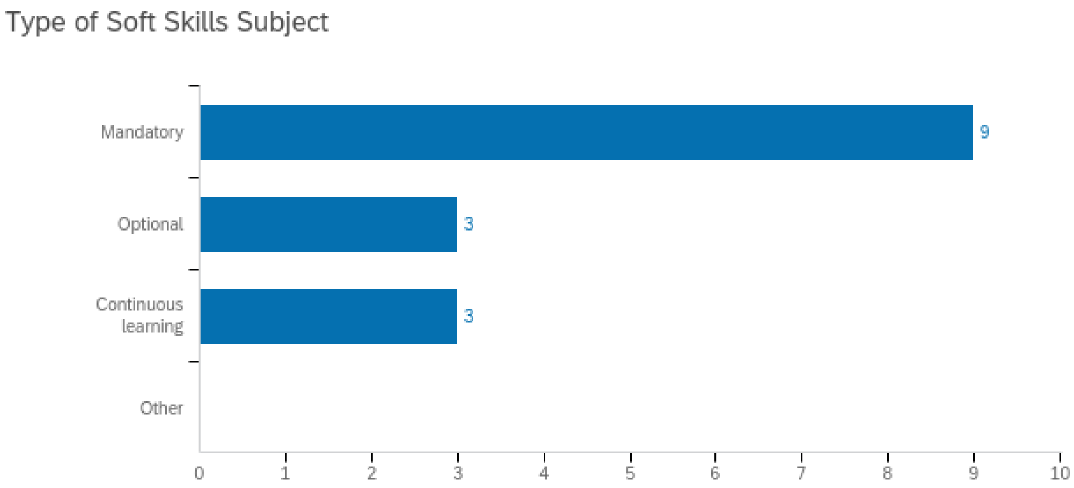


Table 39 : Type of Soft Skills Subject

Lastly, the answers at "*According to you, how many course hours would be conceivable for students to spend on learning applicable soft skills?",* it seems that the majority of Professors (47%) think that the Soft Skills Training must be a 1 ECTS course, while 27% and 13% voted for 2 ECTS and 3 ECTS respectively and lastly 7% voted eqauly for 4 ECTS and 5 ECTS.

Ideal hours of Soft Skills Subject

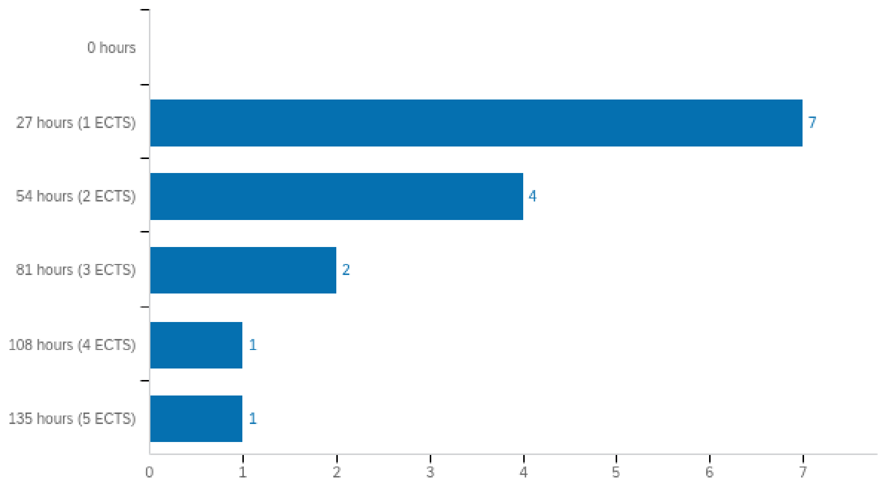


Table 40 : Ideal hours of Soft Skills Subject

4.3.1.2 Data Analysis Belgium - Students

Out of the 47 people that answered the questionnaire in Belgium and are students, the majority, 96% are on their bachelor or master's and 4% phd candidates.

Student VS PhD

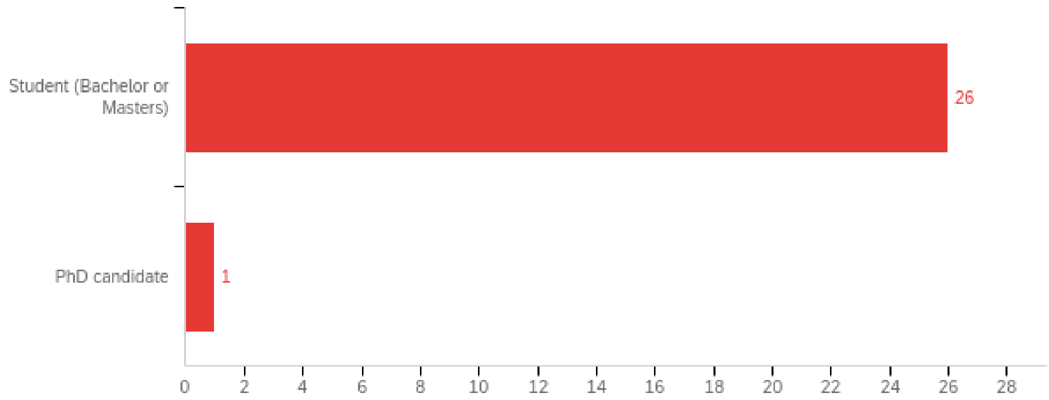


Table 41 : Students VS PhD

4.3.1.2.1 AI Skills

The following graph sums up the answers of the students and phd candidates on the question "*How would you rate your understanding of the following terms?*". From their answers **it is concluded that the understanding of the terms is better for students compared to that of the professors, but still on the low side**.

AI Term	Very Poor		Poor		Fair		Good		Very good		Total
Black box	41%	11	22%	6	7%	2	26%	7	4%	1	27
Turing Test	37%	10	26%	7	19%	5	15%	4	4%	1	27
Natural language processing	15%	4	26%	7	22%	6	30%	8	7%	2	27
Transfer learning	15%	4	41%	11	19%	5	19%	5	7%	2	27
Data Mining	15%	4	19%	5	30%	8	22%	6	15%	4	27
Symbolic reasoning	15%	4	33%	9	15%	4	22%	6	15%	4	27
Neural network	11%	3	19%	5	7%	2	48%	13	15%	4	27
Knowledge Representation	11%	3	11%	3	37%	10	33%	9	7%	2	27
Symbolic AI	11%	3	37%	10	22%	6	15%	4	15%	4	27
Unsupervised learning	11%	3	30%	8	26%	7	26%	7	7%	2	27

Reinforcement learning	7%	2	19%	5	26%	7	37%	10	11%	3	27
Supervised learning	7%	2	19%	5	26%	7	33%	9	15%	4	27
Autonomous system	4%	1	4%	1	33%	9	30%	8	30%	8	27
Deep learning	4%	1	7%	2	37%	10	37%	10	15%	4	27
Machine learning	4%	1	11%	3	26%	7	44%	12	15%	4	27

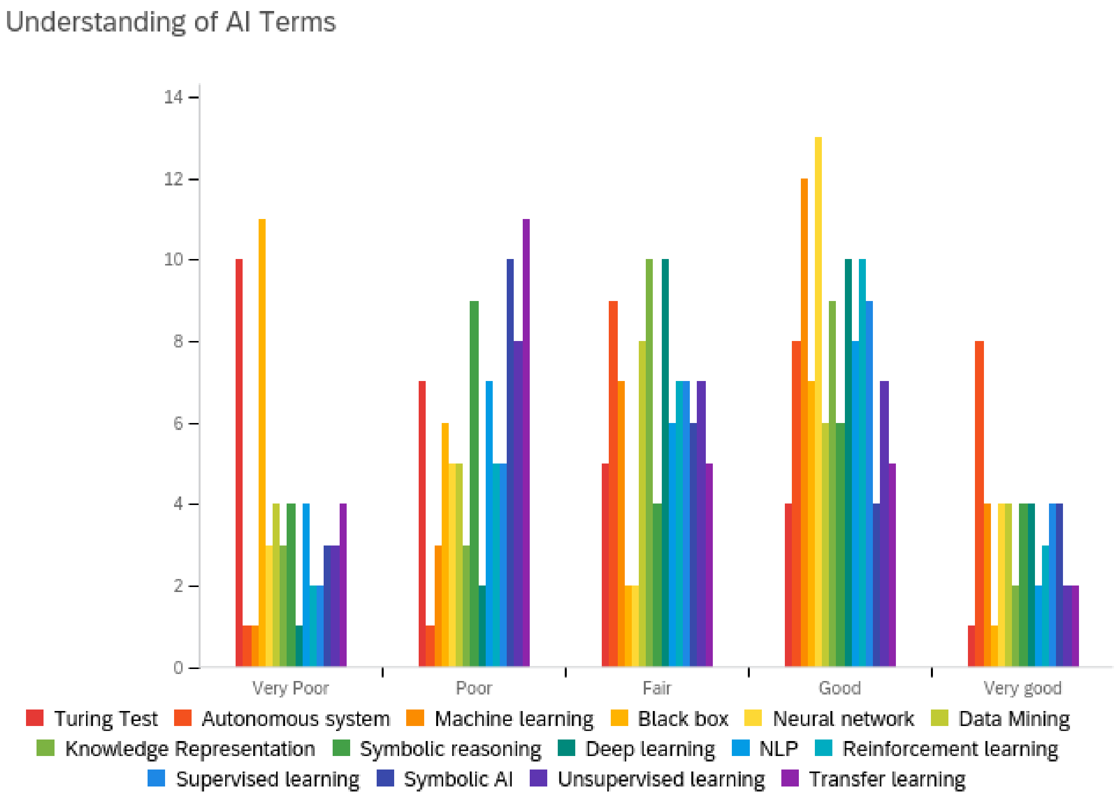


Table 42 : Understanding of AI Terms

The full results of this survey can be found in the Annex of this report.

Most of them were positive on the question "*Do you believe that AI applications are more useful in a period of pandemic (e.g. Covid-19)?"* with 85% (23) answering "Yes" and just 15% (4) answering "No".

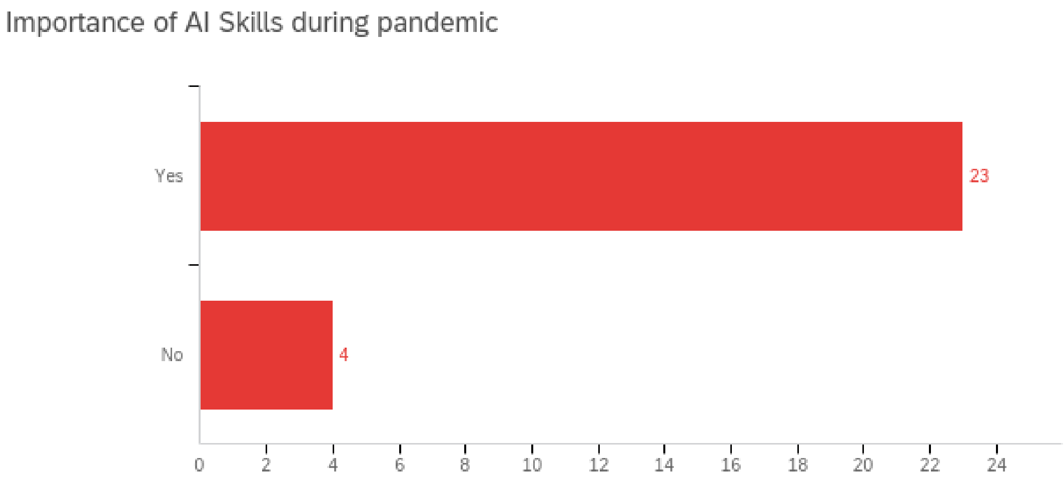


Table 43 : Importance of AI Skills during pandemic

On the question *"In the context of your studies, what AI skills topics would you like to learn?"*, the majority voted for **Machine learning and Image recognition with 22%** (17) **each**. The rest of them voted for Inferencing and expert systems with 20% (16), Natural language processing with 19% (15) and for Heuristics and fuzzy logic with 18% (14).

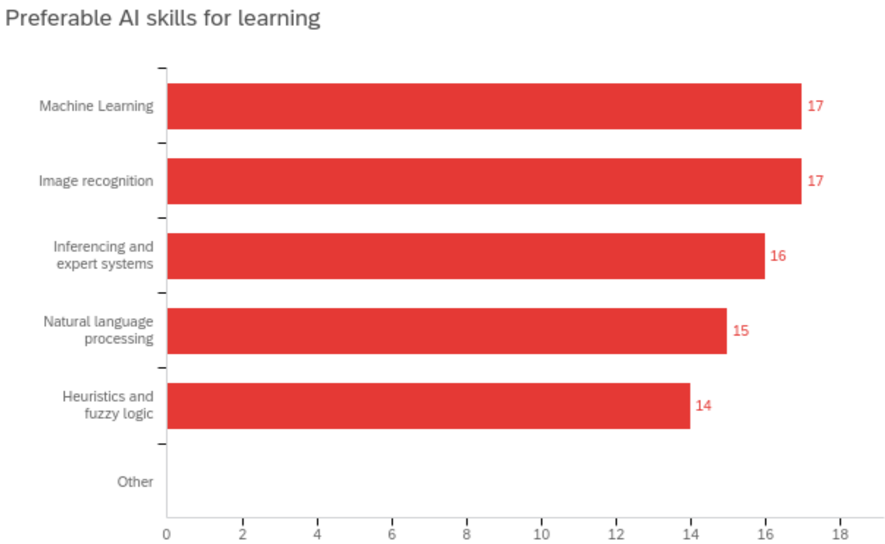


Table 44 : Preferable AI skills for learning

As it seems the majority of **medical students in Belgium think that during their studies want to aquire mostly knowledge at a High-level that will be used in their career as a medical professional (56%)**. Also there is a significant 37% that they want to aquire knowledge at an

Application level that will allow them to know how to use AI in their career as a medical professional.

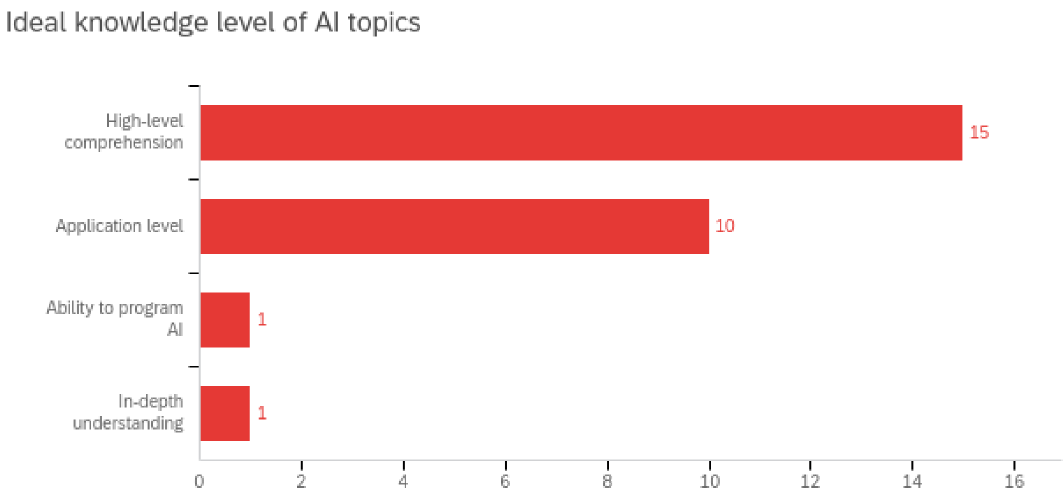


Table 45 : Ideal knowledge level of AI topics

Additionaly, on the question *"How would you like to learn the AI skills material?"*, students answered that mainly **Task-driven self-exploration with peer assistance and secondly Online courses are the best ways of learning.**

Choices	1. Least Effective		2		3		4		5. Most Effective		Total
Technology-assisted virtual environment	22%	6	19%	5	19%	5	26%	7	15%	4	27
Project-based (computer lab)	11%	3	22%	6	26%	7	19%	5	22%	6	27
Instructor-led sessions (online or face-to-face)	52%	14	19%	5	19%	5	7%	2	4%	1	27
Online course	11%	3	19%	5	19%	5	30%	8	22%	6	27

Task-driven, self-exploration with peer assistance	4%	1	22 %	6	19 %	5	19 %	5	37%	10	27

Most effective way to learn AI

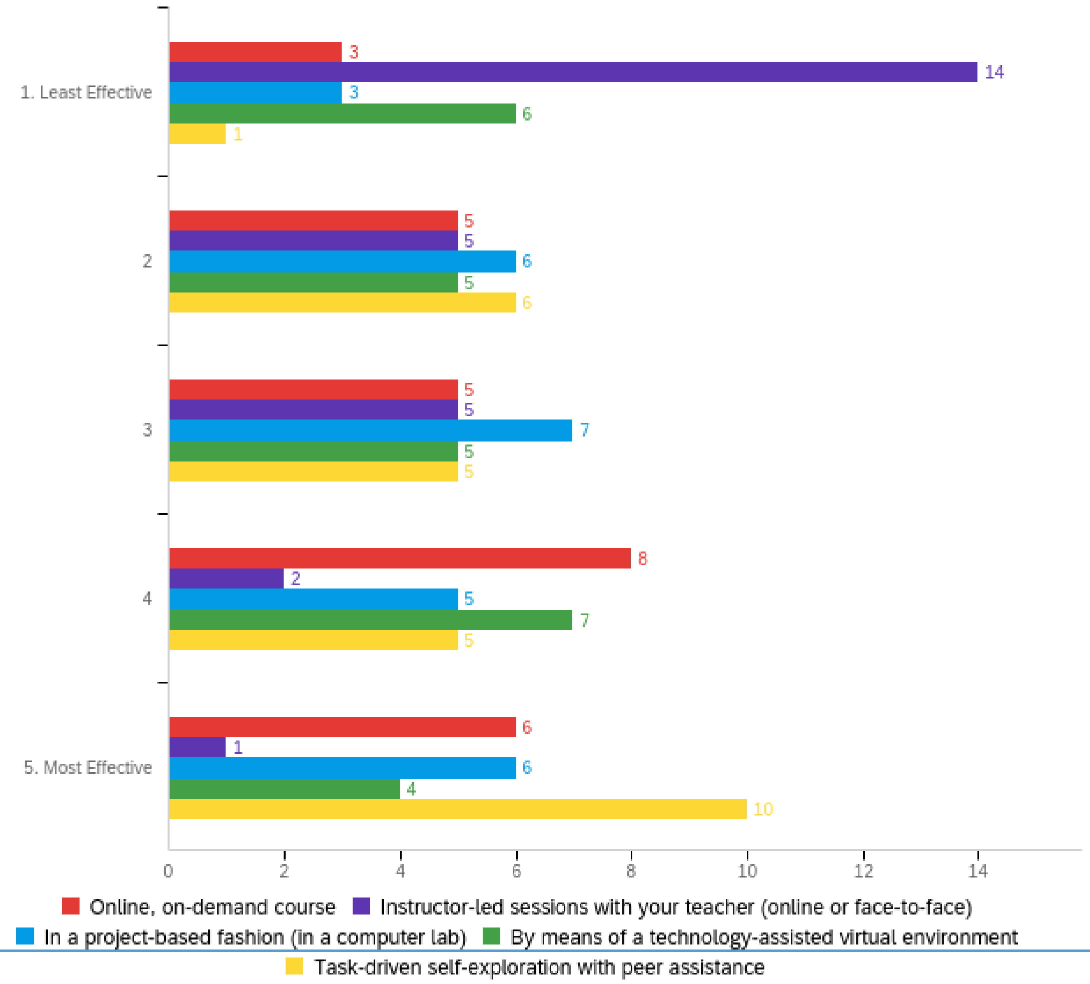


Table 46 : Most effective way to learn AI

The next question was focused on the conditions students want to learn AI. As it is shown in the graph, the majority ot them with 59% think that should be an optional course, althogh there is a 26% and 15% that thinks that as a Continious Learning and as Mandatory Course will be the best way of admission.

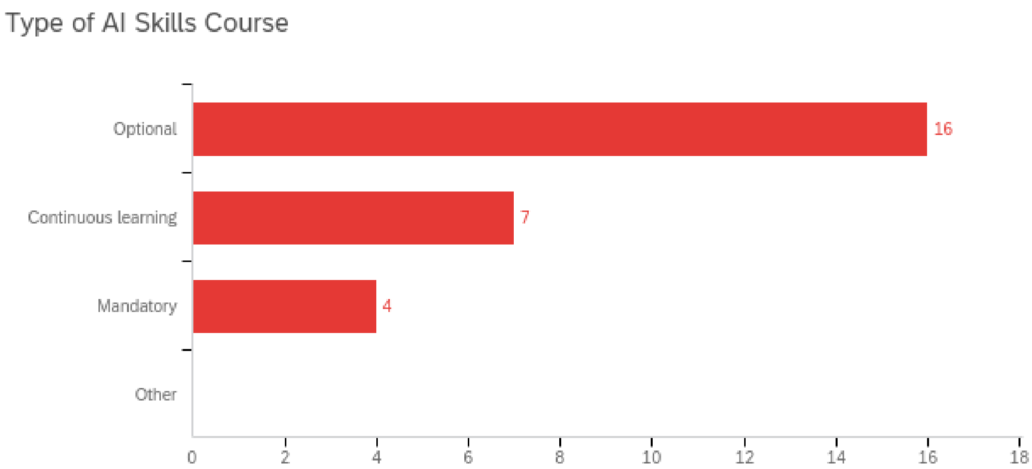


Table 47 : Type of AI Skills Course

The last question concerning AI Skills was about the **ideal hours that the course should last**. As we can see from the graph below **a strong majority of the 44% voted for 2 ECTS**. On the other hand there is the oprion of 1 ECTS with 22% and 3 ECTS with 19% and for the 4 ECTS and 5 ECTS we have a 7% foir each of them.

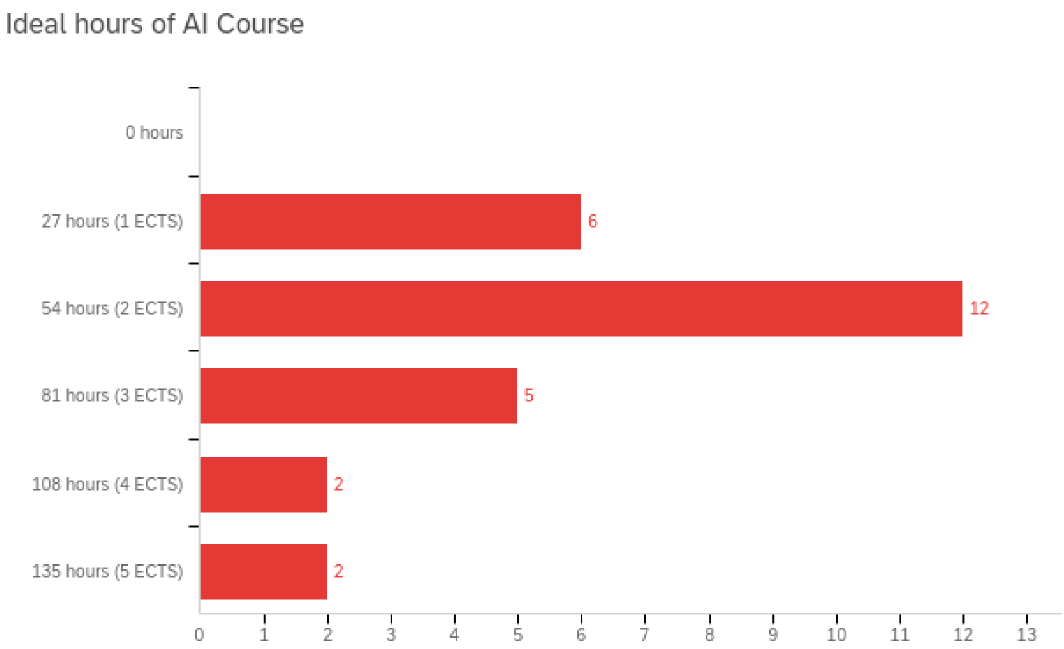


Table 48 : Ideal hours of AI Course

4.3.1.2.2 Soft Skills

It is obvious by the following graph, that the students and phd candidates think that it is Very or Extremely important the training of Soft Skills in their profession and especially the following ones. All the detailed data from this survey can be found in the Annex of this report.

Importance of Soft Skills

Table 49 : Importance of Soft Skills

On the question *"What do you think would be the most effective way to learn the desirable soft skills?"* the students answered that «**Online courses» and «Task-driven self-exploration with peer assistance» are the most preferable educational methods** as it is shown also by the graph.

Most effective way of learning Soft Skills

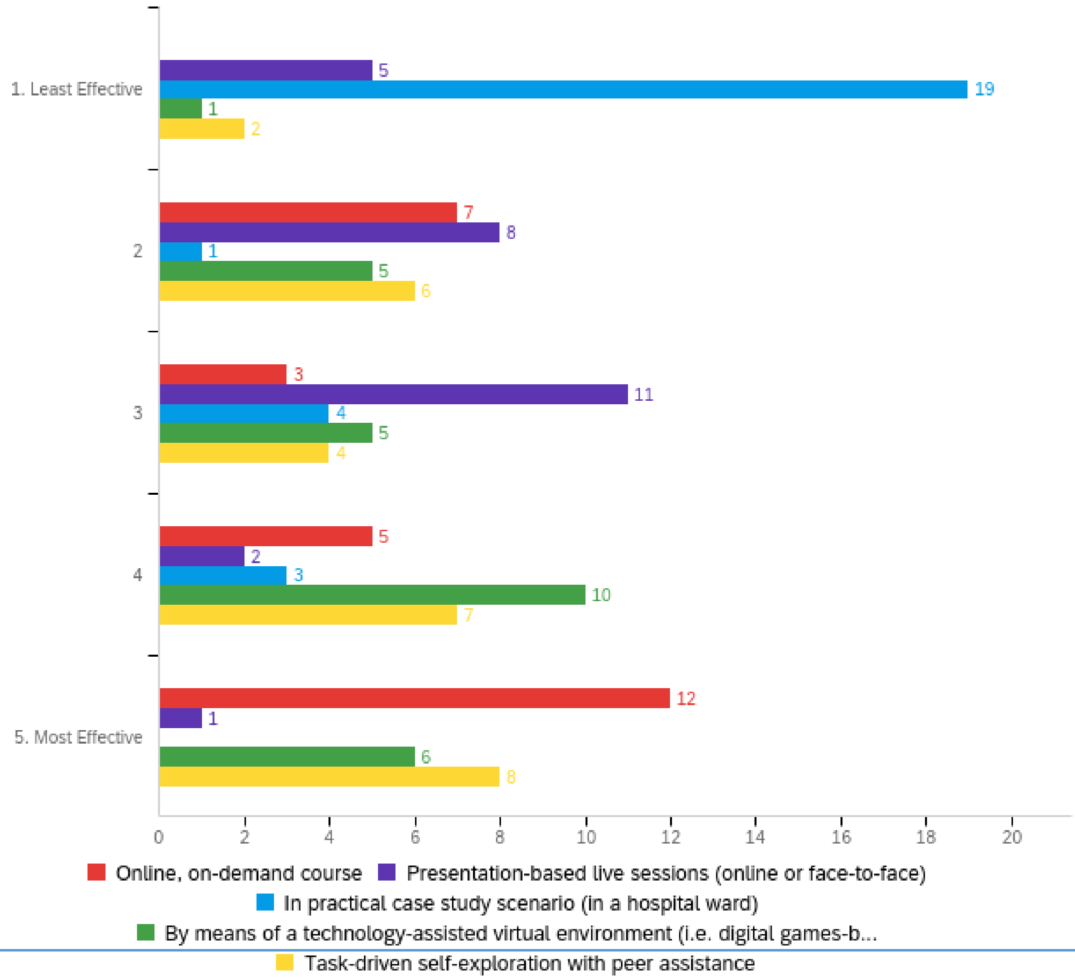


Table 50 : Most effective way of learning Soft Skills

Concerning the introduction of AI subject in the university curriculum**, the 48.15% (13) chose to be included as an optional subject, 30% (8) answered it to be a mandatory, and 22% (6) as continuous learning**.

Table 51 : Type of Soft Skills Subject

Finally, in the question ***"How many course hours would you be able to spend on learning applicable soft skills?"*** **the majority (37%) voted for 2 ECTS**, while 26% for 1 ECTS, 19% for 3 ECTS, 15% for 5 ECTS and finally 4% for 4 ECTS.

Table 52 : Ideal hours of Soft Skills Course

4.3.2 Data Aanalysis - Greece

Regarding Greece, 118 total questionnaires were filled, 86% (101) were filled by university students (bachelor, master's or phd candidates) of the School of Medicine and 14% (17) from professors or medicine expert (Doctors) from university hospitals.

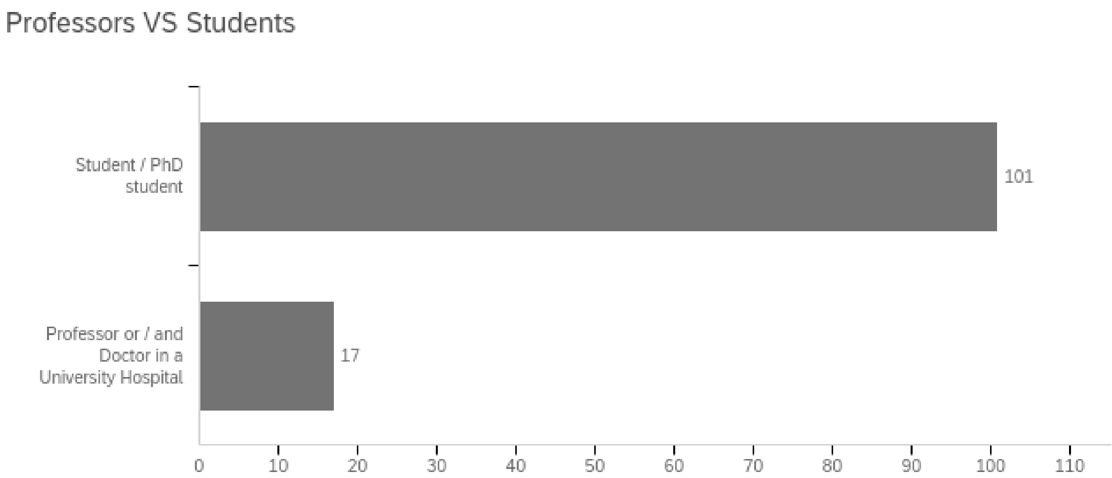


Table 53 : Professors VS Students

4.3.2.1 Data Analysis Greece - Professors

Specifically, for the question "*What is your position in the organization?*" 44% were «Professors», 22% were «Practicing physician» and «Practicing physician and Professor» each and 11% were «Professor and manager».

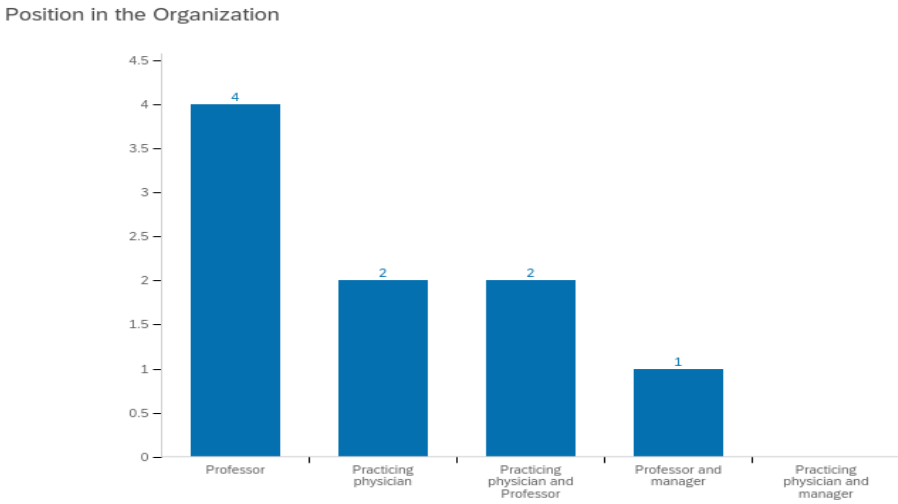


Table 54 : Position in the Organization

From the respondents, at the question "*How long have you been qualified as a medical professional*", 78% answered more than 10 years, and 11% answered that they have less than 5 years of experience and between 5 to 10 years respectively.

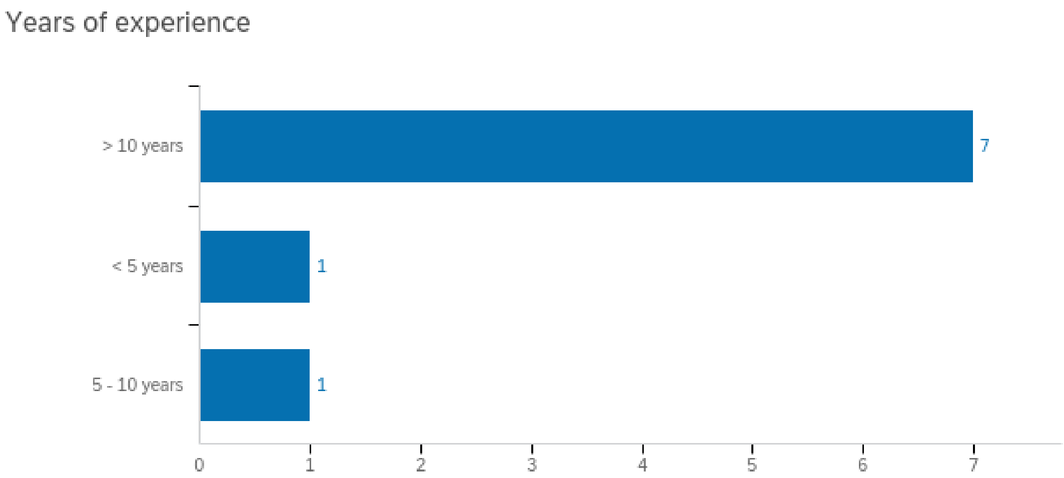


Table 55 : Years of experience

4.3.2.1.1 AI Skills

The next question had to do with the understanding of AI terms. The results from the question "*How would you rate your understanding of the following terms?*" for the included terms are shown at the following graph.

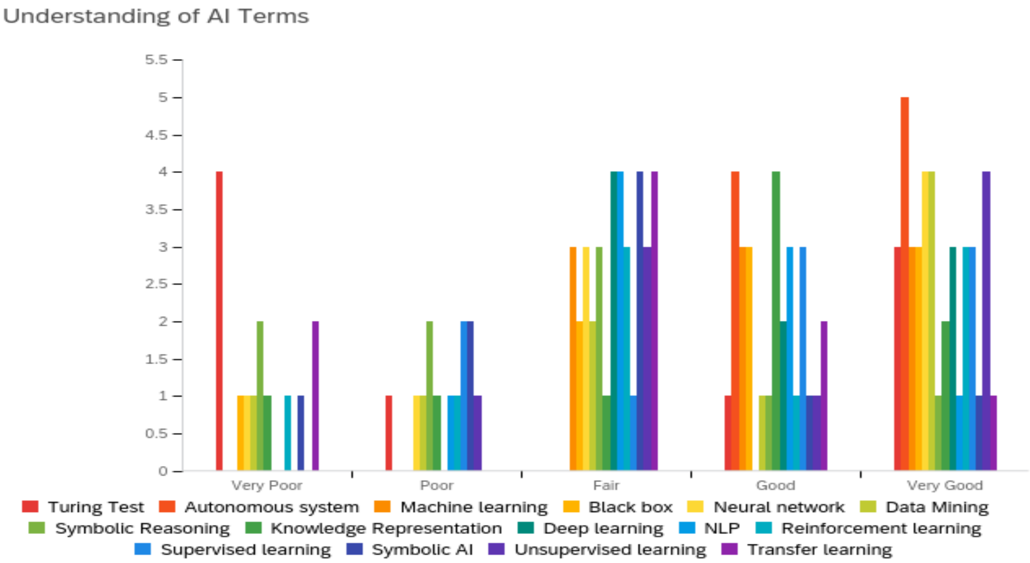


Table 56 : Understanding of AI

From the answers given on the graph, it is concluded that **most professors think that they do not have a good understanding of the basic Artificial Intelligence terms.**

The next question had to do with professional knowledge that the respondent would expect a medical expert to have on the area of AI. These are the AI Skills that the majority of Greek Professros think that are necessary for Medical Studies: **Machine learning and Image recognition with 26% each are the main topics**, while there is a strong 22% for Natural language processing and 19% for the Inferencing and expert systems.

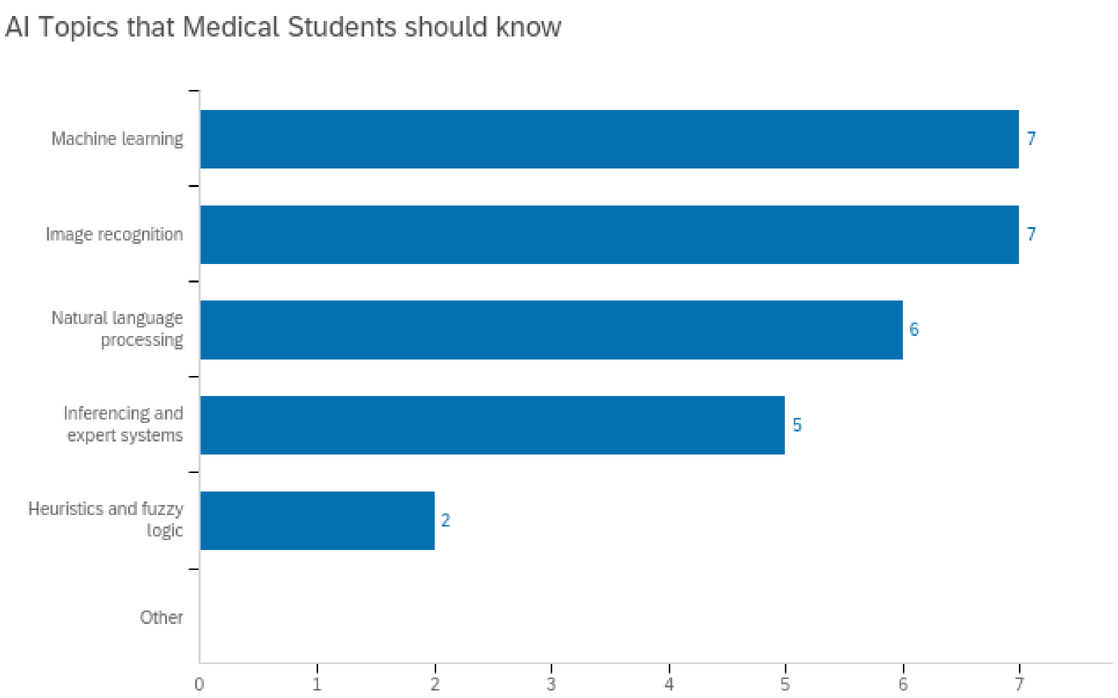


Table 57 : AI Topics that Medical Students should know

At the question *“ What level of knowledge about applicable AI would you like medical graduates to have?”,* **the majority (67%) of the Greek professors think that the Application level of comprehension on how to use AI is ideal**, as it is shown for the graph below.

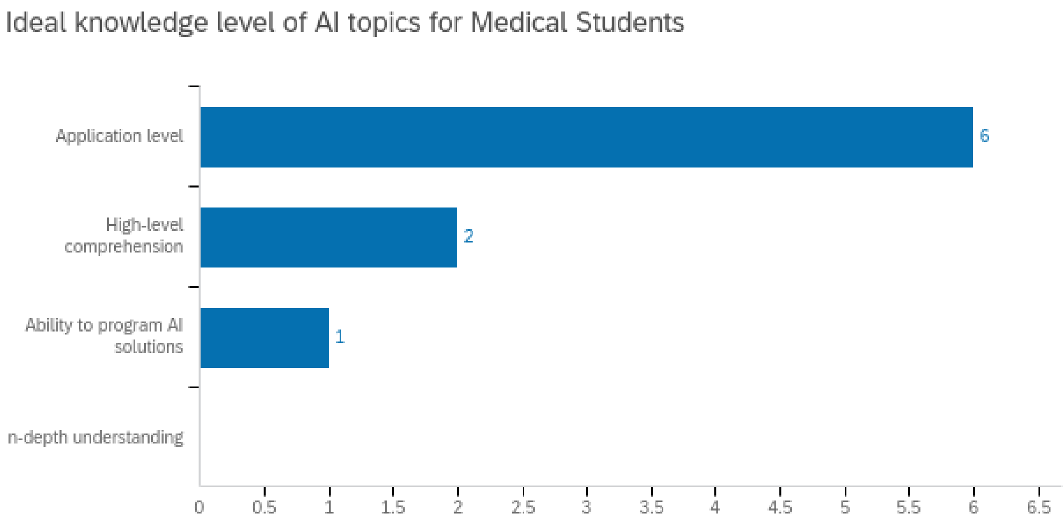


Table 58 : Ideal knowledge level of AI topics for Medical Students

Regarding the way of teaching of AI course, at the question “*What do you think would be the most effective way to teach the applicable AI?*” we had the following results.

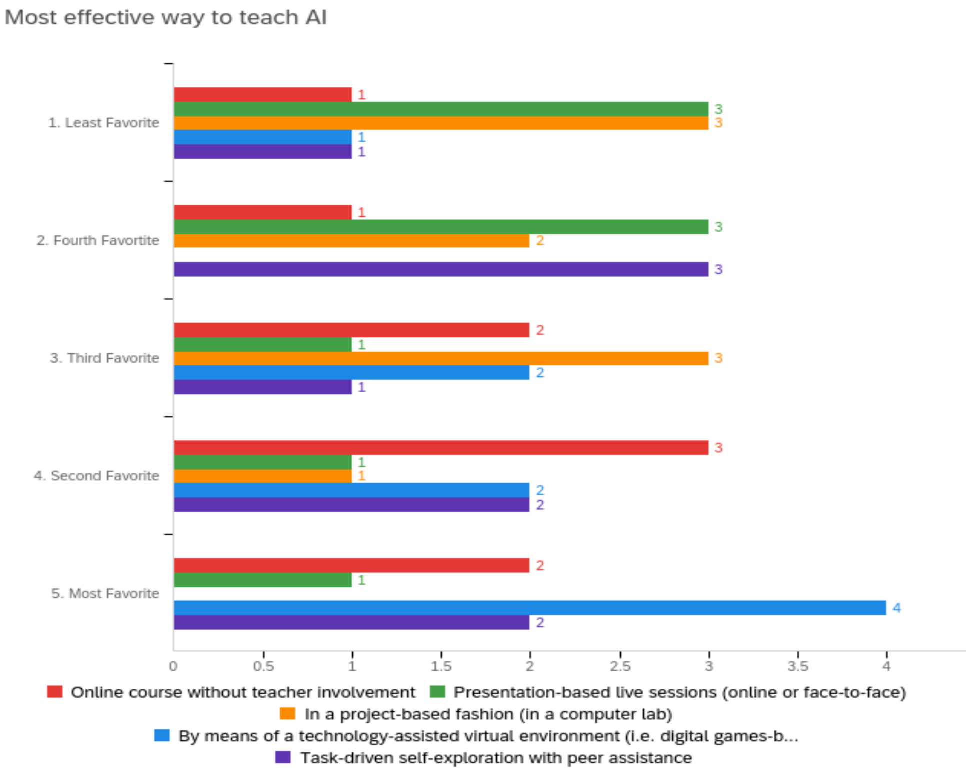


Table 59 : Most effective way to teach AI

As shown on the graph above, it is obvious that **a technology assisted course in a virtual environment it is preferred.**

Concerning the introduction of AI subject in the university curriculum, the 56% voted for Optional Course and Mandatory and Continuous Learning was voted with 22% each.

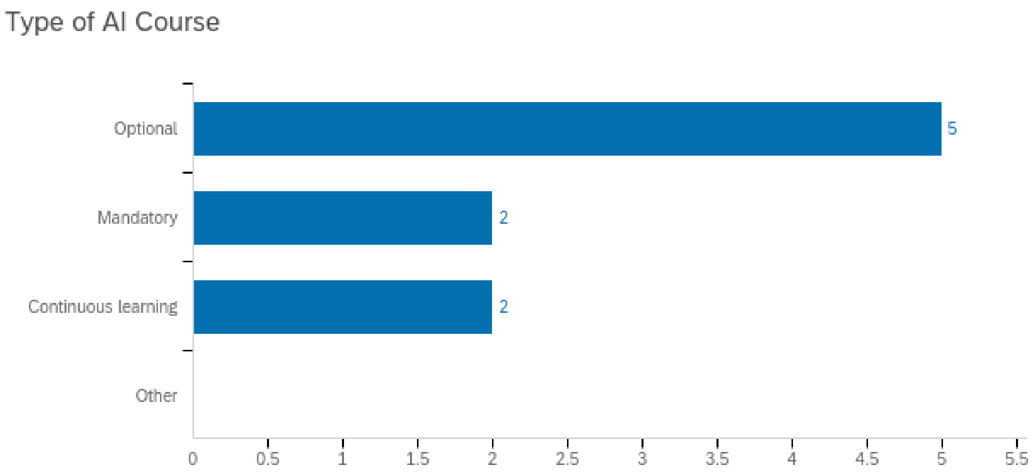


Table 60 : Type of aI Course

The next question had to do with how many teaching hours of AI should be included and a clear majority 44% voted for 3 ECTS.

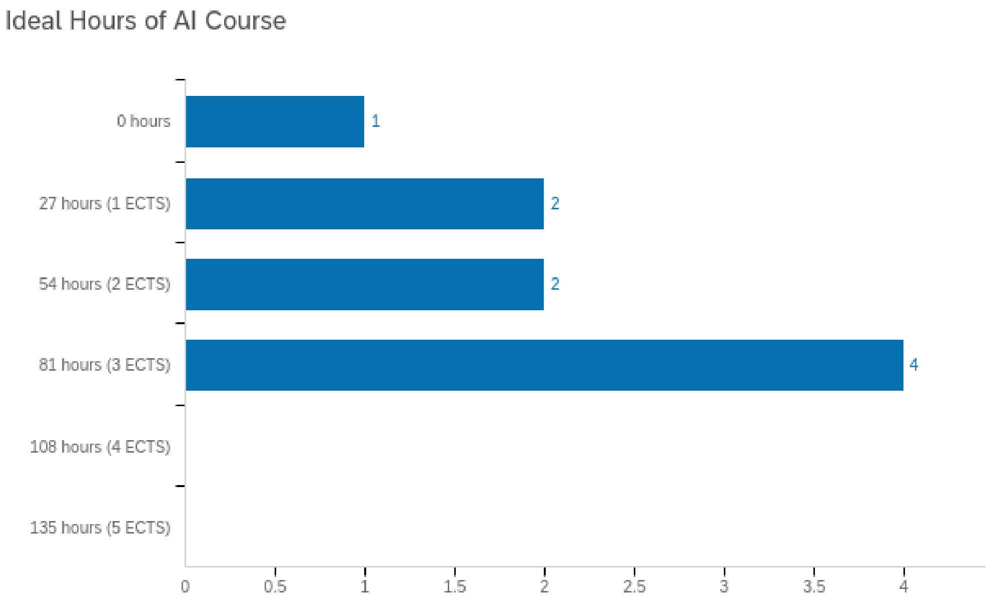


Table 61 : Ideal Hours of AI Course

4.3.2.1.2 Soft Skills

The following graph sums up the answers regarding the question of *how important Greek professors consider the training of the following competencies (soft skills) for doctors in their profession?*. It is obvious that the majority of the professros think that is Extremely or Very important medical students to trained on these skills.

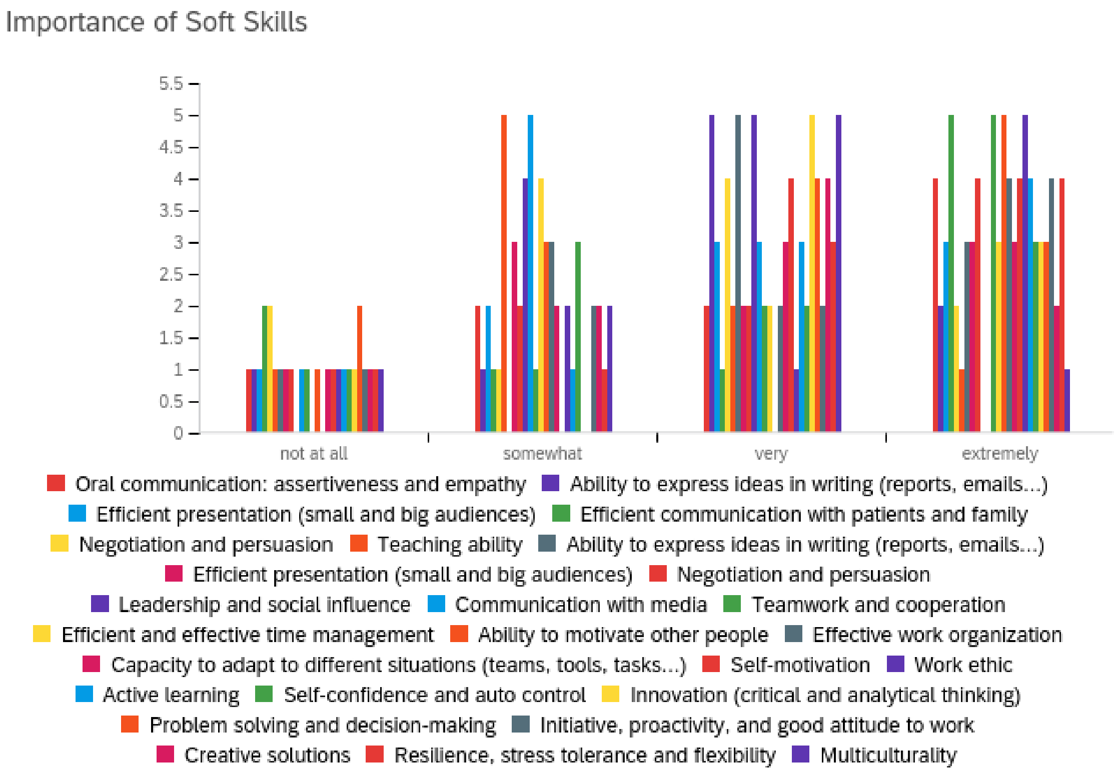


Table 61 : Importance of Soft Skills

The next question was "*What do you think would be the most effective way to teach the applicable soft skills?*" and it is noticed from the graph below that, the **task-driven self-exploration with peer assistance is once again chosen as the preferable teaching method**.

Most Effective way for teaching Soft Skills

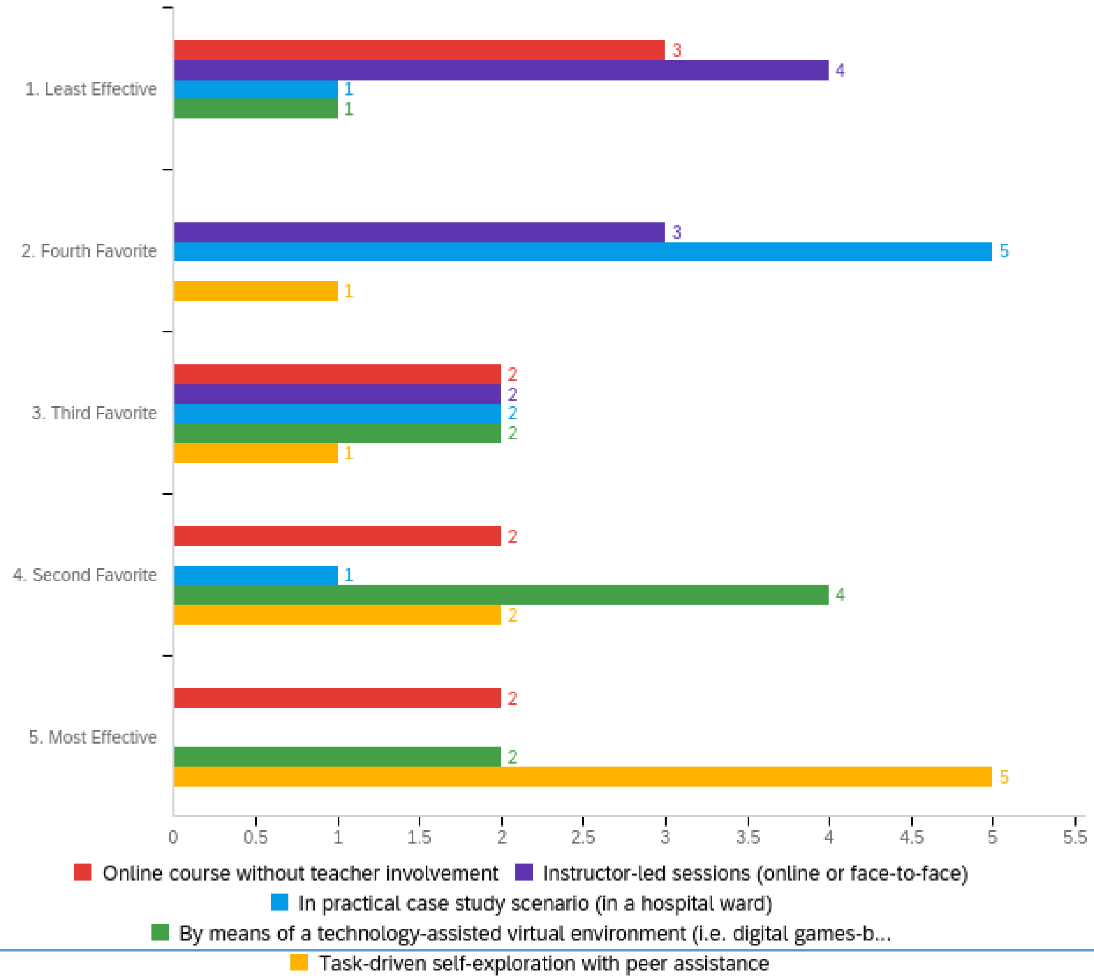


Table 62 : Most Effective way for teaching Soft Skills

As for the ***condition would like the professors to include soft skills content in their current curriculum*****, the 56% voted for optional course and the 33% for mandatory** (following graph, the full results of the survey are annexed in this report).

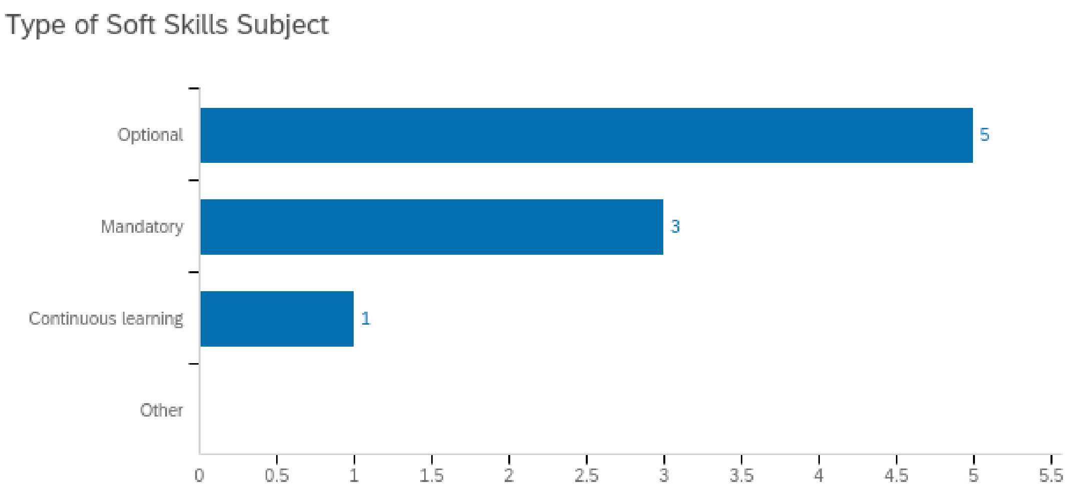


Table 63 : Type of Soft Skills Subject

Last question for the professors was about the ideal hours that a Soft Skills training should last. **As it seems 1 ECTS are ideal for Soft Skills course according to Professros in Greece with 44%**, while an other 22% voted for 2 ECTS.

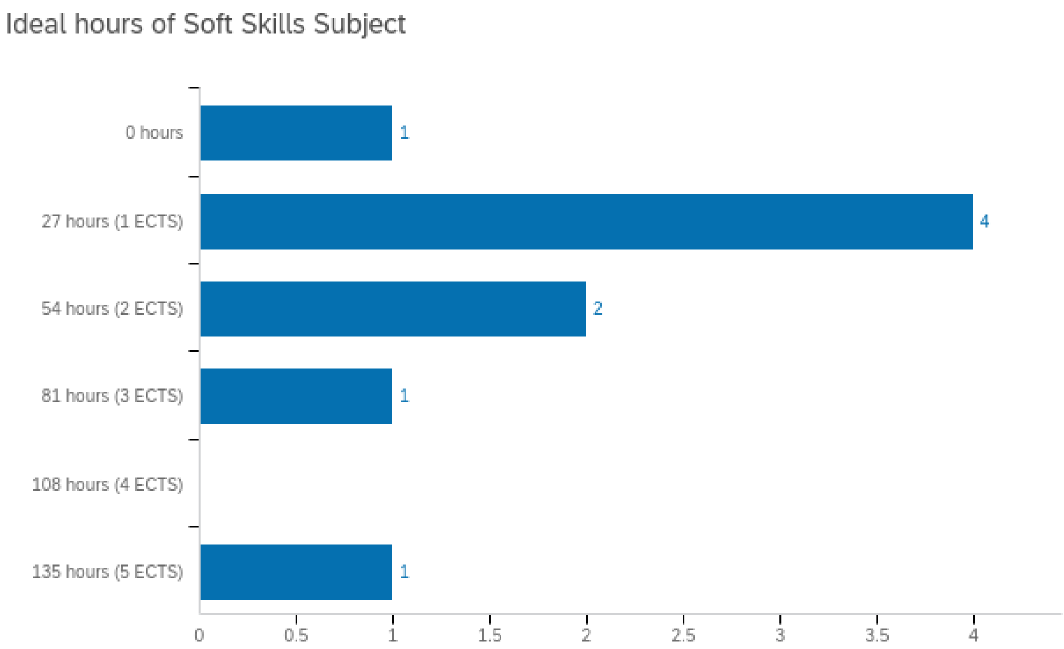


Table 64 : Ideal hours of Soft Skills Subject

4.3.2.2 Data Analysis Greece - Students

Out of the 42 people that answered the questionnaire in Greece and are students, the majority, 79% are on their bachelor or master's and 21% phd candidates as shown in the graph below.

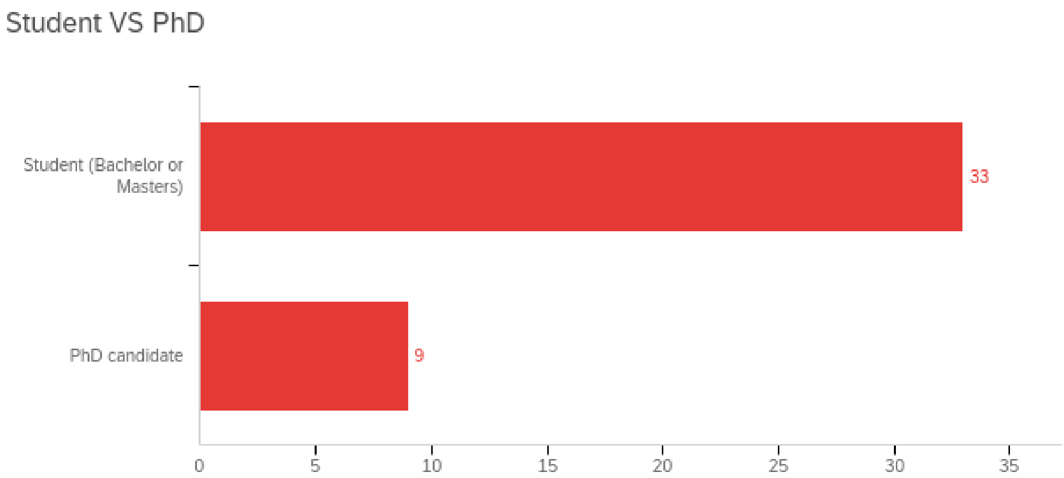


Table 65 : Student VS Phd

4.3.2.2.1 AI Skills

The following table sums up the answers of the students and phd candidates on the question "*How would you rate your understanding of the following terms?*". From their answers it is concluded that **the understanding of the terms is better for students compared to that of the professors, but still on the low side**.

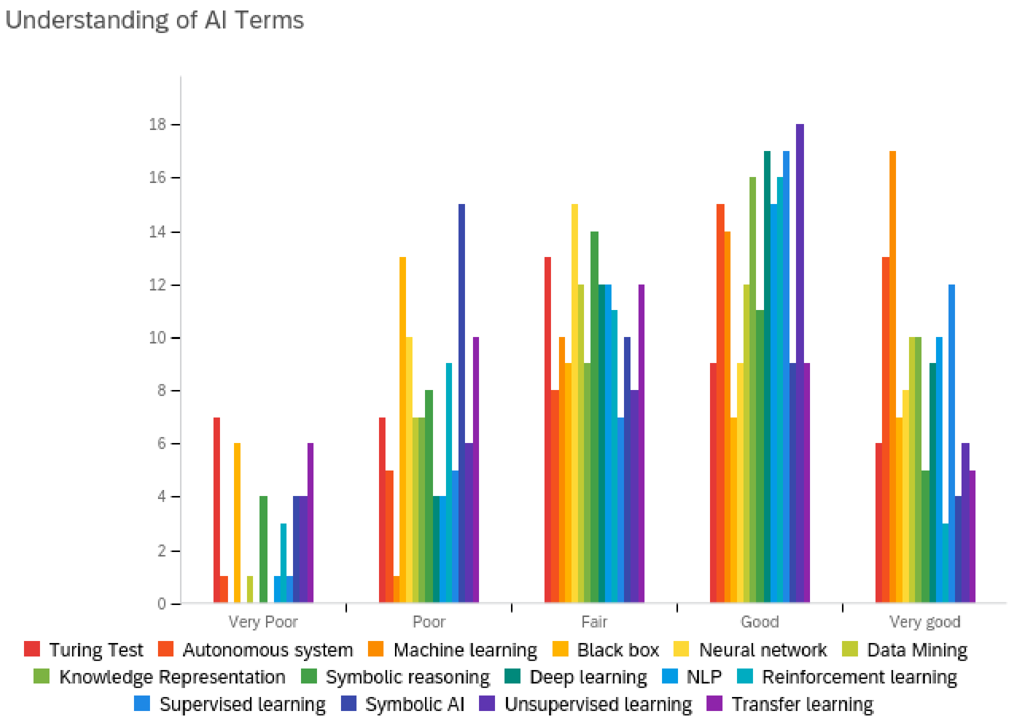


Table 66 : Understanding of AI Terms

Most of them were positive on the question "*Do you believe that AI applications are more useful in a period of pandemic?*" with 90% answering "Yes".

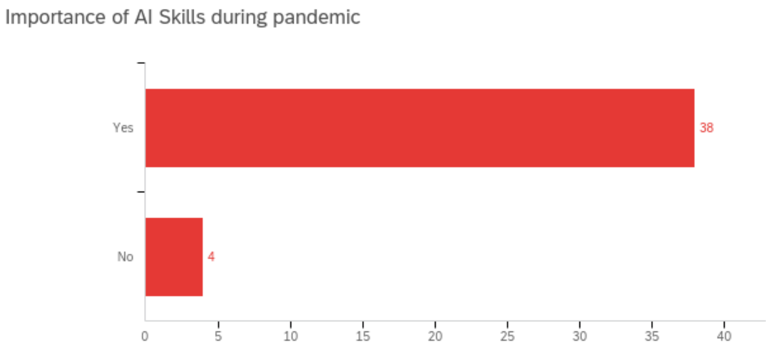


Table 67 : Importance of AI Skills during pandemic

As it is shown on the graph below **the majority of the Greek medical students voted as preferable AI Skill the Image recognition (26%) as well as Machine learning (21%) and Inferencing and expert systems (20%)**, following by Natural language processing.

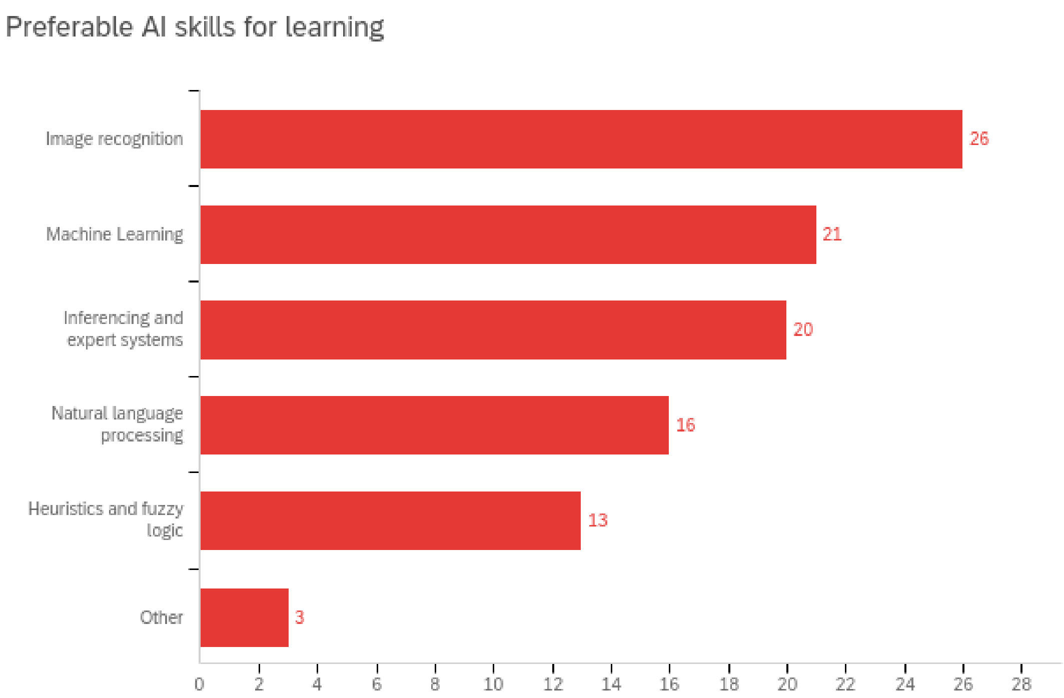


Table 68 : Preferable AI skills for learning

Also we had a clear vote on *what level of knowledge about applicable AI techniques would like to acquire during their studies*. The 38% voted for **High-level comprehension of the AI, the 29% voted for Application level of comprehension on how to use AI** and the Ability to program AI Solutions and In-depth understanding voted for 19% and 14% respectively.

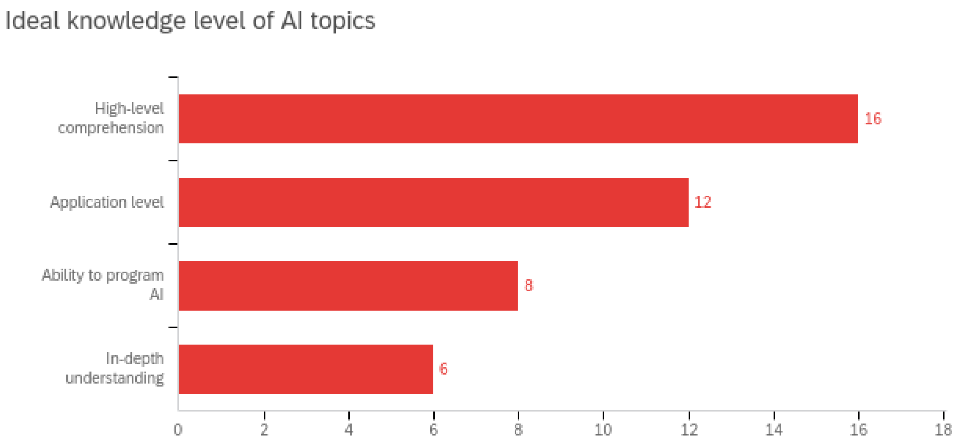


Table 69 : Ideal knowledge level of AI topics

Additionally, on the question “*How would you like to learn the AI skills material?*”, students answered that the **online courses are the best ways of learning AI.**

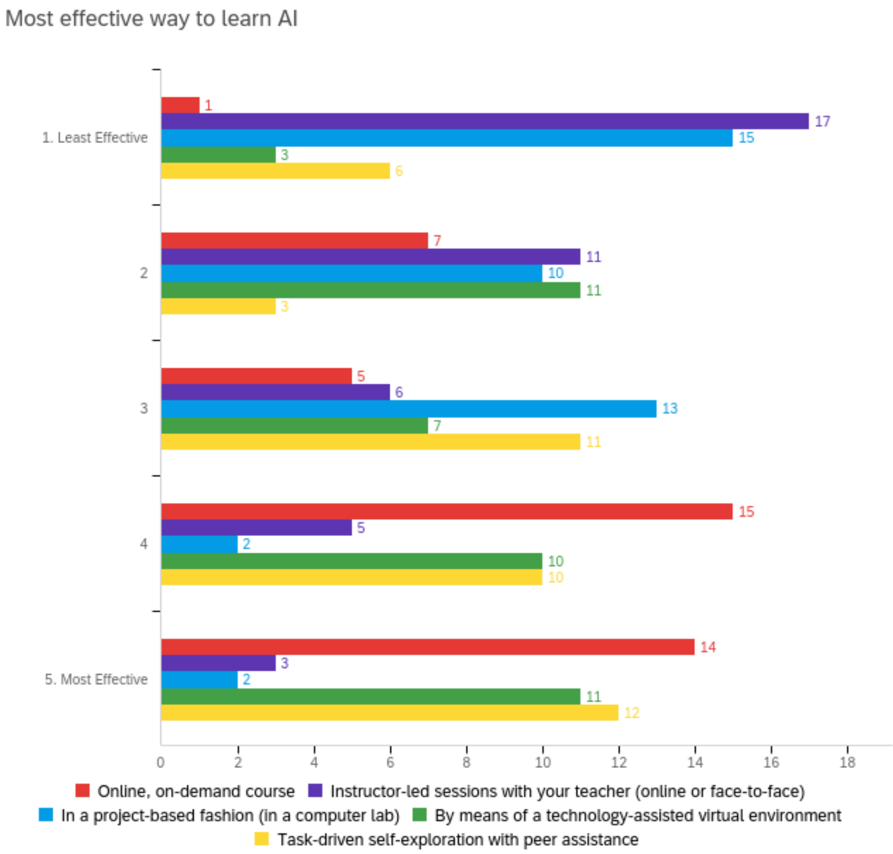


Table 70 : Most effective way to learn AI

As the graph bellow represents **the 48% of Greek students beleive that the Countinuous learing is the ideal way of training on AI.** Of course there is a strong 33% and a 19% that thinks Optional and Mandatory is preferable.

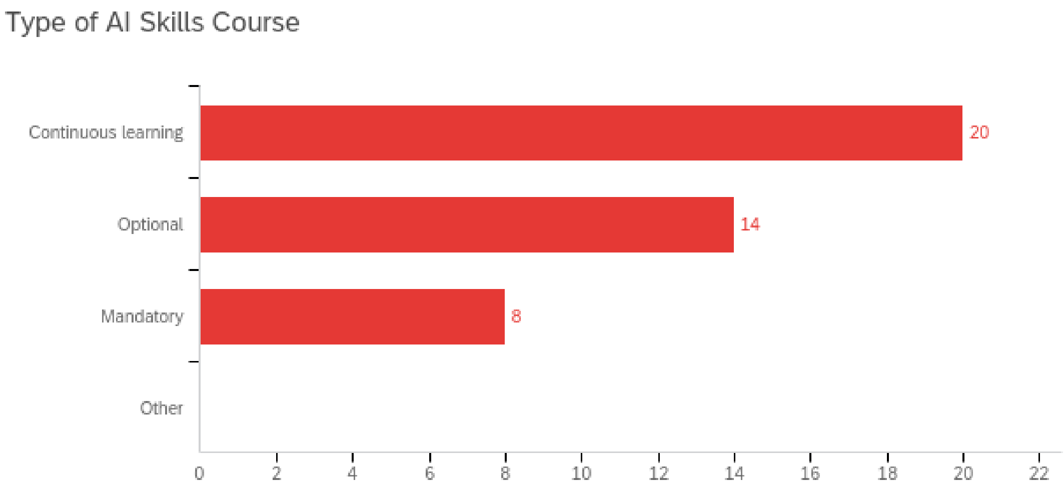


Table 71 : Type of AI Skills Course

Last but not least, **as for the hours of the AI course the Greek students voted for 3 ECTS with a 33% and with a close 31%, 2 ECTS**. The full results of the survey can be found on the Annex of this report.

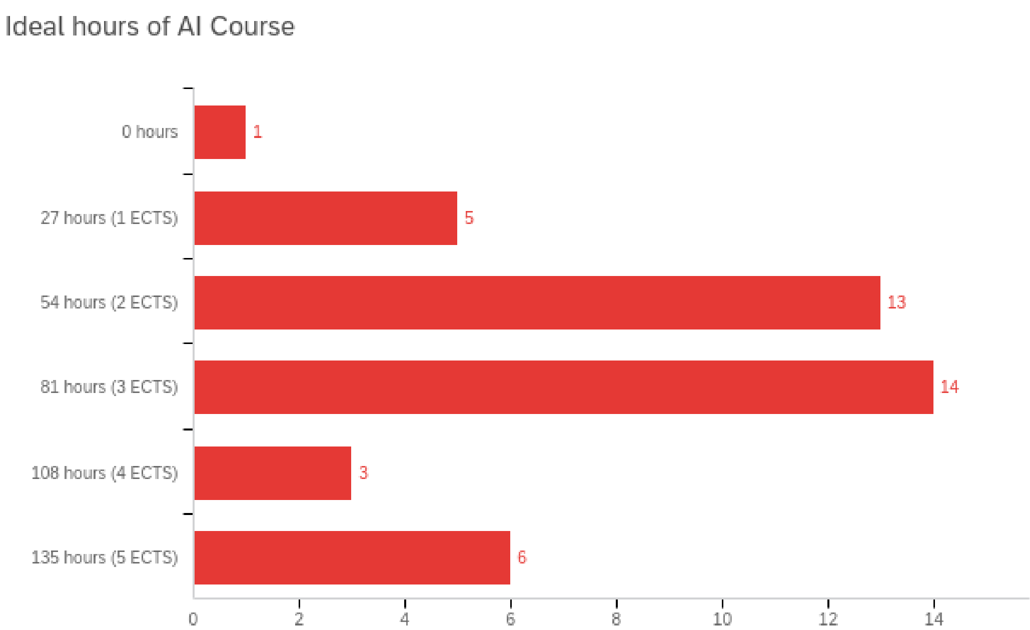


Table 72 : Ideal hours of AI Course

4.3.2.2.2 Soft Skills

It is more than obvious that the **majority of Greek students concider Extremely and Very importan the training of the following competencies (soft skills) for their profession.**

Importance of Soft Skills

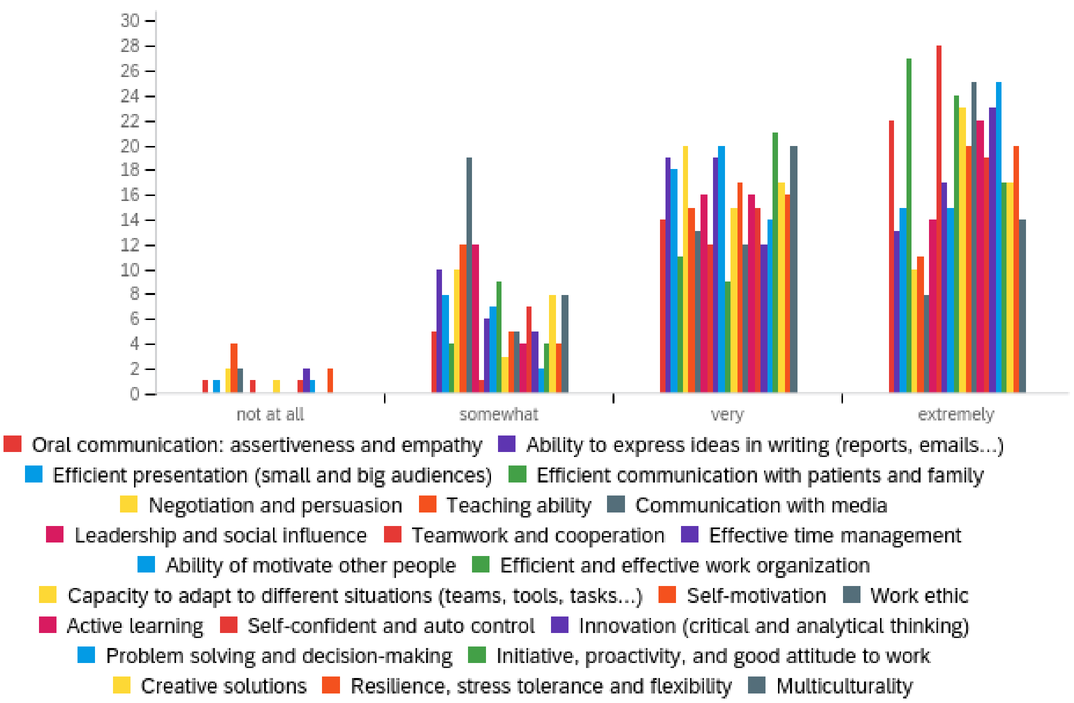


Table 73 : Importance of Soft Skills

On the question *"What do you think would be the most effective way to learn the desirable soft skills?"* the students answered that **on line courses and Task-driven, self-exploration with peer assistance is the most preferable educational methods** as shown in the graph below.

Most effective way of learning Soft Skills

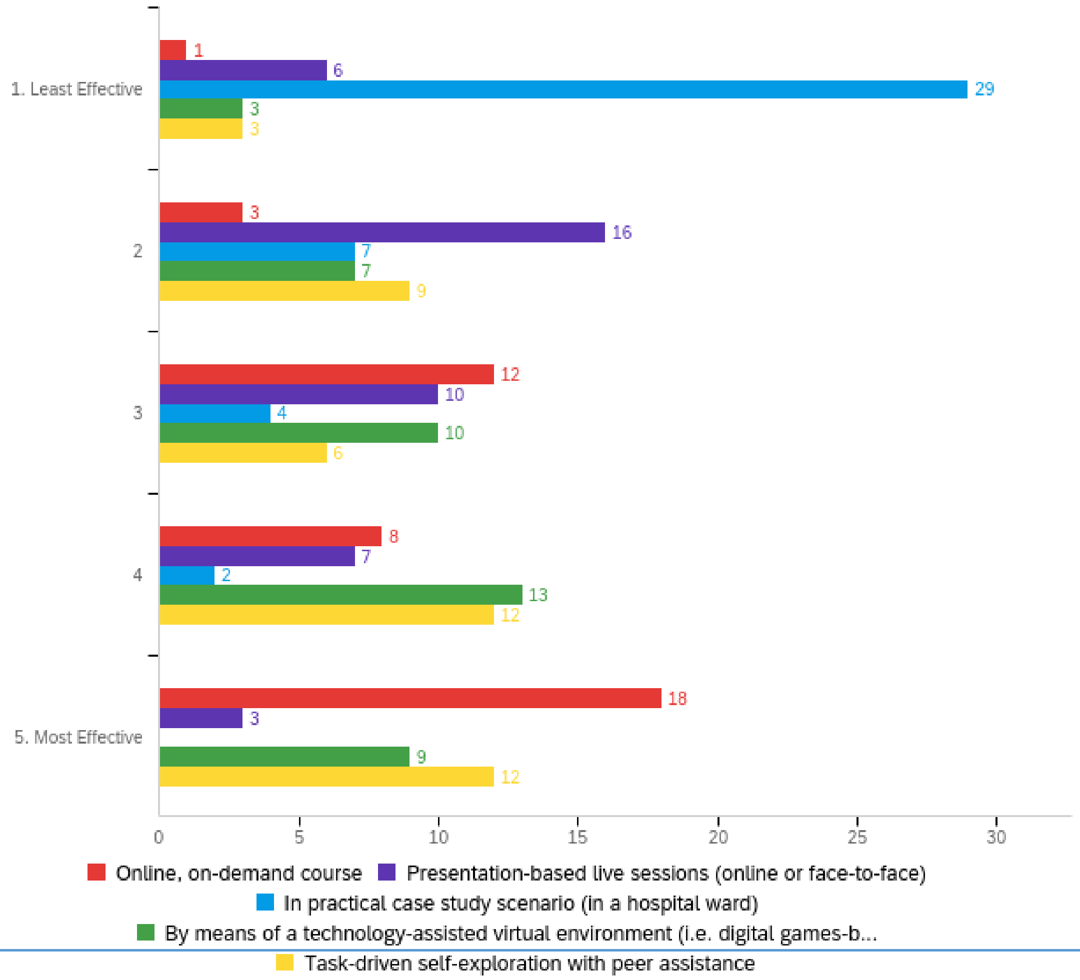


Table 74 : Most effective way of learning Soft Skills

Concerning the introduction of AI subject in the university curriculum, at the question *"Under what condition would you like to study soft skills content in your current curriculum?"* **43% chose as continuous learning,** 30% answered as a mandatory and 26% as an optional course.

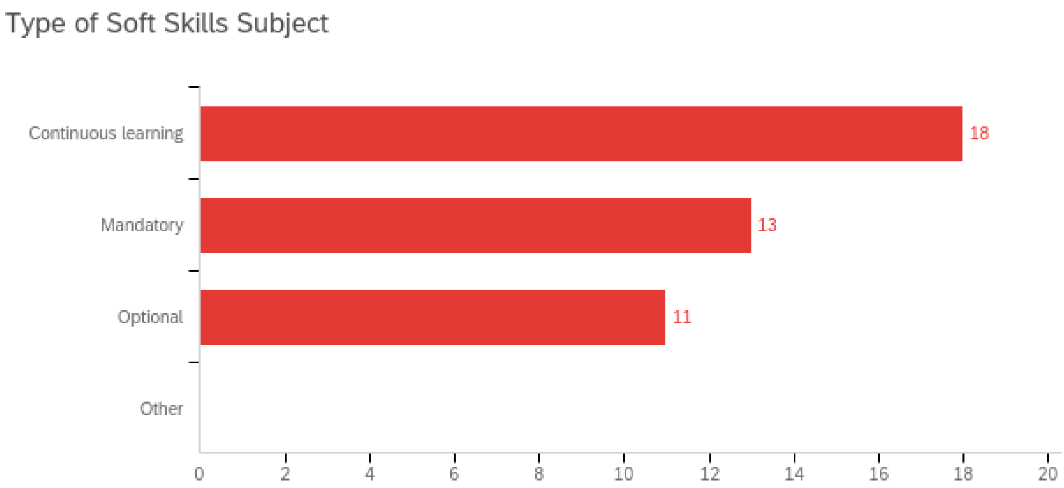


Table 75 : Type of Soft Skills Subject

Finally, in the question *"How many course hours would you be able to spend on learning applicable soft skills?"* as it seems **the majority of Greek students (38%) think that they will be able to attend the course of Soft Skills for 3 ECTS and 30% of them voteeed for 2 ECTS**, as it is shown in the graph below.

Table 76 : Ideal hours of Soft Skills Course

4.3.3 Data Analysis - Finland

Regarding Finland, 71 total questionnaires were filled, 90% were filled by university students (bachelor, master's or phd candidates) of the School of Medicine and 10% from professors or medicine expert (Doctors) from university hospitals.

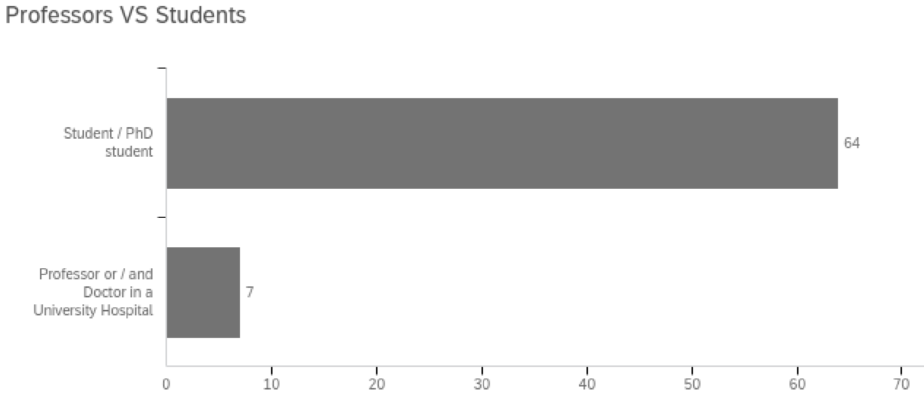


Table 77 : Professors VS Students

4.3.3.1 Data Analysis Finland - Professors

Specifically, for the question "*What is your position in the organization?*" 67% were «Professors» and 33% were «Practicing physician».

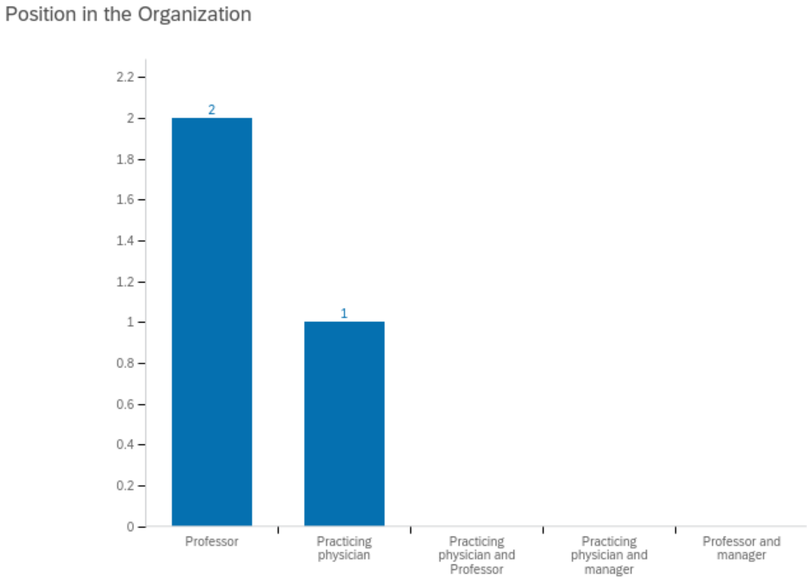


Table 78 : Position in the Organization

From the respondents, at the question "*How long have you been qualified as a medical professional*", all of them answered more than 10 years.

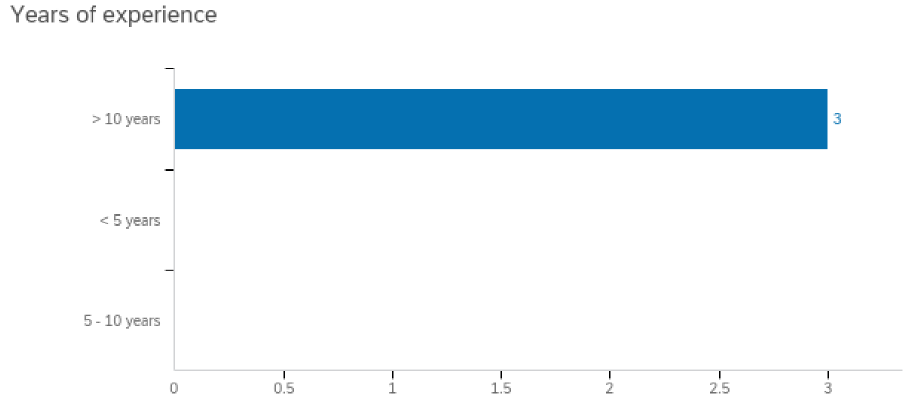


Table 79 : Years of experience

4.3.3.1.1 AI Skills

The next question had to do with the understanding of AI terms. The results from the question "*How would you rate your understanding of the following terms?*" for the included terms are shown at the following graph.

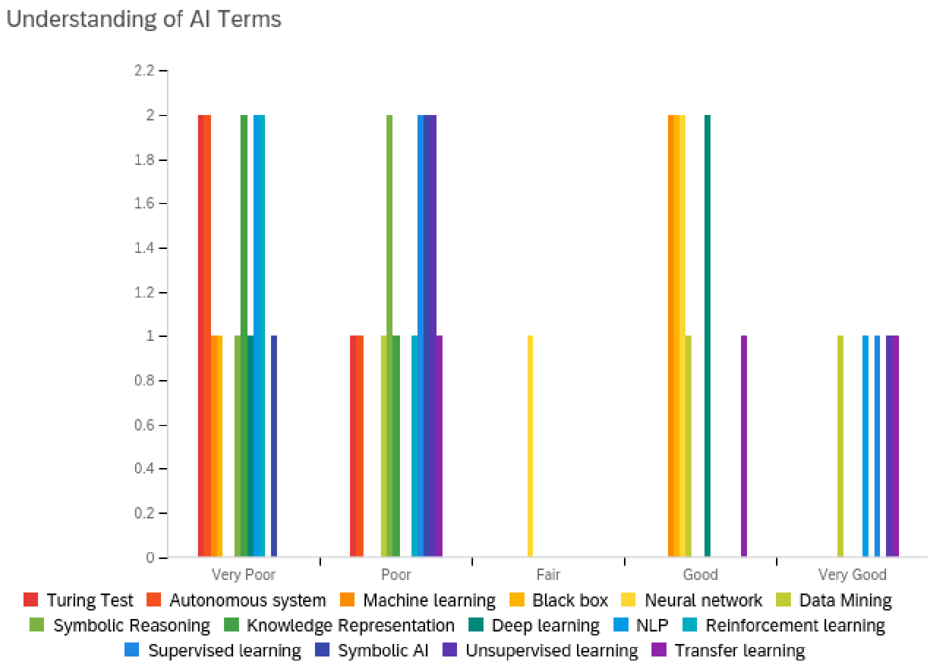


Table 80 : Understanding of AI Terms

From the answers given on the graph, it is concluded that **most professors think that they do not have a good understanding of the basic Artificial Intelligence terms.**

The next question had to do with professional knowledge that the respondent would expect a medical expert to have on the area of AI. These are the AI Skills that the majority of Professros in Finland think that are necessary for Medical Studies: **Machine learning and Image recognition with 38% each are the main topics**, while there is a strong 25% for Natural language processing.

AI Topics that Medical Students should know

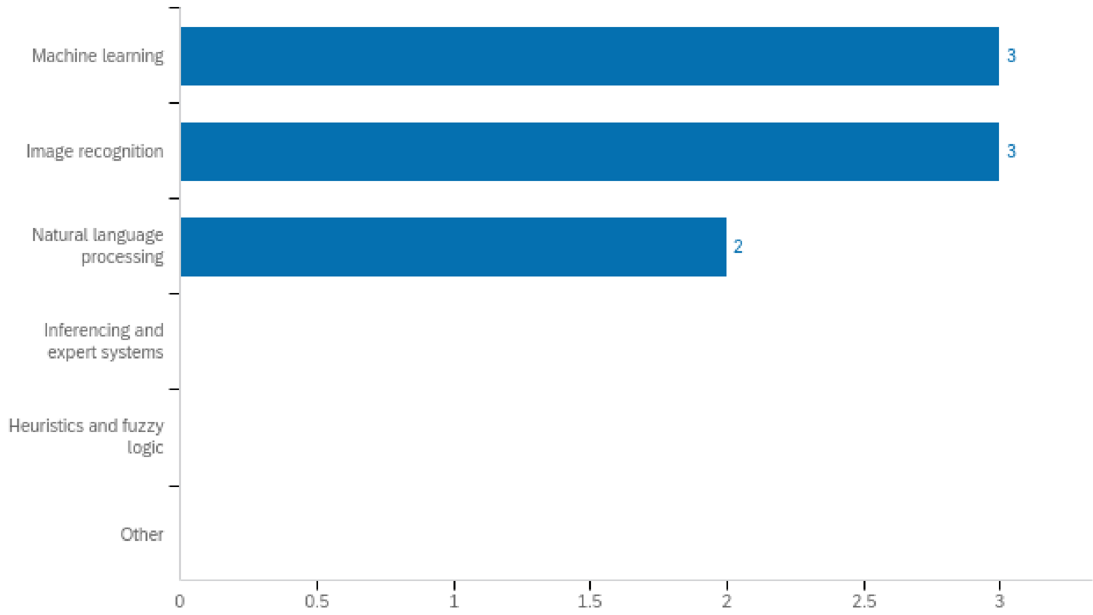


Table 81 : AI Topics that Medical Students should know

At the question *" What level of knowledge about applicable AI would you like medical graduates to have?",* **there is an equal 33% for each of the choices: Application level, High-Level comprehension and In-Depth understanding**, as it is shown for the graph below.

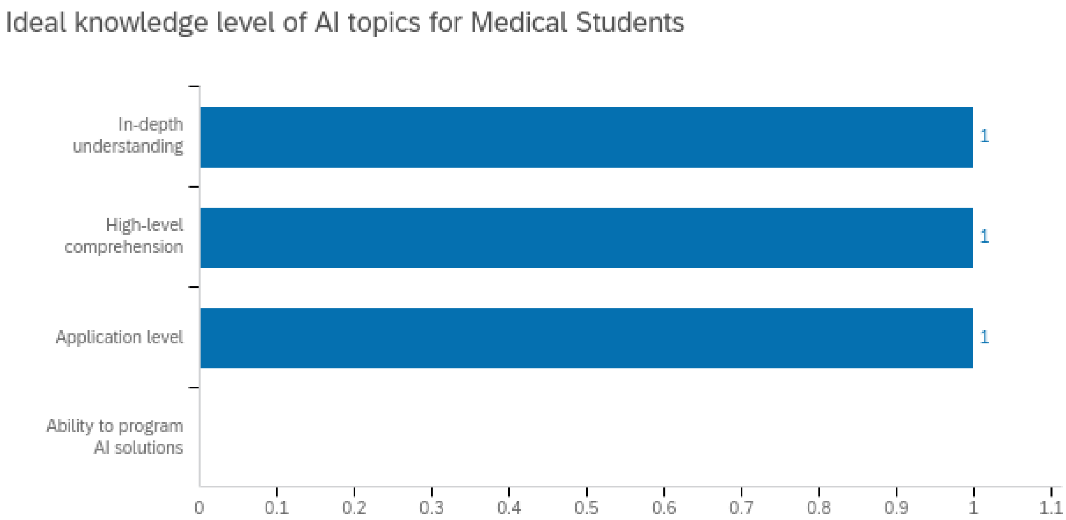


Table 82 : Ideal knowledge level of AI topics for medicaal students

Regarding the way of teaching of AI course, at the question "*What do you think would be the most effective way to teach the applicable AI?*" we had the following results.

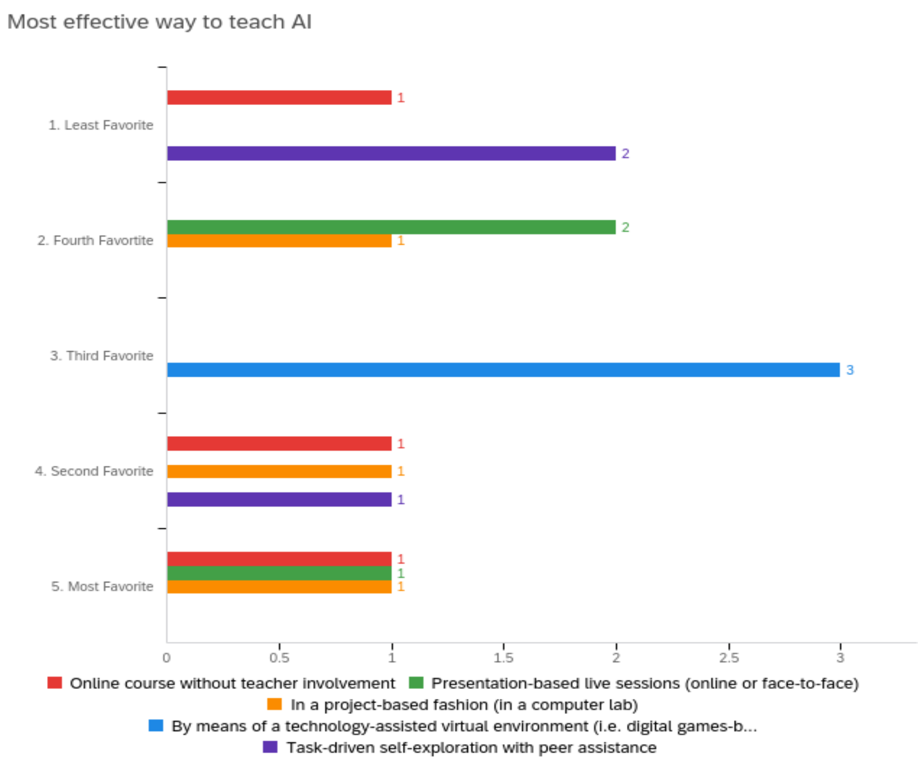


Table 83 : Most effective way to teach AI

As shown on the graph above, professors in Finland think that **a online course, project-based or presentation-based course are voted as the most preferable.**

Concerning the introduction of AI subject in the university curriculum, the 67% voted for Optional Course and 33% for Mandatory course.

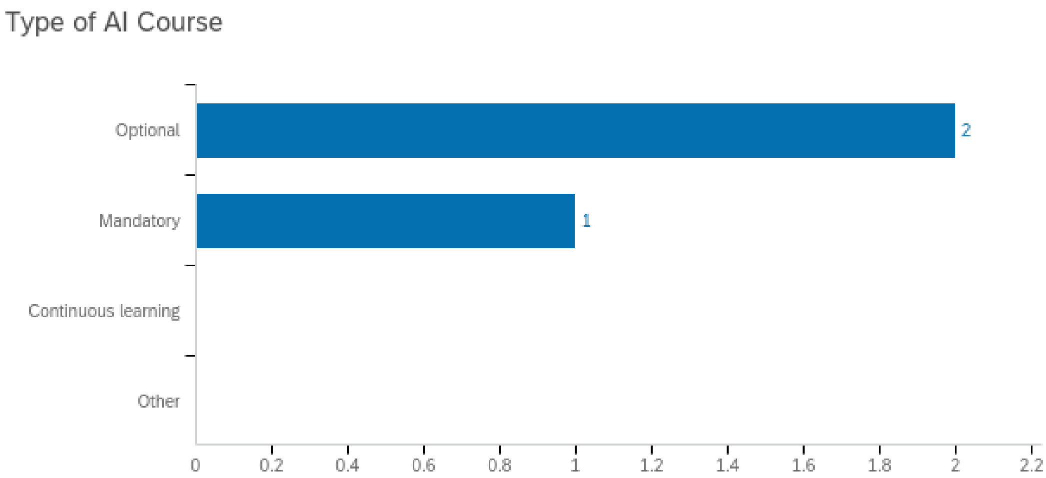


Table 84 : Type of AI Course

The next question had to do with how many teaching hours of AI should be included and the majority of 67% voting for 2 ECTS and 33% for 5 ECTS.

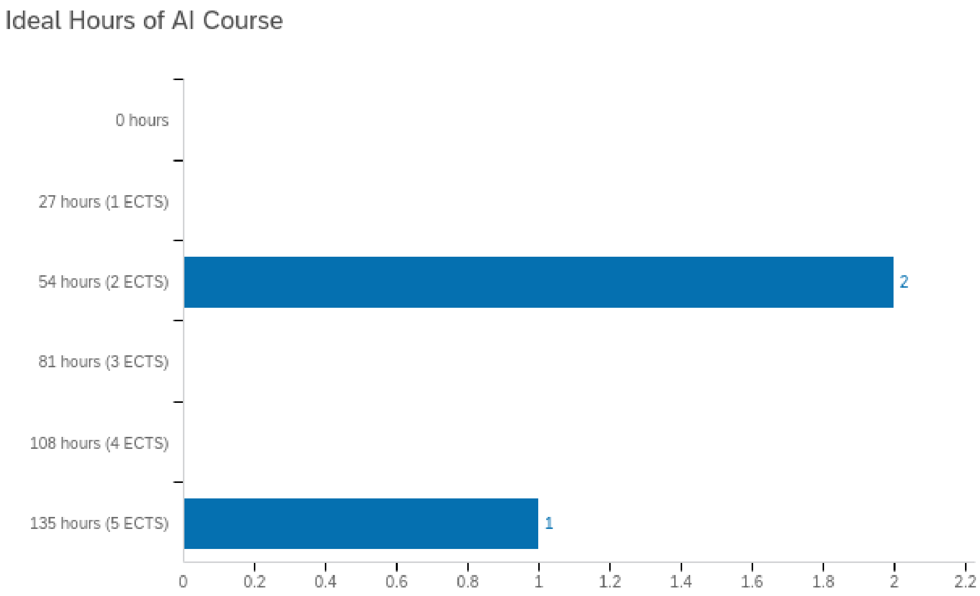


Table 85 : Ideal Hours of AI Course

4.3.3.1.2 Soft Skills

The following graph sums up the answers regarding the question of *how important professors in Finland consider the training of the following competencies (soft skills) for doctors in their profession?*. As we can see some of the Soft Skills are concidered Extremely or Very important for medical students.

Importance of Soft Skills

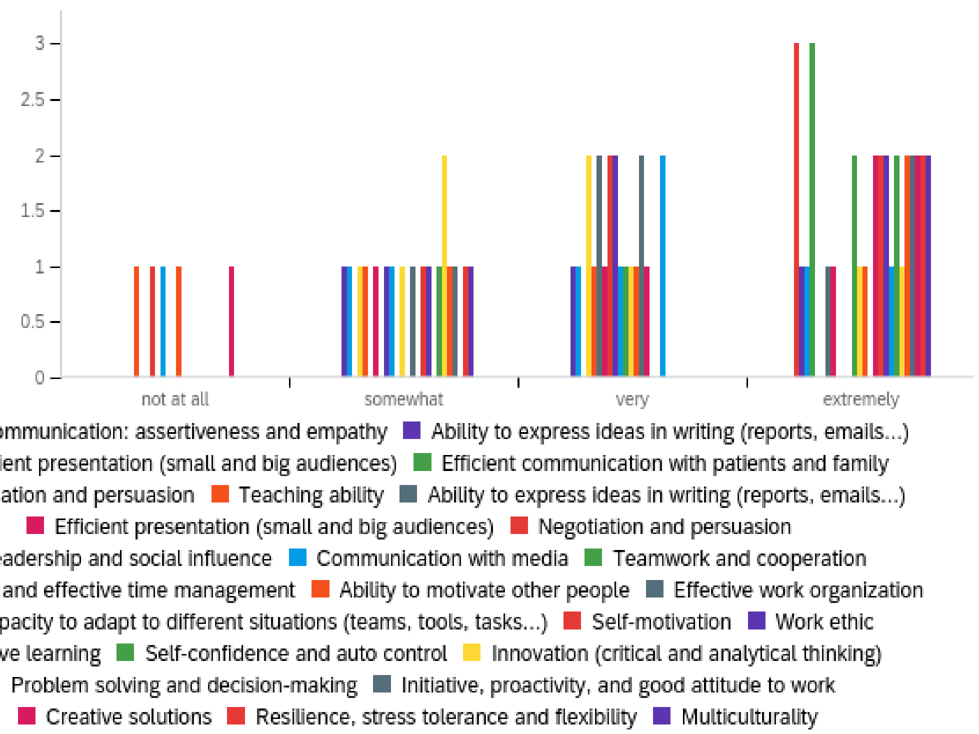


Table 86 : Importance of Soft Skills

The next question was "*What do you think would be the most effective way to teach the applicable soft skills?*" and it is noticed from the graph below that, a **technology-assisted in virtual environment is chosen as the preferable teaching, follwed by the Online way of admission**.

Most Effective way for teaching Soft Skills

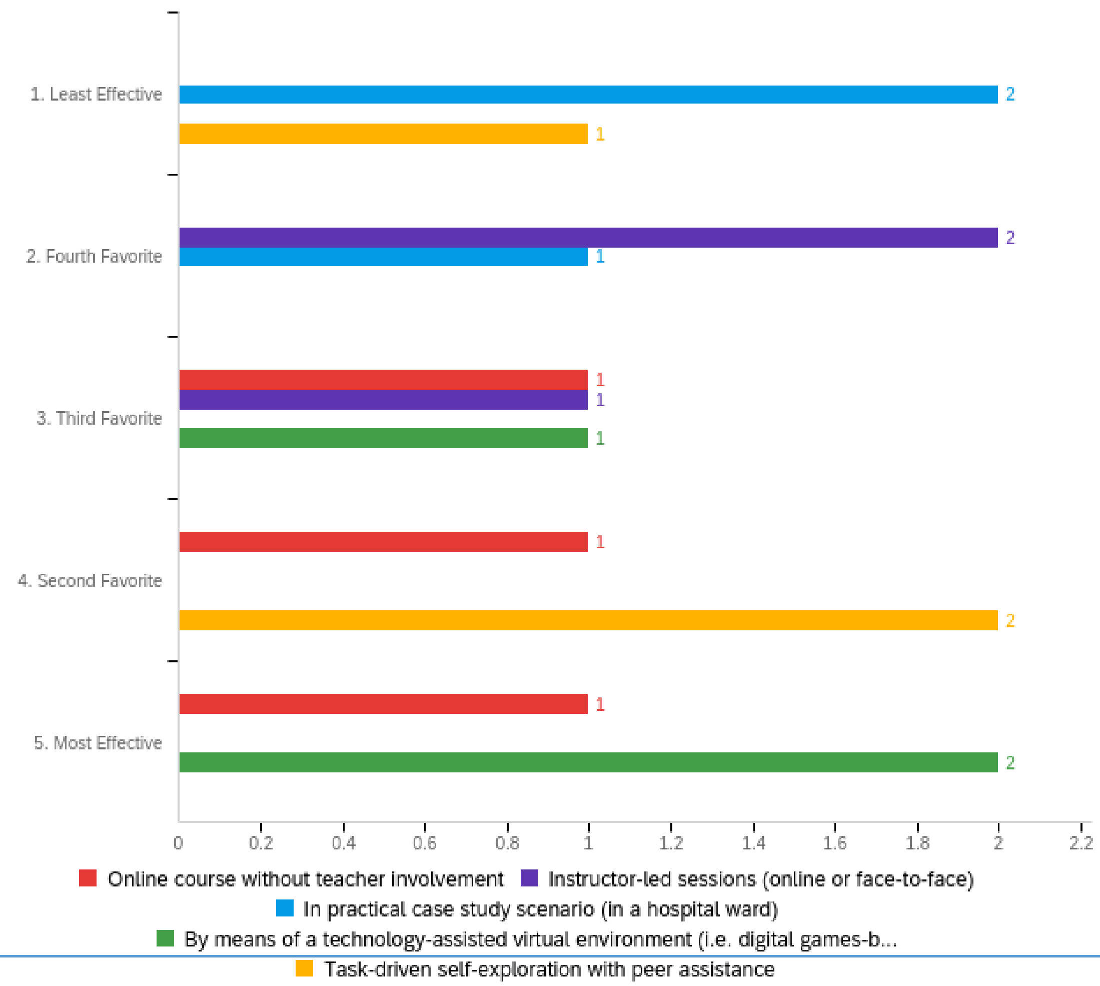


Table 87 : Most Effective way for teaching Soft Skills

As for the ***condition would like the professors to include soft skills content in their current curriculum*, the 67% voted for mandatory course and the 33% for continuous learning** (following graph, the full results of the survey are annexed in this report).

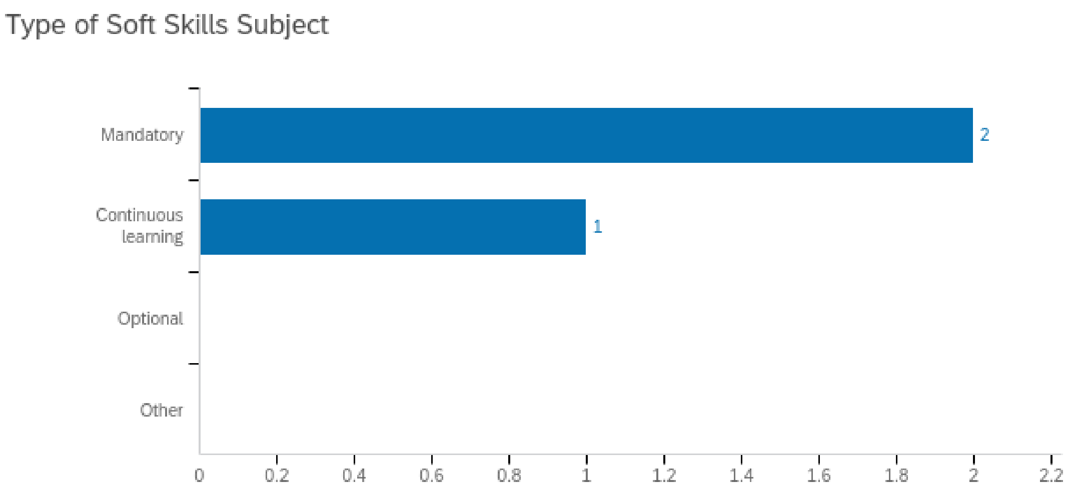


Table 88 : Type of Soft Skills Subject

Last question for the professors was about the ideal hours that a Soft Skills training should last. **As it seems 2 ECTS are ideal for Soft Skills course according to Professros in Finland with 67%**, while an other 33% voted for 5 ECTS.

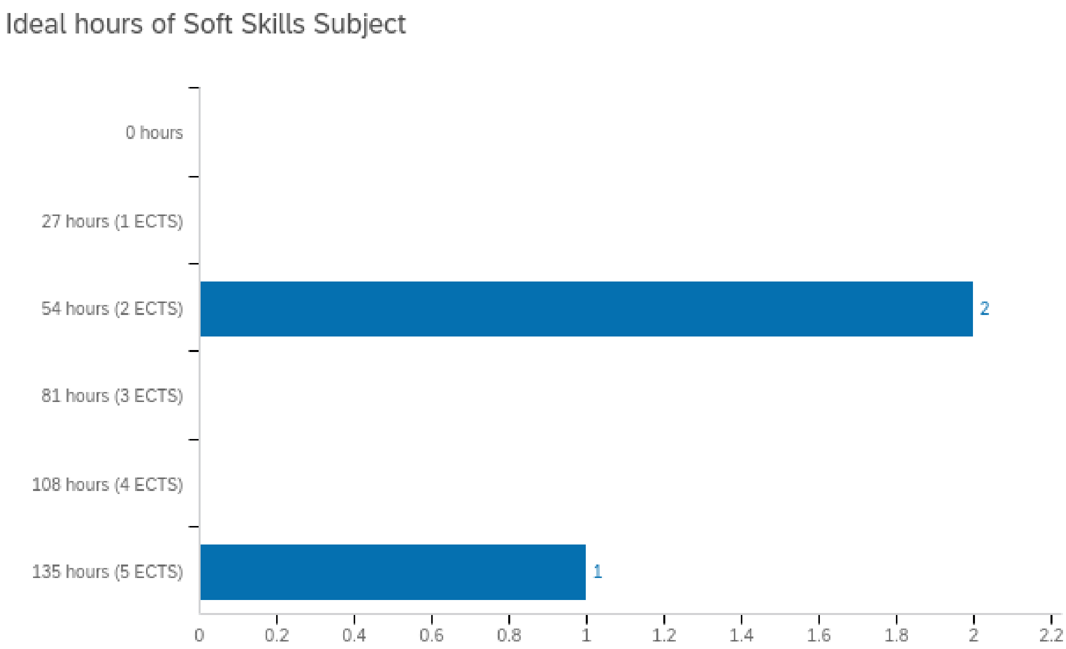


Table 89 : Ideal hours of Soft Skills Subject

4.3.3.2 Data Analysis Finland - Students

Out of the 42 people that answered the questionnaire in Finland and are students, the majority, 90% are on their bachelor or master's and 10% phd candidates as shown in the graph below.

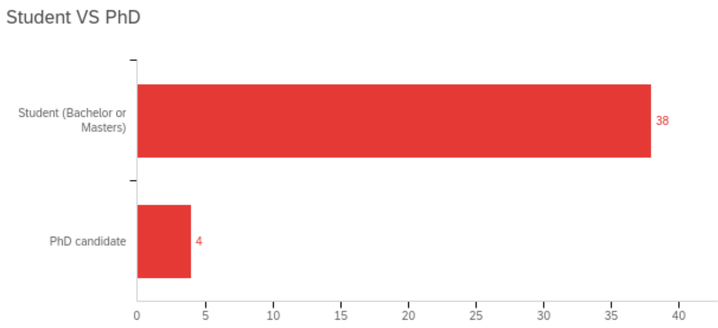


Table 90 : Student VS PhD

4.3.3.2.1 AI Skills

The following table sums up the answers of the students and phd candidates on the question "*How would you rate your understanding of the following terms?*". From their answers it is concluded that **the understanding of the terms is better for students compared to that of the professors, but still clearly on the low side**.

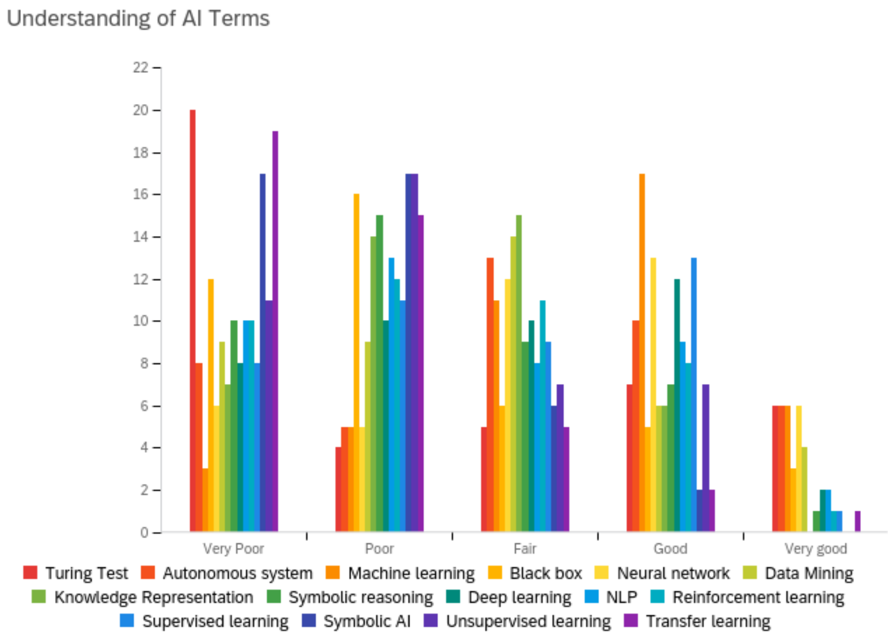


Table 91 : Understanding of AI Terms

Most of them were positive on the question “*Do you believe that AI applications are more useful in a period of pandemic?*” with 76% answering “Yes”.

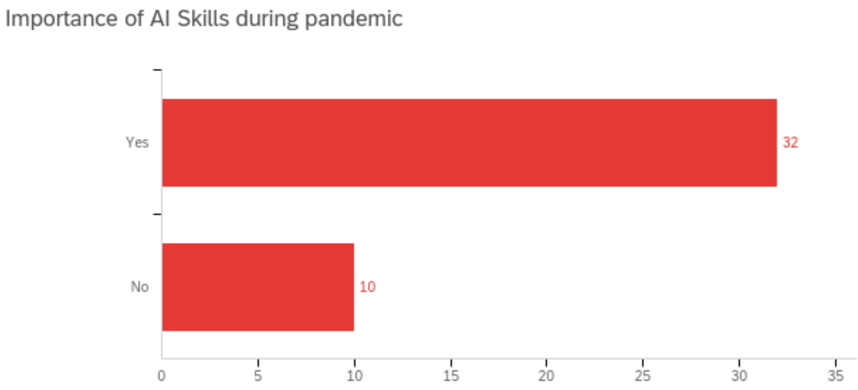


Table 92 : Importance of AI Skills during pandemic

As it is shown on the graph below **the majority of the medical students of Finland voted as preferable AI Skill the Image recognition (24%) as well as Machine learning (22%) and Heuristics and fuzzy logic (19%)**, following by Inferencing and expert systems and Natural language processing with 17% each.

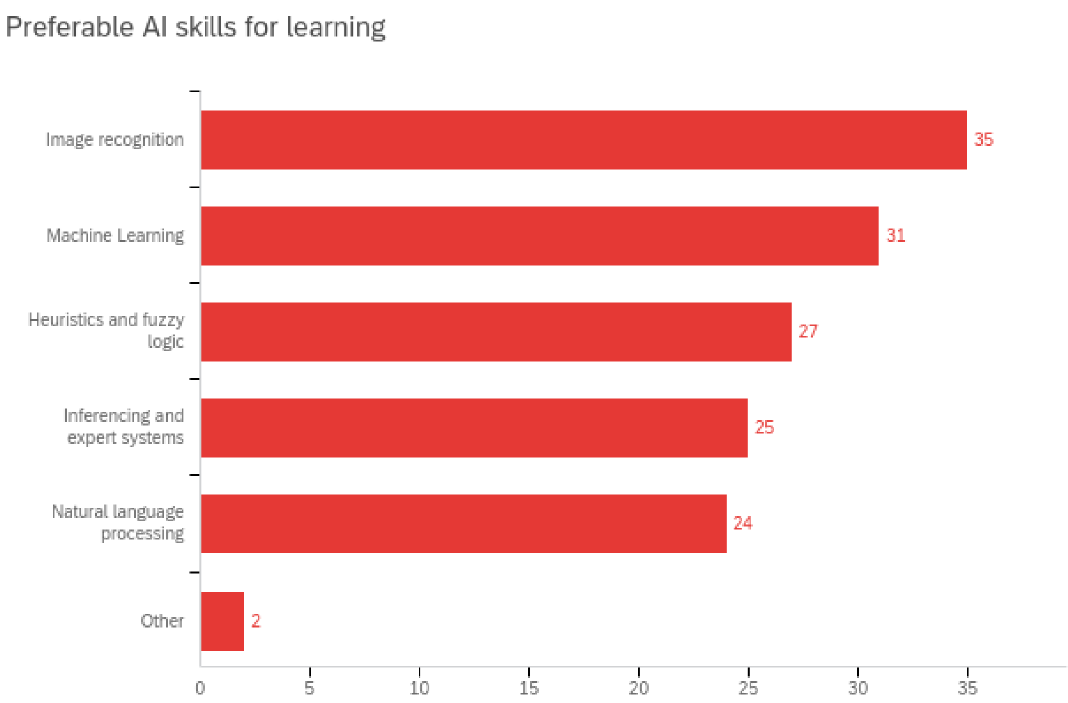


Table 93 : Preferable AI skills for learning

Also we had a clear vote on *what level of knowledge about applicable AI techniques would like to acquire during their studies*. The 52% voted for **Application level of comprehension, the 29% voted for High-level comprehension** and In-depth understanding voted for 14%.

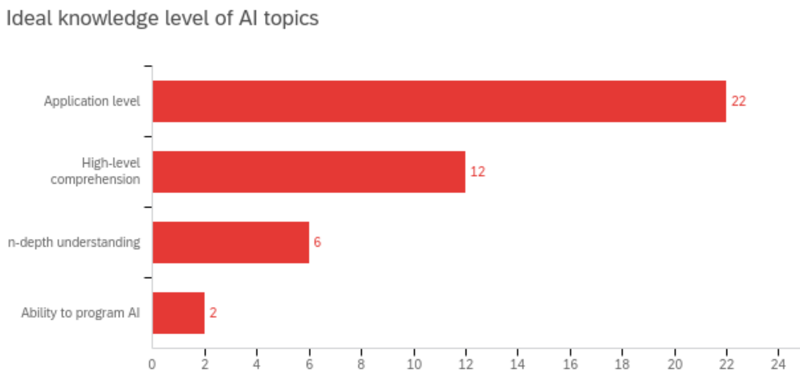


Table 94 : Ideal knowledge level of AI topics

Additionally, on the question "*How would you like to learn the AI skills material?*", students answered that the **online courses are the best ways of learning AI.**

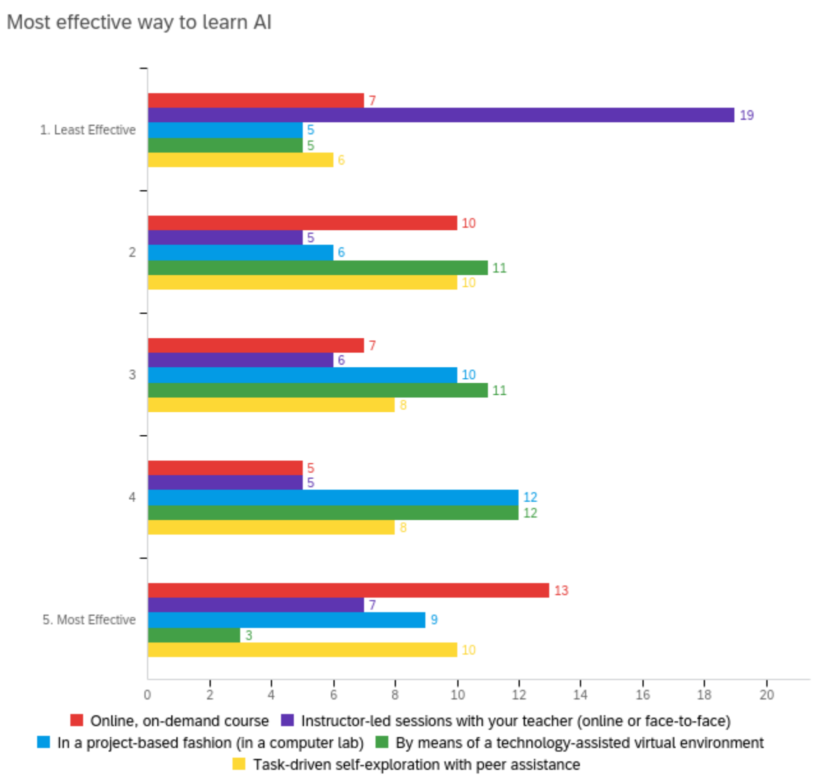


Table 95 : Most effective way to learn AI

As the graph bellow represents **the 57% of students from Finland beleive that the Optional is the ideal way of training on AI.** Of course there is the 24% and a 19% that thinks that Continuous and Mandatory is preferable respectively.

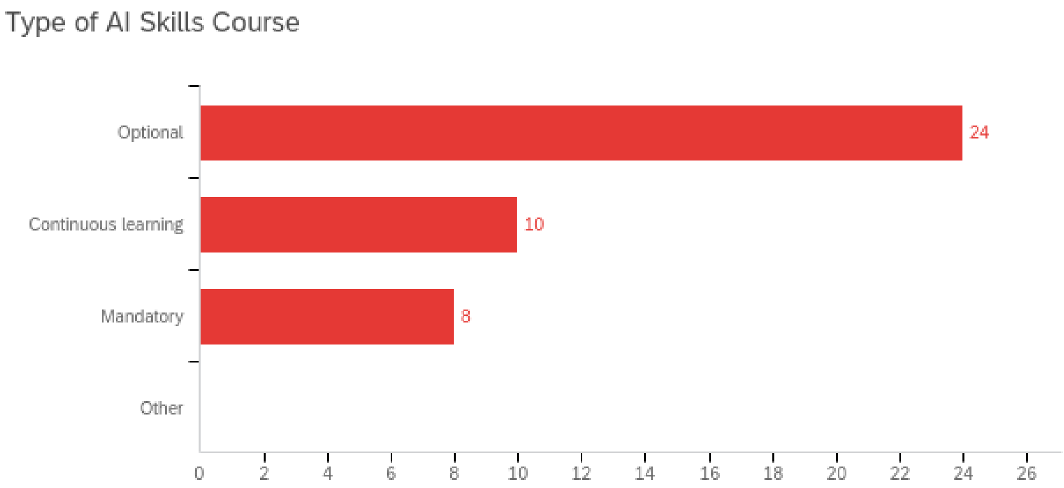


Table 96 : Type of AI Skills Course

Last but not least, **as for the hours of the AI course the students voted for 2 ECTS with a 26% and with a close 24%, 1 ECTS**. The full results of the survey can be found on the Annex of this report.

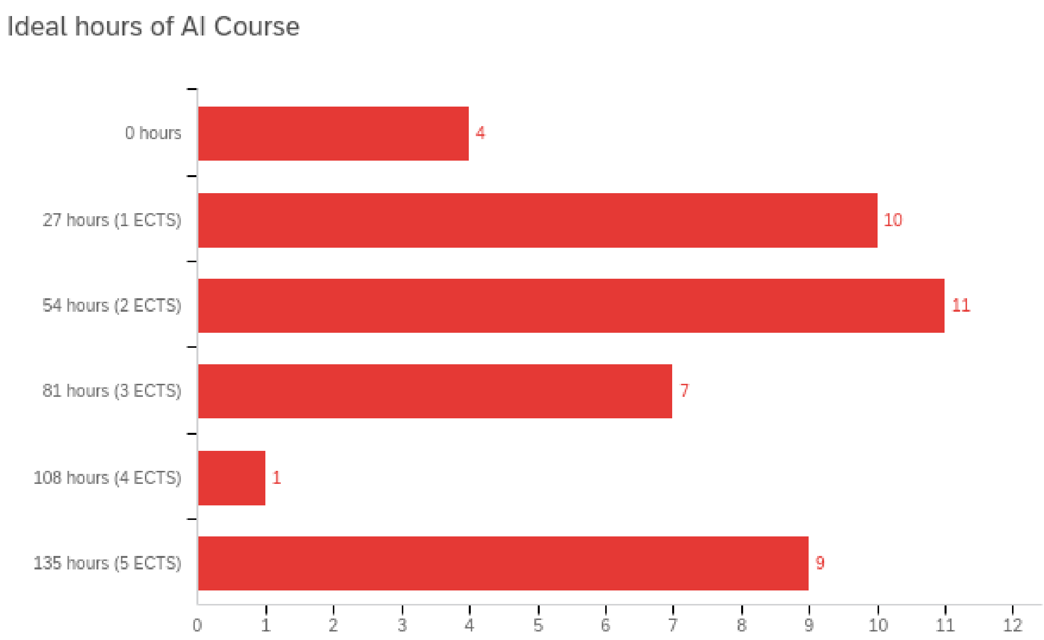


Table 97 : Ideal hours of AI Course

4.3.3.2.2 Soft Skills

It is more than obvious that the **majority of students from Finland concider Extremely and Very importan the training of the following competencies (soft skills) for their profession.**

Importance of Soft Skills

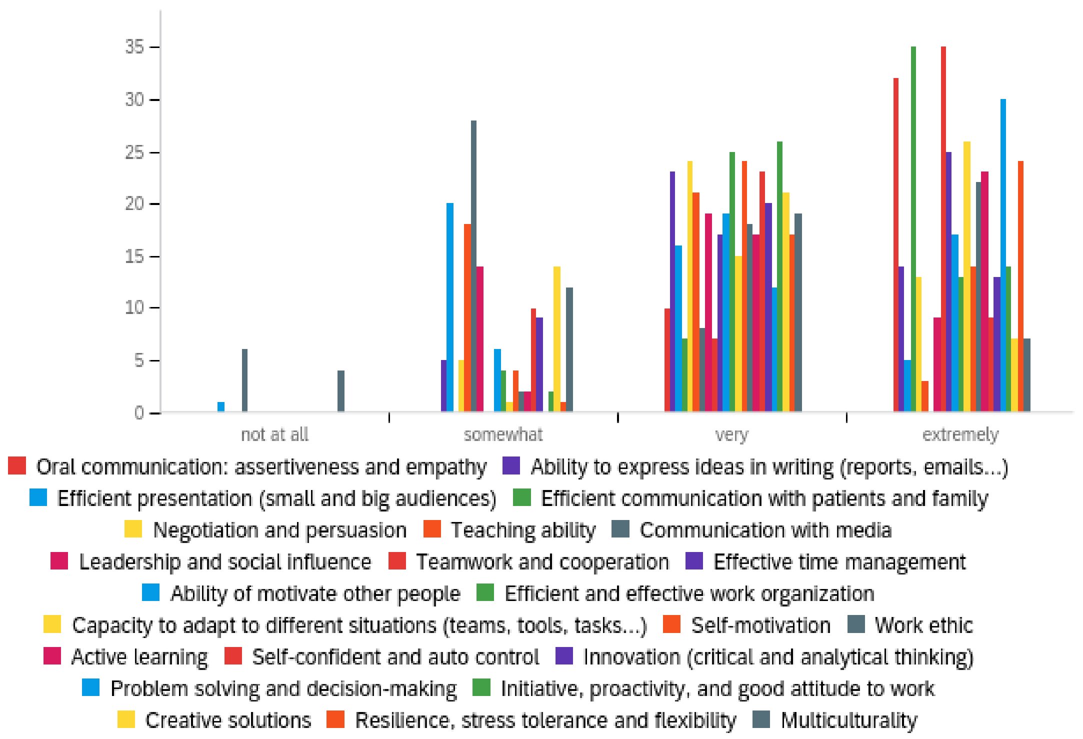


Table 98 : Importance of Soft Skills

On the question *“What do you think would be the most effective way to learn the desirable soft skills?”* the students answered that **Online courses and Task-driven, self-exploration with peer assistance is the most preferable educational methods** once more as shown in the graph below.

Most effective way of learning Soft Skills

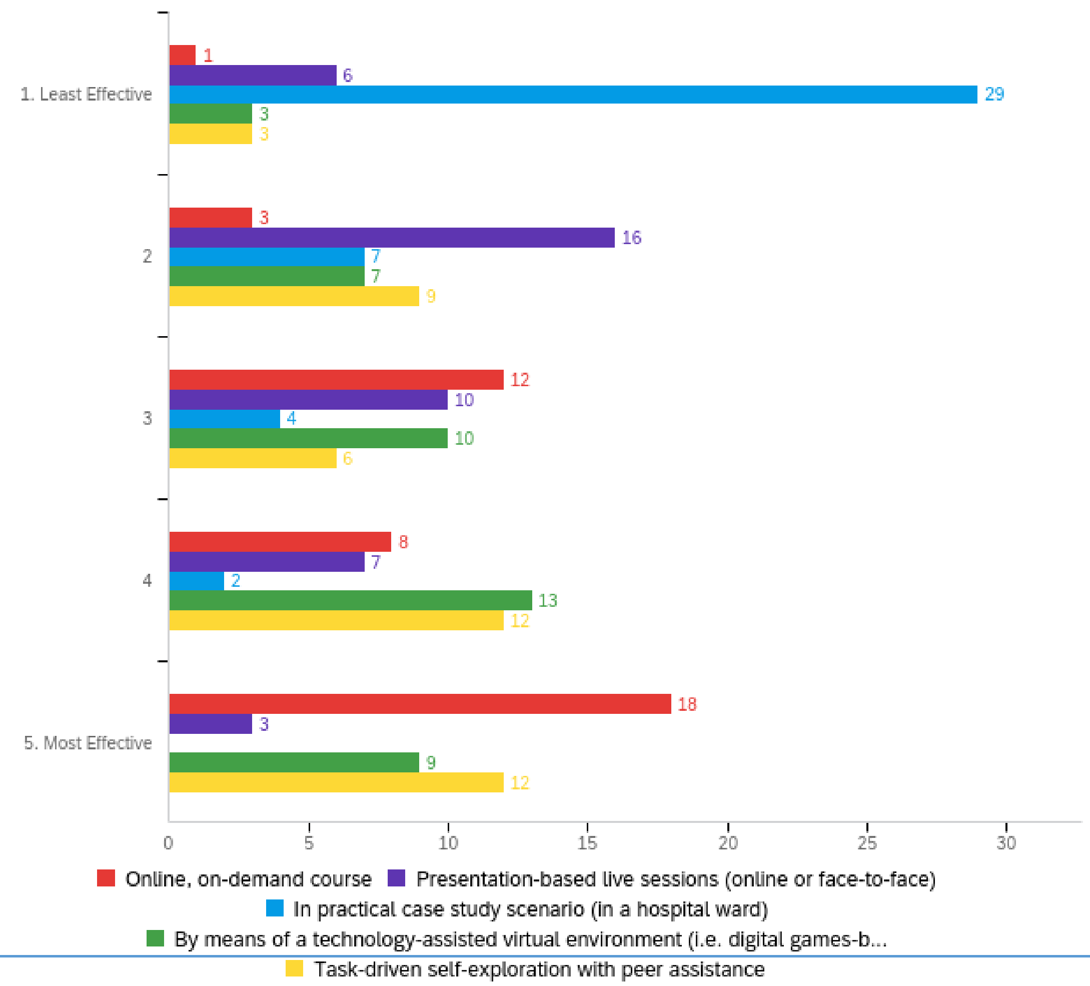


Table 99 : Most effective way of learning Soft Skills

Concerning the introduction of AI subject in the university curriculum, at the question *“Under what condition would you like to study soft skills content in your current curriculum?”* **55% chose as mandatory course,** 33% answered as continuous learning and 12% as an optional course.

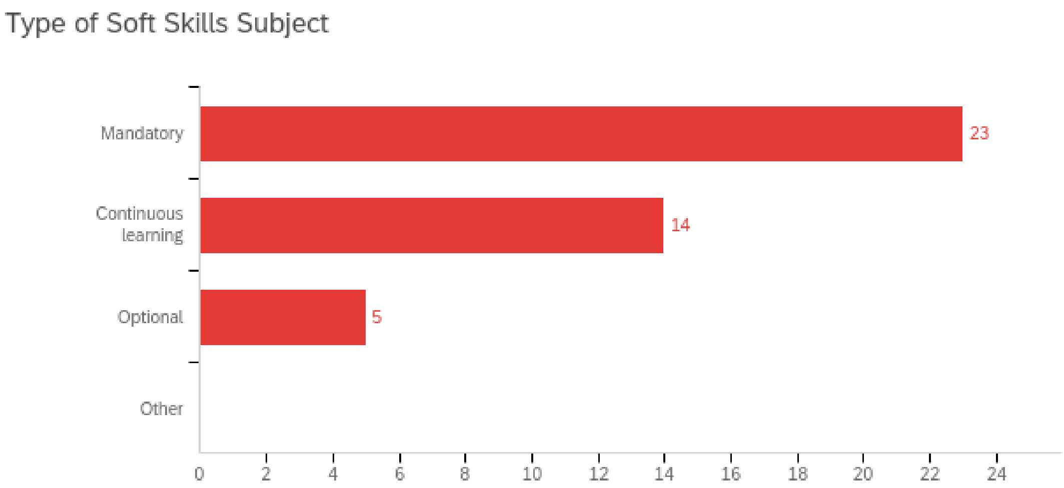


Table 100 : Type of Soft Skills Subject

Finally, in the question *"How many course hours would you be able to spend on learning applicable soft skills?"* as it seems **29% think that they will be able to attend the course of Soft Skills for 2 ECTS and 26% of them voted for 1 ECTS and 24% for 5 ECTS**, as it is shown in the graph below.

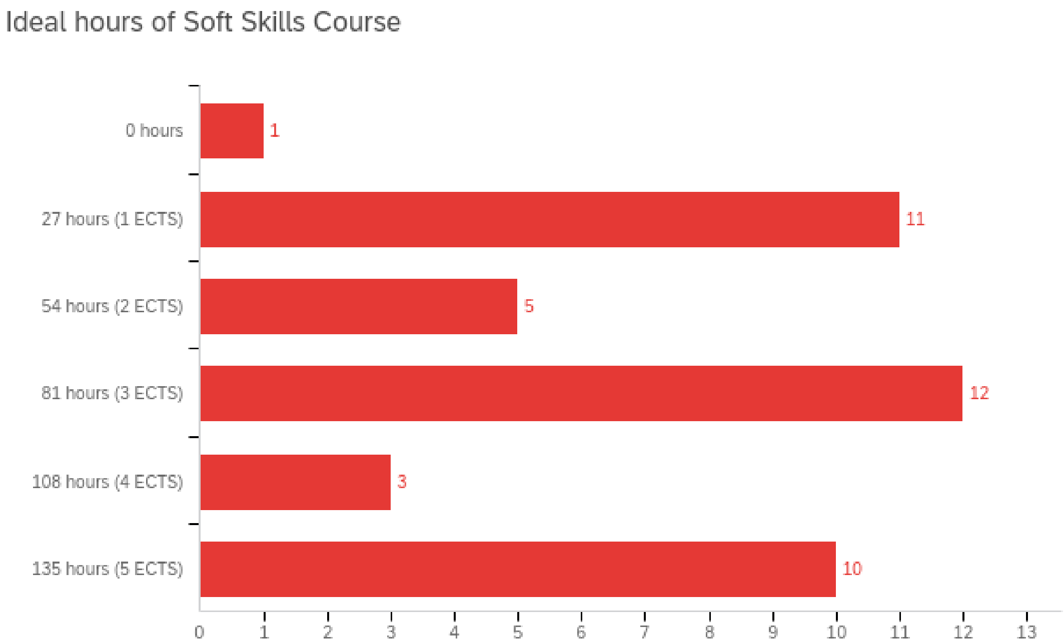


Table 101 : Ideal hours of Soft Skills Course

4.3.4 Data Analysis - Spain

Regarding Spain, 154 total questionnaires were filled, 64% were filled by university students (bachelor, master's or phd candidates) of the School of Medicine and 36% from professors or medicine expert (Doctors) from university hospitals.

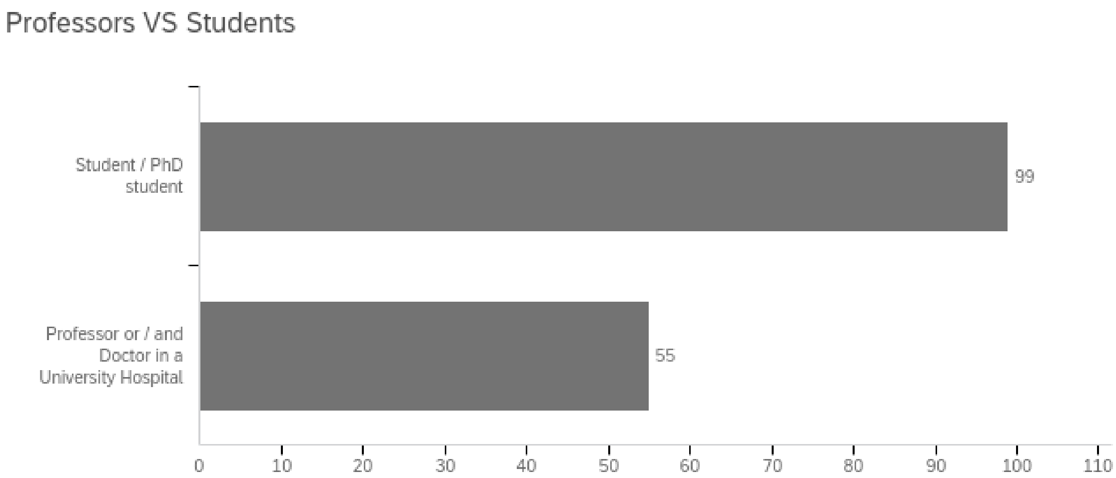


Table 102 : Professors VS Students

4.3.4.1 Data Analysis Spain - Professors

Specifically, for the question “*What is your position in the organization?*” 65% were «Practicing physicians and Professors», 32% were « Professors» and % were «Professors and managers».

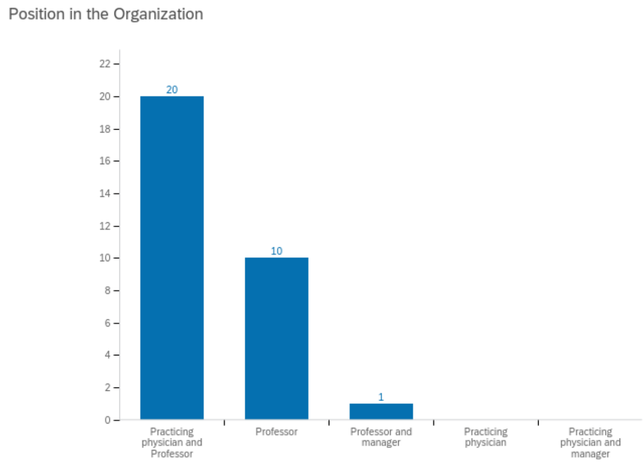


Table 103 : Position in Organization

From the respondents, at the question “*How long have you been qualified as a medical professional*”, 90% had more than 10 years of experience and 10% less than 5 years.

Years of experience

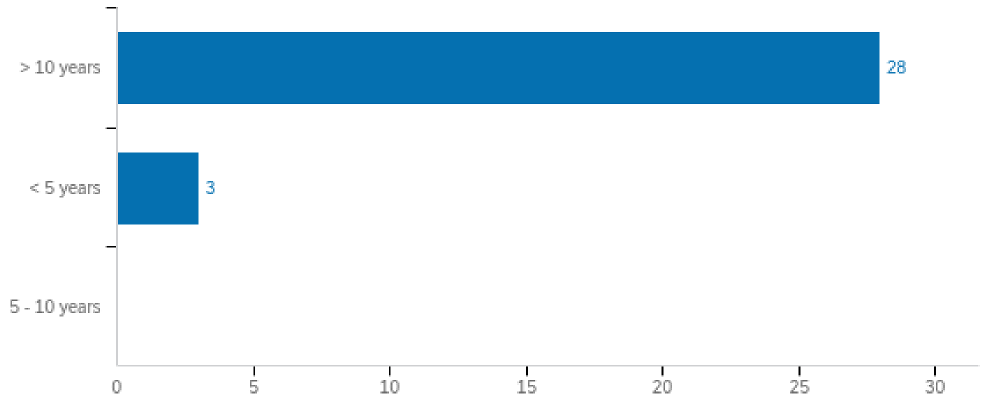


Table 104 : Years of experience

4.3.4.1.1 AI Skills

The next question had to do with the understanding of AI terms. The results from the question "*How would you rate your understanding of the following terms?*" for the included terms are shown at the following graph.

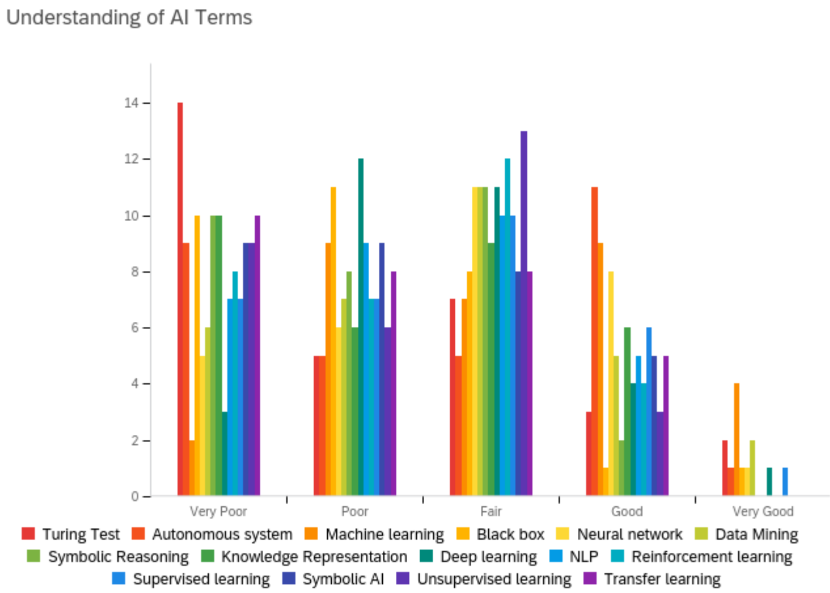


Table 105 : Understanding of AI Terms

From the answers given on the graph, it is concluded that **most professors think that they do not have a good understanding of the basic Artificial Intelligence terms.**

The next question had to do with professional knowledge that the respondent would expect a medical expert to have on the area of AI. These are the AI Skills that the majority of Spanish Professros think that are necessary for Medical Studies: **Machine learning 30% and Image recognition with 23% are the main topics**, while there is a strong 20% for Inferencing and expert systems.

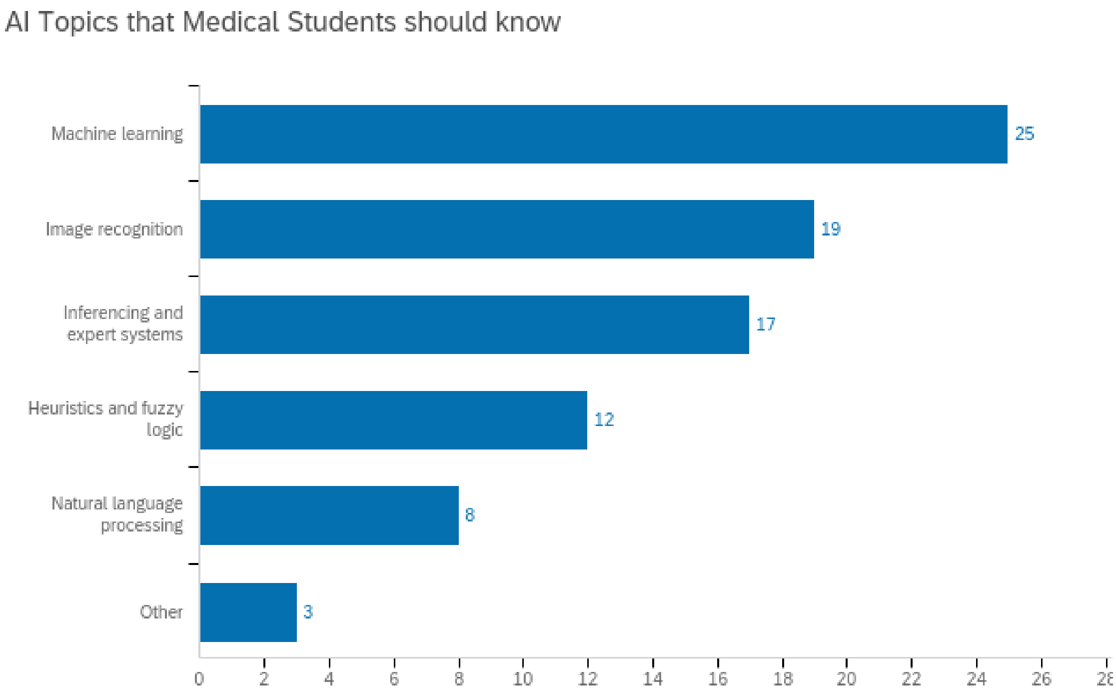


Table 106 : AI Topics that Medical Students should know

At the question *" What level of knowledge about applicable AI would you like medical graduates to have?",* **there was a clear win for the Application level with 61% following by**

26% for High-Level comprehension as the Ability to program AI Solutions and In-Depth understanding voted by the 10% and 3% respectively, as it is shown for the graph below.

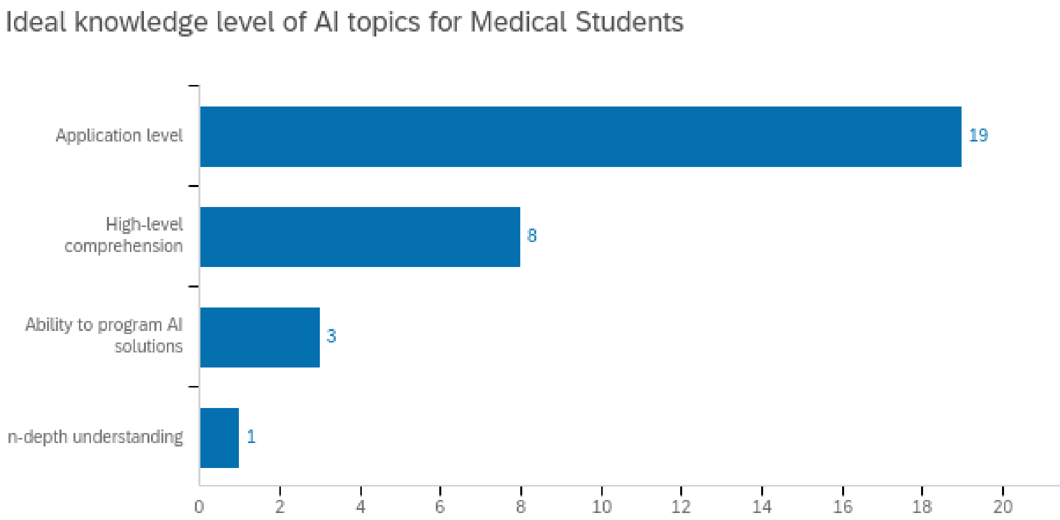


Table 107 : Ideal level of AI topics for Medical Students

Regarding the way of teaching of AI course, at the question "*What do you think would be the most effective way to teach the applicable AI?*" we had the following results.

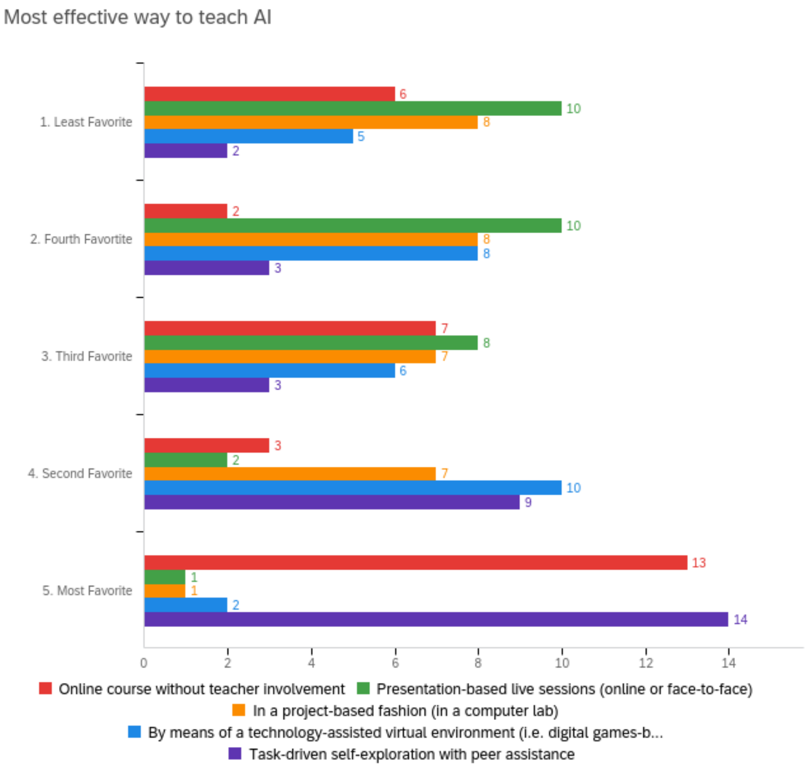


Table 108 : Most effective way to teach AI

As shown on the graph above, professors in Spain think that **a task-driven/self-exploring course as well as an online, will be the better choice to train future doctors about AI. Concerning the introduction of AI subject in the university curriculum, the 42% voted for Optional Course and Countinuous Learning equaly** while there was also a 13% that voted for Mandatory course.

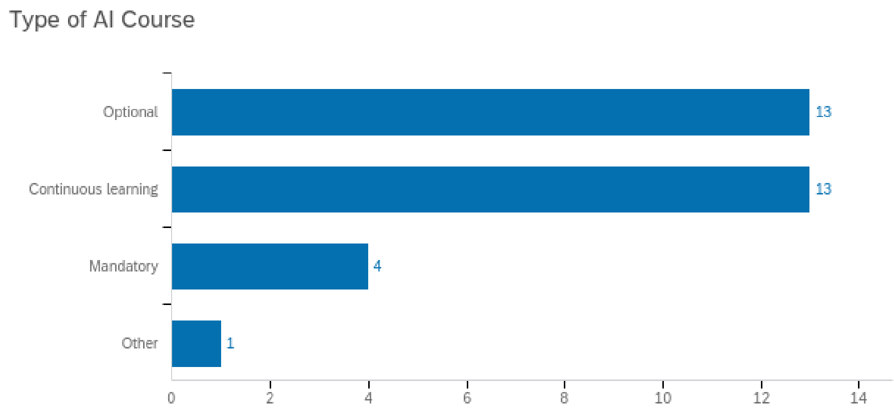


Table 109 : Type of AI Course

The next question had to do with how many teaching hours of AI should be included and the majority of 48% voting for 2 ECTS and 19% for 1 ECTS.

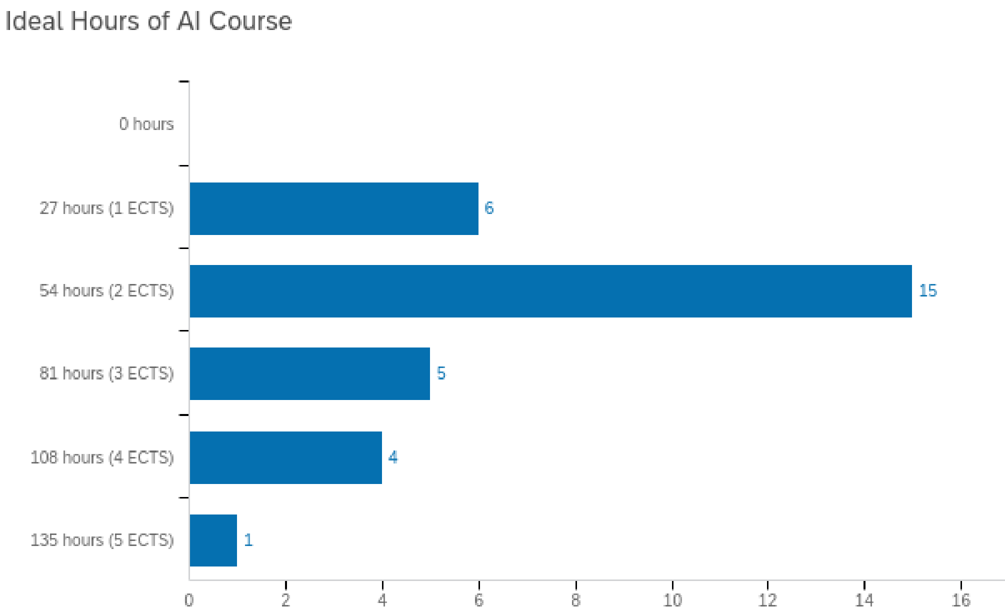


Table 110 : Ideal Hours of AI Course

4.3.4.1.2 Soft Skills

The following graph sums up the answers regarding the question of *how important professors in Spain consider the training of the following competencies (soft skills) for doctors in their profession?*. As we can see some of the Soft Skills are concidered Extremely or Very important for medical students.

Importance of Soft Skills

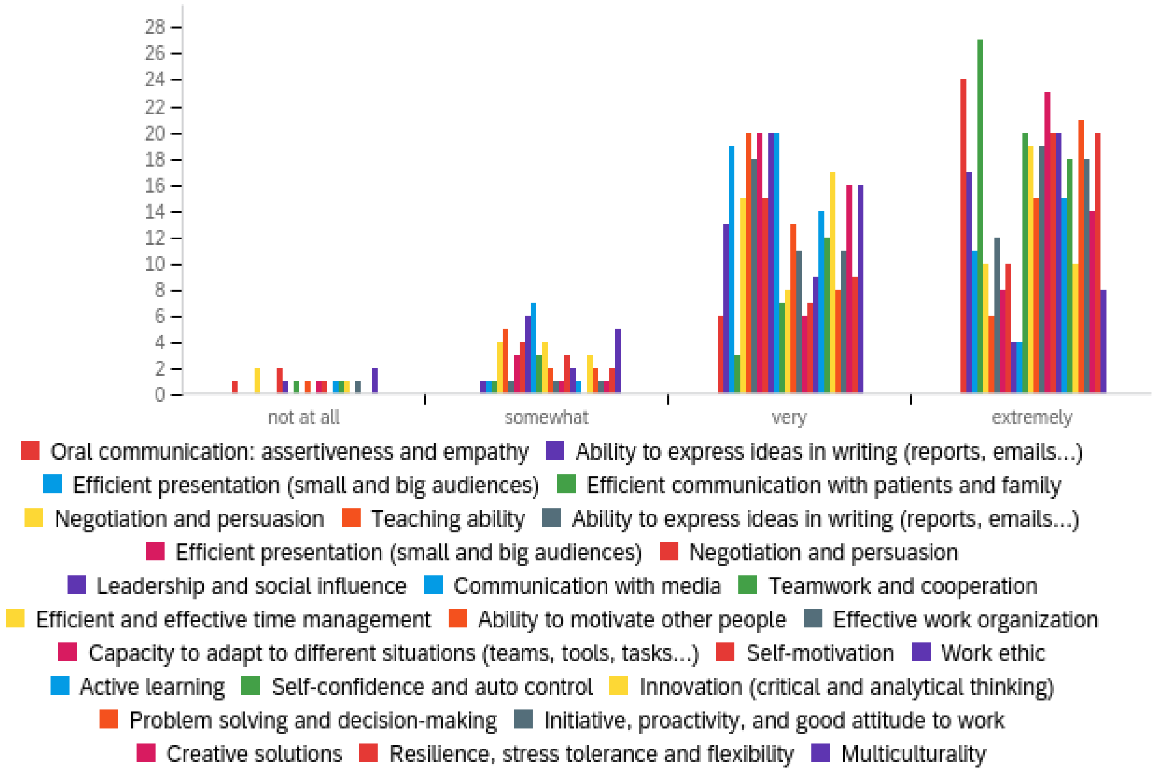


Table 111 : Importance of Soft Skills

The next question was "*What do you think would be the most effective way to teach the applicable soft skills?*" and it is noticed from the graph below that, a **Task-driven/self-exploration is chosen as the preferable teaching method, follwed by the Online course.**

Most Effective way for teaching Soft Skills

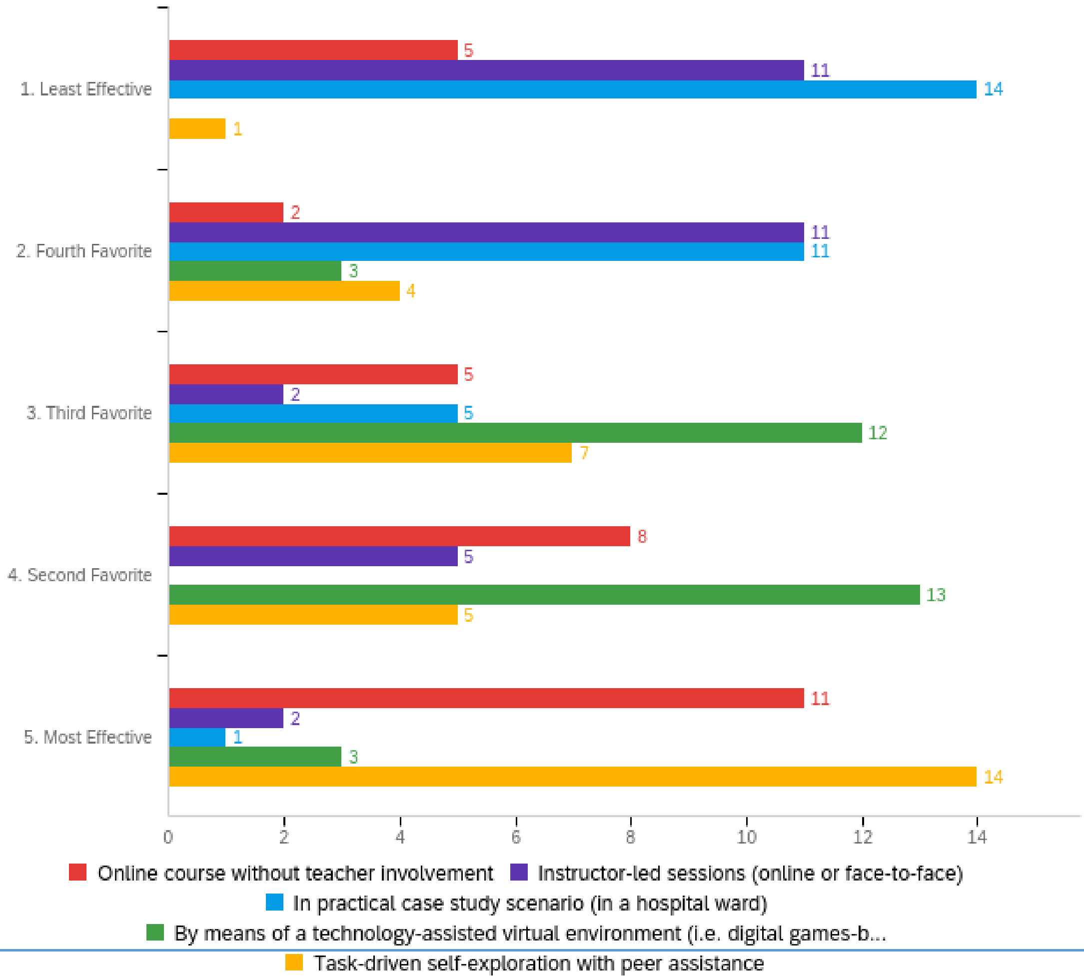


Table 112 : Most Effective way for teaching Soft Skills

As for the ***condition would like the professors to include soft skills content in their current curriculum*****, the 42% voted for continuous learning and the 29% for mandatory** (following graph, the full results of the survey are annexed in this report).

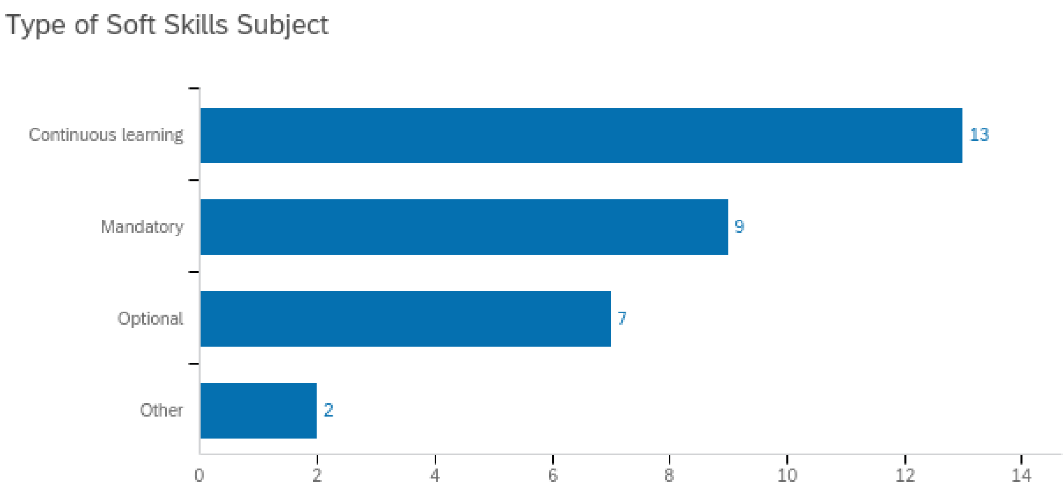


Table 113 : Type of Soft Skills Subject

Last question for the professors was about the ideal hours that a Soft Skills training should last. **As it seems 1 ECTS are ideal for Soft Skills course according to Professros in Spain with 29% closely followed by 3 ECTS with the 26% of the votes**, while an other 23% voted for 2 ECTS.

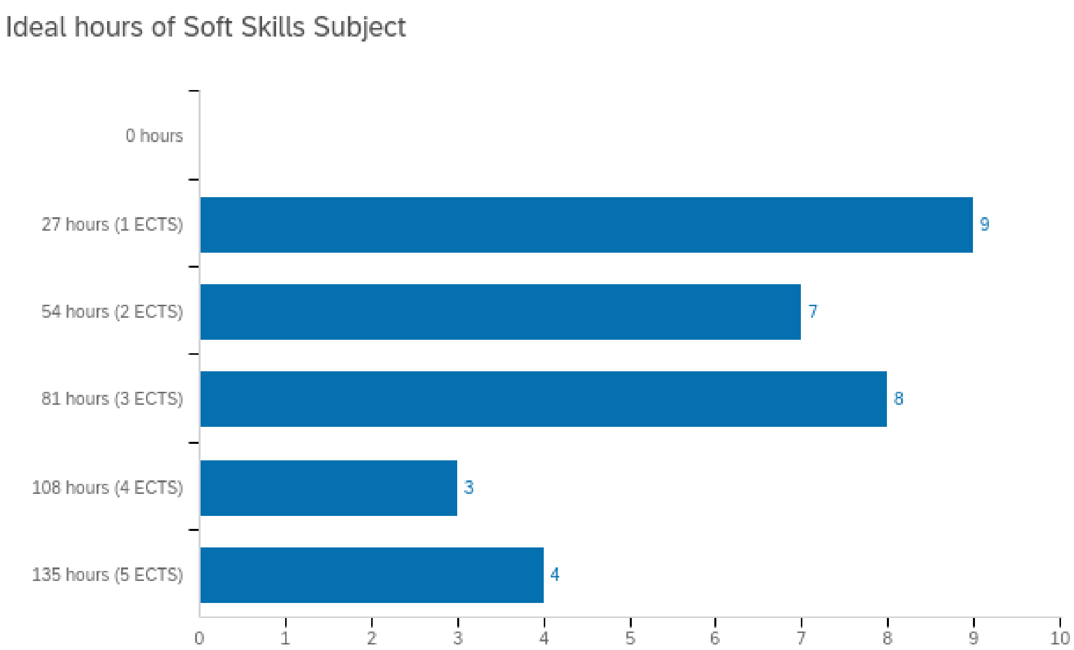


Table 114 : Ideal hours of Soft Skills Subject

4.3.4.2 Data Analysis Spain - Students

Out of the 54 people that answered the questionnaire in Spain and are students, the majority, 91% are on their bachelor or master's and 9% phd candidates as shown in the graph below.

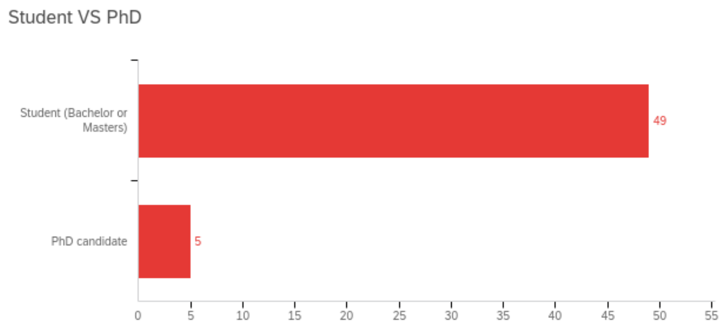


Table 115 : Student VS PhD

4.3.4.2.1 AI Skills

The following table sums up the answers of the students and phd candidates on the question "*How would you rate your understanding of the following terms?*". From their answers it is concluded that **the understanding of the terms is better for students compared to that of the professors, but still clearly on the low side**.

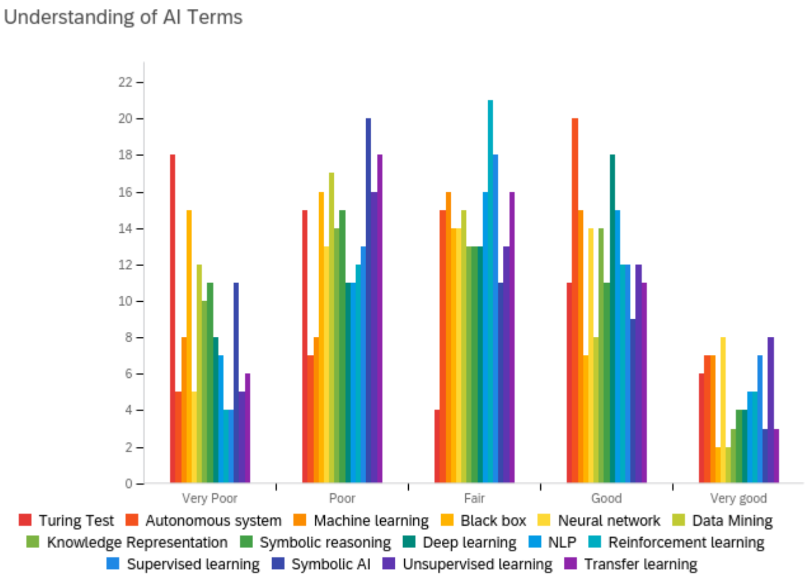


Table 116: Understanding of AI Terms

Almost all of them were positive on the question "*Do you believe that AI applications are more useful in a period of pandemic?"* with 98% answering "Yes".

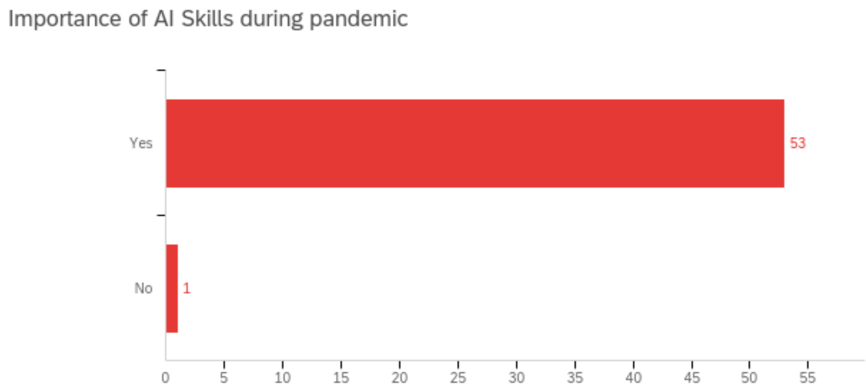


Table 117 : Importance of AI Skills during pandemic

As it is shown on the graph below **the majority of the medical students of Spain voted eqaualy «Image recognition» and «Inferencing and expert systems» and «Machine Learning» with 23% each, followed by** «Natural language processing» and «Heuristics and fuzzy logic» with 16% and 14% respectively.

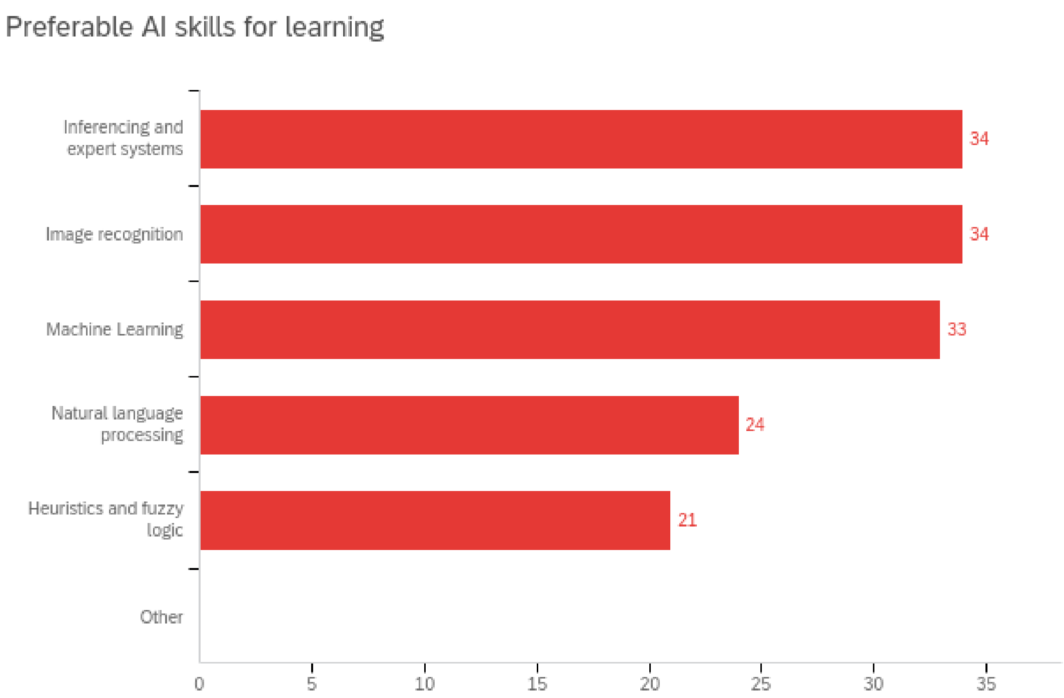


Table 118 : Preferable AI skills for learning

Also we had a clear vote on *what level of knowledge about applicable AI techniques would like to acquire during their studies*. **The 52% voted for Application level of comprehension,**

the 35% voted for High-level comprehension and only 9% and 4 % for Ability to program AI Solutions and In-depth understanding, respectively.

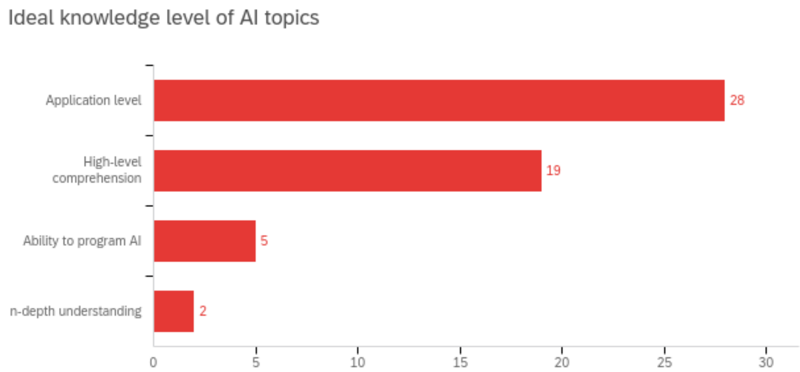


Table 119 : Ideal knowledge level of AI topics

Additionally, on the question "*How would you like to learn the AI skills material?*", students answered that the **Task-driven/Self-exploration and online courses are the best ways of learning AI** as it is shown in the graph bellow.

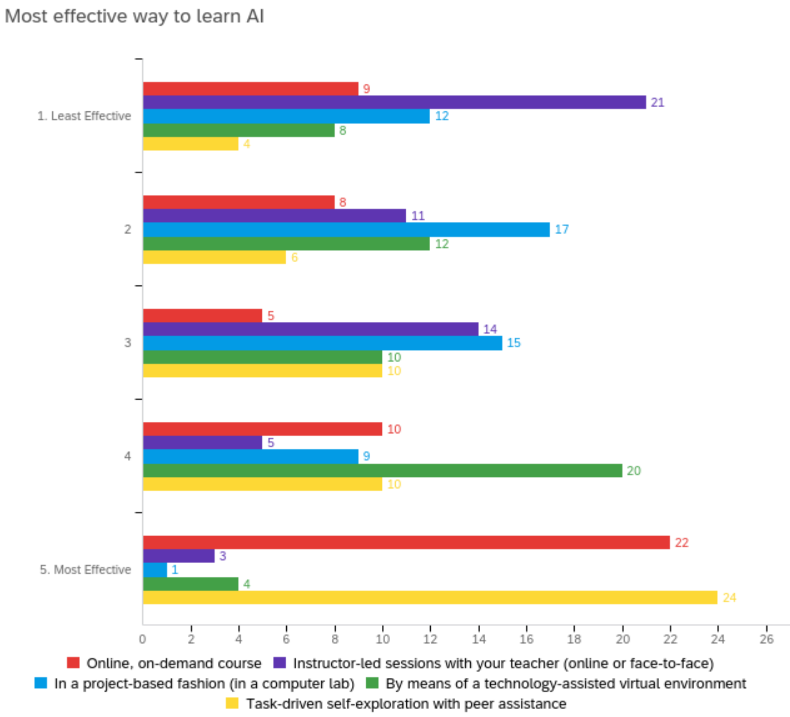


Table 120: Most effective way to learn AI

As the graph bellow represents **the 43% of students from Spain beleive that as an Optional course is the ideal way of training on AI.** Of course there is the 31% and a 22% that thinks that Continuous and Mandatory is preferable, respectively.

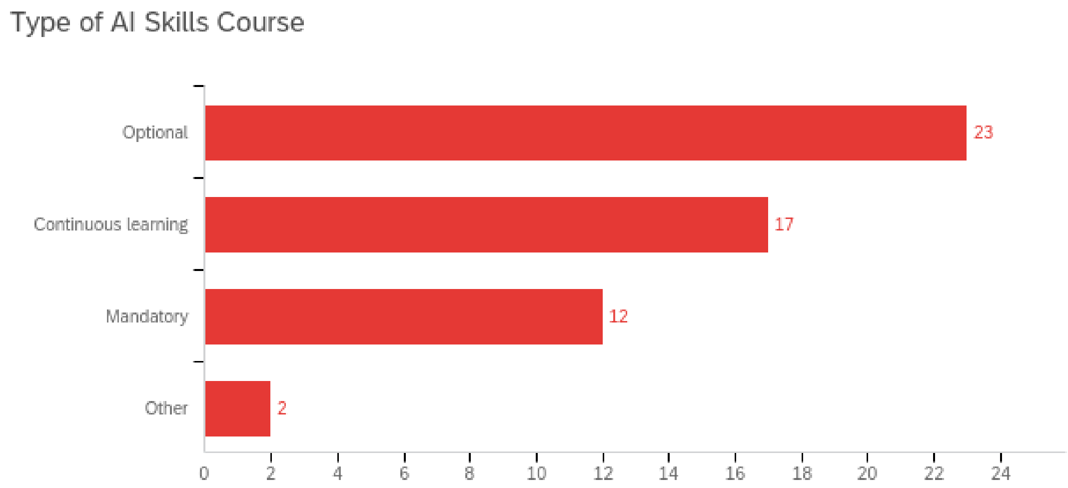


Table 121 : Type of AI Skills Course

Last but not least, **as for the hours of the AI course the students voted for 3 ECTS with a 56% and with a following 20%, 4 ECTS**. The full results of the survey can be found on the Annex of this report.

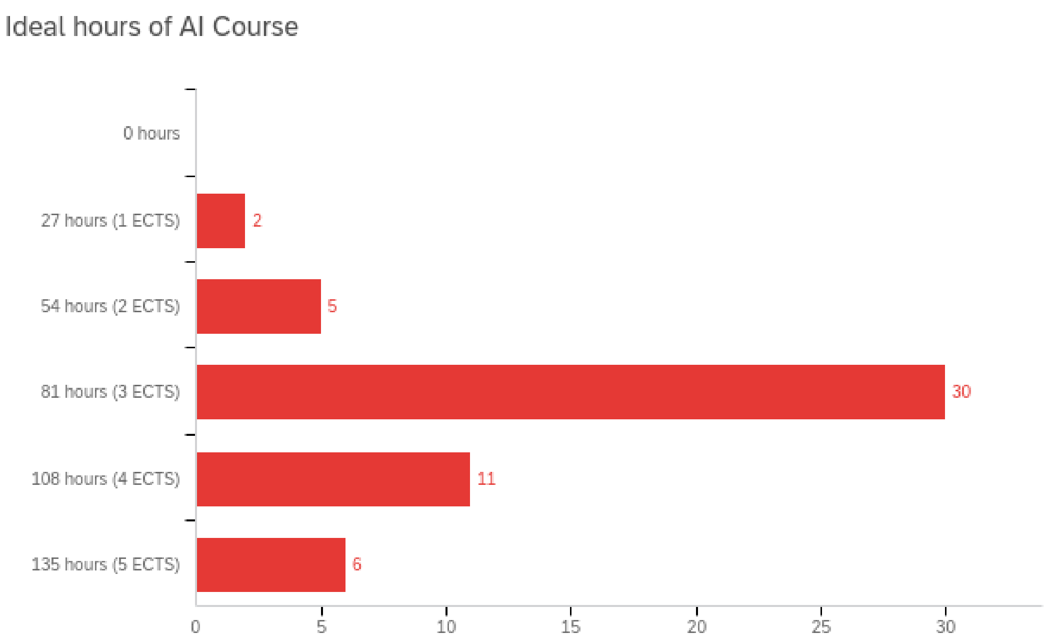


Table 122 : Ideal hours of AI Course

4.3.4.2.2 Soft Skills

One more time it obvious that the **majority of students from Spain also concider Extremely and Very importan the training of the following competencies (soft skills) for their profession.**

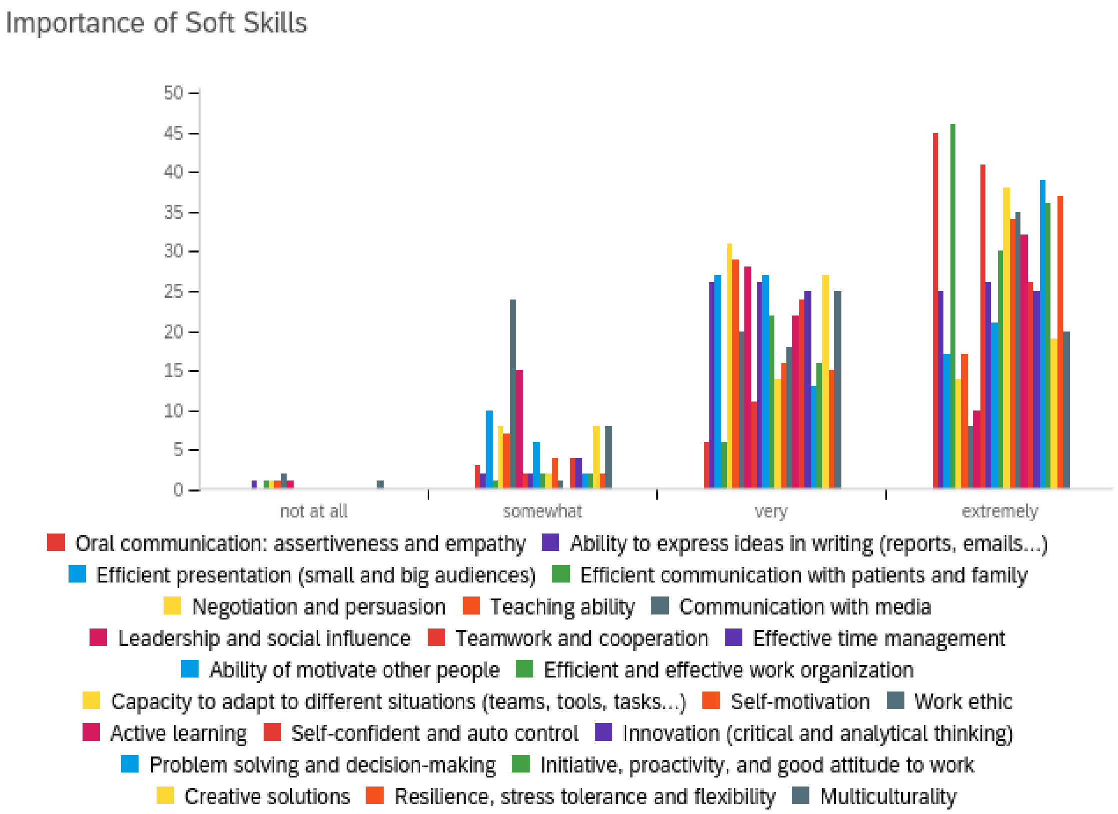


Table 123 : Importance of Soft Skills

On the question *“What do you think would be the most effective way to learn the desirable soft skills?”* the students answered that **Online course is the most preferable educational method** as shown in the graph below.

Most effective way of learning Soft Skills

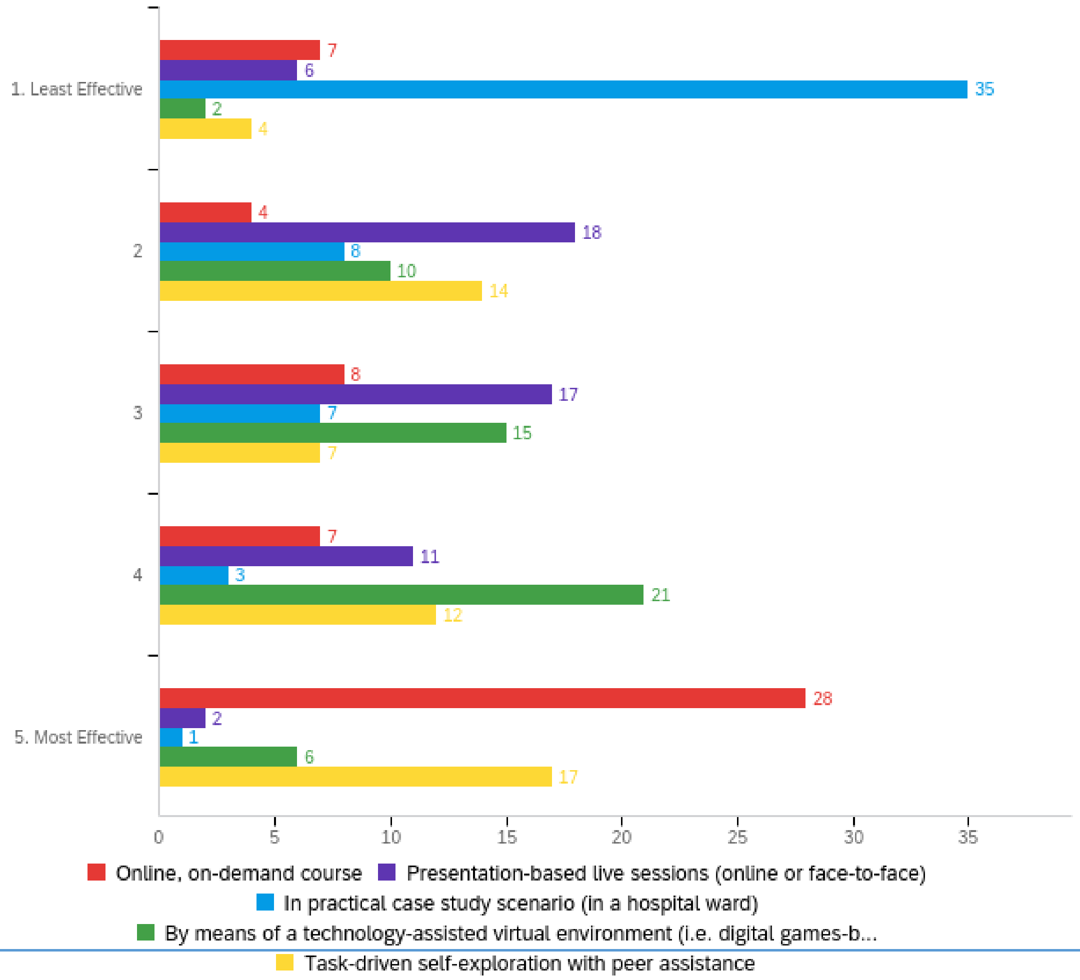


Table 124 : Most effective way of learning Soft Skills

Concerning the introduction of AI subject in the university curriculum, at the question *"Under what condition would you like to study soft skills content in your current curriculum?"* **43% chose as Countinuous Learning, followed by a close 37% which answered as Mandatory Course** and lastly only 20% as an Optional Course.

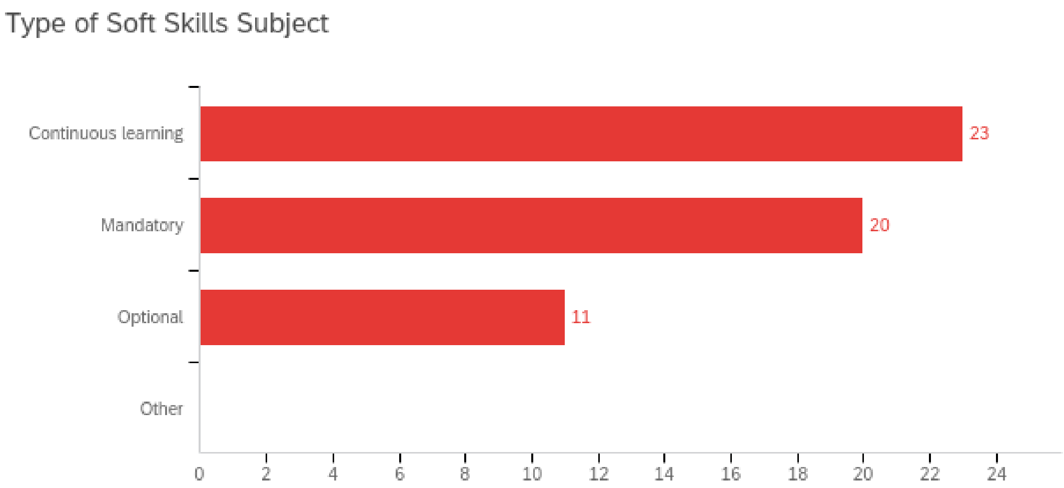


Table 125 : Type of Soft Skills Subject

Finally, in the question *“How many course hours would you be able to spend on learning applicable soft skills?”* as it seems that **41% think that they will be able to attend the course of Soft Skills for 3 ECTS and 30% of them voted for 5 ECTS** and 15% ana 13% for 4 ECTS and 2 ECTS respectively, leaving the 2% choosing 1 ECTS as it is shown in the graph below.

Ideal hours of Soft Skills Course

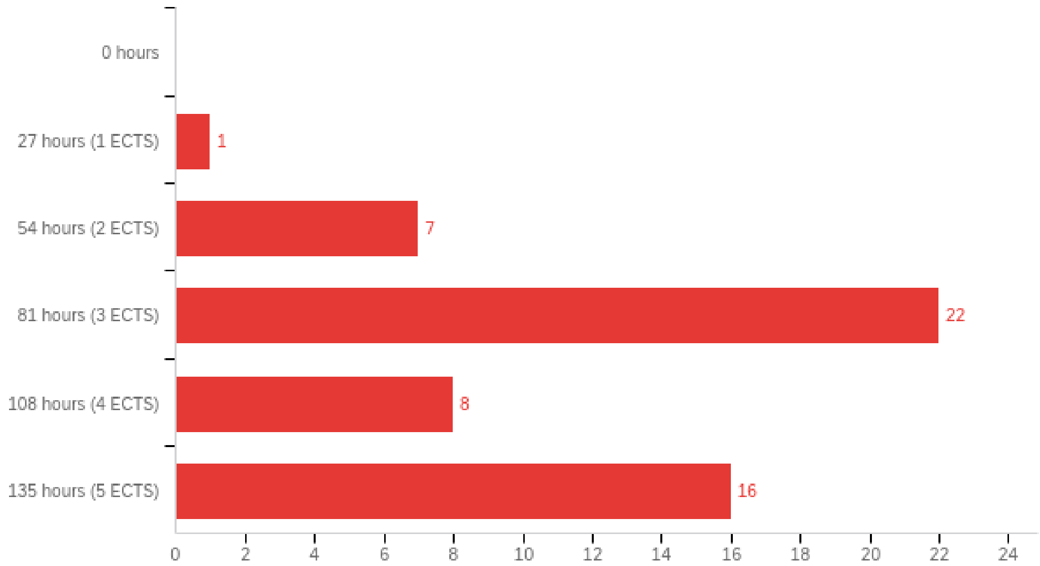


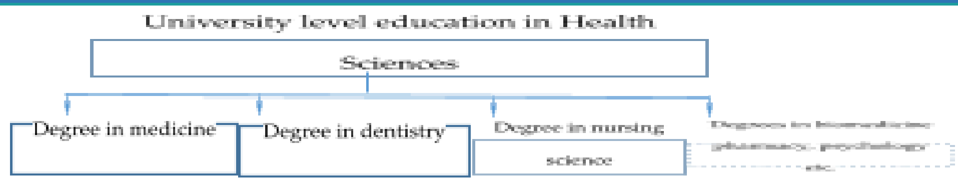
Table 126 : Ideal hours of Soft Skills Course

5 Desk research by Country

5.1 Desk research of Finland

5.1.1 National curricula in Finland

5.1.1.1 Structure

Abstract		
1	The structure of the Medical Schools in Finland	 *In this report, we have focused on the university level education of the degrees in medicine, dentistry and nursing sciences, i.e. to professions working with patients. However, we will present a number of courses on AI and soft skills, which are provided by the discipline of biomedicine in the different Finnish Universities, and*

		which can be taken as elective (optional) studies also within the degrees' studies of medicine, dentistry and nursing sciences. *Specifically, the degree in medicine can be studied in the Universities of Turku, Tampere, Helsinki, Oulu and Eastern Finland, the degree in dentistry in the Universities of Turku, Helsinki, Oulu and Eastern Finland, and the degree in nursing sciences in the Universities of Turku, Tampere, Oulu, Eastern Finland, and Åbo Akademi University.*
2	The structure of curricula	*In* ***Medicine*** *or* ***Dentistry,*** *the degree in Finland consists of 12 or 11 semesters, respectively. This means 6 or 5,5 years of full-time studying. The curriculum consists of preclinical (2-3 years) and clinical studies in the Universities of Turku, Helsinki, Oulu and Eastern Finland. Tampere University applies a problem-based learning pedagogy and, thus, preclinical and clinical studies are taught together. In all the Finnish Universities the curriculum of medicine consists of 360 ECTS and dentistry of 330 ECTS, similarly to other European Universities. Most of the studies are fixed and*

		harmonized across the medical faculties, based on the core learning objectives. However, there are a few ECTS for optional (elective) studies included (about 10-30 ECTS, depending on the university) *In **Nursing Science** there are two degrees available: Bachelor's degree in Health Sciences and Master's degree in Health Sciences. Students are generally required to have a nationally recognized first cycle degree: normally a Bachelor's degree from an accreted institution of higher education from relevant field. A Bachelor's Degree in Health Sciences consists of 2 semesters, which means one year of full-time studying. The curriculum for Bachelor in Health Sciences contains 180 ECTS, out of which 120 ECTS is credited from prior education – that is the required first cycle degree (Bachelor's degree).* *The Master's degree in Health Sciences consists of 4 semesters, which means two years of full-time studying. The curriculum for Master in Health Sciences contains 120 ECTS. Studies are offered mainly in Finnish language but in most universities,*

		some courses are offered in English as well. Students can choose to specialize in nursing leadership and management with expertise in several clinical areas or in health education and the didactics of nursing science (teacher training). The offered programs and the options for specializing vary by different universities. The contents of the curricula for Bachelor in Health Sciences and Master in Health Sciences are different, depending on the university. However, the degrees are similar in structure and law regulates core-learning objectives. Additionally, UTU, in collaboration with the Fudan University, Shanghai, China, provides an International Double Master's Degree Program in Future Health & Technology (120 ECTS) which is provided fully in English (application requirement Bachelor's Degree in Health Sciences).
3	Similarity	*As mentioned above, the degrees in medicine and dentistry are very similar in all the Finnish universities since the core learning objectives are regulated by the law. The basic structure and requirements of the degree of medicine and degree of dentistry (Licentiate in Medicine and Licentiate in Dentistry, respectively) studies are similar to those in other European countries. However, regarding the optional (elective)*

		studies there are minor differences between the Universities. *The degrees in nursing science are similar in structure, but vary in content. Universities offer programs on management and leadership, teacher education, and several clinical areas such as general clinical, gerontological nursing science and mental health and technology (in English).*
4	Depth	*The courses teaching AI vary a lot depending on the University, and the particular topic. Currently, AI courses evolve rapidly, incited by the real life needs and new technology developed for the use of health care sector and medicine &dentistry. Thus, the need for such courses is imminent, both the more general and in-depth courses.* *Similarly, the courses teaching soft skills vary depending on the University. It is important to acknowledge, that besides being taught in specific soft skills courses, components of soft skills are incorporated in a wide variety of theoretical and practical courses teaching different topics of medicine, dentistry and nursing science/health care.*

5.1.1.2 *Courses in Finland*

5.1.1.2.1 Courses of AI

In the Medical Faculties of Finnish Universities there are a few courses in which Artificial Intelligence (AI) and various medical AI-applications used in medical practise are being taught.

Numbering 1.1.1		
1	Course title	*AI in diagnostics, drug discovery & development, and bioimaging (Degree in Biomedicine)* *AI Academy* *University of Turku*
2	Course description	*The course teaches AI applications for processing of genome data and medical imaging data, both of which contribute to and are utilized by the*

		biobanks and digital pathology. *In addition, during this course, students will learn how AI is used to instruct the mining of large sets of medical data for the development of medical instrumentation.* *Finally, students will learn how AI helps to model the interactions between a drug molecule and its target molecules, reveal new interactions/innovate new putative drug molecules and, consequently, predict how a drug candidate will behave in the human body. (link)*
3	Learning outcomes (LOut)	*In this course the Student:* *1) will learn about the use of AI in modern medical research and diagnostics* *2) will understand how medical data mined from different sources (such as bioimaging results, medical reports and case summaries,*

		and laboratory results) can be combined with the help of AI, and how deep learning helps to find completely new analogue relationships. 3) will learn how to apply their knowledge of AI to understand how AI enables mining and exploiting of big data proficiently.
4	Language	*Finnish*
5	ECTS\Hours	*2*
6	Key words	*Artificial intelligence, AI, bio banking, digital pathology*
7	Structure of the course/curriculum	*Theoretical lectures 6 x 1,5 hours* *Independent online learning 45 hours*
Numbering 1.1.2		
1	Course title	*How AI can support Health Science* *AI Academy, Degree in Nursing*

		University of Turku
2	Course description	*The course will provide the student an understanding on (1) how health data accumulates during an individual's lifespan, (2) how these data are stored in the national and local medical record, and (3) how these data can be used for different analyses in order to increase the overall health at the population and individual level.* *(link)*
3	Learning outcomes (LOut)	*In this course the Student:* *1) will get an understanding of the data that accumulates during a lifetime of one individual* *2) knows where the data are preserved in national and local medical registries* *3) will get an idea how health data can be utilized for deep learning analysis to produce health benefits at a population and individual*

		level through better diagnoses, treatments, recommendations and guidelines
4	Language	*Finnish*
5	ECTS\Hours	*1 ECTS*
6	Key words	*Artificial intelligence, data analysis, medical records*
7	Structure of the course/curriculum	*Three separate entities (modules):* I. *Information systems (National Social Affairs and Health/Medical data information systems and records/registries)* II. *Health records (saved in registries of the general practice doctors/nurses and specialists)* III. *Using and implementing health data (examples of applications are from the Digital Nursing Turku, University of Turku)*

		Lectures 10 hours, seminars 10 hours

Numbering 1.1.3		
1	Course title	*Health Technology – When a Physician and an Engineer meet* *Degree in Medicine and Dentistry* *University of Turku*
2	Course description	*A joint course for medicine and engineering degree students where they build multidisciplinary teams to share and combine their knowhow for the benefit of a joint goal, which is to explore, showcase and explain a health technology innovation to other teams/course participants and their teachers. The course includes visits to a company/hospital/health technology developer or provider, chosen by the team. (link)*
3	Learning outcomes	*In this course the Student will:*

	(LOut)	1) *familiarize themselves with health technology/applications from the perspectives of both a physician and an engineer* 2) *gain multidisciplinary perspective, and develop meta-skills to communicate with experts of different fields* 3) *increase their understanding and knowhow of product development processes, and get a boost for their own innovativeness* 4) *gain insight in the ethical challenges related to health technology* 5) *learn how to function as an expert in a multidisciplinary team of product development*
4	Language	*Finnish*
5	ECTS\Hours	*3 ECTS*
6	Key words	*product development, innovation, health technology*
7	Structure of the course/curriculum	• *Three lectures* • *Visit(s) to a company/hospital/health technology developer or*

		provider/etc., which develops or uses a (new) health technology application; choosing of the topic and the technology for the project work ● *Teamwork in the multidisciplinary teams* ● *Oral presentation of the Team's project work and its outcome*

Numbering 1.1.4		
1	Course title	*Health Care Processes and Information Systems* *Degree in Biomedicine* *University of Tampere*
2	Course description	*The purpose of the course is to give students a general understanding of applying ICT technologies in the area of health care, with the focus on the special needs placed for information management in this area.*

		The course aims to: 1. *provide students first a basic understanding of health care processes and health care systems: how they are managed, organized and funded in Finland and in other countries* 2. *present the specifics of health information, how it is utilized in health information systems, what are the key standards and how they are utilized in building health information systems* *The course is intended especially for those students who are planning to work in the health care domain, either in research and development or in managerial roles. (link)*
3	Learning outcomes (LOut)	*In this course the Student will:* 1) *learn to understand and describe the basic processes and governance principles applied in the health and social care domain,*

		and understands how this knowledge can be applied for defining and building health ICT solutions. 2) learn to understand the key principles of health information and key standards related to storing and transferring health information, and how they are utilized in health ICT systems 3) learn to know the definitions, terminology, concepts and architectures of key health information systems, with focus especially on the electronic patient record and personal health record 4) learn to know the principles of health ICT project management, development processes and key measures utilized in the assessment of the quality and effectiveness of health ICT. 5) learn to be aware of the typical pitfalls that can be encountered in health ICT projects and understands the specific role of user-centered development in the health ICT domain.

		6) *get a general understanding of the future trends affecting health ICT development, such as personalized medicine*
4	Language	*English*
5	ECTS\Hours	*5 ECTS*
6	Key words	*Health ICT systems*
7	Structure of the course/curriculum	*Lectures, exercises and multidisciplinary team work*

Numbering 1.1.5		
1	Course title	*Big Data and AI in Clinical Medicine* *Degree in medicine* *University of Helsinki*

2	Course description	*AI and the data (so called "big data"), collected through various methods and technologies, will strongly effect and change the way health care and medical professions will be performed in the near future. The aim of this course is to address these challenges. (link)*
3	Learning outcomes (LOut)	*In this course the Student will:* *1) learn to discuss the concepts of AI and big data* *2) get an insight in how various laboratory results of patients and AI affect clinical work and decision making* *3) learn to describe how data collected through precision medicine related methods and technologies can be used in clinical work and decision making*
4	Language	*Finnish, English*
5	ECTS	*2,5 ECTS*

6	Key words	*Artificial intelligence, AI, Big Data, Clinical Medicine*
7	Structure of the course	1. *Classroom meetings 6 x 3h, with the following topics:* ● *Big Data and AI in clinical work of medicine – An Introduction* ● *Applying AI in physician's work* ● *AI applications – examples from the clinic* ● *The need of a people-driven aspect for the (use of) AI and big data based applications in health care* ● *Big data and and AI in precision medicine and research* 2. *Course admission assignment (prior to course) 6h* 3. *Teamwork 10h* 4. *Independent studying 32h* 5. *Course results evaluation and feedback 1 h*

Numbering 1.1.6		
1	Course title	*Basics in eHealth* *Degree in Medicine and other Health Sciences* *University of Oulu*
2	Course description	*The course will cover the following topics:* ● *Terms and concepts* ● *Societal dimensions* ● *Delivery of health services* ● *Electronic patient records* ● *Data transfer within the health care system* ● *Data transfer between the health care professionals and the citizens* ● *Citizens providing their own health data, mHealth-solutions* ● *National healthcare information exchange in Finland* ● *Remote consultations, examples like teleradiology, telepsychiatry, telerehabilitation*

		• *Economical and functional assessment* • *Remote education in health care* • *Future visions of health care information systems* *(link)* *In addition: changing topics related to health sciences according to availability, such as:* • *Artificial Intelligence,* • *Knowledge based medicine,* • *Cybersecurity*
3	Learning outcomes (LOut)	*In this course the students will:* *1) learn to define central information and communication technology (ICT) terms and solutions in healthcare, and can list respective applications in healthcare services and training.* *2) learn to evaluate the societal and economic significance of information and communication technology in healthcare*

		3) *learn to understand the position of e-health and telemedicine solutions as a part of the national health care information system.* 4) *receive an initial view of future health ICT trends from clinical perspective and possibilities to contribute to these with their professional background*
4	Language	*English*
5	ECTS\Hours	*5 ECTS*
6	Key words	*eHealth, telemedicine*
7	Structure of the course/curriculum	*Web-based teaching. Learning and interaction take place in virtual learning environment Moodle.* *The course consists of videotaped lectures, power point presentations and links to other material available in the web.* *The assignments for students include short essays with peer reviewing, exams and participating in moderated discussions based on the lectures:*

		• *Web/online lectures 15h* • *Web/online exams 40h* • *Written tasks / essays 40h** • *Self-paced studying and participation in the web discussion 40h*

5.1.1.2.2 Courses of Soft Skills

The courses descibed below are those in which the *focus* is on soft skills and which are currently being taught by different Medical Faculties in Finland. It is important to acknowledge, however, that in the curricula of the Medical Faculties soft skills contents are embedded into several other courses as well, where the main focus of the course can be on a wide range of other topics/medical specialities. We only chose courses where soft skills are specifically mentioned in the course description and/or learning outcomes. These courses, which are also depicted in the Figure 1, below, are being taught in six Finnish universities in the disciplines of Medicine, Dentistry and Health Sciences /Nursing Science.

To obtain this list, we first screened and selected manually the study guides (containg all the courses listed in the curricula) of the above mentioned disciplines and faculties. Secondly, the study guides were screened using a computer programmed code to identify the study modules, and to find their corresponding web pages. A second computer assisted search was performed to find out the study codes/course abbreviations of the various courses, the names of the courses and their learning outcomes. Lastly, the search also indicated whether any pre-defined key words referring to soft skills were mentioned in the names and/or learning outcomes of the courses.

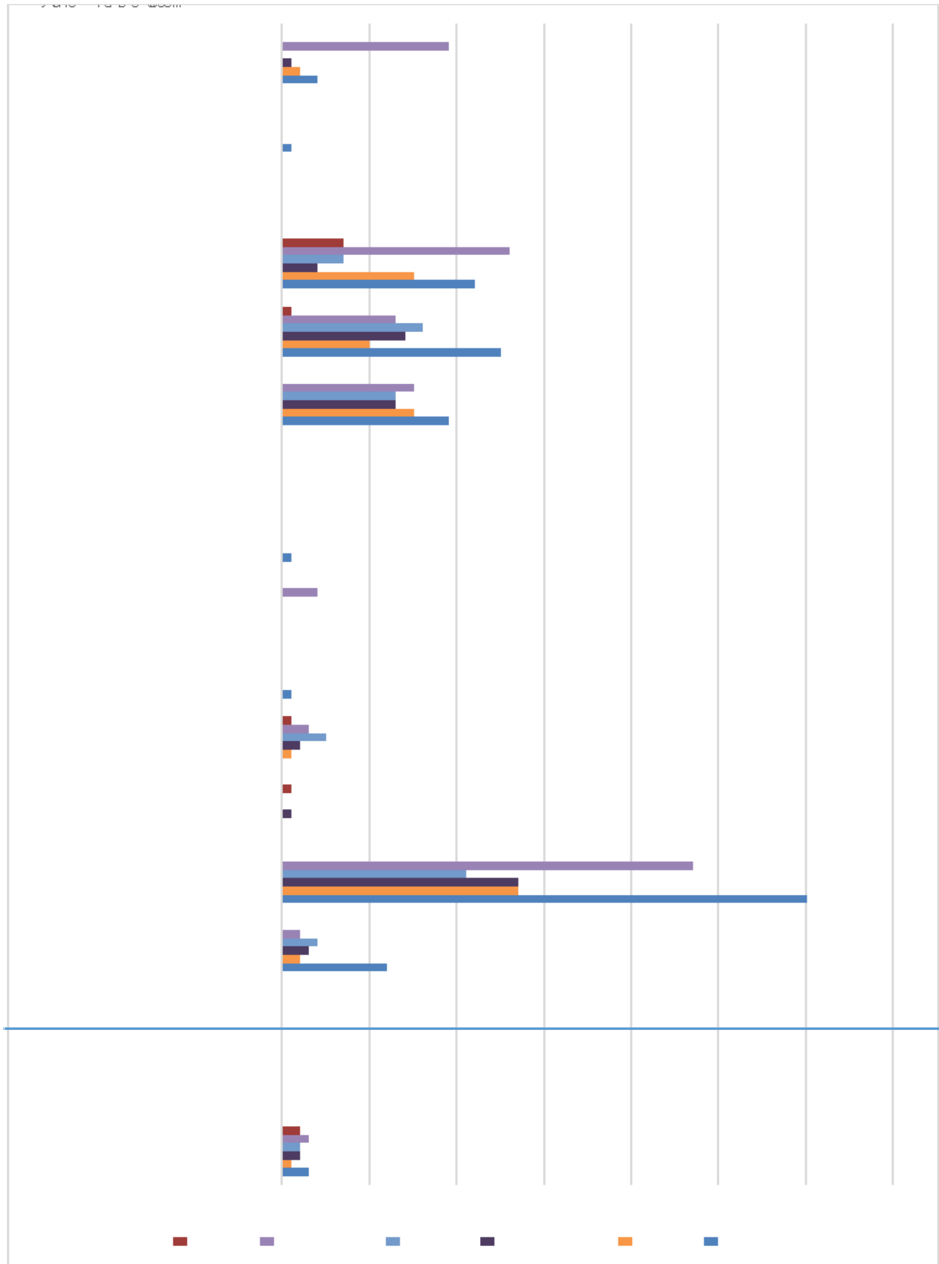


***Figure 1**. Courses of soft skills taught in the disciplines of Medicine and Nursing Sciences in the Finnish Univeristies. Key words are listed on the left column. The (bars of) six different universities* are marked with different colours. The longer the horizontal bar, the bigger the number of courses that are being taught on the said topic. For the explanation how the data mining was performed, see the text above.*

** Abo = Åbo Akademi University*

** Helsinki = University of Helsinki*

** Oulu = Univeristy of Oulu*

** Tampere = Univeristy of Tampere*

** UEF = Univeristy of Eastern Finland*

** Turku = Univeristy of Turku (UTU)*

Numbering 1.2.1		
1	Course title	*Personal Growth and Career Planning (T5-T6)* *Degree program in Bioscience* *University of Turku*

2	Course description	*(link)* *In the career development seminars different bio/medicine career choices and international opportunities will be introduced to the students, as well as a number of national companies and other employers within the field of bio/medicine.* *In addition, alumni will participate in the seminars and introduce their field of work, career paths and work experience. The topics introduced and discussed may vary in different years.* *In the spring semester the students participate in thesis and project work seminars in order to enhance their own scientific thinking*
3	Learning outcomes (LOut)	*In this education entity the Student will:* *1) get help to integrate themselves into the University and its Medical Faculty, which comprises one body of education/learning and research community. The students get support throughout their studies in planning of their studies and career, and making progress in them*

		2) *learn to advance communication and networking skills, which will be integral to communication between the students, teachers, and those already working as specialist and professional in the various professions of the bio/medical field.* 3) *in a special career path planning/career building seminar series will introduce the students to different companies, workplaces and employers within the bio/medical field, and the skills and knowhow that are required for becoming a successful employee. Building the students' professional identity and helping them to grow as experts in their field are being carried out through the example of and encouragement by alumni.* 4) *enhance the development of their scientific thinking by presenting their project and dissertation work in the annual seminars. Students will get*

		feedback of their work and progress. Consequently, the students will learn to identify and recognize the knowledge, skills and various assets they have gained to become experts and scientists in the bio/medical field.
4	Language	*Finnish*
5	ECTS\Hours	*1 ECTS*
6	Key words	*Networking*
7	Structure of the course/curriculum	*1. Active participation in the Personal Growth and Career Planning seminars in each semester, and writing of a learning diary based on each of them* *2. Active participation in the meetings with the Mentor and completing the assigned portfolio building tasks* *3. Writing of a personalized study plan and updating it annually in the University's electronic study planning system (HOPS).*

		4. *Attending the thesis work seminars by student colleagues.*

Numbering 1.2.2		
1	Course title	*Team Communication and Leadership* *Degree programme in Medicine* *University of Turku*
2	Course description	*(link)* *The students familiarize themselves with the principles of interaction and group communication phenomena, and functioning as a team leader and the tasks it requires.* *They get a view and an understanding of the interactions and relationships of a multidisciplinary team, as well as how to be a dialogical and good listener.*

		The students will get an idea and understanding of their own interaction skills, practice team communication, and analyze and specify team interactions.
3	Learning outcomes (LOut)	*In this course the Student will:* 1) *learn to understand the importance of communication and its possibilities in team work and team leadership* 2) *learn to know central communication phenomena of teamwork and communication, and* 3) *learn to recognize factors affecting team interactions within a team* 4) *learn to know how to contribute to the team spirit, what factors play a role in it, and how to enhance the decision making as a team leader* 5) *learn to give constructive criticism to others in the team and how to receive criticism themselves regarding their own performance in the team*
4	Language	*Finnish*
5	ECTS\Hours	*1 ECTS*

6	Key words	*Communication, leadership*
7	Structure of the course/curriculum	1. *Active participation in the course* 2. *accomplishing the course assignments, such as essay writing and practical work*

Numbering 1.2.3		
1	Course title	*Digital Management and Leadership in Health Care* *Master of Health Sciences* *University of Turku*
2	Course description	*(link)* *The course will cover the following topics:* ● *Knowledge management and health technology in leadership* ● *Health care data architecture* ● *Data collection, management and usage*

		• *Big Data, data and text mining* • *Digital health services* • *Health care information systems* • *Data security*
3	Learning outcomes (LOut)	*In this course the Student will:* 1) *learn to understand the basic concepts of health technology as part of leadership and management in health care.* 2) *learn to understand the possibilities of health technology as part of leadership and management in health care.*
4	Language	*English*
5	ECTS\Hours	*5 ECTS*
6	Key words	*Leadership, management*
7	Structure of the course/curriculum	*The course consists of:* 1. *lectures and seminars*

		2. *independent work* 3. *group / teamwork* 4. *written assignments*

Numbering 1.2.4		
1	Course title	*Design Thinking in Healthcare Innovation* *Master of Health Sciences* *University of Turku*
2	Course description	*(link)* *The course concentrates on Design Thinking (DT) process and its application in health care innovation process. It will cover the following topics:* ● *solving of real-life clinical problems during the course* ● *using of the six-phased DT process, from empathizing to testing in multidisciplinary groups*

		The course is suitable for master and doctoral level students of Health and Life Sciences, who are interested in learning about the possibilities of solving clinical problems in health care within a group using a Design Thinking approach.
3	Learning outcomes (LOut)	*The objective for this course is to get a basic understanding in Design Thinking (DT) in healthcare innovation process.* *In this course the Student will:* 1) *learn the basics of DT process and understands how to apply it in health technology and health care* 2) *learn how to use collective thinking and DT approach in solving real-life clinical problems* 3) *develop discussion and presentation skills and understand the principles and importance of group dynamics* 4) *adopt a new mindset and a way of thinking*

		5) *increase their ability to apply the DT approach in an innovation process*
4	Language	*English*
5	ECTS\Hours	*2 ECTS*
6	Key words	*Leadership, management*
7	Structure of the course/curriculum	*The course consists of the following material and assignments for the students:* ● *Weekly online material (articles and video lectures)* ● *Written assignments* ● *Weekly seminars and group working* ● *Design Thinking in Healthcare Innovation* ● *OPS*

Numbering 1.2.5

1	Course title	*Intercultural competence and professionalism* *Health Sciences* *University of Eastern Finland*
2	Course description	*(link)* *Concepts related to inter-culturalism, multiculturalism, professional development, critical incidence technique*
3	Learning outcomes (LOut)	*In this course the Student will:* *1) be able to describe the key concepts related to inter-culturalism and professional development* *2) be able to connect and demonstrate these concepts to the own academic field and future work* 3) *be able to demonstrate a link between inter-culturalism and own future work* 4) *be able to analyze the role of professional development in the multicultural working environment*

4	Language	*English*
5	ECTS\Hours	*5 ECTS*
6	Structure of the course/curriculum	*The course consists of:* ● *Independent studying in Moodle learning environment (129 hours),* ● *Writing of scientific essays and using critical incidence technique* ● *Group discussion in Moodle learning environment (6 hours)*

Numbering 1.2.6		
1	Course title	*Health Technology and Life Science Business* *Master's Programme in Biomedical Technology* *Tampere University*
2	Course description	*(link)* *The course will cover the following topics:*

		Introduction of health tech and life science industries *Business economics and business models* *Legal aspects of partnering and finance* *Entrepreneurial mindset and business thinking* *Design thinking in Business* *Go to market approaches* *Entrepreneurial finance* *Market analysis / How to structure a VC pitch* *How to establish a company*
3	Learning outcomes (LOut)	*In this course the Student will:* 1) *get a basic understanding of the Health Tech and Life Science business environment.* 2) *gains knowledge on what an inventors needs to understand about business and finance when targeting on to exploit the commercial value of their solutions.*

		3) *be able to apply when they will make a course work.* 4) *participate the actual/real life innovation projects in SPARK Finland during their course work* 5) *make work related to business plan, go-to-market plan, financing and market analysis for the projects* 6) *present group work as written document and as an oral presentation in a seminar* 7) *assess the work of other groups and received criticism* 8) *gain solid basis for business expertise in their later career either as entrepreneurs, in industry or in academia.*
4	Language	*English*
5	ECTS\Hours	*5 ECTS*
6	Key words	*Innovation, entrepreneurship*
7	Structure of the	*Approved learning diary and assignment*

	course/curriculum	*Participation in teaching*

Numbering 1.2.7		
1	Course title	*In the News: Viewpoints and Values Represented in International Media* *Bachelor's Programme in Health Sciences* *Tampere University*
2	Course description	*(link)* *The course will cover the following topics:* ● *Societal, political or economic news items* ● *Media literacy & text types* ● *Values represented in the media* ● *Media bias*

3	Learning outcomes (LOut)	*In this course the Student will:* 1) *learn to interpret and explain news stories reported in various media outlets and languages* 2) *learn to describe and evaluate varying viewpoints, values and practices depicted by the news sources* 3) *learn to discuss the objectivity and possible bias in both the information and opinions expressed in the media*
4	Language	*English, Finnish*
5	ECTS\Hours	*2 ECTS*
6	Structure of the course/curriculum	*Participation in teaching*

Numbering 1.2.8

1	Course title	*Entering the Global Workplace: Interculturality and Communication* *Bachelor's Programme in Health Sciences* *Tampere University*
2	Course description	*(link)* *The course will cover the following topics:* ● *Culture vs organizational culture* ● *Internationalization of the workplace at home and abroad* ● *Globalization, localization and glocalization* ● *Languages in the workplace: key or lock?* ● *Communication and negotiating conflict*
3	Learning outcomes (LOut)	*In this course the Student will:* *1) learn to identify the similarities and/or differences between culture(s) and organizational culture* *2) learn to recognize the characteristics and opportunities of the globalized workplace*

		3) *learn to identify how language impacts opportunities and accessibility in the workplace* 4) *learn to formulate strategies to adapt and develop intercultural competence in a multicultural working environment*
4	Language	*English*
5	ECTS\Hours	*2 ECTS*
6	Structure of the course/curriculum	*Participation in teaching*

Numbering 1.2.9		
1	Course title	*Biodesign innovation* *Degree Programme in Medicine*

		University of Helsinki
2	Course description	*(link)* *The course will cover the Biodesign process, consisting of:* ● *needs identification* ● *concept creation* ● *customer-centric design* ● *intellectual property basics* ● *regulatory process of medical technology*
3	Learning outcomes (LOut)	*In this course the Student will:* 1) *have a background and understanding in medicine related activities (study programmes of the medical faculty).* 2) *have the ability and inclination to innovative thinking and interest towards productization of innovations as being a prerequisite* 3) *understand the basics of Biodesign innovation process and how to perform them in both theory and through practical exercises.*

4	Language	*English, Finnish*
5	ECTS\Hours	*5 ECTS*
6	Key words	*Innovation, biodesign, productization, commercialization medical technology*
7	Structure of the course/curriculum	*Course is implemented with blended learning with:* • *lectures* • *small groups /team work* • *decentralized training* • *seminar presentations*

Numbering 1.2.10

1	Course title	*Let´s lean – Lean and healthcare operations management* *Degree Programme in Medicine* *University of Helsinki*
2	Course description	*(link)* ***Part I*** *Methods of industrial engineering and management in operation leadership and development 2,5 ECTS* *(Course literature: Vissers&Beech Health Operations Management, Lillrank Logics of Healthcare)* *1. Leadership and development methods (Lean, TOC, VBHC, SOM)* *2. Leading the service episodes and departments* *3. Describing and modeling of operations; quantitative methods* *4. The different levels of functioning in leadership and development: the operative, tactical, and strategic levels*

		Part II: Lean *(the concept of lean), 2,5 ECTS:* *5. Deepening the general overview (standardizing work; systematic and continuous development of standardized work; Lean) and independent studying of literature: "This is Lean"* *6. Lean as a leadership model* *7. 5S Organizing and visualizing a workplace /case studies & narrative* *8. Standardization and development of work and care in leading the daily work – theories and stories* *9. The day in a hospital: Practical work / observing or interviewing: 'shadowing a patient'(patient/nurse/physician/other)* *10. Practical work*
3	Learning outcomes (LOut)	*In this course the Student will:* *1) get familiarized with systemic thinking and leading and developing of a health care organization*

		2) *understand the methods for developing an industrial engineering and management* 3) *understand the basic principles of 'LEAN' (system thinking, daily governance and leading, 'Lean' as a leadership concept/system, Lean-development)* 4) *know the 5S (in Finnish all the 5 the keywords start with "s": sort out, set in place, clean, make rules of conduct, keep)* 5) *be able to apply analytical development methods for improving operations, work and leadership/management*
4	Language	*Finnish*
5	ECTS\Hours	*5 ECTS*
6	Key words	*Leadership*
7	Structure of the course/curriculum	*The course consists of:* *Seminars* *Workshops*

		Course assignments *Learning diaries* *Quizzes and a final exam* *'Lego'play* *Excursions to hospital and practical work, which will be done in teams*

5.1.2 Vocational Education Training in Finland

Universities in Finland offer 50 specialist training programmes in Medicine and 5 programmes in Dentistry. The number and titles of specialities have been defined in Finnish legislation on specialist education (Decree No 56/2015).

Specialist training in medicine/dentistry can be taken by professionals licensed by the National Supervisory Authority for Welfare and Health (Valvira) of Finland. The specialist degree requires usually 5 or 6 years of medical practice including at least 9 months of services in public health care centers, theoretical and administrative courses and passing a national written exam.

In Finland Universities do not provide any specific curricula or courses. While the Faculty grants the study right, the training itself takes place within the health care system.

The selection of physicians to the training posts at Faculty-approved training units is conducted as per the respective selection procedures of the organisations in question.

5.1.3 Policy making policies in Finland

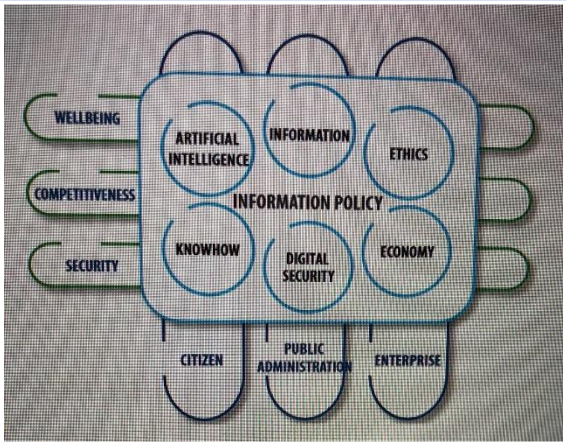
3.1 National Health AI/soft skills Strategy

The previous government (2015 – 2019) of Finland made artificial intelligence (AI) as one of its key projects. The Minister of Economic Affairs launched the Artificial Intelligence Programme in May 2017. Later in the same year, the first eight key actions were presented for making Finland one of the leaders in the application of AI. This work was later supplemented with separate analyses and recommendations for measures on the future of work, ethics and security. (1) It should be mentioned that the governmental funding programs steer strategic decisions, as discussed below in 3.3.

3.2 Policy Principles for AI/soft skills in Health

Finland's stability and security combined with high technology utilization rate and education level provide an excellent platform for the creation and development of digital business. The development of data policy and data management in a way that takes the different life situations of citizens into account is a unique innovation by global standards. (2)

Figure 2. Key dimensions of information policy in Finland, according to the Publications of the Ministry of Finance – 2019:39, reference (2).



In addition to the policy making ministries of the central government of Finland, several universities and other research institutions have actively contributed to the discussion about the **policy making principles for AI**, such as the Helsinki Centre for Data Science (HiDATA), University of Helsinki Legal Tech Lab and the Finnish Center for Artificial Intelligence (FCAI)(3). Figure 3(3) sheds light to some of the topical legal issues involved in AI development and policy making, which culminate in the interrelationship between law, technology and society. A comprehensive yet compact presentation about the problems of policy making regarding AI can be found in the below reference (3).

Figure 3. The three grand scientific objectives: data efficiency, trust & ethics, and understandability**,** according to FCAI publication Regulation of AI, reference [(3)]

As the topic of AI & health data in the context of policy making includes also new person-generated data, recommendations should be discussed and, consequently, applied in the EU and its member states, as discussed in Finland e.g. in "Towards trustworthy health data ecosystems” (4) and “Finland’s AI course to contribute to digital skills of Europeans across the continent” (5).

Several national programs have been set to enhance the ethical use of AI in the health sector services, such as the government-led ‘Well-being and Health Sector Artificial Intelligence and Robotics (“HyteAiRo”) Programme’, which will support and speed up the utilization of AI and robotics within health sector’s services. The AiRo Programme is a joint programme between all parties for communication and development. (6) UTU, and more specifically two of its AIIS team members, Dr Salanterä and Ruusuvuori, are active partners and expert members in the multidisciplinary HyteAiRo consortium.

3.3 Strategy in national funding for AI

In Finland, the government has two long-standing major funding agencies, ‘Academy of Finland’ and ‘Business Finland’ which also fund -and thereby steer strategies of- AI research and AI application development. Business Finland’s AI Business program (7) accelerates the global growth of the Finnish digital service business. AI and platform economy can automatize currently localization-dependent operations and services (7). Most recently, the current Government (started in December 2019) announced the

National Artificial Intelligence Programme AuroraAI (8) based on its strategic objectives for building a dynamic and thriving Finland. The program will create an AuroraAI network, which will be available for citizens and organizations by the end of 2022 to. These funding instruments enable Finland also to provide significant international services. (7)(8)

In addition to the government there are many private funding institutions contributing to funding of scientific research including AI research and development.

References:

1. Final Report of **Finland's Artificial Intelligence Programme 2019** "Leading the way into the age of artificial intelligence" https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/161688/41_19_Leading%20the%20way%20into%20the%20age%20of%20artificial%20intelligence.pdf?sequence=4

- **The National AI strategy** entitled Finland's age of artificial intelligence (2017) by the Finnish Ministry of Economic Affairs and Employment *https://knowledge4policy.ec.europa.eu/ai-watch/finland-ai-strategy-report_en*
- Artificial Intelligence Programme **in Finland** ("AI Finland") *https://www.tekoalyaika.fi/en/*
- **The National Artificial Intelligence Programme "**AuroraAI" **2020-2022** https://vm.fi/en/national-artificial-intelligence-programme-auroraai > ref.# 8

2. **Information policy and ethics** – the future is known "Key dimensions of information policy", in: Publications of the Ministry of Finance – 2019:39 https://www.suomidigi.fi/sites/default/files/2020-06/VM_2019_39_Glimpses_of_the_future.pdf , pages 20-24, Figure 4.

3. **How is law regulating Artificial Intelligence** (AI), in: https://fcai.fi/eab-blog/2020/10/20/regulating-ai-is-the-current-legislation-capable-of-dealing-with-ai

4. Towards trustworthy **health data ecosystems** https://www.sitra.fi/en/publications/towards-trustworthy-health-data-ecosystems/

5. Finland's AI course to contribute to **digital skills of Europeans** across the continent *https://tem.fi/en/-/finland-s-ai-course-to-contribute-to-digital-skills-of-europeans-across-the-continent*

6. The Well-being and Health Sector Artificial Intelligence and Robotics Programme https://stm.fi/en/the-well-being-and-health-sector-s-artificial-intelligence-and-robotics-programme-hyteairo-

7. The AI Business program https://www.businessfinland.fi/en/for-finnish-customers/services/programs/ai-business

8. The National Artificial Intelligence Programme "AuroraAI" 2020-2022 https://vm.fi/en/national-artificial-intelligence-programme-auroraai

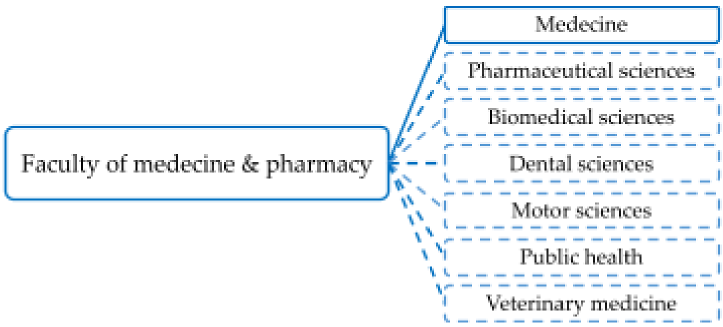
5.2 Desk Research of Belgium

5.2.1 National Curricula in Belgium

5.2.1.1 Structure

The existing situation in national level: it refers to official degree and postgraduate degree (official master´s degree and postgraduate studies)

Abstract

1	The structure of the Medical Schools in each country	*In Belgium we have this structure:*  *Faculties of medicine and pharmacy include medicine (clinical sciences), pharmaceutical sciences, dental sciences, biomedical sciences, veterinary medicine, motor sciences and public health.* *Becoming a Doctor of Medicine (MD) in Belgium means following basic medical training consisting of a 180 credits bachelor's and a 180 credits master's degree. According to the Belgian medical legal system, additional residency training in*

		combination with an advanced master's education (general practice/family medicine, specialty medicine, etc.) is compulsory to become active as a professional physician who can and may practice medicine at his or her own responsibility within the Belgian legal and social security framework.
2	The structure of curricula	*The education to become a professionally active physician is phased through three cycles with an increasing degree of acquired competences:* *1. Bachelor's degree* *180 ECTS, equivalent to three years.* *It includes the basis and introduction in Medical Science, Health Statistics, and other intermediate disciplines useful for Medicine (physics, biology, chemistry, biochemistry, immunology, embryology, physiology, microbiology, immunology and some basic pathology and clinical skills).* *2. Master's degree* *180 ECTS, equivalent to three years*

		The master's degree offers training in a diagnostic and therapeutic approach modeled on clinical practice, organized within sectors, which integrate the different specialties, to cover all aspects of the management of a pathology, from history to treatment. It includes; *• extensive clinical education in all areas of medicine;* *• a large number of internships in the various hospital services* *The bachelor's degree + master's degree led to the MD degree, the starting point for the advanced master's degree to become a practicing physician.* *ECTS stands for European Credit Transfer and Accumulation System.* *3. Advanced master's degree* *The advanced program consists of 120 to 180 ECTS credits as well as a professional medical residency training lasting three to six years depending on the medical specialty.* *It is possible to pursue doctoral training to obtain a PhD-degree after obtaining a master's degree. Doctoral training can occur during or after the advanced master's*

		degree in specialty medicine.
3	The structure of curricula (postgraduate studies)	*To become a professionally active physician a third education cycle "Advanced master's degree" is needed after the bachelor and master.* *The advanced program consists of 120 to 180 ECTS credits as well as a professional medical residency training lasting three to six years depending on the medical specialty. It is possible to pursue doctoral training to obtain a PhD-degree after obtaining a master's degree. Doctoral training can occur during or after the advanced master's degree in specialty medicine.*
4	Similarity	*The medical curricula in Belgium have almost no differences compared to other curricula around the world. They have the same timeframe for the whole degree program which is 6 years long (3 bachelor + 3 master) with an extra two years to become a general doctor or 3 to 6 years to become a specialist. However, the arrangement or the order of the topics that will be taught and discussed is different for every university.*

5.2.1.2 Courses

Numbering 2.1.1		
1	Course title	*Basics of IT in the health sector (UCLouvain; optional course) link*
2	Course description	*The course deals with the study and organization of the information system in the field of health from the perspective of a multidisciplinary communicating system in support of health care. The information system is approached, on one hand, as one of the components of the health system and, on the other hand, as a tool for the practitioner.*
3	Learning outcomes (LOut)	*LOut1: The main objective of the course is to allow the student to understand the context and the technical environment in which he will evolve and to make him/her aware of the constraints and issues related to the development of eHealth.*
4	Language	*French*

5	ECTS\Hours	*2 ECTS*
6	Key words	*Information system and health*
7	Structure of the course/curriculum	*Course accessible for bachelor and master as optional course* *The course comprises:* • *History of IT* • *Operation of digital computers* • *Languages and programming* • *Operating systems* • *Operation of computer networks, the Internet and the Web* • *Basic principles of database management* • *Cryptography, security and confidentiality: basic principles and challenges for the doctor* • *Medical applications of artificial intelligence:* o *Automated logical and probabilistic reasoning: diagnostic and therapeutic applications*

		o *Machine learning: supervised learning, unsupervised learning, reinforcement learning and their diagnostic and therapeutic applications*

Numbering 2.1.2		
1	Course title	*Statistical reminders and clinical studies - preparation for MA thesis - medical informatics (ULB; compulsory course) link*
2	Course description	*The primary objective of this course is to provide the student with logical and technical tools allowing to carry out his MA thesis. Beyond this utilitarian aspect, this course also provides the student with the opportunity to develop his aptitude, reasoning and communication.* *At the end of the unit, the student will be able to:* • *Ask a precise research question* • *Evaluate which statistical methods should be applied*

		• *Compile a file for the ethics committee* • *To have an analysis of how medical reasoning works* • *Be aware of the new General Data Protection Regulation (GDPR)* • *Understand the new paradigms of tomorrow's medicine in a digital world*
3	Learning outcomes (LOut)	*LOut1: demonstrate a critical mind in the face of the validity of scientific medical papers* *LOut2: master statistical methods* *Lout3: practice the transfer of knowledge* *Lout4: have a vision of the historicity of medicine and to understand how the medicine taught in universities has been constructed over time. Understand the place of reductionism, clinical and epidemiological studies in the genesis of medical knowledge.* *Lout5: Have a global view of the digital transition in medicine, including aspects of the Belgian eHealth plan and IT security.*
4	Language	*French*

5	ECTS\Hours	*(lecture: 35h, practical work: 15h) - 1st and 2nd semester* *5ECTS*
6	Key words	*statistics; informatics*
7	Structure of the course/curriculum	*Course accessible to MA students as obligatory course. The course content:* *1- Epistemology:* *2- Medical informatics:* • *An introduction to the current digital world and the new paradigms of medicine* • *The general bases of data processing and technical interoperability* • *The general bases semantic interoperability with medical classifications and terminologies* • *The criticality of IT in biomedical research* • *The functions of clinical decision support* • *The structuring of the Computerized Medical File in General Medicine* • *The current eHealth plan in Belgium and future, and the GDPR*

		• *Artificial intelligence in medicine today and tomorrow* *3- Bio-statistics*

Numbering 2.1.3		
1	Course title	*Artificial Intelligence for everyone (KULeven; optional course) link*
2	Course description	*The course offers an introduction to AI at a university level, specifically aimed at the non-technical student. It introduces the necessary basic concepts, principles and techniques that allow to understand AI applications. This way the student will better understand the potential, but also the limitations, of AI. So, he gets a clearer picture of what AI can and cannot do. This also allows him to discover opportunities to apply AI in your own domain.*

		In addition, the course offers an ethical framework that allows for a critical look at existing and new AI evolutions. This will equip him to enter a discussion about AI and the ethical and societal consequences that the application of AI entails.
3	Learning outcomes (LOut)	*LOut1: Learn what AI is, get an idea how AI works, what is possible (and what is not) with AI and what impact it has on our lives.* *LOut2: Discover the potential of AI and understand their applications.*
4	Language	*Dutch*
5	ECTS\Hours	*Elements of AI 1st and 2nd semester 2 ECTS* *AI for Everyone: Methodological and Ethical Framework- 1st and 2nd semester 1 ECTS* - *Total 3 ECTS* *Assessment form: Written, Paper/Project, Self-assessment /Peer assessment* *Essay (25% of the points)* *- Students submit an essay. This essay discusses a self-chosen contemporary*

		application from the AI domain and applies the learned methodological and ethical framework to it. *- Students evaluate the essay of three or four fellow students.* *- The essay is scored based on the peer evaluations. The teachers of the subject can make a correction apply to the peer evaluation if one or more peer evaluations are not reliable.* *Final exam (75% of the points)* *- One final exam is planned in the second semester. The exam takes place in the evening on one weekday in the week before the start of the second examination period*
6	Key words	*AI*
7	Structure of the course/curriculum	*Online Course accessible to BA students as compulsory course* *This online course divided into 2 parts:* *1- Elements of AI: offered as Massive Open Online Courses MOOC that is part of a comprehensive European project "Elements of AI" that offers a MOOC with an*

		introduction to AI at university level in the various European languages (https://www.elementsofai.com/). The MOOC was developed by the technology company Reaktor and the University of Helsinki. The development was funded by the Finnish government as part of the Finnish Presidency of the European Parliament. Translation was supported by the European Commission. *In this MOOC, the following 6 chapters are discussed:* *- What is AI?* *- Troubleshoot with AI* *- AI in practice* *- Machine Learning* *- Neural Networks* *- Implications* *The MOOC contains practical exercises and assignments. It is offered completely online. The student goes through the MOOC independently at his own pace. Support is provided, from fellow students and supervisors, via an online forum.*

		2- AI for Everyone: Methodological and Ethical Framework: This OLA consists of three parts: *- Ethical framework for AI for non-ethicists:* *This part offers an ethical framework that allows to critically approach AI applications and the impact they can have on the individual and society.* *- Essential AI algorithms for non-engineers:* *This section introduces several algorithms (such as decision trees, logic, Bayesian networks, reinforcement learning, support vector machines, deep learning) that are at the root of important breakthroughs in AI. In addition to the methodological framework for approaching AI applications. Each algorithm is linked to a contemporary application, to which the student immediately applies the methodological and ethical framework.* *- Contemporary AI applications that change your life:* *Guest lecturers offer a look at an AI application from their field of expertise (e.g., technology, medical world, sports, education, business) that can change life. The*

		guest lecturers make use of the ethical and methodological framework provided in this OLA. *This OLA is offered completely online, via a learning module in Toledo. Therefore, student follow this module independently at his own pace. Support is provided, from fellow students and supervisors, via the Toledo forum.*

Numbering 2.1.4		
1	Course title	*Integration 1,2 & 3 (Antwerpen university, Compulsory courses)* [*link*]
2	Course description	*Students are taught to make connections and to broadly open their own thinking process to different perspectives. On the basis of the teaching methods used, attention will also be paid to the development of various generic competences, such as working in a group, looking up information and presenting.*

3	Learning outcomes (LOut)	*The students learn to "integrate" knowledge, skills and competencies in professional behavior:* *1. The student is able to make an active and adequate contribution in a group of 10 - 12 students in processing a complex study assignment, which requires research and integration of knowledge and skills from different domains.* *2. The student can carry out a study assignment in pairs, in which contact with a person/patient is central.* *3. The student is able to write down his findings, with regard to the questioning and examination of a person/patient, in a correct manner in a medical file.* *4. The student is able to map the actual health status of a person/patient.* *5. The student is able to describe a reasoned future picture of the health of a person/patient.* *6. The student can describe how doctors can have a positive influence on the future health of a person/patient.* *7. The student is able to make a poster based on a number of thematic analyzes in groups on the basis of a study assignment (see point 3, 4, 5 and 6), which requires*

		patient contact, research and integration of knowledge and skills from different domains. *8. The student can present a self-made poster for a group of fellow students and teachers.* *9. After his own poster presentation, the student is able to respond adequately to questions and comments from the audience, both in terms of form and content.* *10. After a poster presentation by a fellow student, the student can ask questions to the presenter and comment on the presentation in order to provoke a discussion.* *11. The student reproduces that part of the knowledge that was discussed in the 1st, 2nd and 3rd Bachelor, and that has been designated by a panel of UA lecturers as obligatory ready for functioning as a doctor.* *12. In a plenary clinical consultation, the student can actively contribute to the development of a clinical case on the basis of knowledge and skills that have been discussed in the 1st, 2nd and 3rd Bachelor.* *13. In a clinical exam, the student can develop a clinical case based on knowledge and skills from the 1st, 2nd and 3rd Bachelor.*

		14. The student can provide stimulating feedback on the contributions of other students and themselves to the education during the integration weeks. *15. The student can process and use feedback received as a result of his contribution to the group and as a result of test moments for his own professional development.*
4	Language	*English*
5	ECTS\Hours	*Integrate 1, 1st and 2nd semester, 112 hours (study load), 4 ECTS* *Integrate 2, 2nd semester, 112 hours (study load), 4 ECTS* *Integrate 3, 2nd semester, 112 hours (study load), 6 ECTS*
6	Key words	*Integrate*
7	Structure of the course/curriculum	*Study assignments on patient presentations bring the lesson content of the different modules together. The results of the assignments are presented and assessed in posters and in small group presentations and on the basis of critical questions.*
Numbering 2.1.5		

1	Course title	*Media and digital society (Antwerpen university, optional course)* [link]
2	Course description	*The basic aim of the course is to make students aware of the mechanisms of the media in the digitized society and the risks of distorted opinion formation and polarization. By making students familiar with these mechanisms, they are better prepared to see the opportunities and risks in their own domain for the dissemination and application of (scientific) knowledge and information, as well as the development of ICT applications. The course is built up by approaching the subject from different angles.*
3	Learning outcomes (LOut)	1. *Students learn to analyze social phenomena, evolutions and problems from an interdisciplinary perspective and on that basis to think in a solution-oriented way and to arrive at a long-term vision.* 2. *Students develop a critical and active attitude towards a complex, digitized and mediated world.* 3. *Students learn to deal with information in a media-wise way by consulting and interpreting reliable, qualitative sources in order to answer an*

		information question or problem statement and to substantiate this answer in depth. 4. *Students can dialogue and reflect critically on the mechanisms of the media on the far-reaching digitization that affects almost every aspect of society and that can entail risks of polarization with regard to various groups.* 5. *Students learn how different disciplines, philosophies of life, moral and philosophical views can meet, interact and influence each other, and they learn how to participate in that conversation in a reasonable way (active pluralism) .* 6. *Students learn to analyze social phenomena, evolutions and problems from an interdisciplinary perspective and on that basis to think in a solution-oriented way and to arrive at a long-term vision (interdisciplinary thinking).* 7. *Students develop the ability to describe, analyze and understand the complexity and different dimensions of a social phenomenon (systems thinking).*

		8. *Students learn to map, clarify and weigh values, principles and goals (normative thinking)*
4	Language	*English*
5	ECTS\Hours	*30 hours (1st semester of 3rd bachelor years), 3 ECTS*
6	Key words	*Media*
7	Structure of the course/curriculum	*The following themes will be discussed, in which dialogue and reflection are important, attention is paid to different ideological principles, and in which other ideas, points of view and ideas are given a prominent place:* 1. *News & information (including fake news, opinion forming & confirmation bias);* 2. *Media responsibility and media ethics (eg technology is not neutral);* 3. *Advertising (including mixtures of news/advertising, privacy and the role of legislation);* 4. *Entertainment (including sexualization);*

		5. *Social media (including cyberbullying, hate speech, interpersonal relationships);* 6. *Technology (including automation, impact of data, economic background and monopoly formation, Big data, artificial intelligence, Internet of Things (IoT), algorithms).*

5.2.2 Vocational Education Training (VET) in Belgium

5.2.2.1 Structure

Abstract		
1	The structure of the Medical VET programs lifelong learning	*The doctor has the obligation to follow continuous training. The terms and conditions of this continuing education are set by the Minister on the proposal of the National Medico-Mutual Commission. This continuing education implies at least the obligation to obtain 20 credit points (CP) including 3 CP in the "ethics and economy" section and 2 participations to the meetings of the local medical quality assessment group (GLEM) to*

		which the doctor is registered. *The Faculties of Medicine organize a series of complementary training courses in the form of a certificate for professionals. Access conditions are specified for each training. More than twenty continuing education cycles are offered at the school of medicine, very often in collaboration with other universities or other training institutions.* *A policy of self-training is also encouraged (medical journals, webinars, etc.) and the participation to national and international meetings can also be credited.*
2	The structure of curricula	*The proposed courses categorize under:* ● *Short courses* ● *Advanced cycle in hospital sciences* ● *University or inter-university certificates* *The major topics of formation* ● *Health economics*

- *Health system*
- *Health management*
- *Medicine (sports and / or professional context, hospital hygiene and environmental medicine)*
- *Society*
- *Certificates required by Belgian law for professional practice (University Certificate in Physical and Biological Radiation Protection and University Certificate in School Medicine)*
- *Public health*

Some webinars are organized for the presentation of AI generalities to non-specialists.

Training initiatives are organized in specialties specifically concerned with AI: radiology, dermatology, ophthalmology and anatomopathology (image analysis); neurology, cardiology (analysis of EEG, ECG)

Link 1, Link 2, Link 3

5.2.2.2 Courses

Numbering 2.2.1		
1	Course title	*Design and Management of the Strategy of Healthcare Institutions (UCL-ULB) link*
2	Course description	*This certificate aims to provide, well beyond strategic tools, real strategic know-how and interpersonal skills for anyone with institutional responsibilities at any level in a repositioning project in this context link.* *The program is intended for graduates of long-type higher education.*
3	Learning outcomes (LOut)	*LOut1: recognize major strategies and trends in the hospital environment* *LOut2: identify possible approaches, methods and tools in order to establish a strategic plan and implement it* *LOut3: identify the characteristics of strategic management and ways to implement it* *LOut4: use the skills (knowledge, know-how and interpersonal skills) necessary for the implementation of a change, its support and its evaluation*

4	Language	*French*
5	ECTS\Hours	*10 ECTS, 9 days (72h)*
6	Key words	*Management*
7	Structure of the course/curriculum	*The course consists of 9 modules:* *1. The strategic approach in healthcare institutions* • *The concept of strategy among the different types of planning and management schools.* • *The particular problem of health institutions and professional organizations.* • *The challenges in the environment of health systems and Belgium in particular.* *2. Strategic analysis of the activity, positioning of services and hospital products* • *Presentation of quantitative approaches, methods and tools and qualitative to carry out the strategic analysis.*

		• *The synthesis of the strategic analysis. The SWOT matrix. How to build it? how to use it?* *3. The formalization of the vision* • *How to define the Vision?* • *Construction of scenarios and selection of the desired Vision* • *The attributes of vision.* *4. Innovation* • *Innovation.* • *How to create a competitive advantage?* *5. Change management* • *Identification of risks to the implementation of the strategy.* • *Change management in professional organizations.* *6. The Balanced Scorecard, programming and project management* • *The formalization of the strategy: The Balanced Scorecard approach* • *Programming of the implementation of the strategy.*

		7. Implementation • *The implementation of the strategy at the operational level.* • *Identification of objectives, indicators, goals and initiatives.* • *The keys to success for an effective implementation.* *8. The financial plan, strategic management and monitoring* • *How to formulate the financial plan of the strategy? Its purpose and possible approaches.* • *Strategic management* *9. Presentation and discussion of cases* • *Presentation of cases.* • *Presentation of major trends influencing development health systems.* • *End of training work: defenses*

Numbering 2.2.2

1	Course title	*Multidisciplinary management of exceptional situations* [link]
2	Course description	*This teaching extends from the basics of disaster medicine to notions of the overall management of a collective emergency event.* *It becomes essential for professionals to train and update their knowledge and skills, necessary for the management of terrorist attacks, rail disasters or other major accidents ... The management of exceptional situations is becoming more and more important in our current society.*
3	Learning outcomes (LOut)	*Familiarize doctors, nurses and other people working in an emergency department and participating in the activity of a Mobile Emergency Resuscitation Service with collective emergency and disaster situations*
4	Language	*French*
5	ECTS\Hours	*10 ECTS, 81 hours*
6	Key words	*Disaster*

7	Structure of the course/curriculum	*This training is spread over one year:* *1. Theoretical courses* *6 days of multidisciplinary theoretical training - D1 to D6* *2. Practical exercises* *Two days of practical exercise - D7 and D8:* - *A day of practical workshops* - *A day of field exercise - "life-size" disaster simulation* *3. Training seminar (3 seminars)*

5.2.3 Policy Making Policies in Belgium

Belgium is a complicated country, and the Belgian AI strategy presents policy actions at federal and regional levels, distinguishing between measures for the Federal State, Flanders, the Walloon region, Brussels Capital, and those of the Wallonia-Brussels Federation.

The Federal Government launched AI4Belgium the Belgian coalition for AI. Among them, a specific AI4Health working group aims to promote the implementation of AI in healthcare and AI education in medicine. The AI4Belgium coalition recommends developing a responsible data strategy where trust is the cornerstone of any transformation, while a robust and up-to-date legal framework, ethical principles and more transparency are needed. Building a data ecosystem that facilitates more responsible data-sharing with reinforced open data policies, more collaborations and a platform with well-structured tools and approaches is one of their objectives.

Also, the Secretary of State for Digitalization has launched "Digital Minds" to tackle the broader digital sense. Among these Digital Minds, health is included in government *competences in specialized "Councils" (each council represents a pillar - government, industry, etc.). Digital Minds and AI4Belgium work very closely together.*

The regions, for their part, operate in various fields:

In the Walloon region the DigitalWallonia4.ai program has the objective of accelerating the adoption of AI in the region. The overall budget, which also includes industry 4.0 and the regional digital strategy "Digital Wallonia", is 18 million EUR per year. Since December 2020, the regional AI program includes a research project called "ARIAC by DigitalWallonia4.ai" launched in the framework of the TRAIL consortium, which brings together universities and research centers in the Wallonia-Brussels Federation. The 32 million EUR project is funded by the Walloon Region and runs from 2021 to 2026.

The Flemish Government launched the Flemish action plan to foster AI in Flanders. The Flemish AI action plan foresees an annual budget of EUR 32 million for its implementation, broken down as follows: EUR 15 million dedicated to the implementation of AI within companies, EUR 12 million allocated to basic research, and EUR 5 million to supporting measures (training, ethical and legal aspects related to AI-adoption, and outreach

activities). This funding is complemented with other policy instruments of both FWO (funding for HEIs) and VLAIO (funding for enterprises). In 2020 FWO invested about EUR 15 million and VLAIO some EUR 45 million in AI related projects. The same amounts are expected for the following years. The Flemish AI policy plan also draws particular attention to the development of AI for the healthcare sector. In line with the Flemish policy plan for 2019-2024 and the framework of Flanders Care, a specific focus is given to support new cooperation models between the public health care sector and the industry. Agoria has recently launched an AI-MOOC for the health sector. *For the Brussels-Capital Region, the innovation funding body Innoviris has been playing a major role in the support of AI-related research and innovation efforts in Brussels* *All these regional initiatives are joined up at the level of AI4Belgium.*
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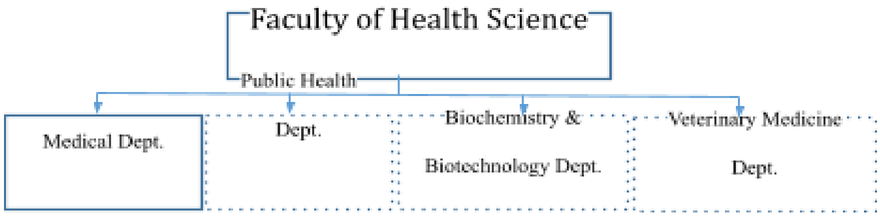
https://www.ewi-vlaanderen.be/onze-opdracht/excellerend-onderzoek/ai-voor-vlaanderen

https://innoviris.brussels/

5.3 Desk Research of Greece

5.3.1 National Curricula in Greece

5.3.1.1 Structure

Abstract		
1	The structure of the Medical Schools in each country	

		Faculties of Health Science include the following departments: a) medical, public health, biochemistry and biotechnology, and veterinary medicine. Becoming a Doctor of Medicine (MD) in Greece means following basic medical training consisting of a 364 credits (ECTS).
2	The structure of curricula	*The grade in medicine in Greece consists in a 6-year degree. Each academic year is divided into teaching periods called semesters, the winter and spring semesters. Curriculum courses are divided into* *twelve independent semesters of study and has a total of 364 ECTS.* *The national curriculum (link) consists in a list of core subjects with their respective ECTS.* *In the Medical Department there are 8 sectors (morphology, basic sciences, clinical laboratory, pathology, surgery, mother and child, neurology and sensory organs and social medical sciences) as well as 27 clinics and 24 laboratories which are distributed in all sectors.*

3	The structure of curricula	*According to Law 4485/2017, article 8, which refers to the internal regulations of the Universities, the curriculum is determined by each department by decision of the Senator which is issued after the recommendation of the Rector(Dean) and the opinion of the Rector's Council and is published in the Journal of Government.* *Regarding the degree of medicine, students in all Departments of Medicine in Greece must complete 6 years of basic university education. After obtaining their degree, they are obliged to carry out the training program entitled "Rural General Practicioners" lasting 12 months, where the first month concerns training in a hospital and the remaining 11 months of training in a rural health center. After the entire training, the doctors state the medical specialty in which they want to specialize in a specific sector such as cardiology, pediatrics, surgery, etc.. Each specialization program has a different training time and duration.*
4	Similarity	*The medical curricula in Greece have almost no differences compared to other curricula around the world. There is the basic university education which lasts 6*

		years. After the end of the university education there is the specialization program which lasts from 3-7 years in some specialties such as pediatric surgery, thoracic surgery, neurosurgery and vascular surgery to last 7 years. *Also, in Greece there is a Rural General Practicioner program which is the main difference with the other medical programs.*

5.3.1.2 Courses

Numbering 3.1.1		
1	Course title	*Medical Statistics*
2	Course description	*The course deals with the study of descriptive medical statistics, sampling, the concept of statistical test - zero hypothesis - statistical errors, possible error and mean values of reliability - comparison of mean values (t test) - statistical test x^2, possible error ratio and reliability limits, basic probability*

		rules, correlation and simple linear dependence (regression) of quantitative characteristics, multiple linear dependence and other statistical models, interpretation of statistical findings, non-parametric statistical tests, evaluation of laboratory findings.
3	Learning outcomes (LOut)	LOut1: Introduction to statistical terms Lout2: Introduction to SPSS programming language. Statistical/computational analysis of data and graphic representation of results
4	Language	*Greek*
5	ECTS\Hours	*6*
6	Key words	Medical Statistics, biostatistics
7	Structure of the course/curriculum	*Module 1: Description, presentation and summary of data* *Module 2: Central location and dispersion measures* *Module 3: Populations and samples*

		Module 4: The normal distribution *Module 5: Case control* *Module 6: Parametric tests of a sample* *Module 7: Parametric tests of two samples* *Module 8: Variance analysis* *Module 9: Correlation of two quantitative variables* *Module 10: Relationship between qualitative variables* *Module 11: Non-parametric tests* *Module 12: Diagnostic tests* *Module 13: Survival analysis* *Theoretical lectures. Practice classes with computer. Evaluation: written exams and projects.*

Numbering 3.1.2

1	Course title	*Medical informatics*
2	Course description	*The aim of the course is to familiarize students with introductory topics computer science as well as their introduction to programming environment issues for the development of artificial intelligence programs and medical image processing.*
3	Learning outcomes (LOut)	LOut1: Basic knowledge of computer science, and use of word processing programs, spreadsheets, presentations. LOut2: Design and creation of medical databases. LOut3: Basic programming knowledge in GNU-octave environment LOut4: Digital medical image processing
4	Language	*Greek*
5	ECTS\Hours	*5*
6	Key words	Medical informatics, computer science, programming, artificial

		intelligence, medical image processing
7	Structure of the course/curriculum	*The Informatics course consists of the following subjects:* - *Informatics in Medicine.* - *Description of the computer hardware and software.* - *Operating systems: MS Windows, Linux.* - *Basic principles of programming languages.* - *Word processing, spreadsheet management, presentation creation, and management of medical databases.* - *Artificial intelligence in Medicine, neural networks, genetic algorithms.* *-Medical image processing, histogram transformations, spatial transformations, filtering using transfer functions.* *Theoretical lectures. Elaboration and presentation of a scientific work and written test.*

Numbering 3.1.3		
1	Course title	*Bioinformatics with applications in Medicine*
2	Course description	*The course includes students' practical training in specific scenarios for the use of bioinformatics tools and databases.*
3	Learning outcomes (LOut)	LOut1: To identify the types of problems that can be solved with the help of Bioinformatics methods. LOut2: Select and use the appropriate databases and tools correctly. LOut3: Apply the computational steps of the analyzes and evaluate the results. LOut4: To understand the applications of Bioinformatics in diagnosis and personalized treatment.
4	Language	*Greek*

5	ECTS\Hours	*2.5 ECTS*
6	Key words	Bioinformatics, algorithms, high-performance, data -omics analysis
7	Structure of the course/curriculum	*The course consists of two main sections. The first section deals with the introductory concepts of Bioinformatics, the basic algorithms and the problems to which they apply. These include sequence alignment algorithms, biological information modeling techniques as well as methods of functional gene analysis and macromolecule analysis / imaging. The practical part of this section includes the acquaintance of students with the main databases and their familiarity with available tools that implement the above techniques through representative exercises and usage scenarios that have medical applications. The second section focuses on applications of Bioinformatics in Medicine with the help of modern processing techniques that meet the need: a) analysis of a very large volume of data and b) integrated processing of this data. The basic principles governing high-performance technologies such as microarrays and next-generation sequencing technologies are described and the steps of computational analysis in*

		their basic applications, such as polymorphism detection and gene expression, are analyzed. The introduction to programming environments completes the second section and aims to acquaint students with tools necessary in computational analysis and user-friendly.

5.3.2 Vocational Education Training in Greece

5.3.2.1 Structure

Abstract		
1	The structure of the Medical VET programs	*The Universities of Athens and Crete, through their lifelong learning programs, offer educational programs in health professions in order to specialize in specific topics of Medical Science. These programs have a specific course structure, with approximately 3 to 8.4 ECTS, lasting a few months.*
2	The structure of	*The Draft Law "National System of Vocational Education, Training and Lifelong*

	curricula	*Learning and other provisions" foresees for service providers, in the context of non-formal learning provided to adults:* *a) continuing vocational training,* *b) reskilling,* *c) upskilling;* *d) general adult education; and* *e) counseling and career guidance. The tainees may belong to the public or private sector.* *The Continuing Vocational Training and General Adult Education programs, provided by VET, have a theoretical or laboratory part or both, or an internship, where provided in the foreseen program. The total duration of the training program is determined based on its subject matter, the purpose of the intervention and the profile of the participants, in accordance with the specific definitions in the respective invitations / announcements of the project beneficiaries. Regarding the number of participants in learning classes cannot exceed twenty five (25) people or fifteen (15) in cases of programs aimed exclusively at special social groups, such as the disabled. The criteria*

		for the inclusion of the participants in the learning sections are determined in the respective programs. *After the end of a successful attendance of a certified program of VET, a certificate of attendance is issued, which are signed by the Director of Training of VET, bear the distinctive title, the logo of VET and its licensing code and indicate the exact title, duration in hours, dates and location of the program. For the successful attendance of a certified program of VET, the following conditions must be met:* *a) Confirmed participation, live or remote, of the participant in the programs;* *b) evaluation of learning outcomes and* *c) successful completion of the internship, where required.*

5.3.2.2 Courses

Numbering 3.2.1		
1	Course title	*Biomedicine and Engineering Science Applications. University of Athens*

2	Course description	*The purpose of the program is to familiarize the trainees with a number of applications of Engineering Science in Biomedicine, which include medical imaging, recording of physiological parameters, medical data and artificial intelligence, biomaterials and robotics, as well as the systematization of knowledge.* *By presenting basic concepts of mathematics, computational thinking, physics, engineering and electronics, in direct contrast and correspondence with the above biomedical applications, an in-depth understanding of advanced technological applications in Biomedicine is achieved.* *At the same time, specific and applicable techniques for the analysis of medical signals and medical images, which are useful in clinical diagnosis, will be taught. The study of biomedical applications of Engineering Science will enable learners to identify and articulate complex issues of biomedical research and practice, and to develop innovative interdisciplinary approaches to solving them.*

3	Learning outcomes (LOut)	No specific information. Generally, familiarize the healthcare professionals with the many applications of Engineering Science in Biomedicine.
4	Language	*Greek*
5	ECTS\Hours	*4 months (102 hours) 4.08 ECTS*
6	Key words	Mathematics, informatics, biomedicine, engineering, data, artificial intelligence, ethics
7	Structure of the course/curriculum	*Course - Introduction: Basic Concepts and Definitions* *Module 1: Basic Concepts and Definitions* *Course - Mathematics, Informatics and Biomedicine* *Module 1: Basic Concepts and Biomedical Mathematics: function of one variable and medical signals, a function of two variables, and* *Medical Images.* *Module 2: Basic Concepts and Biomedical I: Principles Computational Thinking* *Module 3: Concepts of Information Technology and Biomedicine II: The Mat Lab Software Package for Biomedicine*

		<u>*Course - Engineering, Physics, Electronics and Biomedicine*</u> *Module 1: Basic Concepts of Engineering and Biomedicine I: Solid State Engineering* *Module 2: Basic Concepts of Engineering and Biomedicine II: Biofluid Engineering* *Module 3: Basic Concepts of Physics and Biomedicine I: Bioelectricity* *Module 4: Basic Concepts of Physics and Biomedicine II: Acoustics* *Module 5: Basic Concepts of Electronics and Biomedicine I: Biosensors and Electrical Circuits* *Module 6: Basic Concepts of Electronics and Biomedicine II: Advanced Methods of Recording Physiological Parameters* <u>*Course - Biomedical Signals, Images and Data*</u> *Module 1: Biomedical Signals: Basic Concepts and Analysis* *Module 2: Biomedical Images: Basic Concepts and Analysis* *Module 3: Biomedical Data I: Basic Concepts and Principles* *Module 4: Biomedical Data II: Methods of Analysis and Applications* <u>*Course - Biomaterials and Robotics*</u>

		Module 1: Biomaterials: Basic Concepts and Design *Module 2: Robotics and Biomedicine* *Course - Ethical Issues* *Modules 1: Ethical Issues*

Numbering 3.2.2		
1	Course title	*Medical Ethics and Bioethics, University of Athens*
2	Course description	*This program presents the basic directions of modern Medical Ethics, as a branch of Bioethics, focusing on the regulatory issues encountered in a wide range of medical practices. In the context of this presentation, reference is also made to the applicable law but without limiting ethical reflection and debate alternatives.*

3	Learning outcomes (LOut)	No specific information. Generally, getting the basic knowledge about the topics included in the curriculum
4	Language	*Greek*
5	ECTS\Hours	*5 months, 100 hours, 4 ECTS*
6	Key words	bioethics
7	Structure of the course/curriculum	*Course: Basic Concepts* *Course 1 - The Medical Practice* *Module 1: Patient Autonomy and Medical Duty* *Module 2: Medical Practice and Privacy* *Module 3: Public Health and Autonomy* *Module 4: Medical Responsibility* *Course 2 - Special Medical Operations* *Module 1: Transplants* *Module 2: Genetic Tests Health Protection*

		Module 3: "Improvement" of the Human Organization *Module 4: Decisions at the End of Life* *Biomedical Research* *Course 1 - Basic Institutions* *Module 1: Ethics of Biomedical Research* *Module 2: Research Ethics Test* *Module 3: Biobanks* *Course 2 - Research Types* *Module 1: Preclinical Studies - Animal Research* *Module 2: Embryo Research - Stem Cells* *Module 3: Clinical Studies* *Reproduction Issues* *Course 1 - Negative Reproduction* *Module 1: Contraception* *Module 2: Sterilization*

		Module 3: Abortion *<u>Course 2 - Positive Reproduction</u>* *Module 1: Distribution of Reproductive Material* *Module 2: Assisted Reproduction Methods* *Module 3: Fetal Selection*

Numbering 3.2.3		
1	Course title	*Medical Psychology, University of Athens*
2	Course description	*The Educational Course "Medical Psychology" was developed in order to examine issues of mental health and illness, through the prism of the field of Psychiatry, as well as training in the evaluation, diagnosis and treatment planning of relevant cases, in a holistic and specialized way. to the special care requirements of patients with physical or mental disorders.*

3	Learning outcomes (LOut)	No specific information. Generally, getting the basic knowledge about the topics included in the curriculum
4	Language	*Greek*
5	ECTS\Hours	*5 months, 160 hours, 6.4 ECTS*
6	Key words	psychology
7	Structure of the course/curriculum	<u>*Course: The Functions of the Organization*</u> *Module 1: Introduction to Medical Psychology* *Module 2: Nervous System* *Module 3: Endocrine and Immune System* *Module 4: Mental functions* *Module 5: Emotions and Instincts* *Module 6: Sexuality* <u>*Course: The Evolution of Man in his Environment*</u> *Module 1: The Life Cycle*

		Module 2: Personality *Module 3: Environment and Mental Health* *Module 4: Interpersonal Relationships - Family – Group* <u>*Course: Psychosomatic Medicine*</u> *Module 1: Psychosomatic Medicine* *Module 2: Organizational Systems and Psychopathology* *Module 3: Organic Disorders and Psychopathology* *Module 4: Gynecological Situations and Psychopathology* *Module 5: Psychiatric Problems in Hospitalization and Terminal Disease* *Module 6: Medicine and the Doctor* <u>*Course: Psychiatric nosology*</u> *Module 1: Introduction to Psychiatry* *Module 2: Psychiatric Examination and Diagnosis* *Module 3: Disorders of Psychological and Mental Development* *Module 4: Personality Disorders*

		Module 5: Sexual Disorders *Module 6: Anxiety Disorders* *Course: Psychiatric disorders* *Modules 1: Emotional Disorders* *Modules 2: Psychotic Disorders* *Modules 3: Hysterical and Physical Disorders* *Modules 4: Organic Psychosyndromes* *Modules 5: Sleep and Eating Disorders* *Course: Psychiatric therapy* *Module 1: Treatments in psychiatry* *Module 2: Psychoactive Drugs* *Module 3: Methods of Psychotherapy* *Module 4: Social Psychiatry dules 6: Addiction Disorders* *Course: Cognitive Behavioral Therapy for Depression through Case Analysis Conducted* *via live streaming and is OPTIONAL.*

Numbering 3.2.4		
1	Course title	*Clinical Medical Practice - Emergency Clinical Cases, University of Athens*
2	Course description	*The main purpose of the Program is to develop skills and clinical applications in clinical medicine for all health professionals, based on basic knowledge Pathology, Surgical Pathology, Traumatology as well as Neurophysiology and Functional Neuroanatomy.*
3	Learning outcomes (LOut)	No information about learning outcomes
4	Language	*Greek*
5	ECTS\Hours	*3 months, 84 hours, 3.4 ECTS*
6	Key words	*clinical practice, Pathology, Surgical Pathology, Traumatology*
7	Structure of the course/curriculum	*Course: Clinical Cases with Sudden Onset or Invasion Symptomatology* *Module 1: Basic Concepts and Definitions in the Management of Clinical Manifestations*

		with Sudden Symptoms *Module 2: Emergency Symptoms - Application of Basic Clinical Knowledge and Skills with Reference to Clinical Examples* *Module 3: Sudden Level of Consciousness Disorder - Differential Diagnosis with Reference to Clinical Cases* *Module 4: Sudden Headache - Differential Diagnosis with Reference to Clinical Cases* *Module 5: The Sudden Decrease in Muscle Strength - Differential Diagnosis with Reference to Clinical Cases* *Module 6: Sudden Respiratory Disorder - Differential Diagnosis of Dyspnea and Respiratory Disorders with Reference to Clinical Cases* *Module 7: Sudden Circulatory System Disorder and Shock - Differential Diagnosis with Reference to Clinical Cases* *Module 8: Acute Abdomen - Differential Diagnosis and Reference in Clinical Cases* *Module 9: Clinical Evaluation and Reporting of Special Cases* *Course: Serious Injuries - Multi-Injured* *Module 1: Severe Craniocerebral Injury with Clinical Report*

		Cases *Module 2: Limb Injuries with Reference to Clinical Cases* *Module 3: Chest and Abdominal Injuries with Reference to Clinical Cases* *Module 4: The Special Case and Treatment of Multiple Injury with Report of Clinical Cases* *Module 5: Summary Report and Description of Different Cases*

Numbering 3.2.5		
1	Course title	*Telemedicine and Health services, University of Athens*
2	Course description	*This program does not aim at a simple description of its theoretical framework Telemedicine. The aim is to overcome the barrier of theory and to introduce the learner*

		to the essence of Telemedicine, i.e. to the applied services, while giving the basic elements on the organizational impact of the services.
3	Learning outcomes (LOut)	No information about learning outcomes
4	Language	*Greek*
5	ECTS\Hours	*5 months, 150 hours, 6 ECTS*
6	Key words (of this course and similar ones)	Telemedicine
7	Structure of the course/curriculum	*INTRODUCTION TO TELEMEDICS* *Module 1: Definition of telemedicine* *Module 2: Necessity of telemedicine* *Module 3: Expected benefits*

		Module 4: A brief historical overview *GENERAL PRINCIPLES OF ADMINISTRATION* *Module 1: The Management of an Organization - Introductory Concepts* *Module 2: Programming in an Organization - Its Functions* *Organization and Management* *Module 3: Business Structure and Organization* *Module 4: The Activity of Control* *ANALYSIS OF TELEMEDICAL SERVICES* *Module 1: Introduction to telemedicine services* *Module 2: Necessity of telemedicine services* *Module 3: Telemedicine services* *ORGANIZATION AND ADMINISTRATION OF HEALTH SERVICES BASED ON TELEMEDICAL TECHNOLOGIES* *Module 1: Introduction to the organization and management of health services* *Module 2: Organizational and administrative part of telemedicine applications*

		Module 3: The Impact of Telemedicine on the Organization and Management of Health Services *APPLICATION OF TELEMEDICAL SYSTEMS* *Module 1: Telemedicine applications* *Module 2: Applied telemedicine systems in Greece* *Module 3: Applied telemedicine systems abroad* *Module 4: User training* *Module 5: Interoperability of telemedicine systems with other Information Systems in the field of health* *INVESTMENT EVALUATION TECHNIQUES AND FINANCIAL DECISION-MAKING RULES* *Module 1: Basic Principles of Investment Decision Making* *Module 2: Theoretical Investment Issues* *EVALUATION OF TELEMEDICAL SYSTEMS AND THE FUTURE OF TELEMEDICS* *Module 1: Evaluation of telemedicine systems* *Module 2: Economic evaluation of telemedicine programs*

		Module 3: New trends and technologies in telemedicine - the trend towards virtual reality

Numbering 3.2.6		
1	Course title	*Child and Adolescent Psychiatry, University of Athens*
2	Course description	*A course on scientific dissemination with the objective of bringing the science to society.*
3	Learning outcomes (LOut)	No information about learning outcomes
4	Language	*Greek*
5	ECTS\Hours	*10 Months, 210 hours, 8.4 ECTS*
6	Key words (of this course and similar	Child, adolescent, psychiatric issues

	ones)	
7	Structure of the course/curriculum	<u>*Course 1: Introduction to Child Psychiatry*</u> *Module 1: The subject of Child Psychiatry* *Module 2: The normal and the pathological in the mental health of the child (from program 2)* *Module 3: Interdisciplinary Group* <u>*Course 2: The effect of psychoanalysis on child psychiatry*</u> *Module 1: Basic psychoanalytic theories for the development of the child* *Module 2: Newer psychoanalytic approaches* *Module 3: The psychoanalytic view of autism* *Module 4: Psychoanalysis in therapy and education* <u>*Course 3: Diagnostic Assessment, Classification*</u> *Module 1: Child psychiatric examination* *Module 2: The Game* *Module 3: Painting*

		Module 4: The classification in child psychiatry *<u>Course 4: Neurodevelopmental disorders</u>* *Module 1: Speech development disorders* *Module 2: Disorder of motor coordination* *Module 3: Written speech* *Module 4: Autism Spectrum Disorders I.* *Module 5: Autism Spectrum Disorders II* *Module 6: Learning Disorders* *Module 7: Mental Retardation* *Module 8: Hyperactivity-Attention Deficit Disorder (from program 1)* *<u>Course 5: Psychosomatic disorders of childhood</u>* *Module 1: Psychosomatic problems (abdominal pain, headaches)* *Module 2: Eating Disorders (Anorexia - Bulimia)* *Module 3: Sleep Disorders (from program 1)* *Module 4: The child against the disease*

		<u>*Course 6: Emotional disorders*</u> *Module 1: Anxiety Disorders* *Module 2: Post-traumatic stress disorder (from program 2)* *Module 3: Selective mutism (from program 1)* *Module 4: Child fears - School phobia (from program 1)* *Module 5: Depression* *Module 6: Suicidal behavior in children and them teenagers* *Module 7: Self-harm in adolescence (from program 2)* *Module 8: Child Psychosis - Child Schizophrenia* *Module 9: Asperger's Syndrome and Schizophrenia* <u>*Course 7: Behavioral disorders*</u> *Module 1: Excretion disorders. Clamp test (from program 1)* *Module 2: Conduct Disorder* *Module 3: Addictive behaviors* *Module 4: Obsessive Compulsive Disorder*

		Module 5: Muscle spasms (from program 1) *Module 6: Gender Identity Disorder* <u>*Course 8: Prevention and treatment*</u> *Module 1: Basic principles of prevention in the mental health of children and adolescents (from program 2)* *Module 2: Hospitalization, Day Hospital, Community Child Psychiatry* *Module 3 : Pharmacotherapy : Antidepressants, Neuroleptics, Amphetamine derivatives* *Module 4: Psychotherapy*

Numbering 3.2.7		
1	Course title	*Biostatistics, University of Crete*
2	Course description	*The aim of the course is to gain sufficient knowledge of the fundamental statistical concepts and techniques that are widely used in medical research. The course emphasizes*

		the development of statistical thinking and the correct interpretation of the results of research studies. The lectures aim to get to know and understand the statistical way of thinking, the concept of uncertainty and the connection between research design and statistical analysis, but also to know the common errors in statistical analysis and to critically evaluate the statistical methodology of clinical trials. The lectures are supplemented by practical exercises of applied statistical analysis with the use of statistical software.
3	Learning outcomes (LOut)	Distinguish between data types and variables in relation to both the measurement scale and their role in research design. Briefly describe the basic research designs in observational and experimental studies and recognize the role of variability and uncertainty in these studies. Explain the meaning of the terms: sampling variability, sample distribution, and accuracy or reliability of sample statistics. Distinguish between standard deviation and standard error, reference period and confidence interval, validity and reliability.

		To conduct descriptive statistical analysis by selecting appropriate statistical tools such as frequency allocation tables, statistical charts and numerical data summary measures. Interpret and explain verbally the information provided by arithmetic measures, tables and diagrams. To estimate population average values, percentages and their differences or reasons (in problems of two samples) point by point and with intervals of confidence. Explain the information provided by trust intervals. Summarize the relationship between two variables using graphs, tables and numerical statistical measures, which they will choose taking into account the type of data, the research question and the research design. Define the terms: null hypothesis, p-value, and statistical significance. Interpret p-values in hypothesis tests as indicators of the strength of evidence against null hypotheses or as indicators of the degree of uncertainty when making comparisons.
4	Language	*Greek*
5	Key words (of this	*Biostatistics, probabilities, cluster, programming*

	course and similar ones)	
6	Structure of the course/curriculum	*Introduction: the necessity and usefulness of statistical concepts, techniques and methods in biomedical research.* *Research designs and sampling techniques. Distinction between observational studies and experimental studies. Description of the basic designs in observational studies (cohort design, patient-control, synchronous study, case series), their advantages and disadvantages. Explain the problem of confounding. Description of the basic layout of a randomized controlled trial. Sketch / summary of basic random sampling designs: simple, systematic, stratified, cluster, multistage.* *Descriptive statistics. Data Types & Frequency Distributions, Normal Distributions, Standard Values, Central Trend Indicators (Medium, Mean, Dominant, Geometric Mean), Scatter Indicators (Variation, Standard Deviation, Amplitude, IQR), Graphs, Preparation, Organizing and Organizing data in SPSS statistical software. Production of descriptive statistical measures, tables and diagrams with SPSS.* *Inductive Statistics. Normal distribution. Sample distribution of the mean value and*

		standard error. Central Limit Theorem. Confidence intervals & statistical hypothesis checks, type I and II errors, sample strength and size. Average price comparisons *Quantitative analysis of outcomes. Procedures for comparing population average values with the paired samples t-test and the t-samples for independent samples t-test. Conditions for application of t-tests and conditions for application of non-parametric tests (Wilcoxon signed ranks test, Mann-Whitney U test). Determination of sample size and study validity.* *Analysis of quality outcomes. Good fit check. Independence check in correlation tables. Pairs comparisons and McNemar control. Risk measures, relative risk, absolute risk odds ratio (quotation of complementary probabilities), risk difference, necessary number of patients. Diagnostic tests, sensitivity, specificity and predictive value.* *Correlation and regression. Correlation between quantitative variables. Scatter diagrams. Correlation factors. Linear and non-linear relationships. Possible correlation interpretations and confusing effects. Correlation and causation. The linear regression equation. Interpretation of the coefficients in the linear regression model. Extend to Regression Accounting, Poisson and Cox. Interpretation of the results of multivariate*

		regression analyzes.

5.3.3 Policy making policies in Greece

The Hellenic National Strategy for Artificial Intelligence was concluded on December of 2020 but it is not yet published. The strategy developed by a multidisciplinary team of Greek Scientists and AI Experts under the auspices and supervision of the Ministry of Digital Governance. The strategy is aligned to the EU policies and recommendations for AI, as well as to relevant initiatives (e.g., the
EU HLEG expert group, Council of Europe on AI (CAHAI), AI4EU, AI4People). Moreover, its development has considered international best practices from the strategies of other EU-27 countries and the UK, as well as from other prominent AI strategies outside the EU. However, the development of the AI Strategy is primarily driven by the socio-economic priorities of the country, including:

- Economic Growth
- Digital Transformation
- Boosting EU Values and Fundamental Rights

To successfully address the above listed socio-economic priorities the strategy sets three top-level objectives being:

- A Strategy for AI-based Economic Growth
- Accelerated Transformation of the Greek Public Sector
- “AI Democratization” with Greece in a Leading Role

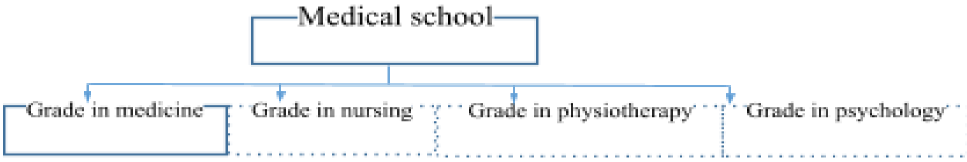
In parallel a number of actions are being developed in Greece concerning the AI strategy, in particular:

- White paper on Greek AI Strategy (link)
- Sectoral Scientific Councils - ESETEK advises in a policy-making level for topics such as AI and Data Policy
- Greece participates in a discussion about AI and ethics organized by UNESCO (link)
- Finally Greece is represented by a partner of AIIS project, SciFY, as an expert on AI in the «DIGITAL SME Focus Group on AI» is an initiative of the European Commission (AI Watch) and the European DIGITAL SME Alliance where they have set up a team composed of almost 40 AI experts representing companies from all over Europe (link1, link2). The goals of the focus group are:
    - Monitoring the development, adoption and impact of AI by companies
    - Providing immediate feedback on their policies and regulatory needs

5.4 Desk Research of Spain

5.4.1 National Curricula in Spain

5.4.1.1 Structure

Abstract		
1	The structure of the Medical Schools in each country	 *Medical school may have other names like “Health sciences faculty”. In dotted line grades that usually have their own faculty but may or may not be taught in the faculty of medicine. Other health sciences grade like nutrition, biomedicine, biomedical engineering, etc., may be taught in this faculty.*

2	The structure of curricula	*The grade in medicine in Spain consists in a 6-year degree. The national curriculum ([link]) consists in a list of core subjects with their respective ECTS that must be included in the particular curricula of each university. This national core curriculum has a total of 160 ECTS, so each university has room to include in their curricula the subjects they may consider since the grade usually has a total of 360 ECTS.* *The core subjects of the grade are organized in 2 stages with the next subjects:* *Stage 1: psychological bases of health and illness states; structure, function, morphology and development of the systems of the human body; general epidemiology and demography; introduction to medicine and scientific methodology (this includes a subject in biostatistics); introduction to the pathology; cellular, molecular, tissular and organic morphology and structure of human body.* *Stage 2: legal medicine and toxicology; preventive medicine and public health; medicine and surgery of systems; obstetrics and gynecology; pediatric; psychiatry.*
3	The structure of curricula	*There is not a unique curriculuma concerning the post graduate studies. Each oficial master degree is designed by the university and then approved by an academic*

		comision of the region and the Minister of Education. Regarding the masters for graduates in medicine, there are degrees related with many medical specialities, and the majority of the medical schools have a master in biomedical research, mainly oriented for future doctoral students. *Another important post-graduate process for medical students is the MIR (resident internal doctor) exam. This is an exam at a national level for medical graduates who want to access to a position as specialist doctor.*
4	Similarity	*As said, the grade in medicine is very similar for all the universities since the core subjects are regulated and the rest of the contents are very close. We have found a few differences in the optional subjects, some universities have a broader package of courses, sometimes with more transversal contents (like the ones with courses on artificial intelligence and big data).* *As for the post-graduate curricula, excepting the titles about biomedical research, we found very different curricula. Most of the masters are focused on different biomedical specialties, but some of them are more transversal with topics like healthcare systems management.*

5	Depth	*Generally, the courses are broad and not only focused on a particular topic. The courses are oriented to the teaching of a topic related to AI or soft skills and the application to the healthcare area. For example, in the 1.2.1 course, there are contents about R programming, but they are oriented and combined with the analysis of omics data.*

5.4.1.2 Courses (Undergraduate)

There are no subjects related to IA or soft skills in the grade in medicine national curriculum. However, we have looked all the study plans of all medicine schools in Spain and we have found a few subjects of interest. Only 5 out of 36 examined study plans had courses with contents related to artificial intelligence and soft skills.

To notice, it is common to find courses slightly related to artificial intelligence and soft skills in the curricula. All faculties had courses on statistics and many of them have contents on informatics (office programs, internet tools, etc.), economy of the health sector and ethics. We consider these courses are not the ones we are trying to target.

Numbering 4.1.1		
1	Course title	*Omics techniques and bioinformatics. Grade in medicine, Universidad de Sevilla*
2	Course description	*Study of omics techniques and an introduction to bioinformatics.* *Required subject (link)*
3	Learning outcomes (LOut)	LOut1: Introduction to biological data bases LOut2: Biological sequence alignment LOut3: Introduction to R programming language. Statistical/computational analysis of data and graphic representation of results
4	Language	*Spanish*
5	ECTS\Hours	*6*
6	Key words	R programming, Data bases, data analysis

7	Structure of the course/curriculum	*Module 1: introduction to bioinformatics (data bases, biologic sequences alignment, introduction to R programming)* *Module 2 : Omics Techniques (microarray analysis)* *Theoretical lectures. Practice classes with computer. Evaluation: written exams and projects.*

Numbering 4.1.2		
1	Course title	*Basic informatics and personal and professional values. Grade in medicine, Universidad de Cantabria*
2	Course description	*The course consists in an introduction to the use of tools to manage data bases in the clinical field (also in form of medical images) and a course on personal values applied to the medical career (ethics, decision making, personal values)* *Required subject (link)*

3	Learning outcomes (LOut)	LOut1: knowing systems to storage, manipulate and find data LOut2: knowing systems to transfer, storage and analyse medical image data. Standard dicom LOut3: identifying important personal values in medicine LOut4: knowing the ethics aspects involved in the clinical practice and developing skills to an adequate decision making process
4	Language	*Spanish*
5	ECTS\Hours	*6*
6	Key words	Data bases, medical imaging, DICOM, soft skills, ethics, decision making
7	Structure of the course/curriculum	*27 subjects: digital hospital, data storage systems, Dicom standard, medical image processing, medical image management, scientific research presentation, Access, Excel, medical image processing, biomedical data searching, bioethics, ethics problems, clinic relationships, communication in medicine, patients' rights, confidentiality, informed consent, decision making, situation dilemmas, life*

		principle, conscientious objection, genetics and society, ethics comites, end of life, follow-up. *Theoretical lectures. Elaboration and presentation of a scientific work and written test.*

Numbering 4.1.3		
1	Course title	*Artificial intelligence and health. Grade in medicine, Universidad Autónoma de Barcelona*
2	Course description	*A theoretical course to know the basics of artificial intelligence (machine learning, deep learning, big data) applied in medicine and other subjects related with technology (robotics, digital health, internet of things) and healthcare.* *Elective Subject (link)*
3	Learning outcomes (LOut)	LOut1: to know the basics - methodological and scientific bases - of digital health and the new technologies applied to the Smart Health. LOut2: to know the main fields of contemporary digital health development. LOut3: to Acquire competence with basic technologies based on their theoretical foundations and indications, using clinical models as facilitators of learning. LOut4: Students will be introduced to the concepts and basic tools of Artificial Intelligence focused on their future professional practice. Sessions will aim to familiarize students with the use of the most used tools and online resources. LOut5: Introduce the student in the ethical considerations in the use of massive data and Artificial Intelligence.

4	Language	*Spanish/Catalan*
5	ECTS\Hours	*3 ECTS*
6	Key words	Artificial intelligence, machine learning, deep learning, big data, robotics, digital health
7	Structure of the course/curriculum	*SUBJECT 1 - Introduction to artificial intelligence and automatic learning.* *SUBJECT 2 - Evidence-based medicine and surgery. Linguistic normalization. Search engines.* *SUBJECT 3 - Smart city environment. Smart Health. Liquid Hospital. The role of the doctor in a Smart Health environment.* *SUBJECT 4 - Biometrics of the environment and Big Data. Internet of Things. Apps and Telemetry.* *SUBJECT 5- Neuromorphic computation. Deep learning. Supervised and unsupervised predictive models.* *SUBJECT 6- The global medical brain.* *SUBJECT 7- Robotics applied to the healthcare field.*

		SUBJECT 8 - Bioethics of Automatic Learning. Algorithmic ethics *Theoretical lectures, seminars, field research project and presentation*

Numbering 4.1.4		
1	Course title	*Big data and artificial intelligence in medicine. Grade in medicine, Universidad Complutense de Madrid*
2	Course description	*There is no information about the contents and outcomes of the course. It is expected to be similar to the course described in 1.2.3* *Elective Subject (link)*
3	Learning outcomes (LOut)	No information
4	Language	*Spanish*

5	ECTS\Hours	*3 ECTS*
6	Key words	Artificial intelligence, big data
7	Structure of the course/curriculum	*No information*

Numbering 4.1.5		
1	Course title	*Online training program Boost your future*
2	Course description	*Know and develop the most demanded skills for employability* https://empleo.usal.es/format/cursos.php
3	Learning outcomes (LOut)	**Course 1**

		- Acquire basic skills from your first years of study and to access the world of work. - Learn about some resources and tools that will be very useful during your time at the University of Salamanca. **<u>Course 2</u>** - Provide you with techniques, tools and skills that you will have the opportunity to implement in your first contact with the business world through company practices. - Learn basic tools for job search such as the Curriculum Vitae and the cover letter, as well as some strategies to pass job interviews and other selection tests that are used today. **<u>Course 3</u>** - Be autonomous and decisive in the job search that you are about to start. - Learn to look for offers in the open market and manage your network of contacts to access the hidden market.

		• Awaken your sense of initiative, create your own brand, learn to negotiate and cope with pressure.
4	Language	*Spanish*
5	ECTS\Hours	*30 hours per course. 3 different courses*
6	Key words	Soft skills, employability
7	Structure of the course/curriculum	**Course 1** • Self-knowledge 1 • Succeed in college • Managing your finances • Organization and planning • Effective communication • Teamwork **Course 2** • Self-knowledge 2

		- Looking for academic internship opportunities - Career decision making - CV and cover letter - Interviews and selection tests - Negotiation and problem solving <u>**Course 3**</u> - Self-knowledge 3 - Creating your personal brand (Branding) - Managing the pressures - Entrepreneurship (sense of initiative) - Looking for job opportunities - Succeed in the job market

5.4.1.3 Courses (Postgrduate)

In this section, we have examined the curricula of the master degrees of all univiersities in Spain that offer the degree in medicine. Usually, univiersities group their masters in branches: humanities, sciences, health sciences, engineering and arquitecture, social and legal sciences. We have considered the masters in the health science branch and, among them, only the masters we have considered more direcltly related with the medicine grade, since there are other masters oriented for graduates in psycology, nursing or physiotherapy. We have only considered courses with detailed information about their contents, but we found more results that could be related to AI and soft skills according to their course title. Also, we have only considered official master degrees, i.e. those certified by the Education Ministry that give official competences (like the access to a doctoral degree). The rest of non-official masters are included in section 2 of this report.

We have found many courses with contents related to AI and soft skills in this section as masters are more specialized than the medicine grade. To make the report more accesible, we have grouped this courses by their similarity in the nexts groups:

- 1.3.1 Courses on artificial intelligence: in this group we include courses with contents related to the theory of machine learning, deep learning or big data.
- 1.3.2 Courses on innovation: in this group we included contents related with intellectual property, entrepeneurship or management, that we found related with soft skills.
- 1.3.3 Courses on communication: contents related with the development of communication skills and other social skills for medical professionals.
- 1.3.4 Courses on programming: the purpose of these courses is to learn different programming languages, mainly R, Python or shell/bash. There are also contents related with the management of data bases. Some courses share contents with the group 1.3.1. To notice: several courses in this group are included in masters in bioinformatics or biomedical engineering. We find these masters more appropiate for studends with a technical background, but their contents are transversal and also offered to students from health sciences.
- 1.3.5 Courses on scientific communication: although they share contents with group 1.3.3, we have found several courses specifically oriented to communication in a

scientific context, mainly through the redaction of scientific papers or the presentantion of scientific projects.

- 1.3.6 Courses on computer vision: We have included one course with contents related to computer vision applied to medical images.

Numbering 4.2.1		
1	Course title	*New techniques of analysis of massive data. Master in healthcare economy, management and rational use of medication. Universidad de Málaga*
2	Course description	*A course on big data, data minning, Business intelligence, machine learning and its applications in healthcare. (link)*
3	Learning outcomes (LOut)	LOut1: decision making in a new digital scenario LOut2: to know the processes of generation and of information LOut3: to know new techniques of data mining LOut4: to understand, present and evaluate the results obtained by techniques of data mining

4	Language	*Spanish*
5	ECTS\Hours	*3 ECTS*
6	Key words	Big data, data mining, machine learning, business intelligence, statistics, R, Python
7	Structure of the course/curriculum	1. *Big data: knowledge engineering and data mining* 2. *Data Mining process* 3. *Data mining techniques (this is mainly machine learning models)* 4. *Applications in healthcare (languages and tools, WEKA)* *Theoretical lectures, practical exercises, practice with computer, reports about the state of the art of artificial intelligence in healthcare. Final exam.*
8	Similar courses	- *Processing and simulation of biological data. Master in biomedic engineering. Universidad del País Vasco (link, 4 ECTS)* - *Advanced data analysis. Master Erasmus Mundus in Leading Vaccinology Education. Universidad Autónoma de Barcelona. (link page 26, 3 ECTS)*

		- *Biomedical Data Analysis. Master in Bioinformatics for Health Sciences. Universidad Pompeu Fabra (link, 5 ECTS)* - *Data Mining and Data Integration in Biomedicine. Master in bioinformatics for Health Sciences (link, 5 ECTS)* - *Storytelling with data. Master in biomedical research. Universidad de Lleida (link, 4 ECTS)* - *Machine learning. Master in bioinformatics and computational biology. Universidad Autónoma de Madrid (link, 6 ECTS)* - *Text mining. Master in bioinformatics and computational biology. Universidad Autónoma de Madrid (link, 3 ECTS)* - *Clustering Techniques / Classification Techniques / Introduction to bayesian data analysis. Master in methodology of sciences of behaviour and health. Universidad Autónoma de Madrid / Universidad Complutense de Madrid (link).*

Numbering 4.2.2		
1	Course title	*Knowledge transfer, patentability, and protection of knowledge policies. Master in translational research and personalized medicine. Universidad de Granada.*
2	Course description	*The course is focused on intellectual property, innovation and transfer of knowledge in the medicine area. Furthermore, the course has contents related with entrepeneurship, research project management or comercialization of the results of research.* (link)
3	Learning outcomes (LOut)	LOut1: to know the strategies in the transfer of knowledge in the healthcare field. LOut2: to know the mechanisms to protect the intellectual property of the research results and how to apply for a patent. LOut3: to know the ways to make collaborative research activities between the university or other public organizations and companies.
4	Language	*Spanish*

5	ECTS\Hours	*3 ECTS*
6	Key words	Innovation, intellectual property, entrepreneurship, project management
7	Structure of the course/curriculum	1. *Introduction to transfer of knowledge and innovation systems* 2. *Knowledge value* 3. *Research results protection in healthcare* 4. *Intellectual and industrial property* 5. *Open innovation* 6. *Relationships between research centers and pharma and biotechnology companies* 7. *R+D+I projects collaborative management* 8. *Agreements used in transfer of knowledge* 9. *Commercialization of the results of research* 10. *Creation on companies based on knowledge* *Theoretical lectures, practical exercises, visits to r+D+i institutes. Final exam.*
8	Similar courses	- *Creation of technology based companies. Master in biomedical research.*

		Universidad del País Vasco. (link, 125 hours) - *Project management. Master Erasmus Mundus in Leading Vaccinology Education. Universidad Autónoma de Barcelona. (link: page 38, 3 ECTS)* - *Communication, management and innovation at science. Master in biomedical research. Universidad de Lleida (link, 4 ECTS)*

Numbering 4.2.3		
1	Course title	*Nursing and communication. Master in medical attention, management and care. Universidad de Santiago de Compostela*
2	Course description	*The course is focused on the importance of the social skills in the medical practice. (link)*
3	Learning outcomes	LOut1: to know different aspects of the concept of social skills.

	(LOut)	LOut2: to develop competent social skills (cognitive, emotional and behavioural) to enable successful personal interactions. LOut3: to develop necessary skills to interview patients in a clinical context. LOut4: to express terms and concepts precisely and adequately. LOut5: to know to put in practice the main social skills in a clinical context.
4	Language	*Spanish*
5	ECTS\Hours	*4 ECTS*
6	Key words	Soft skills, communication, social skills
7	Structure of the course/curriculum	1. *Social skills* 2. *Skills to start, keep and end conversations* 3. *Assertive skills* 4. *Skills for interviews* *Theoretical lectures, practical exercises, interactive sessions. Evaluation through tests and case studies.*

8	Similar courses	- *Training in social and communicative skills for professionals. Master in human resources management / Master in in health research and quality of life. Universidad de Islas Baleares. (link, 5 ECTS)* - *Teamwork. Master in Social Gerontology. Universidad de Aragón. (link, 2 ECTS)* - *Internship in companies. Master in Social Gerontology. Universidad de Aragón. (link)* - *Communicating on vaccines and public health. Master Erasmus Mundus in Leading International Vaccinology Education. Universidad Autónoma de Barcelona (link page 37, 6 ECTS)* - *Advanced clinical Research. Master in clinical research applied in health sciences. Universidad Autónoma de Barcelona (link)* - *Health and society. Master in public healthcare. Universidad Autónoma de Madrid (link, 4,5 ECTS)*

Numbering 4.2.4		
1	Course title	*Introduction to programming and bioinformatics data analysis. Master in genomics and genetics. Universidad de Santiago de Compostela*
2	Course description	*The course offers an introduction to bash/shell, R and Python programming languages to manage and analyze omics data. (link)*
3	Learning outcomes (LOut)	LOut1: to Acquire the skills for the management and development of basic data analysis tools. Developing automated data analysis, filtering, and classification skills programmatically. To get a basic understanding of the Python and R languages
4	Language	*Spanish*
5	ECTS\Hours	*4 ECTS*
6	Key words	Programming, Python, R, data bases

7	Structure of the course/curriculum	1. *Bash/Python/R programming* 2. *Omics data bases* 3. *Sequences files formats* 4. *Introduction to computational analysis of genomic data* *Theoretical lectures, practical exercises, interactive sessions. Evaluation through tests and case studies.*
8	Similar courses	- *Introduction to Python. Master in Bioinformatics for Health Sciences. Universidad Pompeu Fabra (link, 5 ECTS)* - *Introduction to PERL. Master in Bioinformatics for Health Sciences. Universidad Pompeu Fabra (link, 5 ECTS)* - *Advanced Statistics. Master in bioinformatics for health sciences. Universidad Pompeu Fabra (link, 5 ECTs)* - *Bioinformatics. Master in molecular biology and biomedicine. Universidad de Girona. (link, 3 ECTS)* - *Processing and management of massive data. Master in bioinformatics*

		and computational biology. Universidad Autónoma de Madrid (link, 6 ECTS) - *R programming and statistics. Master in bioinformatics and computational biology. Universidad Autónoma de Madrid (link, 6 ECTS)*

Numbering 4.2.5		
1	Course title	*Scientific Writing and Communication Skills for Scientists. Master molecular biology and biomedicine. Universidad de Cantabria*
2	Course description	*This course aims at providing the necessary techniques and concepts for efficient oral and written communication at different stages of scientific career development. (link)*
3	Learning outcomes (LOut)	LOut1: Ability to understand and critically evaluate a research article in the areas of work subject to the master.

		LOut2: Ability to understand, interpret, analyse and evaluate scientific texts LOut3: Ability to communicate in writing the results of their research work using an appropriate linguistic and discursive approach and knowing how to organize the information. LOut4: Ability to use different data presenting and bibliography software programs. LOut5: Ability to present orally scientific results.
4	Language	*Spanish*
5	ECTS\Hours	*5 ECTS*
6	Key words	Communication, writing skills
7	Structure of the course/curriculum	1. *Oral presentations* 2. *Writing (and reading) skills* 3. *Presentation skills for scientific career development* 4. *Use of bibliographic reference manager programs* *Theoretical lectures and seminars. Evaluation through assistance and participation*

		and elaboration of a written and oral project.
8	Similar courses	- *Scientific Writing and Communication Skills for Scientists. Master molecular biology and biomedicine. Universidad del País Vasco (The course is shared by both universities).* - *Presentation of research projects: communication skills and techniques in the biomedical scientific context. Master in biomedical research. Universidad del País Vasco (*link, 5 ECTS*)* - *Analysis and presentation of scientific data. Master in cytogenetics and reproduction biology. Universidad Autónoma de Barcelona (*link*)* - *Advanced clinical Research. Master in clinical research applied in health sciences. Universidad Autónoma de Barcelona (*link, 6 ECTS*)* - *Science in action. Master in Bioinformatics for Health Sciences. Universidad Pompeu Fabra (*link, 5 ECTS*)* - *Communication, management and innovation at science. Master in biomedical research. Universidad de Lleida (*link, 4 ECTS*)*

		- *Scientific communication. Master in pharmaceutical industry and biotechnology. Universidad Pompeu Fabra (link, 5 ECTS)* - *Research in promotion of health, basic aspects. Master in promotion of health. Universidad de Granada (link, 3 ECTS)*

Numbering 4.2.6		
1	Course title	*Biomedical informatics: image and communications. Master in biomedical engineering. Universidad del País Vasco*
2	Course description	*A course on computer vision focused on medical imaging. (link)*
3	Learning outcomes (LOut)	LOut1: to know methods to obtain, improve and analyse medical images. LOut2: to process medical images through typical methods: filtering, transforming, segmenting, registering.

		LOut3: to develop algorithms of processing and analysis of medical image data. LOut4: to know the basics of storage, distribution and visualization of medical images.
4	Language	*Spanish*
5	ECTS\Hours	*4 ECTS*
6	Key words	Computer vision, medical imaging
7	Structure of the course/curriculum	1. *Advanced analysis of biomedical images* 2. *Advanced processing of images* 3. *Telemedicine systems* 4. *Medical visualization* 5. *Obtention and processing of biomedical images* *Theoretical lectures, exercises with computer and personal tutorships. Evaluation through a written test*
8	Similar courses	

5.4.2 Vocational Education Training in Spain

5.4.2.1 Structure

Abstract		
1	The structure of the Medical VET programs	*We did not find a specific structure for Medical VET programs. On one hand, there are not-official masters and courses offered by the university to students and mainly graduates in medicine. These courses have a master structure, with approximately 50 ECTS, 10 subjects, a final project and a duration of 1 year. On the other hand, there exist many VET courses offered by the universities to all the students and even external people, which consist in a specific course with 3 to 5 ECTS approximately.*
2	The structure of curricula	*In the same way, there are no specific curricula of VET education, since every university can offer their own not-official post-graduate programs and VET courses for students.*
3	Similarity	*As in section 1.3, we have found a reduced group of course profiles with contents very*

		similar between different universities. See section 2.2
4	Depth	*Similarly, to the courses in graduate and official post-graduate scenario, the courses of not-official masters and titles specific for medical graduates are generally broad and put the subject of interest (AI or soft skills) in the healthcare context. On the other hand, there are VET titles and courses offered for all the university community which are specific on a particular subject. In the context of AI and data science, some of these courses are maybe not so accessible to students without a technical background, however, as for the soft skills, we find the appropriate to any student.*

5.4.2.2 Courses

In this last section, there are included the rest of educational programs offered by universities with a medicine degree. This includes the aforementioned non-official master degrees, titles offered for students that are already graduates and courses offered by the universities to all of their students (graduates or not).

Since these educational resources are generally offered to all the university community, we have only considered courses with adequate contents for students or graduates in medicine. For example, a course about artificial intelligence with requisites consisting in a basic programming knowledge were not considered, since the latter is not a subject of medical schools curricula.

As in section 1.3, we have grouped the results we found in a reduced number of groups according to their similarity:

- 2.2.1 Courses related to data science. We found courses that combined contents about programming skills, mainly in R and data science topics, like data mining, big data or artificial intelligence.
- 2.2.2 Courses about technology and health. Here we found two not-official master degrees.
- 2.2.3 Courses about social skills. We found here many courses about soft skills in the laboral context, mainly related with communication.
- 2.2.4 Courses about management and leadership in the laboral context.
- 2.2.5 Courses about innovation and entrepreneurship

- 2.2.6 Courses about scientific communication and dissemination.

Numbering 4.3.1		
1	Course title	*Expert at modelling and data mining (with R software). Universidad de Castilla La Mancha (link)*
2	Course description	*A non-official grade on different topics of data science as data visualization, data mining, model generation or business analytics based on R language. The target of the course is any professional or graduated student. The course can be expanded to a non-official master degree of 60 ECTS.*
3	Learning outcomes (LOut)	LOut1: identifying the type of statistical problem according to the data and objectives. LOut2: knowing techniques and tools to visualize data and recognize visual patterns LOut3: analysing and processing data with techniques from big data or artificial intelligence LOut4: knowing the competences and functions of a data scientist

		LOut5: incorporating these techniques in real projects
4	Language	*Spanish*
5	ECTS\Hours	*27 ECTS*
6	Key words	Data science, big data, data mining, artificial intelligence, business analytics,
7	Structure of the course/curriculum	*No information*
8	Courses with similar contents	- *Master in cloud data science and data engineering. Universidad de Castilla la Mancha (link, 60 ECTS)* - *Expert in bioinformatics and computational genomics. Universidad de Salamanca (link, 30 ECTS)* - *Introduction to artificial intelligence: machine learning and neural networks. Universidad de Salamanca (link, 30 hours)* - *Programming and data analysis with R. Universidad de Salamanca (link, 80 hours)*

		- *Data processing, visualization and presentation in R. Universidad Autónoma de Madrid (link, 22 hours)* - *Big data in healthcare. Universidad de Alcalá de Henares (link, 6ECTS)*

Numbering 4.3.2		
1	Course title	*Expert in eHealth and technological development for health use. Universidad de Oviedo (link)*
2	Course description	*Non-official title with contents related with the use of technology in healthcare, with topics like eHealth, augmented reality, 3d printing, data science, apps, digital tools, social networks and gamification. Also contents about the legal and ethical aspects of this technologies.*

3	Learning outcomes (LOut)	No specific information. Generally, getting the basic knowledge about the topics included in the curriculum
4	Language	*Spanish*
5	ECTS\Hours	*50 ECTS*
6	Key words	eHealth, data science, technology
7	Structure of the course/curriculum	- *Module 1: eHealth, virtual and augmented reality* - *Module 2: digital technology and tools at service of healthcare* - *Module3: research and legal basis of the use of eHealth and innovative technology at healthcare* - *Module 4: final project and internship*
8	Courses with similar contents	- *Master (not official) in innovation in digital health. Universidad Complutense de Madrid (link, 60 ECTS)*

Numbering 4.3.3		
1	Course title	*Effective management of conflicts at the working environment. Universidad de la Laguna (link)*
2	Course description	*A course about conflict management and resolution at the work environment*
3	Learning outcomes (LOut)	LOut1: identify causes of conflicts LOut2: recognize the impact of attitudes in conflicts LOut3: identify different styles to approach conflict resolution LOut4: decision making to achieve problem resolutions LOut4: knowing the importance of looking for satisfactory solutions for all parts
4	Language	*Spanish*
5	ECTS\Hours	*3 ECTS*
6	Key words	Soft skills, Social skills, conflict management, communication, employability

7	Structure of the course/curriculum	- *Introduction to conflict management* - *Effective communication skills in the conflict* - *Negative emotions management* - *Effective strategies to come to an agreement*
8	Similar courses	- *Emotional Intelligence: the practice of social and emotional skills in education. Universidad de Sevilla (link)* - *Successful Interpersonal communication: neuro linguistic programming. Universidad de la Palma (link, 40 hours)* - *Communication skills. Universidad de la Laguna (link, 30 hours)* - *Soft skills for social volunteering. Universidad de Murcia (link, 5 ECTS)* - *Oratory and communication 4.0. Universidad de Salamanca (link, 30 hours)* - *Promote your future. Universidad de Salamanca (link, 3 courses, 30 hours each)* - *Interpersonal and profesional skills for health sciences. Universdad San Pablo Ceu (link, 15 ECTS)*

		- *Employability courses. Universidad Autónoma de Madrid (link)* - *Public speaking. Universidad Complutense de Madrid (link)*

Numbering 4.3.4		
1	Course title	*University Expert in patient security, organization and teams. Universidad de Cádiz (link)*
2	Course description	*A course focused on the importance of the patient security mainly for students and graduates oriented to work on the health area. Some contents are related with management skills and leadership.*
3	Learning outcomes (LOut)	No information about learning outcomes
4	Language	*Spanish*
5	ECTS\Hours	*16 ects*

6	Key words	Management, leadership
7	Structure of the course/curriculum	*Module 1: concept and importance of patient security* *Module 2: organization management and patient security* *Module 3: people management and patient security* *Module 4: management skills and patient security*
8	Similar courses	- *Motivation at work: motivation techniques in organizations. Universidad de la Laguna (link, 30 hours)* - *Effective meeting techniques. Universidad de la Laguna (link, 20 hours)* - *Training in competences. Universidad Pública de Navarra (link, 3 ECTS)* - *University expert in transversal professional skills. Universidad Pública de Navarra (link, 15 ECTS)* - *Health Coach. Universidad Complutense de Madrid (link, 21 ECTS)* - *Team direction and talent management. Universidad Miguel Hernández (link, 200 hours)*

Numbering 4.3.5		
1	Course title	*University Expert in entrepreneurship and innovation. Universidad de Cádiz (link)*
2	Course description	*A course about entrepreneurship and innovation oriented for graduates and students with no background in management and business*
3	Learning outcomes (LOut)	LOut1: learning the “entrepreneur method” and different innovation techniques LOut2: carrying out projects in a professional way, learning to receive support from other social agents (stakeholders). LOut3: boosting the intra-entrepreneurship and corporative entrepreneurship LOut4: mobilizing and developing surrounding resources to generate opportunities and create value.
4	Language	*Spanish*
5	ECTS\Hours	*10 ECTS*

6	Key words (of this course and similar ones)	Entrepreneurship, Innovation,
7	Structure of the course/curriculum	*Module 1: entrepreneurship ecosystem* *Module 2: creativity, opportunities and business models* *Module 3: company plan and viability analysis, procedures and supporting instruments*
8	Similar courses	- *Innovation promotion and management. Universidad de la Laguna (link, 60 hours)* - *Expert in innovation and entrepreneurship. Universidad Pública de Navarra (link, 18 ECTS)* - *Professional skills, employability and entrepreneurship. Universidad Miguel Hernández (link, 200 hours)*

Numbering 4.3.6		
1	Course title	*Introduction to scientific and technologic dissemination. Universidad de Extremadura (link)*
2	Course description	*A course on scientific dissemination with the objective of bringing the science to society.*
3	Learning outcomes (LOut)	LOut1: to give value to the relation between science and society LOut2: to develop strategies for an effective communication LOut3: to promote the scientific dissemination as a complement to professional and academic careers. LOut4: to ease the relation between researchers and journalists
4	Language	*Spanish*
5	ECTS\Hours	*3 ects*
6	Key words (of this	Soft skills, dissemination, communication,

	course and similar ones)	
7	Structure of the course/curriculum	*Module 1: written dissemination texts elaboration and oral communication* *Module 2: digital communication*
8	Similar courses	- *Resources for the public presentation of the final grade projects and final master projects. Universidad de la Palma (link, 20 hours)* o *Plan the exposition, select information, presentation with digital resources, oral communication.* - *University Expert at social communication of science. Universidad de Oviedo (link, 21 ECTS)*

5.4.3 Policy making policies in Spain

Estrategia Española de Ciencia, Tecnología e Innovación 2021-2027: Among the strategic lines we can find “precision medicine” and the following sublines, “artificial intelligence” and “digital health in personalized

medicine". "Artificial intelligence and robotics" is also a strategic line on its own, including "computer vision" and "digital health" as sublines. Estrategia Española de I+D+i en Inteligencia Artificial: Describes primary care as a sector which will benefit from AI, and the focus in cost savings through improvements prevention, early diagnosis and treatment of child obesity, cardiovascular diseases, neurogenerative diseases and breast cancer, among other subjects. It states the need for an AI able to explain its decision to health professionals and improving the interaction human-computer. "P4 medicine" (predictive, personalized, preventive and participative) will be based on AI, big data, machine learning and computer vision. "Estrategia Nacional en Inteligencia Artificial": Identifies the sinergy between the health sector and AI as a strategic field for research. It states that AI will drive strategic projects like simplification of algorithms in healthcare, such as patient triage, and improve the efficiency of the healthcare system.
References
https://www.ciencia.gob.es/dam/jcr:e8183a4d-3164-4f30-ac5f-d75f1ad55059/EECTI-2021-2027.pdf https://www.lamoncloa.gob.es/presidente/actividades/Documents/2019/040319-estrategia-inteligencia.pdf https://www.lamoncloa.gob.es/presidente/actividades/Documents/2020/ENIA2B.pdf

6 Conclusion

1. The courses of artificial intelligence in the curricula of medical schools are not considered as a whole. AI and some of its topics are presented in fragments or not at all. Hence the need for a curriculum that will cover the full spectrum of conflicting intelligence. It will start with learning the basic concepts and will continue with the applications. It is VERY essential to emphasize that the existing individual AI courses do not offer substantial training to the students in the various fields they need to be connected to the physical subject of medicine.
2. Soft skills courses are practically absent (except in Belgium and Spain), basic skills such as problem solving etc. are ignored.

3. The results of our research are fully in line with the results of the OECD for which only a few countries (Belgium, Denmark, Finland, the Netherlands, Norway, Sweden) are considered to have the necessary digital skills and appropriate education and lifelong learning systems to allow full and timely use of the possibilities and challenges of artificial

intelligence. Research shows that both medical personnel and students often have deficient digital skills; therefore, lifelong learning systems, both formal and informal, need to be significantly strengthened to facilitate capacity building and the acquisition of the new skills needed in the future digital world of artificial intelligence.

4. Digital integration and the elimination of digital illiteracy in AI is not a sprint, but a marathon that requires strategic planning and coordinated action. Supporting people far from AI is a self-evident need. Digital technologies - having invaded all fields of medicine - are radically shaping the ways of life, work and education. They can thus be an ideal ally for tackling everyday pressing challenges. Understanding the issue and coordinated action, through lifelong learning, can build more inclusive, more equitable and more sustainable societies, where everyone will be able to take advantage to the fullest in this new digital age, its potential and skills for a more sustainable development.

7 Annex

The full results of the survey are extract as follow:

- Results for all the countries combined here: https://drive.google.com/drive/folders/1H9pVlUrZVBSEIrmdxMgQM5KnwKO8gFrx?usp=sharing
- Results of Spain here: https://drive.google.com/drive/folders/1K0O78A_AKoSObR12Dwto3Xm4ueAaRDDY?usp=sharing
- Results of Belgium here: https://drive.google.com/drive/folders/1nn3QPBBoCXJT8SaVDfZbu-6EgXjBqd0U?usp=sharing
- Results of Finland here: https://drive.google.com/drive/folders/1yQ_VbQ6lZARVhdikjGrrXD6Iwub4dL9i?usp=sharing

- Results of Greece here:
https://drive.google.com/drive/folders/1bDczpuCNpOGSWgP-FpE1PzkwVxiVqLb0?usp=sharing