Digital Transformation in Advanced Manufacturing

DTAM

Impact of the Curriculum on IVET and CVET learners and companies

DTAM

DIGITAL TRANSFORMATION IN ADVANCED MANUFACTURING

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Introduction

This report endeavors to provide a comprehensive analysis of the effects of the DTAM Curriculum on both IVET and CVET learners, as well as its impact on companies. The evaluation of the Curriculum's impact took place during the pilot phase (WP5), conducted by Politeknika Ikastegia Txorierri, APRO Formazione, Da Vinci College, and the University of Patras. Throughout the pilots, all modules were implemented by VET Institutions, i.e. Information Technology and Operational Technology, Big Data, Machine Learning, Internet of Things and Sensors, Cybersecurity, and Transversal Competencies.

To assess the impact systematically, we developed targeted questionnaires distributed to three key stakeholders:

a) IVET students, surveyed both before and after the pilot courses, with separate questionnaires for each module. These evaluation questionnaires were integrated into the Moodle platform to ensure widespread participation.

b) CVET trainers who participated in the pilots, utilizing questionnaires developed on Google Forms to gauge the impact on their professional development.

c) Companies involved in the pilots or engaged in DTAM project activities (TPMs, Multiplier Events), who became familiar with the Curriculum. For companies, an Interview Guide was created to supplement the questionnaires with qualitative data.

Aligned with the aforementioned objectives, the report is organized into three distinct chapters:

Chapter 1. Impact on IVET learners: This section delves into how the modules have influenced participating students, examining outcomes from pre- and post-course evaluations.

Chapter 2. Impact on CVET learners: Here, we explore trainers' perspectives and experiences in teaching the modules, as well as the impact on their pedagogical approach.

Chapter 3. Impact on Companies: This segment examines how the knowledge acquired by students in the course can be exploited within the corporate environment.

Chapter 1: Impact on IVET learners

This first chapter of the report is predicated on analysing the responses of students from each partner institution, as recorded in both the pre-evaluation and post-evaluation phases. In addition there is a dedicated subchapter that depicts the evolution on the skills and competences of the students in each module through a comparison between the pre-evaluation with the post-evaluation, in order to assess the impact of the modules on the students.

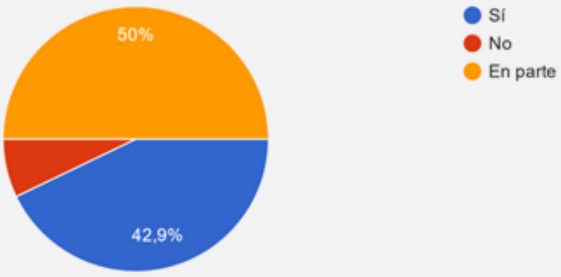
Pre-Evaluation of the DTAM course by students

This section of the first chapter of the report focuses on the analysis of students' responses to the pre-evaluation questionnaire, which they completed before embarking on the course. Through a structured assessment process, valuable insights have been collected regarding the students' initial knowledge, expectations, and perspectives. This foundational data serves as a crucial starting point for a comprehensive analysis of their progress and development throughout the course.

Learners from Politeknika Ikastegia Txorierri (ES)

Expectations from Module Cybersecurity

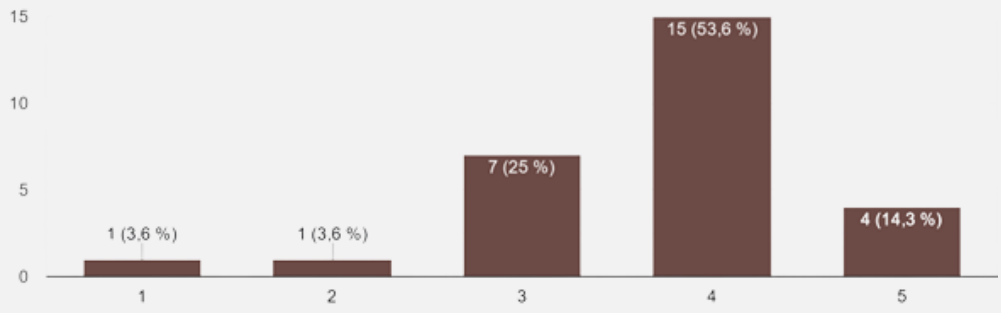
Do you feel that this learning programme would be motivational for you?



Yes No Partly

Half of the participants are not sure that the programme would be motivational for them, however, 42,9% of them are sure that it will be, while 7,1% (2 people) are sure that it will not.

Do you think that this programme will be useful for your professional development?



Where → 1: Not useful ; 5: Extremely useful

The majority of students (53,6% choosing 4 and 14,3% choosing 5) assure that for them the programme will be useful for their professional development, 25% of them are not that sure

about the programme's utility and 2 people (1 choosing 1 and 1 choosing 2) think that it will not be useful at all.

Learners from DaVinci College (NL)

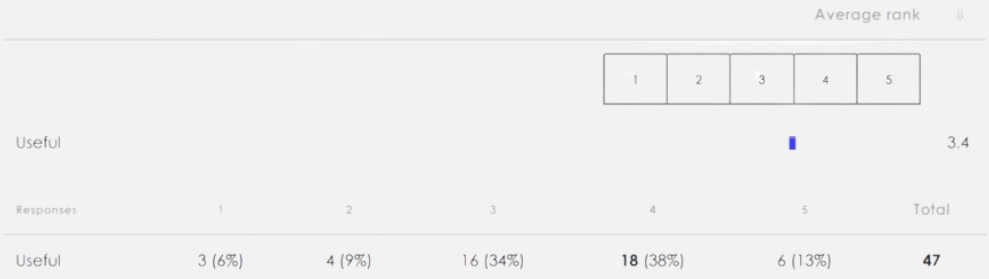
Expectations from Module Sensors

Do you feel that this training on Sensors will be motivational for you?

Response	Average	Total
Yes	32%	15
No	19%	9
Partly	49%	23

Almost half (49%) of the participants are not sure whether the course will be motivational for them or not and 32% are sure it will be motivational for them while 19% are sure it will not.

Do you believe that the learning programme will prove useful for your professional development?



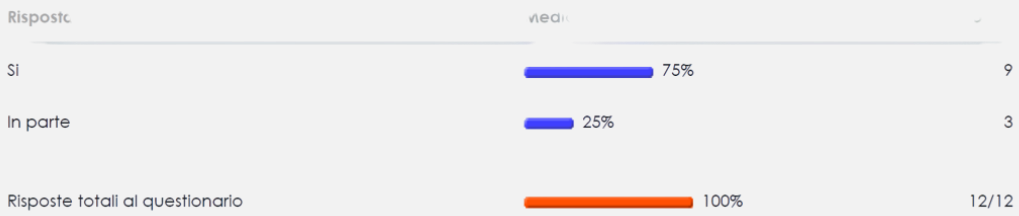
Responses	1	2	3	4	5	Total
Useful	3 (6%)	4 (9%)	16 (34%)	**18** (38%)	6 (13%)	**47**

The majority of responses are between 4 (38%) and 3 (16%), with 4 being quite useful and 3 neutral. However, some students voted not at all useful (6%) or a little useful (9%), and others saw it as completely useful (13%).

Learners from Apro Formazione (IT)

1.Expectations from Module "Introduction"

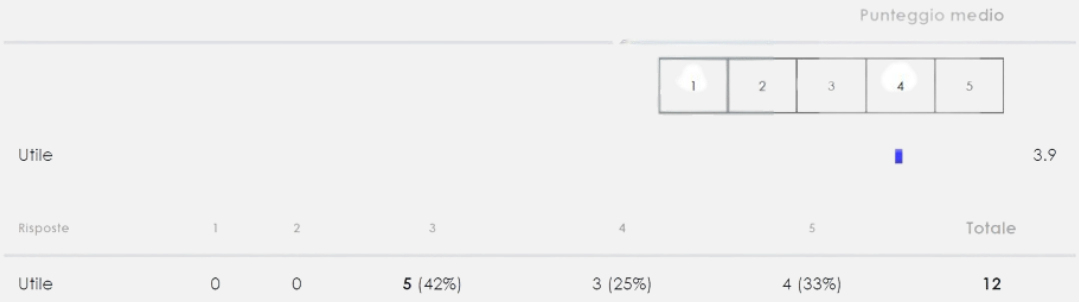
Do you think this training will be motivational for you?



Where → 1: Yes / 2: Partly

The majority of students (75%) think that the training will be motivational for them, while a 25% of them are not sure. No one voted negatively.

Do you think the learning program will be useful for your professional development?



Where → 1: Not useful / 5: Very useful

42% of the participants are not sure that the programme will be useful for their professional development, this being the most voted category. 33% think it will be very useful and 25% voted useful. None voted that it would not be useful at all.

2. Expectations from Module Machine Learning

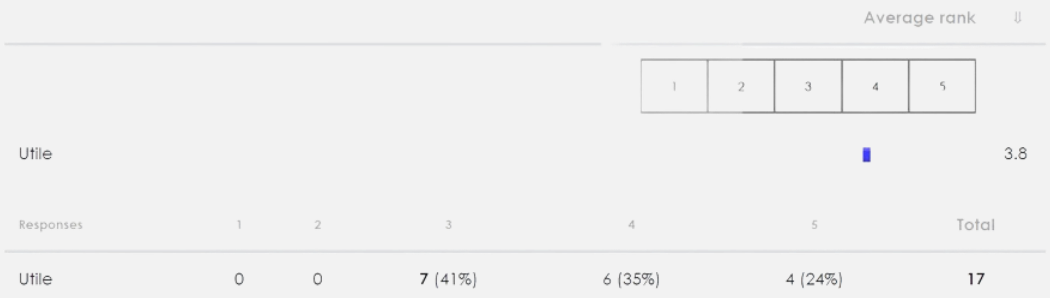
Do you think this training will be motivational for you?

Response	Average	Total
Si	76%	13
In parte	24%	4
Total responses to question	100%	17/17

Where → 1: Yes / 2: Partly

A greater part of the participants (76%) are sure that the training will be motivational for them, on the other hand, a 24% of them are not sure about that. There are no negative answers.

Do you think the learning program will be useful for your professional development?



Responses	1	2	3	4	5	Total
Utile	0	0	7 (41%)	6 (35%)	4 (24%)	17

Where → 1: Not useful / 5: Very useful

In the graph it can be seen that the majority of votes are concentrated in the neutral option, with 41% of participants voting that they are not sure that the programme is useful to them. However, 33% of them voted that they think it will be useful to them and 24% that they think it will be very useful in their professional development.

3. Expectations from Module Transversal Skills

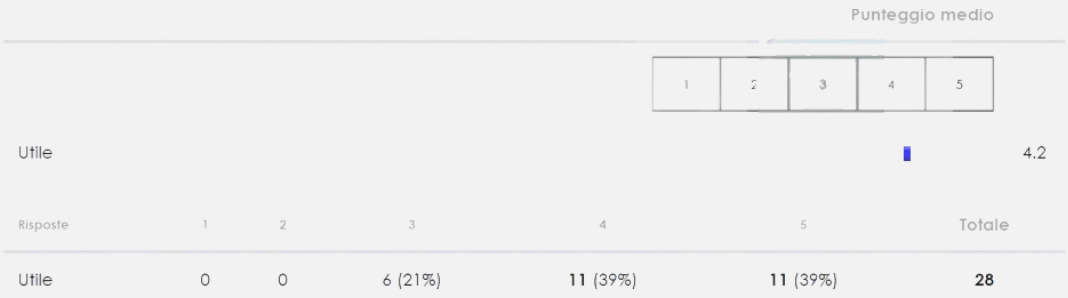
Do you think this training will be motivational for you?

Risposta	Media	Totale
Si	79%	22
In parte	21%	6
Risposte totali al questionario	100%	28/28

Where → 1: Yes / 2: Partly

The majority of students (79%) voted that they believe the programme will be motivational for them, while 21% are not sure.

Do you think the learning program will be useful for your professional development?



Risposte	1	2	3	4	5	Totale
Utile	0	0	6 (21%)	11 (39%)	11 (39%)	28

Where → 1: Not useful / 5: Very useful

39% of participants say the programme will be useful and another 39% say it will be very useful. Meanwhile 21% are not sure that it will be useful for their professional development and there are no negative responses.

Learners from University of Patras (EL)

1.Expectations from Module Big Data

Do you feel that this training will be motivational for you?

Response	Average	Total
Ναι	93%	14
Μερικώς	7%	1
Total responses to question	100%	15/15

Where → 1: Yes 2: Partly

93% of the students think that the training will be motivational for them. 7% are not sure.

Do you believe that the learning programme will prove useful for your professional development?

Average rank

	1	2	3	4	5
Χρησιμότητα					4.4

Responses	1	2	3	4	5	Total
Χρησιμότητα	0	0	3 (20%)	3 (20%)	**9** (60%)	**15**

Where → 1: Not useful 5: Very useful

More than half of the participants (60%) think that the programme will be very useful for their professional development. Then, 20% of them voted useful and 20% neutral, with no negative responses.

2. Expectations from Module Machine Learning

In this Pre-Evaluation, we only showcase responses from one student, as he was the sole participant in the course, and due to its incomplete status, we do not possess a Post-Evaluation.

Do you feel that this training will be motivational for you?

Response	Average	Total
Ναι	100%	1
Total responses to question	100%	1/1

Where → 1: Yes

The participant think that this training will be motivational.

Do you believe that the learning programme will prove useful for your professional development?

Average rank ⇓

	1	2	3	4	5	
Χρησιμότητα						4.0

Responses	1	2	3	4	5	Total
Χρησιμότητα	0	0	0	1 (100%)	0	1

Where → 1: Not useful / 5: Very useful

The student thinks that the programme will be useful.

How do you assess your existing knowledge and skills in the area of Machine Learning

	Average rank
	1 2 3 4 5
Γνώση του αντικειμένου	4.0

Responses	1	2	3	4	5	Total
Γνώση του αντικειμένου	0	0	0	1 (100%)	0	1

Where → 1: No knowledge 2: A little knowledge 3: A lot of knowledge 4: Expert / 1. Knowledge of the subject matter.

The student voted for adequate knowledge.

If you plan to participate in the introductory module, assess your current level of the following skills

Responses	Πολύ Χαμηλό	Χαμηλό	Μέτριο	Υψηλό	Πολύ υψηλό	Total
Κατανόηση και ανάλυση βασικών εννοιών της Μηχανικής Μάθησης	0	0	0	0	1 (100%)	1
Σχεδιασμός και εφαρμογή μοντέλων μηχανικής μάθησης με χρήση πραγματικών συνόλων δεδομένων	0	0	0	1 (100%)	0	1
Understand how machine learning algorithms work and how they can be applied in industrial applications.	0	0	0	1 (100%)	0	1
Κατανοείτε πώς λειτουργούν οι αλγόριθμοι μηχανικής μάθησης και πώς μπορούν να εφαρμοστούν σε βιομηχανικές εφαρμογές.	0	0	0	0	1 (100%)	1
Αναφέρετε τα αποτελέσματα των αναλύσεων κια των μοντέλων Μηχανικής Μάθησης σε γραφική παράσταση.	0	0	0	0	1 (100%)	1

Where → 1: Very poor 2: Poor 3: Neutral 4: Good 5: Very good / 1. Understanding and analysis of basic concepts of Machine Learning 2. Design and implementation of machine learning models using real datasets 3. Understand how machine learning algorithms work and how they can be applied in industrial applications. 4. Understand how machine learning algorithms work and how they can be applied to industrial applications. 5. Report the results of the analyses and machine learning models in graphical form.

The student's level before taking the course in understanding and analysis of basic concepts of Machine Learning is very good, in design and implementation of machine learning models

using real datasets is good, as well as in understand how machine learning algorithms work and how they can be applied in industrial applications. And in the last two sections, understand how machine learning algorithms work and how they can be applied to industrial applications and report the results of the analyses and machine learning models in graphical form, is very good.

Concluding Remarks

As depicted in the pre evaluation the students held high expectations for the DTAM course, as in average the majority evaluated that it would be motivational and will impact positively their professional development. Even from the pre evaluation phase it is depicted that the Modules of the DTAM course are effectively chosen and can result in improved competences in AM sector.

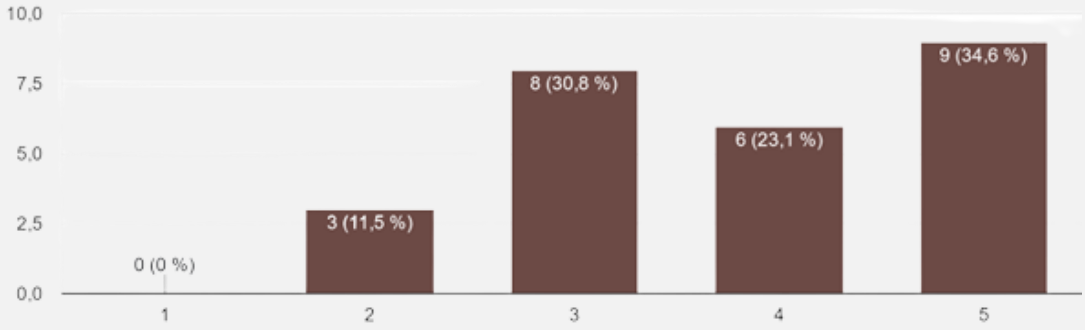
Post-Evaluation of the DTAM course by students

This section of the initial chapter is dedicated to the analysis of students' responses to the post-evaluation questionnaires. These responses were collected after the completion of the pilot modules. A structured assessment process has provided valuable insights into the students' knowledge, perceptions, and experiences upon concluding the course. This dataset forms the fundamental basis for conducting a comprehensive analysis of the impact and outcomes within their learning journey.

Learners from Politeknika Ikastegia Txorierri (ES)

General evaluation of the module Cybersecurity

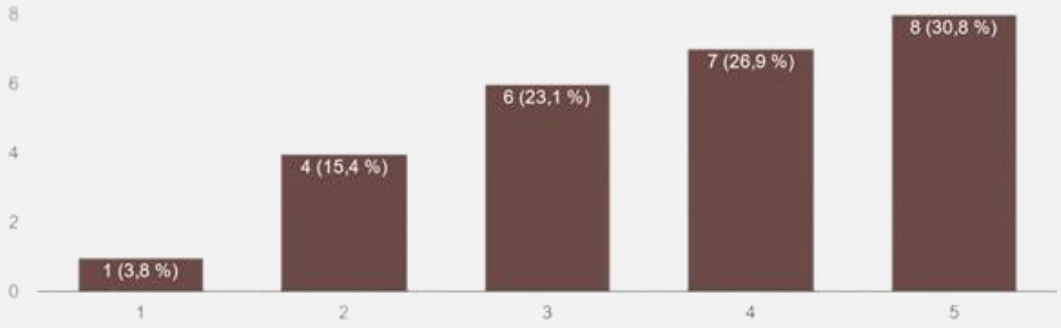
- **How would you evaluate the overall learning experience of the module?**



Where → 1: Very poor ; 5: Excellent

More than half of the participants evaluated the experience as good (23,1%) and excellent (34,6%). On the other side a 30,8% stayed neutral and the 11,5% of them evaluated it as poor.

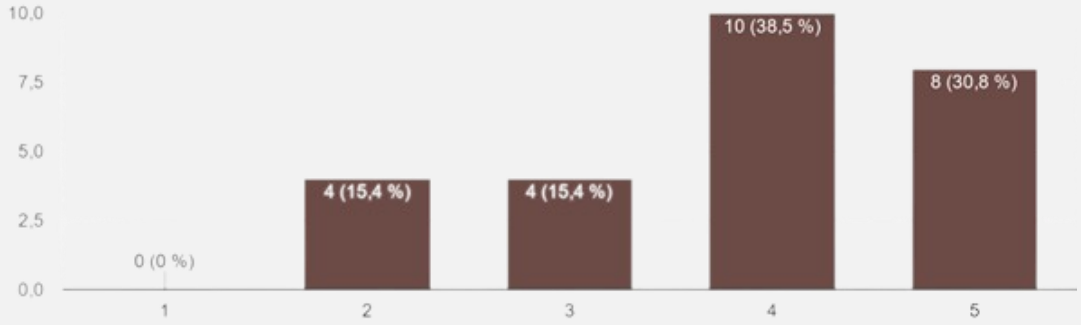
- **Did the quality of the module meet your expectations?**



Where → 1: Not at all ; 5: Absolutely

The 30,8% and the 26,9% agree that the module did meet their expectations. Meanwhile, a 23,1% of the participants are neutral and a 15,4% and 3,8% of them assure that the quality did not meet their expectations at all.

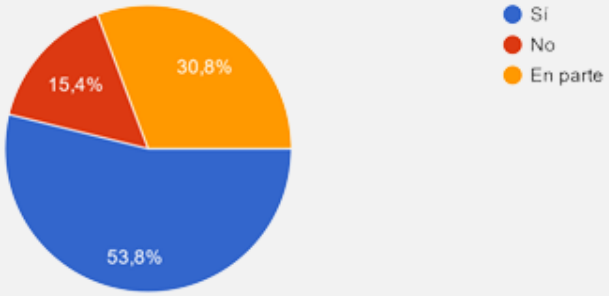
- **Did you find the module useful for your professional development?**



Where → 1: Not useful at all ; 5: Extremely useful

A greater part of the students (30,8% choosing 5 and 38,5% choosing 4) assert that they found the module useful for their professional development. Nevertheless, 15,4% of them stayed neutral and another 15,4% answered that it was not useful for them.

- **After your participation, have your initial expectations been met?**



Yes No Partly

More than half of the participants (53,8%) states that their initial expectations have been met while a 30,8% think that they have partly been met and a 15,4% say that they have not been met.

- **What need and expectations, if any, do you consider have not been effectively addressed?**

11 students stated that there are no needs nor expectations that have not been effectively addressed, affirming that the module is well designed. On the other hand, some participants consider that there is a lack of dynamism, practical lessons, and more closeness to cybersecurity. The overall complain is the large amount of theory and the few practices.

- **Which part of the material did you find more interesting?**

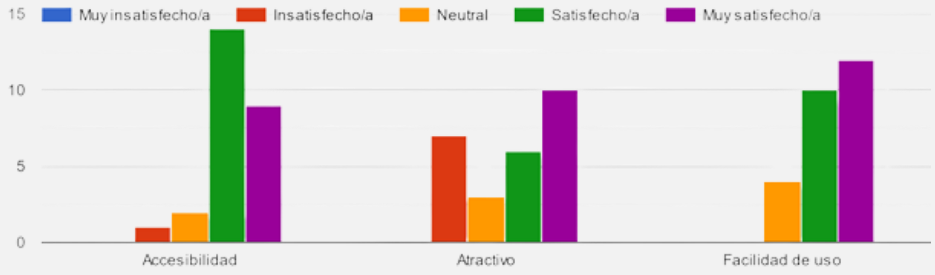
5 students considered everything interesting, the rest of them consider the practice exercises more interesting, especially the cyberattacks and the hacking parts, but also the industrial communication solution's and the identification of good practices, norms and applicable regulations.

- **Which part of the material did you find less interesting?**

9 participants think that nothing is not interesting and they enjoyed everything, meanwhile, other 9 students consider the theory their least interesting part of the course, saying that the theory part was too long and sometimes repetitive, and suggesting that it could have

been summarized. And two students say that their least interesting parts were the policies and the tests.

- **Classify your satisfaction concerning the course's learning platform.**



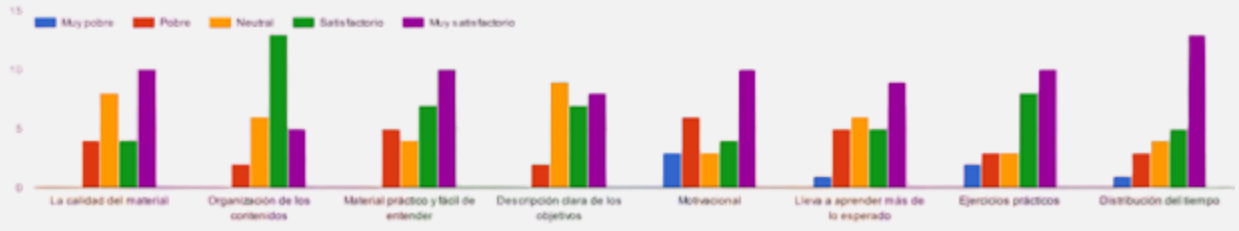
• *Very unsatisfied* • *Unsatisfied* • *Neutral* • *Satisfied* • *Very satisfied / 1. Accessibility 2. Attractiveness 3. Ease of use*

In terms of accessibility, 14 students say they are satisfied with the course's learning platform and 9 are very satisfied. 2 remain neutral and 1 dissatisfied.

In the section of attractiveness 10 participants are very satisfied and 6 satisfied, leaving 3 neutral and 7 dissatisfied.

And, finally, in ease of use 12 were very satisfied, 10 were satisfied and 4 remained neutral, with no dissatisfied respondents.

- **Please, evaluate the Cybersecurity module minding the following aspects.**



• Very poor • Poor • Neutral • Satisfying • Very satisfying / 1. The quality of the material 2. Content organization 3. Practice material and easy to understand 4. Clear description of the objectives 5. Motivational 6. Leads to learn more than expected 7. Practice exercises 8. Time distribution

Considering the quality of the material 10 people are very satisfied and 4 are satisfied. 8 are neutral and 4 say the quality is poor.

5 consider the organisation of the contents to be very satisfactory and 13 satisfactory, leaving 6 neutral and 2 who consider it to be poor.

Within the material, 10 consider it very satisfactory, being practical and easy to understand, and 7 consider it satisfactory. There are 4 who consider it neutral and 5 who consider it poor.

8 students are very satisfied and consider that the objectives have a clear description, 7 others are satisfied. 9 remain neutral and 2 see it as poor.

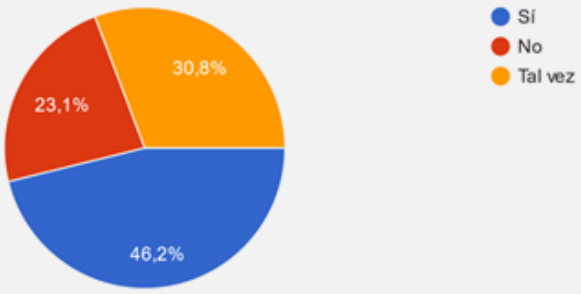
10 participants see the module as very motivational, with 4 seeing it as motivational, 3 neutral, 6 poor and 3 very poor.

14 learners agree that the module leads to learning more than expected while 6 remain neutral and 6 consider that it does not lead to learning more.

Considering the practical exercises 10 are very satisfied, 8 satisfied, 3 neutral, 3 consider it poor and 2 very poor.

And finally, in the distribution of time section, 13 are very satisfied, 5 are satisfied, 4 are neutral, 3 are poor and 1 is very poor.

Will you suggest the course to other people?



• Yes • No • Maybe

46.2% say they would recommend the course to others, while 30.7% are not sure if they would recommend it and 23.1% say they would not.

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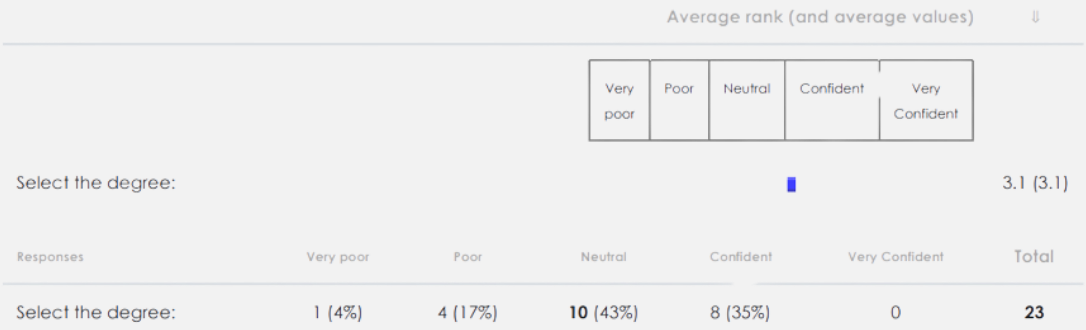
Learners from DaVinci College (NL)

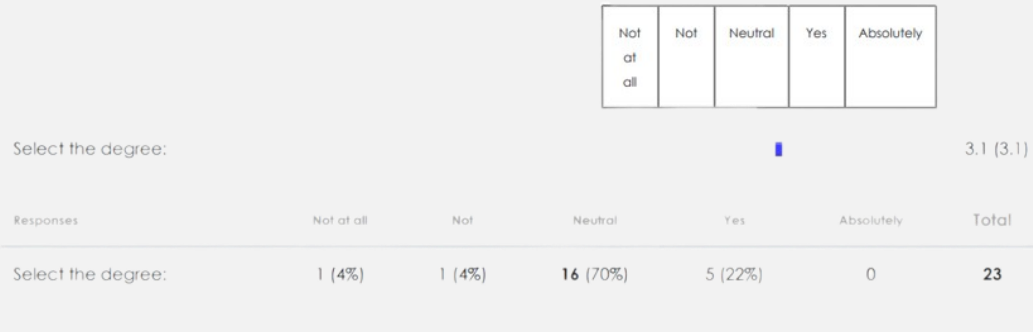
How would you evaluate the overall learning experience of the Module Advanced Sensors?



Responses	Very poor	Poor	Neutral	Confident	Very Confident	Total
Select the degree:	1 (4%)	4 (17%)	**10** (43%)	8 (35%)	0	**23**

43% of participants consider the experience neutral, while 35% consider it confident. Then, 17% found it poor and 4% very poor.

Did the quality of the module met your expectations?



Responses	Not at all	Not	Neutral	Yes	Absolutely	Total
Select the degree:	1 (4%)	1 (4%)	**16** (70%)	5 (22%)	0	**23**

The majority of students (70%) voted neutral, on the other hand 22% voted that the module did meet their expectations, leaving 4% who voted no and another 4% who voted not at all.

Which needs and expectations do you consider that they were not effectively addressed, if any?

Students had varied opinions about needs and expectations. Some were not sure about their expectations, while others felt their needs were met. A few preferred hands-on learning over online quizzes. Some found parts of the course less interesting and had trouble with the website. But many students seemed uncertain about their needs and expectations.

Which part of the training material did you find the most interesting?

When asked about the most interesting part of their training, students had varying answers. Some did not find it very interesting, while others liked building real projects or working with Arduino. A few appreciated experimenting, and some enjoyed specific tasks like assembling components or learning about sensors. Overall, what fascinated each student differed, from hands-on activities to specific topics within the training.

Which part of the training material did you find the less interesting?

Participants had a variety of opinions regarding the training material. Some found certain aspects uninteresting, like the ball-throwing game, learning about resistors, or extensive reading. Others did not enjoy reading or felt overwhelmed by information. Some students mentioned disliking the research process, while others found the coding aspects less engaging. A few did not specify any particular part as uninteresting. In summary, students had different areas within the training material that they found less interesting, from specific activities to reading and certain aspects of the course website.

Please rate your satisfaction regarding the course' s learning platform

Responses	Very dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied	Total
Accessibilty	1 (4%)	3 (13%)	7 (30%)	**11** (48%)	1 (4%)	**23**
Attractiveness	2 (9%)	6 (26%)	**12** (52%)	3 (13%)	0	**23**
User Friendliness	3 (13%)	5 (22%)	**8** (35%)	7 (30%)	0	**23**

For accessibility, most students were Satisfied (48%) and some were Neutral (30%). Regarding attractiveness, the majority were Neutral (52%) and some were Dissatisfied (26%). In terms of user-friendliness, a significant portion were Neutral (35%) and others were Satisfied (30%).

Please evaluate the Advanced sensors training module regarding the...

Responses	Very Poor	Poor		Satisfying		
Quality of the training material	0	4 (17%)	**11** (48%)	8 (35%)	0	**23**
Organisation of the contents	2 (9%)	5 (22%)	**11** (48%)	5 (22%)		
Practical and easy to follow material	1 (4%)	3 (13%)	**12** (52%)	7 (30%)		
Clear discription of objectives	0	6 (26%)	**10** (43%)	6 (26%)		
Motivational	2 (9%)	**8** (35%)	**8** (35%)	5 (22%)		
Challenged to learn more than I expected	2 (9%)	6 (26%)	**10** (43%)			
Practical Exercises	1 (4%)	4 (17%)	**11** (48%)			
Time allocation	1 (4%)	7 (30%)	(39%			

Quality of the training material had most students in the Neutral (48%) and Satisfying (35%) categories. Organization of the contents had a mix of students in Neutral (48%) and Poor (22%) categories. Practical and easy-to-follow material saw a majority in the Neutral (52%) and Satisfying (30%) categories. Clear description of objectives was mainly in the Neutral (43%) and Poor (26%) categories. Motivational aspects were divided between Poor (35%), Neutral (35%), and Satisfying (22%). Feeling challenged to learn more than expected had students mainly in the Neutral (43%) and Poor (26%) categories. Practical exercises were divided between Neutral (48%) and Satisfying (30%) categories. Time allocation was split between Neutral (39%) and Satisfying (26%) categories.

Please share your comments and suggested improvements

Students provided various feedback and suggestions, including comments about the learning platform and the course content. Some students found certain aspects of the course challenging or unengaging, while others suggested making the material more interactive and improving user interface and teaching methods. Additionally, there were requests for more engaging course content, clearer explanations, and offering content in the local language.

Are you going to suggest the course to other people?

Response	Average	Total
Yes	9%	2
No	35%	8
Maybe	57%	13
Total responses to question	100%	23/23

More than half of the participants (57%) are not sure if they would recommend the course, while 35% say they would not recommend it and 9% say they would.

Learners from Apro Formazione (IT)

Module Introduction

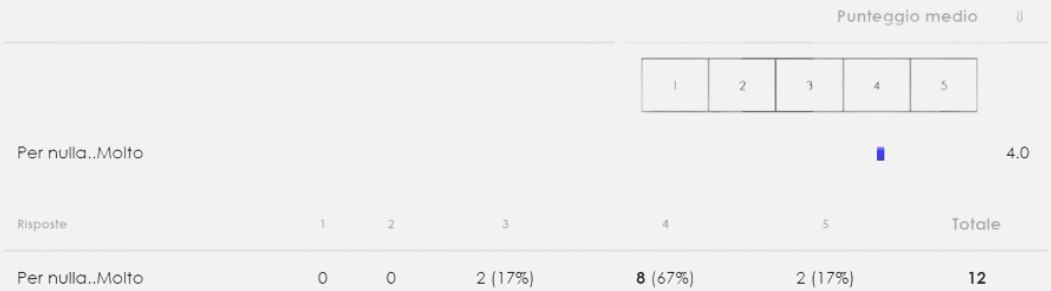
How would you rate the overall learning experience of the module?

Risposte	1	2	3	4	5	Totale
Molto scarsa..Eccellente	0	0	3 (25%)	**6** (50%)	3 (25%)	**12**

Where → 1: Very Poor / 5: Excellent

Half of the students rated the experience as very good and 25% rated it as excellent. On the other hand, 25% rated the experience as neutral, leaving no negative responses to the question.

Did the quality of the module meet your expectations?



Risposte	1	2	3	4	5	Totale
Per nulla..Molto	0	0	2 (17%)	**8** (67%)	2 (17%)	**12**

Where → 1: Not at all / 5: Very much

The majority of participants (67%) voted that the quality of the module very much met their expectations. 17% answered that it met very much, while another 17% answered neutral.

What needs and expectations do you feel have not been effectively addressed, if any?

Participants' responses varied, with some stating that no unaddressed needs or expectations existed. Others mentioned specific areas of improvement, such as outdated information or the need for more effective coverage of topics like Python and databases, computer networks, and fundamentals. Overall, opinions ranged from satisfaction with the explanations provided to a desire for more effective coverage of certain subjects.

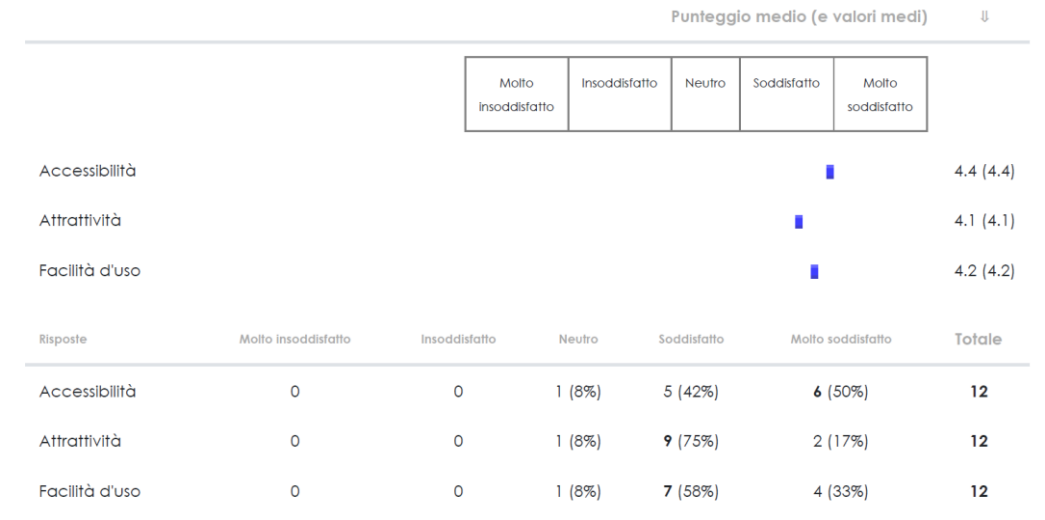
Which part of the training material did you find most interesting?

Participants found various parts of the training material interesting. Some highlighted topics such as Fundamentals of PC networks and Rasberry Pi, Python and databases, types of connections, electronics basics, automation, robotic programming and PLC, and Python. Each participant had a distinct area of interest within the training material.

Which part of the training material did you find least interesting?

Participants found different parts of the training material less interesting. Some mentioned Python basics, fundamentals of Python, robotics, Python, Big Data, and PC network fundamentals as less engaging topics. However, a few participants stated that they did not find any part of the material uninteresting. Overall, opinions varied regarding the least interesting aspects of the training material.

Assessing one's satisfaction with the course learning platform



Risposte	Molto insoddisfatto	Insoddisfatto	Neutro	Soddisfatto	Molto soddisfatto	Totale
Accessibilità	0	0	1 (8%)	5 (42%)	**6** (50%)	**12**
Attrattività	0	0	1 (8%)	**9** (75%)	2 (17%)	**12**
Facilità d'uso	0	0	1 (8%)	**7** (58%)	4 (33%)	**12**

Where → 1: Very unsatisfied 2: Unsatisfied 3: Neutral 4: Satisfied 5: Very satisfied / 1. Accessibility / 2: Attractiveness / 3: Ease of use

Within accessibility, half of the participants voted that they were very satisfied with this aspect of the platform, while 42% voted that it was satisfactory. 8% voted neutral, leaving no negative responses. Following the attractiveness of the platform, 75% voted that they are satisfied, plus 17% that they are very satisfied, leaving 8% who voted neutral, and again with no negative votes. Finally, in terms of user-friendliness, 58% consider it satisfactory and 33% very satisfactory, leaving only 8% neutral and no negative votes.

Evaluate the introductory training module with regard to the...

Where → 1: Very unsatisfied 2: Unsatisfied 3: Neutral 4: Satisfied 5: Very satisfied / 1. Quality of the didactic material 2. Content organization 3. Practice material and ease of use 4. Clear description of objectives 5. Motivation 6. Encourage to learn more than expected 7. Practical exercises 8. Time management

While participants were generally satisfied with the quality of didactic material, with 83% voting very satisfied, content organization received lower satisfaction scores, 67% satisfied. Practice material and ease of use garnered a positive response with 58% satisfied and 42% very satisfied. Participants found the clear description of objectives to be satisfactory voting the 83% for satisfied and 17% for very satisfied. Motivation and encouragement to learn more than expected received neutral to positive responses, 75% satisfied for motivation, 58% satisfied for encouragement. Practical exercises also received neutral to positive feedback with 58% satisfied, and time management was mostly neutral with some satisfaction 83% satisfied.

Share your comments and suggested improvements

Participants provided feedback and suggestions for improvement as follows: one participant mentioned the need to update the material, while another expressed satisfaction with the current content. Several participants reported no specific feedback, and one suggested keeping topics updated with upcoming changes.

Would you suggest this training course?

Risposta	Media	Totale
Si	83%	10
Probabilmente si	17%	2
Risposte totali al questionario	100%	12/12

Where → 1: Yes / 2: Probably yes

83% of the participants say they would recommend the course, while the remaining 17% believe they would probably recommend it.

Module Machine Learning

How would you rate the overall learning experience of the module?

Average rank ⇓

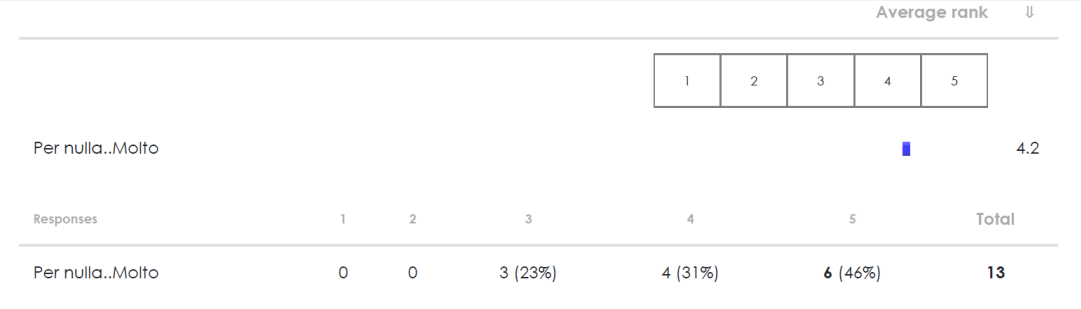
	1	2	3	4	5	
Molto scarsa..Eccellente						3.9

Responses	1	2	3	4	5	Total
Molto scarsa..Eccellente	0	0	3 (23%)	**8** (62%)	2 (15%)	**13**

Where → 1: Very Poor / 5: Excellent

62% of the students believe that the learning experience has been very good, 23% consider it neutral and 15% excellent.

Did the quality of the module meet your expectations?



Responses	1	2	3	4	5	Total
Per nulla..Molto	0	0	3 (23%)	4 (31%)	**6** (46%)	**13**

Where → 1: Not at all / 5: Very much

The majority of students (46%) voted that the quality of the module met very much their expectations, with 31% voting a lower category. The remaining 23% voted neutral and there were no negative responses.

What needs and expectations do you feel have not been effectively addressed, if any?

Participants' responses indicated that they did not have any specific unaddressed needs or expectations from the training module. Some participants explicitly stated that there were no such concerns, while others expressed satisfaction with how everything had been addressed effectively. One participant mentioned a desire for unsupervised learning, but overall, the feedback highlighted a lack of significant unmet needs or expectations.

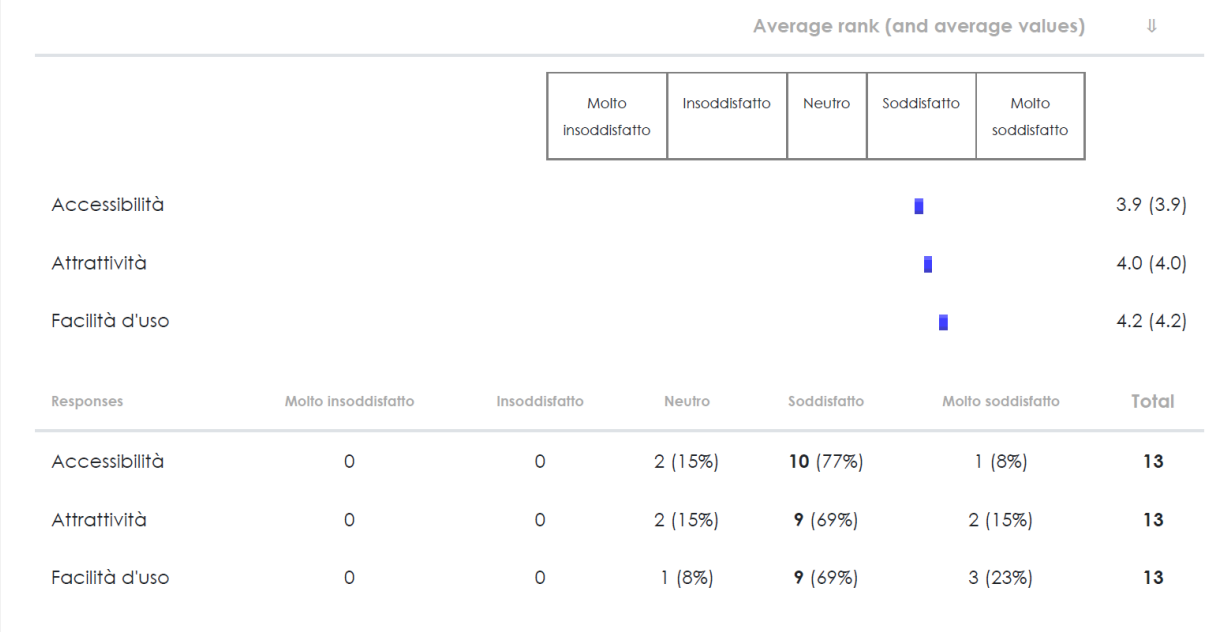
Which part of the training material did you find most interesting?

Some participants found the entire training material interesting, while others specifically mentioned topics such as unsupervised learning, regression with Python for machine learning, and machine learning as particularly engaging. However, a few participants did not specify a particular part as interesting or mentioned having no specific preferences.

Which part of the training material did you find least interesting?

Participants' responses regarding the least interesting part of the training material generally indicated a lack of specific dissatisfaction with any particular aspect. Many participants expressed that they did not find any part less interesting. Some participants explicitly mentioned "nothing," while others stated that they found everything interesting. A few participants mentioned specific topics like classification and decision trees in Python or regression with Python for machine learning as less engaging, but these responses were in the minority.

Assessing one's satisfaction with the course learning platform



Responses	Molto insoddisfatto	Insoddisfatto	Neutro	Soddisfatto	Molto soddisfatto	Total
Accessibilità	0	0	2 (15%)	**10** (77%)	1 (8%)	**13**
Attrattività	0	0	2 (15%)	**9** (69%)	2 (15%)	**13**
Facilità d'uso	0	0	1 (8%)	**9** (69%)	3 (23%)	**13**

Where → 1: Very unsatisfied 2: Unsatisfied 3: Neutral 4: Satisfied 5: Very satisfied / 1. Accessibility / 2: Attractiveness / 3: Ease of use

A total of 77% voted accessibility as satisfactory, plus 8% voted it as very satisfactory, leaving 15% neutral. Then, focusing on attractiveness we have 69% of votes in satisfactory plus 15% in very satisfactory, leaving another 15% in neutral. Finally, referring to ease of use we have another 69% in satisfactory plus 23% in very satisfactory, leaving 8% in neutral. In none of the three there are negative votes.

5 Evaluate the Machine Learning module with regard to the...

Where → 1: Very unsatisfied 2: Unsatisfied 3: Neutral 4: Satisfied 5: Very satisfied / 1. Quality of the didactic material 2. Content organization 3. Practice material and ease of use 4. Clear description of objectives 5. Motivation 6. Encourage to learn more than expected 7. Practical exercises 8. Time management

The quality of the didactic material received generally positive feedback, with 77% of participants expressing satisfaction. Content organization was met with a mix of responses, including 54% satisfied and 23% very satisfied, but also 23% who were neutral. The practice material's ease of use garnered positive reviews, with 62% satisfied and 23% very satisfied, though 15% were neutral. Clear description of objectives was generally positive, with 69% satisfied and 15% very satisfied, alongside 15% neutral responses. Motivation and encouragement to exceed expectations were also viewed positively, with 62% satisfied and 15% very satisfied, but 23% neutral. Practical exercises received positive feedback, with 62% satisfied and 23% very satisfied, alongside 15% neutral responses. Time management was generally positive, with 62% satisfied and 15% very satisfied, though 23% expressed neutrality.

Share your comments and suggested improvements

Participants' feedback on the shared comments and suggested improvements was generally minimal. Most participants indicated that they had no specific comments or

suggestions and one participant mentioned the topic being very interesting for the industrial world.. Overall, the feedback did not contain specific suggestions for improvement, with many participants expressing satisfaction or a lack of comments.

Would you suggest this training course?

Response	Average	Total
Si	69%	9

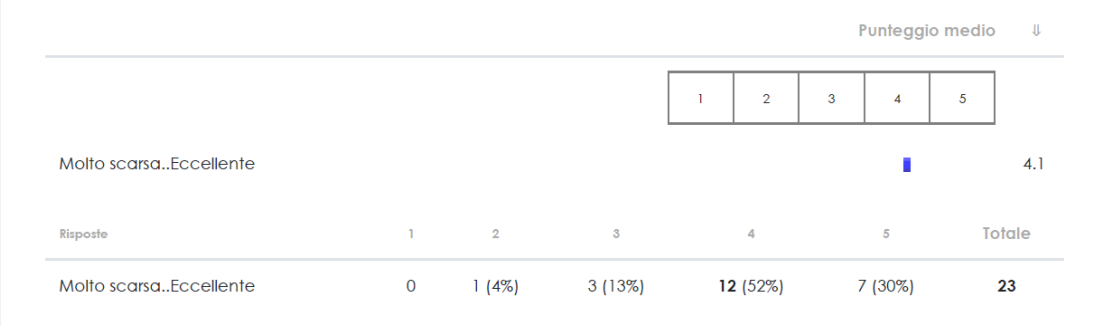
Response	Average	Total
No	8%	1
Probabilmente si	23%	3
Total responses to question	100%	13/13

Where → 1: Yes / 2. No / 3: Probably yes

69% would recommend the course, 23% are not sure if they would do it and 8% would not recommend it.

Module Transversal Skills

How would you rate the overall learning experience of the module?

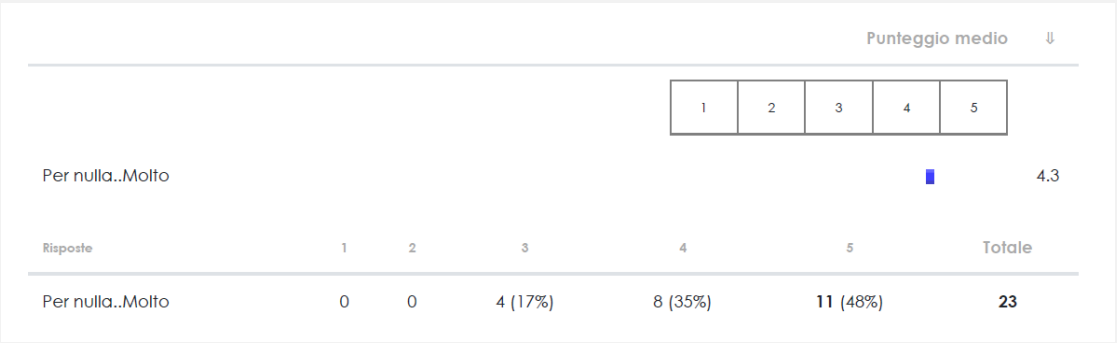


Risposte	1	2	3	4	5	Totale
Molto scarsa..Eccellente	0	1 (4%)	3 (13%)	**12** (52%)	7 (30%)	**23**

Where → 1: Very Poor / 5: Excellent

About half of the participants, 52%, rated the experience as very good, with another 30% rating it as excellent. However, 13% rated it as neutral and 4% as poor.

Did the quality of the module meet your expectations?



Risposte	1	2	3	4	5	Totale
Per nulla..Molto	0	0	4 (17%)	8 (35%)	**11** (48%)	**23**

Where → 1: Not at all / 5: Very much

48% believe that the quality of the module has met their expectations, with 35% voting 'much'. There are 17% who voted neutral and no negative responses.

What needs and expectations do you feel have not been effectively addressed, if any?

Participants' responses regarding unmet needs and expectations were generally positive, with many expressing satisfaction and stating that all their needs and expectations were effectively addressed. A few participants explicitly mentioned that their expectations were met adequately, while one participant expressed uncertainty, and another simply stated that they were satisfied. Overall, the feedback indicated that participants felt their needs and expectations had been addressed effectively.

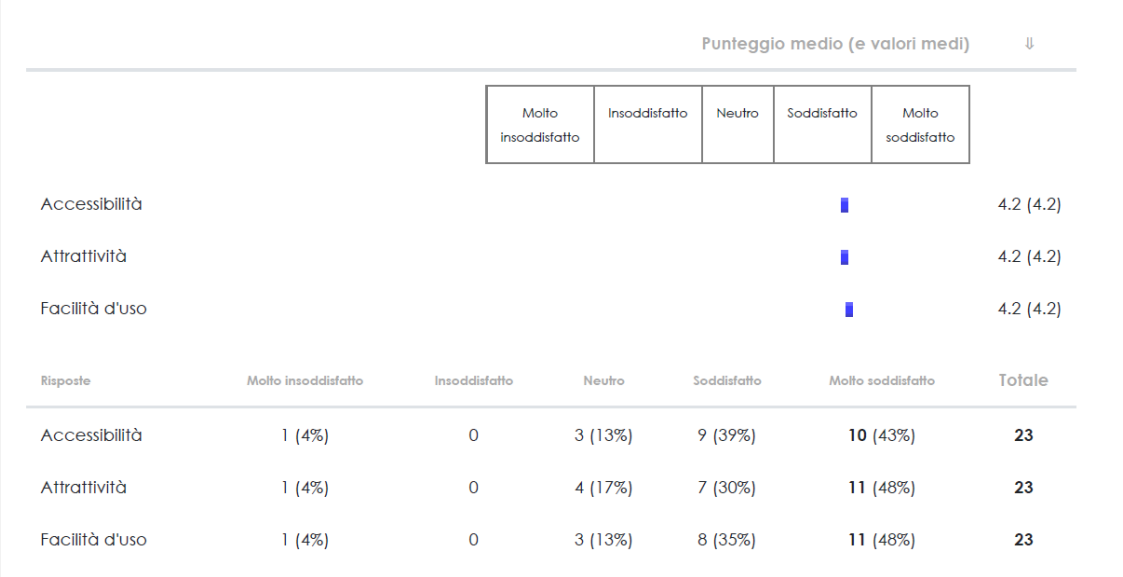
Which part of the training material did you find most interesting?

While some students expressed interest in the entire course, others highlighted specific sections. Topics such as leadership, industrial automation, problem-solving, and effective communication were mentioned as particularly interesting. Some students emphasized the importance of reading and understanding the course material before taking quizzes. Overall, the responses indicated a diverse range of interests among the participants.

Which part of the training material did you find least interesting?

Participants generally found the training material interesting, with a majority expressing that they did not find any part less interesting. A few participants highlighted particular sections they found less interesting, such as data analysis or specific numbered sections (“Part 7”, “Text 2”, “Text 3”, “Text 4”). However, these responses were in the minority, as most participants did not identify any part as less interesting.

Assessing one's satisfaction with the course learning platform



Risposte	Molto insoddisfatto	Insoddisfatto	Neutro	Soddisfatto	Molto soddisfatto	Totale
Accessibilità	1 (4%)	0	3 (13%)	9 (39%)	**10** (43%)	**23**
Attrattività	1 (4%)	0	4 (17%)	7 (30%)	**11** (48%)	**23**
Facilità d'uso	1 (4%)	0	3 (13%)	8 (35%)	**11** (48%)	**23**

Where → 1: Very unsatisfied 2: Unsatisfied 3: Neutral 4: Satisfied 5: Very satisfied / 1. Accessibility / 2: Attractiveness / 3: Ease of use

Starting with accessibility, 43% of students considered it very satisfactory, with 39% considering it satisfactory. There are also 13% who voted neutral and 4% who voted very unsatisfactory. Continuing with attractiveness, 48% voted very satisfactory plus 30% voted satisfactory, 17% remained neutral and 4% considered it very unsatisfactory. Finally, considering ease of use, 48% were very satisfactory, 35% satisfactory and 13% neutral, leaving 4% who again voted very unsatisfactory.

Evaluate the transversal skills module with regard to the...

Risposte	Molto insoddisfatto	Insoddisfatto	Neutro	Soddisfatto	Molto soddisfatto	Totale
Qualità del materiale didattico	1 (4%)	0	4 (17%)	**10** (43%)	8 (35%)	**23**
Organizzazione dei contenuti	1 (4%)	0	4 (17%)	**9** (39%)	**9** (39%)	**23**
Materiale pratico e facile da seguire	1 (4%)	0	3 (13%)	9 (39%)	**10** (43%)	**23**
Descrizione chiara degli obiettivi	1 (4%)	0	5 (22%)	6 (26%)	**11** (48%)	**23**
Motivazionale	1 (4%)	2 (9%)	3 (13%)	8 (35%)	**9** (39%)	**23**
Sfida a imparare più di quanto mi aspettassi	1 (4%)	0	5 (22%)	7 (30%)	**10** (43%)	**23**
Esercizi pratici	1 (4%)	1 (4%)	3 (13%)	6 (26%)	**12** (52%)	**23**
Assegnazione del tempo	1 (4%)	0	5 (22%)	8 (35%)	**9** (39%)	**23**

Where → 1: Very unsatisfied 2: Unsatisfied 3: Neutral 4: Satisfied 5: Very satisfied / 1. Quality of the didactic material 2. Content organization 3. Practice material and ease of use 4. Clear description of objectives 5. Motivation 6. Encourage to learn more than expected 7. Practical exercises 8. Time management

When assessing the quality of the didactic material, 43% expressed satisfaction, while 35% were very satisfied; however, a small percentage (4%) conveyed very unsatisfaction. Similarly, regarding content organization, 39% were satisfied and 39% very satisfied, but 4% were very unsatisfied.

Participants' experiences with practice material and ease of use were generally positive, with 39% satisfied and 43% very satisfied, although 4% expressed very unsatisfaction. The clarity of objectives received a favorable response, with 26% satisfied and 48% very satisfied, but 4% reported very unsatisfaction.

Regarding motivation, 35% were satisfied, and 39% expressed very satisfaction, while 9% reported unsatisfaction, and 4% conveyed very unsatisfaction. Feedback on encouragement to surpass learning expectations was predominantly positive, with 30% satisfied and 43% very satisfied; however, 4% expressed very unsatisfaction.

Practical exercises have a 26% vote on satisfied and 52% on very satisfied, although 4% expressed unsatisfaction, and 4% were very unsatisfied. Lastly, time management was

generally positive, with 35% satisfied and 39% very satisfied, but 4% reported very unsatisfaction.

Share your comments and suggested improvements

Some participants mentioned they had no comments or suggestions. A few participants provided specific feedback, such as translating quizzes from English to Italian. One participant found the platform interesting and had no suggestions for improvement, while another mentioned sharing comments with the class.

Would you suggest this training course?

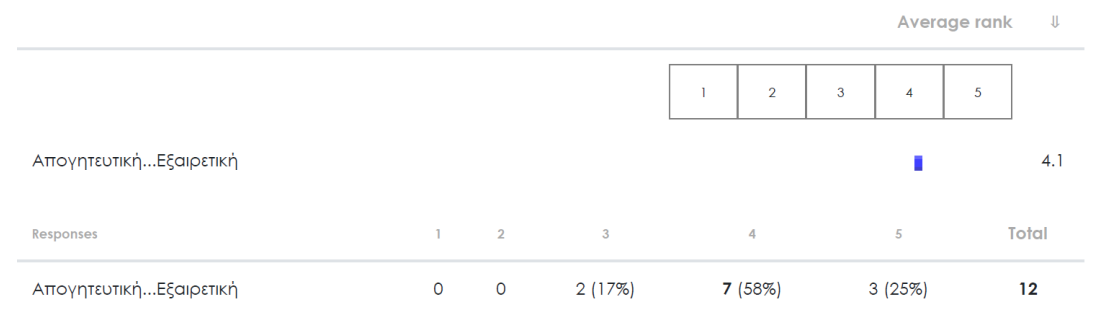
Risposta	Media	Totale
Si	71%	17
No	4%	1
Probabilmente si	21%	5
Risposte totali al questionario	100%	24/23

Where → 1: Yes / 2. No / 3: Probably yes

Most students (71%) stated that they would recommend this training course, with 21% unsure voting that they would probably recommend it and only 4% that would not do it.

Learners from University of Patras (EL)

How would you evaluate the overall learning experience of the Module Big Data?

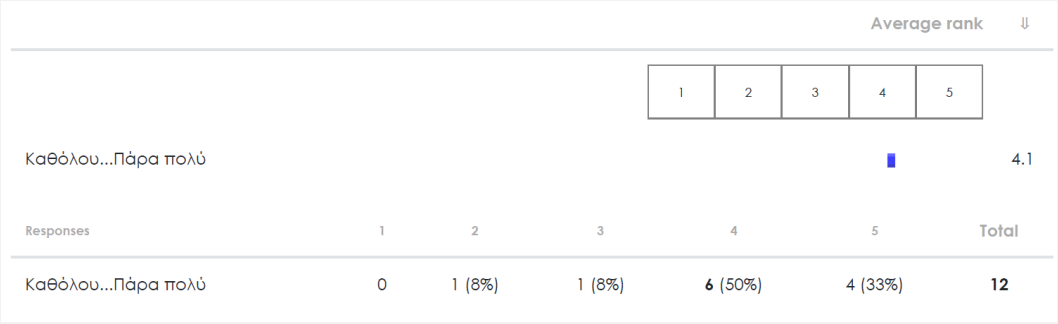


Responses	1	2	3	4	5	Total
Απογητευτική...Εξαιρετική	0	0	2 (17%)	**7** (58%)	3 (25%)	**12**

Where → 1: Very poor 5: Excellent

58% of students voted the learning experience as good, plus 25% voting it as excellent and 17% stayed neutral.

Did the quality of the module met your expectations?



Responses	1	2	3	4	5	Total
Καθόλου...Πάρα πολύ	0	1 (8%)	1 (8%)	**6** (50%)	4 (33%)	**12**

Where → 1: Not at all 5: Absolutely

Half of the students assure that the module met their expectations and 33% said that it absolutely did. 8% stayed neutral and 8% voted that it did not.

Which needs and expectations do you consider that they were not effectively addressed, if any?

Some participants stated that it would have been better if there were video tutorials on using Hadoop with Putty. Some participants wanted more interactive content. Others found Hadoop challenging to understand. A few participants were satisfied with the course, while

one mentioned struggling due to a lack of Python knowledge. Overall, some had their needs met, while others had mixed experiences.

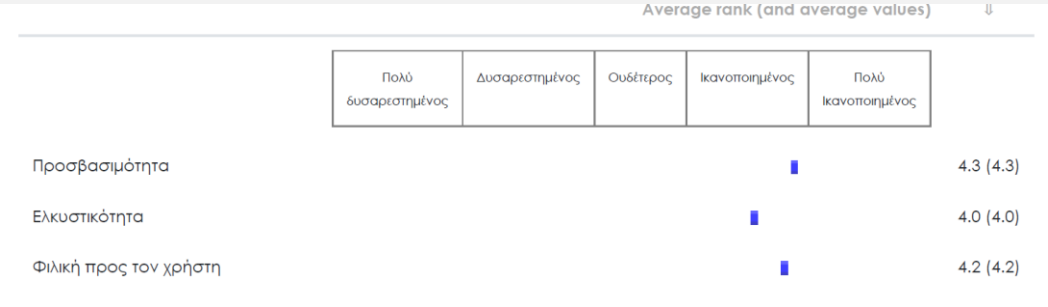
Which part of the training material did you find the most interesting?

Some participants found the Python chapter interesting. Overall, most chapters were deemed interesting, particularly Hadoop for those less familiar with it. Python for data analysis was highlighted, along with learning materials. Evaluation tests and working with clusters were also mentioned. The practical application of theory through Python and Hadoop was appreciated by some.

Which part of the training material did you find the less interesting?

Some participants found the Hadoop chapter challenging to understand, while others mentioned introductory courses and the Apache Hadoop part. Python was highlighted by one participant. Overall, many found the course interesting, and there were no specific parts that were deemed less interesting. For some, technology related to Apache Hadoop stood out. Despite some challenges with Python due to limited prior study, the detailed theory helped in understanding.

Please rate your satisfaction regarding the course' s learning platform



Where → 1: Very dissatisfied 2: Dissatisfied 3: Neutral 4: Satisfied 5: Very satisfied / 1. Accessibility 2. Attractiveness 3. User friendliness

Concerning accessibility, 42% of the students rated it as very satisfying, with half of them voting for satisfying and 8% for neutral. Then, attractiveness obtained 42% of votes in satisfied, 33% in very satisfied, 17% in neutral and 8% in dissatisfied. Finally, half of

participants were satisfied with the user friendliness of the platform and 42% of them were very satisfied. On the other hand, 8% of participants found that dissatisfying.

Please evaluate the Big Data training module regarding the...

Responses	Πολύ δυσαρεστημένος	Δυσαρεστημένος	Ουδέτερος	Ικανοποιημένος	Πολύ Ικανοποιημένος	Total
Ποιότητα του εκπαιδευτικού υλικού	0	0	1 (8%)	**9** (75%)	2 (17%)	**12**
Δομή του μαθήματος	0	0	1 (8%)	5 (42%)	**6** (50%)	**12**
Πρακτικό και εύκολο στην παρακολούθηση	0	1 (8%)	2 (17%)	**5** (42%)	4 (33%)	**12**
Σαφής περιγραφή των στόχων	0	0	1 (8%)	**8** (67%)	3 (25%)	**12**
Παρακινεί το ενδιαφέρον	0	0	2 (17%)	**8** (67%)	2 (17%)	**12**
Με προκαλεί να μάθω περισσότερα από όσα περίμενα	0	0	2 (17%)	**5** (42%)	**5** (42%)	**12**
Πρακτικές ασκήσεις	0	0	3 (25%)	**6** (50%)	3 (25%)	**12**
Απαιτούμενος χρόνος	0	0	2 (17%)	**7** (58%)	3 (25%)	**12**

Where → 1: Very poor 2: Poor 3: Neutral 4: Satisfying 5: Very satisfying / 1. Quality of training material 2. Organisation of contents 3. Practical and easy to follow material 4. Clear description of objectives 5. Motivational 6. Challenging to learn more than expected 7. Practical exercises 8. Time allocation

Starting with the quality of the training material, 75% of participants found it satisfying, while 17% found it very satisfying and 8% neutral. Concerning the organization of contents, half of the participant found it very satisfying, with 42% voting for it as satisfying and 8% as neutral. Then, 42% found the material practical and easy to follow, 33% found it very satisfying, 17% neutral and 8% poor. The clear description of objectives was satisfying for a 67% of them, and very satisfying for a 25% of the students, with the remaining 8% voting neutral. 67% of the students found the module motivational, with 17% finding it very satisfying and another 17% neutral. 41% of the participants consider it very satisfying when it comes to challenging to learn more than expected, another 42% consider it satisfying and 17% neutral. Half of the students think that the practical exercises are satisfying, 25% very satisfying and 25% neutral. Finally, more than half of the participants (58%) think that the time allocation was satisfying, with a 25% of them rating it as very satisfying and a 17% neutral.

Please share your comments and suggested improvements

Participants suggested adding more videos and practical exercises, especially for coding in Python and Hadoop. They also wanted a clearer explanation of Hadoop and its components. Some found a helpful YouTube video and suggested more like it. Faster responses to queries were requested. Overall, most found the course content well-prepared and easy to understand, with few suggestions for improvement.

Will you suggest the course to other people?

Response	Average	Total
Ναι	92%	11
Ίσως	8%	1
Total responses to question	100%	12/12

Where → 1: Yes 2: Partly

92% of students would recommend the course, and 8% might recommend it.

Concluding Remarks

Regarding the post evaluation phase the results of the evaluation are very positive and validate the initial expectations of the students. There was only a common request for more practical exercises instead of theory, which was taken into account in the Division Index and the subsequent improvements that took place after the pilots.

An average rate of 4/5 of satisfaction is a very positive result for the impact of the curriculum on the students. Especially the high evaluation rates for the module of transversal skills should be considered as a great success, as their integration in technical occupations was an innovative element and a challenge.

Co-funded by the Erasmus+ Programme of the European Union

Impact assessment on students' skills

This section is dedicated to evaluating the course's impact on the students skills after the pilots (all modules). This evaluation is conducted by analyzing the disparities between their responses in the pre-evaluation and post-evaluation. This approach serves as a means to gauge the extent to which the course has influenced their knowledge and skill development.

Learners from Politeknika Ikastegia Txorierri (ES): Module Cybersecurity

Evaluation of the impact on student's competences before and after piloting the module

How would you assess your competence right now, regarding this module of the learning programme?

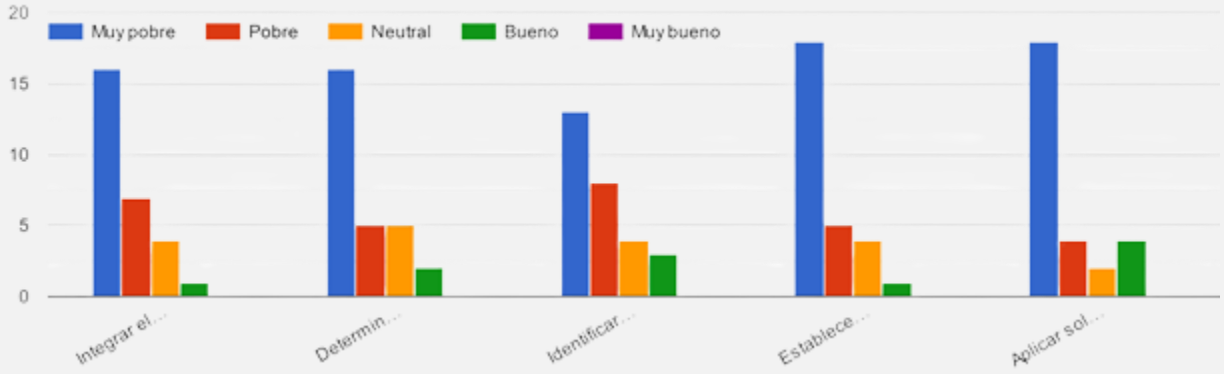
• No knowledge • I have some notions • I understand a few things • I am an expert

In the following analysis, we'll examine a graph depicting the varying levels of cybersecurity knowledge among a group of students before taking the Cybersecurity module . Within this group, it is evident that half of the students (15 individuals) possess some degree of familiarity with cybersecurity. Remarkably, only one student considers themselves highly knowledgeable in this field. Conversely, a total of 12 students have yet to gain any exposure to cybersecurity, and none of them identify as experts.

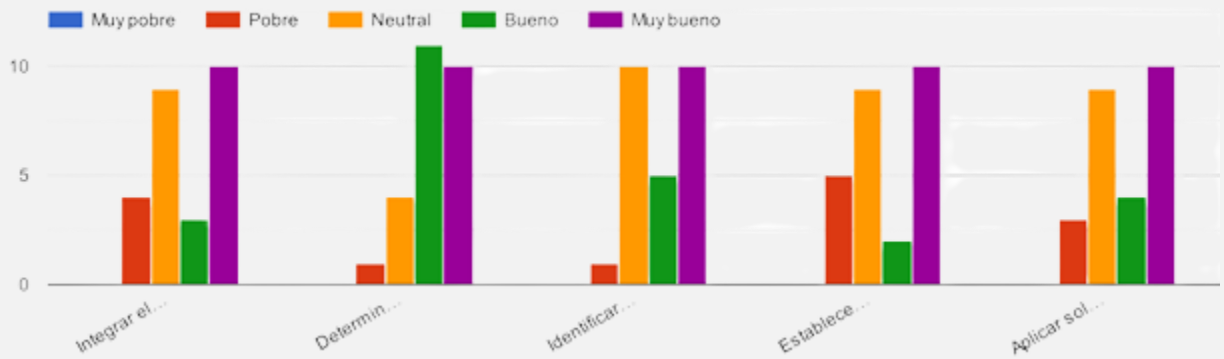
This observation leads us to a noteworthy conclusion: the course participants predominantly fall within the category of individuals with limited or no prior knowledge of cybersecurity. This distinction holds the potential to significantly magnify the disparity between their knowledge levels before and after participating in the course, thus affording us a unique opportunity to assess the course's efficacy.

- **Evolution of the students' level in the following competences.**

Pre-Evaluation graphic: If you are going to participate in the Cybersecurity module, assess your current level in the following competences.



Post-Evaluation graphic: After your participation in the Cybersecurity module, rate your current level in the following competences.



• Very poor • Poor • Neutral • Good • Very good / 1. Integrate the production control system with the company's digital management systems. 2. Determine the company's cybersecurity risk profiles, identifying applicable best practices, standards and regulations. 3. Identify the different technologies, architectures and protocols that make an IoT ecosystem possible. 4. Establish an industrial control system configuration, minimising the company's risk. 5. Implement industrial communication solutions, collecting data and integrating data storage systems.

Before the course, students had varying levels of confidence in their competencies. For example, in the "Integration of Production Control Systems with Digital Management Systems," 16 students rated themselves as very poor, with notable shifts after the course—10 students now described their skills as very good. A similar pattern emerges in the "Determination of Cybersecurity Risk Profiles," where post-course assessments indicate an improved grasp. In the "Identification of IoT Ecosystem Technologies," there is a perceived enhancement, with more students rating themselves as "very good" post-course. Notably, the "Establishment of Industrial Control System Configuration" and "Implementation of Industrial Communication Solutions" saw significant improvements in self-evaluations, reflecting the course's effectiveness in enhancing knowledge and competencies in these areas.

Concluding, the self-evaluation data, both before and after the course, vividly demonstrates the program's influence on students' knowledge and their self-assessed abilities in the five areas under review. Initial self-assessments often revealed differing confidence levels, whereas post-course self-assessments consistently revealed perceived improvements.

Learners from DaVinci College (NL): Module Advanced Sensors

Evaluation of the impact of Advanced Sensors Module on student's competence before and after the course

Pre-Evaluation:

How would you evaluate your competence right now, regarding the following training modules of the learning program?

Responses	No knowledge at all	I have some undertanding	I understand a lot	I am an expert	Total
Advanced sensors	**25** (53%)	18 (38%)	3 (6%)	1 (2%)	**47**

The majority of the participants (53%) voted that they have no knowledge about advance sensors. 38% have some knowledge, 6% know a lot and 2% are experts on the subject.

Post-Evaluation:

After your participation in the Module Advanced sensors, please rate your current level of the following competences

Responses	Very Poor	Poor	Neutral	Satisfying	Very Satisfying	Total
Characterize existing production processes by defining and measuring appropriate key performance indicators (KPIs)	2 (9%)	3 (13%)	**15** (65%)	3 (13%)	0	**23**
Reprogram and/or adjust manufacturing parameters in the intelligent manufacturing environment.	1 (4%)	4 (17%)	**14** (61%)	3 (13%)	1 (4%)	**23**
Apply industrial communication solutions, carrying out data collection and integrating data storage systems.	1 (4%)	4 (17%)	**14** (61%)	3 (13%)	1 (4%)	**23**
Integrate the production control system with the company's digital management systems.	1 (4%)	5 (22%)	**15** (65%)	2 (9%)	0	**23**
Identify the different technologies, architectures and protocols that make an IOT ecosystem possible.	2 (9%)	5 (22%)	**14** (61%)	2 (9%)	0	**23**
Design and deploy communications networks for IoT devices, selecting the most appropriate technology.	2 (9%)	7 (30%)	**12** (52%)	2 (9%)	0	**23**
Do a preliminary assessment of IT/OT network	2 (9%)	5 (22%)	**12** (52%)	4 (17%)	0	**23**
Adapt the processes and/or machines by incorporating the selected digital technologies taking into account safety, efficiency and sustainability criteria.	1 (4%)	5 (22%)	**15** (65%)	2 (9%)	0	**23**
Reprogram and adjust operating parameters and re-adjust the system to new operating and monitoring requirements in the maintenance process environment.	2 (9%)	3 (13%)	**14** (61%)	4 (17%)	0	**23**

On average, about 4% of students rated their competence as very low, while about 13% rated it as low. The majority of students, with 65% on average, placed themselves in the neutral category. An average of 17% rated their competence as satisfactory, and there were no very satisfactory ratings.

In conclusion, the pre-evaluation indicated that the majority of participants had little to no knowledge about advanced sensors, with only a small percentage having some expertise. However, in the post-evaluation, a significant portion of students still rated their competence as low or neutral.

Co-funded by the Erasmus+ Programme of the European Union

Learners from Apro Formazione (IT)

Module Introduction

Pre-Evaluation:

How would you assess your competence at this time with regard to the following training modules of the learning program?

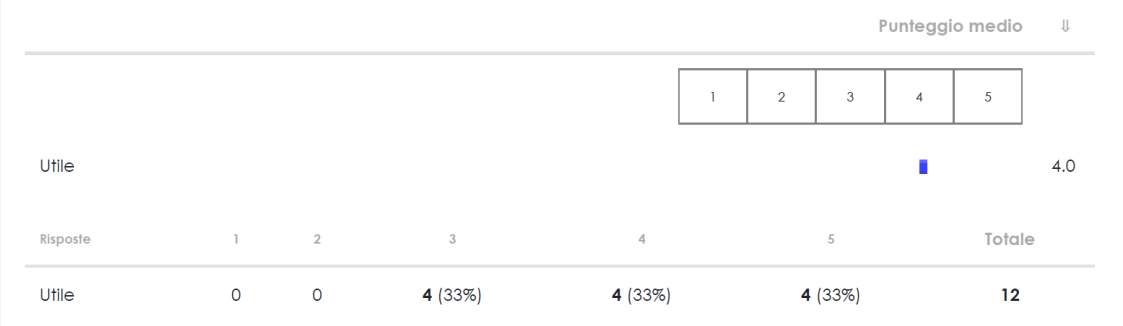
Risposte	Nessuna conoscenza	Conoscenza di base	Conosco molto	Sono un esperto	Totale
Big Data	**9** (75%)	3 (25%)	0	0	**12**
Machine Learning	**10** (83%)	2 (17%)	0	0	**12**
Sensori IoT	**9** (75%)	3 (25%)	0	0	**12**
Cybersecurity	**9** (75%)	3 (25%)	0	0	**12**
Green Skills	5 (42%)	**6** (50%)	1 (8%)	0	**12**

Where → 1: No knowledge 2: A little knowledge 3: A lot of knowledge 4: Expert / 1. Big Data 2. Machine Learning 3. Sensors IoT 4. Cybersecurity 5. Green Skills

In Big Data 75% of the student body has no knowledge, however 25% have some knowledge but none have voted more than that. In Machine Learning 83% have no knowledge and 17% have some knowledge. Continuing with Sensors IoT, 75% know nothing about it and 25% have some knowledge. In Cybersecurity 75% voted not to have any knowledge and 25% know something about it. Finally, in Green Skills, 42% have no knowledge and 50% know something, leaving 8% who claim to have a lot of knowledge.

Post-Evaluation:

Did you find the module useful for your professional development?

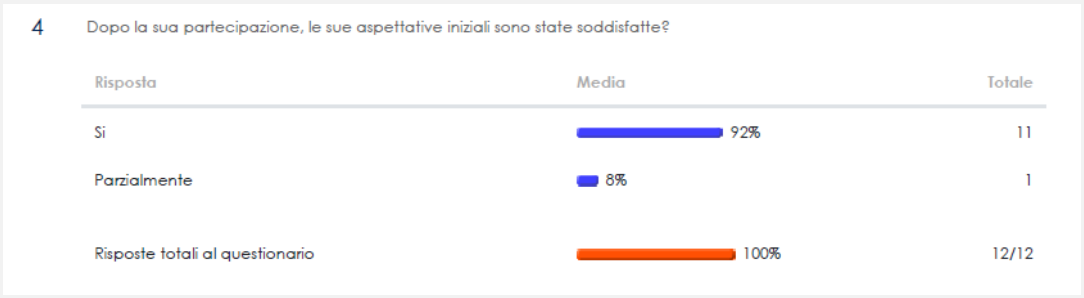


Risposte	1	2	3	4	5	Totale
Utile	0	0	**4** (33%)	**4** (33%)	**4** (33%)	**12**

Where → 1: Not useful / 5: Very useful

33% of the participants stated that the module was very useful for their professional development. Another 33% said it was useful and another 33% were neutral.

After your participation, were your initial expectations met?



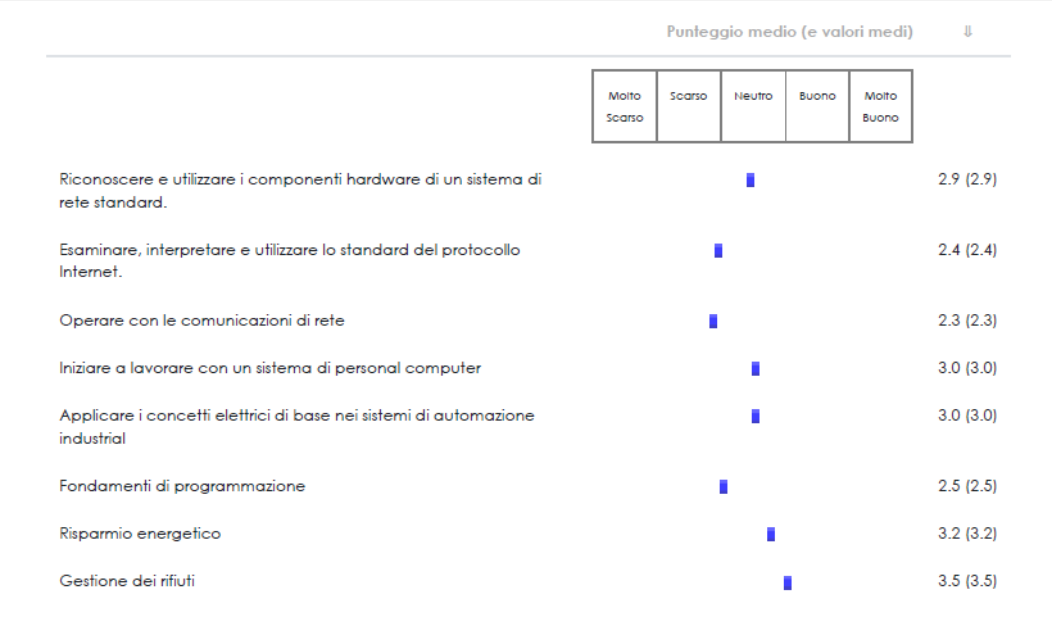
Where → 1: Yes / 5: Partially

92% say their expectations have been met and 8% believe they have been partially met.

Evaluation of level of competences

Pre-course: Module A - Introduction

If you plan to participate in the introductory module, assess your current level of the following skills

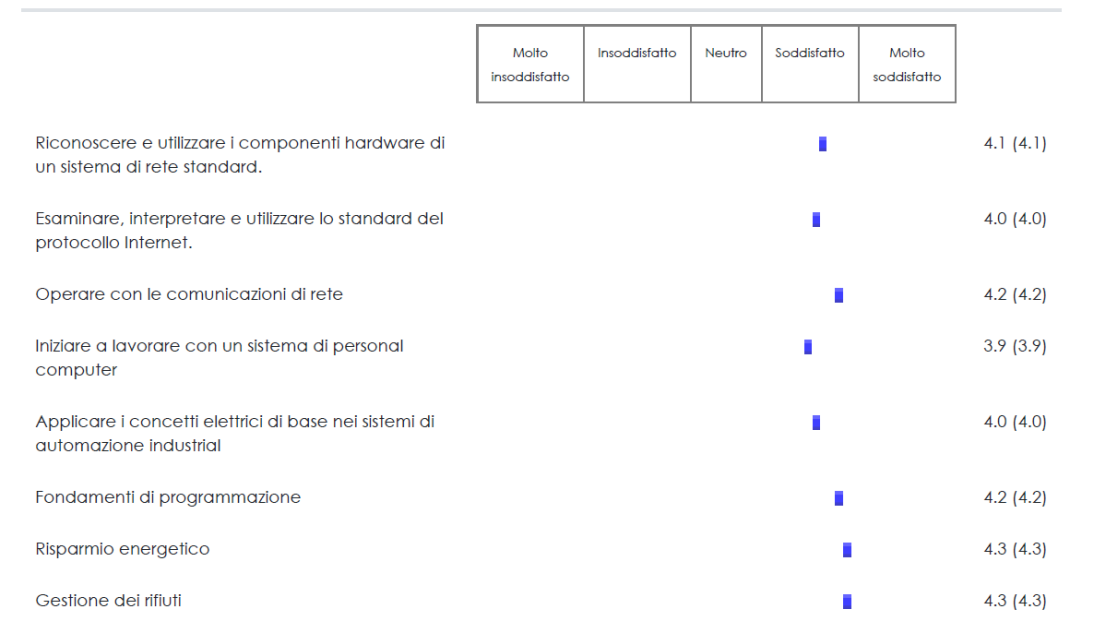


Where → 1: Very poor 2: Poor 3: Neutral 4: Good 5: Very good / 1. Recognizing and using standard network hardware components 2. Examining, understanding and applying Internet protocol standards 3. Operating with network communications 4. Getting started with a personal computer system 5. Applying basic electrical concepts in industrial automation 6. Fundamentals of programming 7. Energy conservation 8. Waste management

When it comes to recognizing and using standard network hardware components, 42% rate themselves as poor, 25% as neutral, and 33% as good. In terms of understanding and applying Internet protocol standards, 25% feel very poor, 25% poor, 33% neutral, and 17% good. Operating with network communications sees 25% rating themselves as very poor, 33% as poor, 25% as neutral, and 17% as good. Working with personal computer systems reveals 42% rating themselves as poor, 17% as neutral, and 42% as good. Applying basic electrical concepts in industrial automation shows 8% rating very poor, 25% poor, 25% neutral, and 42% good. Fundamentals of programming are perceived as 25% very poor, 25% poor, 25% neutral, and 25% good. In the realm of energy conservation, 8% find themselves

very poor, 17% poor, 17% neutral, and 58% very good. Lastly, in waste management, 17% consider themselves poor, 17% neutral, and 67% good.

After attending the introductory module, please assess your current level of the following skills



Where → 1: Very unsatisfying 2: Unsatisfying 3: Neutral 4: Satisfying 5: Very satisfying / 1. Recognizing and using standard network hardware components 2. Examining, understanding and applying Internet protocol standards 3. Operating with network communications 4. Getting started with a personal computer system 5. Applying basic electrical concepts in industrial automation 6. Fundamentals of programming 7. Energy conservation 8. Waste management

In recognizing and utilizing standard network hardware components, 17% found it neutral, 58% satisfying, and 25% very satisfying.

Regarding examining, interpreting, and utilizing Internet protocol standards, 17% indicated neutrality, 67% found it satisfying, and 17% very satisfying.

For operating with network communications, 8% felt neutral, 58% satisfied, and 33% very satisfying.

Starting to work with a personal computer system was rated as neutral by 33%, satisfying by 42%, and very satisfying by 25%.

In applying basic electrical concepts in industrial automation systems, 17% reported neutrality, 67% found it satisfying, and 17% very satisfying.

Fundamentals of programming were perceived as neutral by 8%, satisfying by 58%, and very satisfying by 33%.

Concerning energy conservation, 17% indicated neutrality, 33% found it satisfying, and 50% very satisfying.

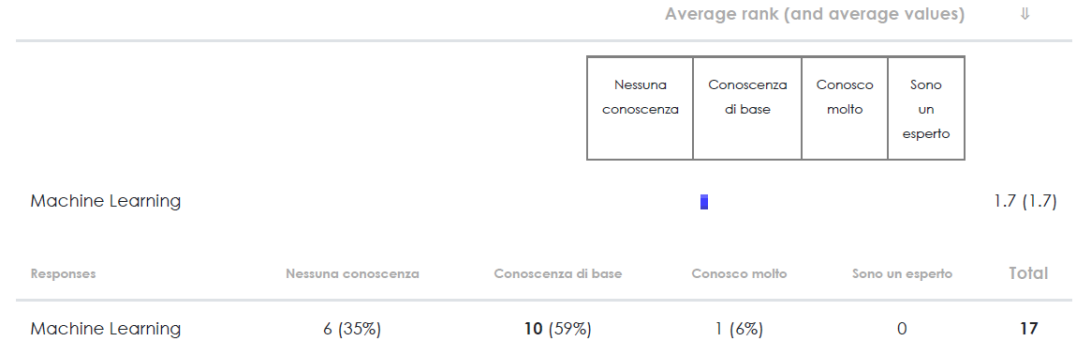
Finally, in waste management, 17% rated it as poor, 33% as neutral, and 50% as good.

Initially, participants displayed varying levels of confidence in their skills, with some rating themselves poorly in areas like network hardware components and Internet protocol standards. However, after completing the introductory module, there was a noticeable improvement in their self-assessment. Many reported greater satisfaction with their abilities in network-related tasks, computer systems, and even programming fundamentals. Notably, energy conservation and waste management skills also saw significant progress, with more participants feeling very satisfied with their capabilities. The module appeared to have a positive impact on participants' skill levels in various domains.

Module Machine Learning

Pre-Evaluation:

How would you assess your competence at this time with regard to the following training modules of the learning program?



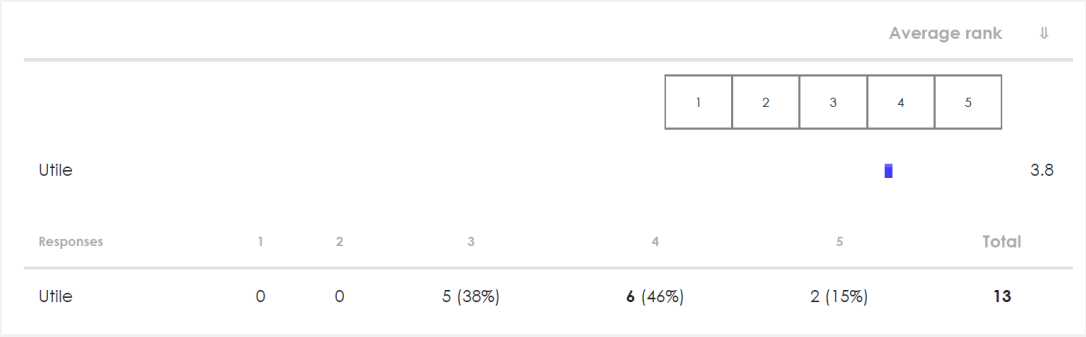
Responses	Nessuna conoscenza	Conoscenza di base	Conosco molto	Sono un esperto	Total
Machine Learning	6 (35%)	**10** (59%)	1 (6%)	0	**17**

Where → 1: No knowledge 2: A little knowledge 3: A lot of knowledge 4: Expert

More than half of the students (59%) consider that they have basic knowledge of the subject, 35% have no knowledge at all and 6% have a high level of knowledge.

Post-Evaluation:

Did you find the module useful for your professional development?



Responses	1	2	3	4	5	Total
Utile	0	0	5 (38%)	**6** (46%)	2 (15%)	**13**

Where → 1: Not useful / 5: Very useful

46% of the participants considered the module to be useful, 15% considered it very useful. The remaining 38% voted neutral.

After your participation, were your initial expectations met?

Response	Average	Total
Si	92%	12
Parzialmente	8%	1
Total responses to question	100%	13/13

Where → 1: Yes / 5: Partially

92% of the students voted that their initial expectations were met, with the remaining 8% saying partially.

Evaluation of level of competences

Pre-course: Module B – Machine Learning

If you plan to participate in the Machine Learning module, assess your current level of the following skills

Responses	Molto Scarso	Scarso	Neutro	Buono	Molto Buono	Total
Comprendere e analizzare i concetti di base del machine learning.	5 (29%)	**6** (35%)	4 (24%)	2 (12%)	0	**17**
Progettare e implementare modelli di apprendimento automatico utilizzando set di dati del mondo reale.	**5** (29%)	4 (24%)	**5** (29%)	3 (18%)	0	**17**
Capire come funzionano gli algoritmi di apprendimento automatico e come possono essere applicati nelle applicazioni industriali	5 (29%)	**6** (35%)	4 (24%)	1 (6%)	1 (6%)	**17**
Essere in grado di comprendere e analizzare i dati provenienti da diagrammi	5 (29%)	**7** (41%)	2 (12%)	1 (6%)	2 (12%)	**17**
Riportare i risultati delle analisi e dei modelli di apprendimento automatico in una trama costruttiva..	**5** (29%)	4 (24%)	**5** (29%)	3 (18%)	0	**17**

Where → 1: Very poor 2: Poor 3: Neutral 4: Good 5: Very good / 1. Understanding and analysing basic concepts of machine learning 2. Design and implement machine learning models using real-world datasets. 3. Understanding how machine learning algorithms work and how they can be applied in industrial applications. 4. Being able to understand and analyse data from diagrams. 5. Reporting the results of analyses and machine learning models in a constructive plot...

Looking at the graph we can see that in terms of understanding and analysing the basic concepts of machine learning, it scored 35% as poor, followed by 29% as very poor, 24% as neutral and 12% as good. On Design and implement machine learning models using real-world datasets 29% voted very little, with 24% voting little. Also, 29% left it neutral, and 18% said it was good. In the third part, understanding how machine learning algorithms work and how they can be applied in industrial applications, 35% voted poor and 29% voted very poor. Then, 24% voted neutral and 6% good, followed by another 6% very good. 41% of participants voted poor on being able to understand and analyse data from diagrams, with 29% voting very poor and 12% voting neutral. On the other hand, 12% voted it very good and 6% good.

After attending the introductory module, please assess your current level of the following skills

Where → 1: Very poor 2: Poor 3: Neutral 4: Good 5: Very good / 1. Understanding and analysing basic concepts of machine learning 2. Design and implement machine learning models using real-world datasets. 3. Understanding how machine learning algorithms work and how they can be applied in industrial applications. 4. Being able to understand and analyse data from diagrams. 5. Reporting the results of analyses and machine learning models in a constructive plot...

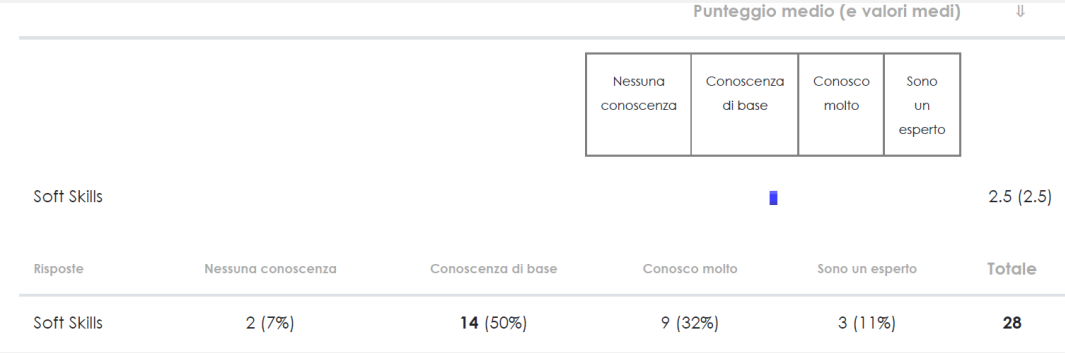
In understanding and analysing basic concepts of machine learning 62% are satisfied and 8% very satisfied, with 23% neutral and only 8% dissatisfied. In the next category, design and implement machine learning models using real-world datasets, 46% are satisfied along with 15% very satisfied and 38% neutral, with no negative responses. Then, in understanding how machine learning algorithms work and how they can be applied in industrial applications 46% of the students voted satisfied, with 23% saying they were very satisfied, 23% neutral and 8% dissatisfied. In the fourth part, being able to understand and analyse data from diagrams, 62% voted satisfied, to which 8% voted very satisfied. There are also 31% who voted neutral and no negative responses. And finally, on reporting the results of analyses and machine learning models in a constructive plot, 54% voted satisfied, with 15% very satisfied, 23% neutral and 8% very dissatisfied.

In the initial pre-evaluation, students faced substantial challenges across various aspects of machine learning. They struggled to grasp basic concepts, implement machine learning models, understand algorithmic workings, and analyze data from diagrams. However, in the subsequent post-evaluation, significant progress was evident. A majority of students expressed satisfaction in their understanding of basic concepts and the ability to implement real-world machine learning models. They also demonstrated improved comprehension of algorithmic workings and data analysis from diagrams. These results underscore the students' commendable effort and remarkable growth in their machine learning skills, which have evolved from initial difficulties to a much-improved level of competence and confidence.

Module Transversal Skills

Pre-Evaluation:

How would you assess your competence at this time with regard to the following training modules of the learning program?



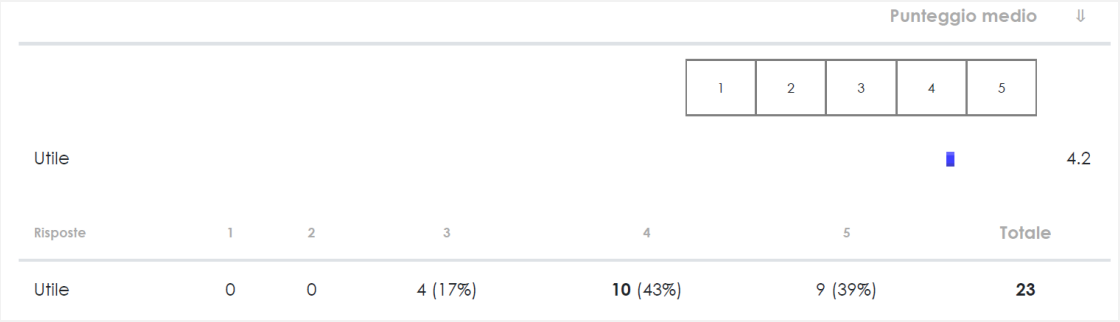
Risposte	Nessuna conoscenza	Conoscenza di base	Conosco molto	Sono un esperto	Totale
Soft Skills	2 (7%)	**14** (50%)	9 (32%)	3 (11%)	**28**

Where → 1: No knowledge 2: A little knowledge 3: A lot of knowledge 4: Expert

Half of the participants have a little knowledge about the subject, 32% have a lot of knowledge and 11% are experts, with only 7% of the participants do not have any knowledge.

Post-Evaluation:

Did you find the module useful for your professional development?



Risposte	1	2	3	4	5	Totale
Utile	0	0	4 (17%)	**10** (43%)	9 (39%)	**23**

Where → 1: Not useful / 5: Very useful

Almost half of the students (43%) considered the module to be useful, plus 39% considered it very useful. On the contrary, 17% of the students voted neutral and there were no negative votes.

After your participation, were your initial expectations met?

Risposta	Media	Totale
SI	75%	18
Parzialmente	21%	5
Risposte totali al questionario	100%	24/23

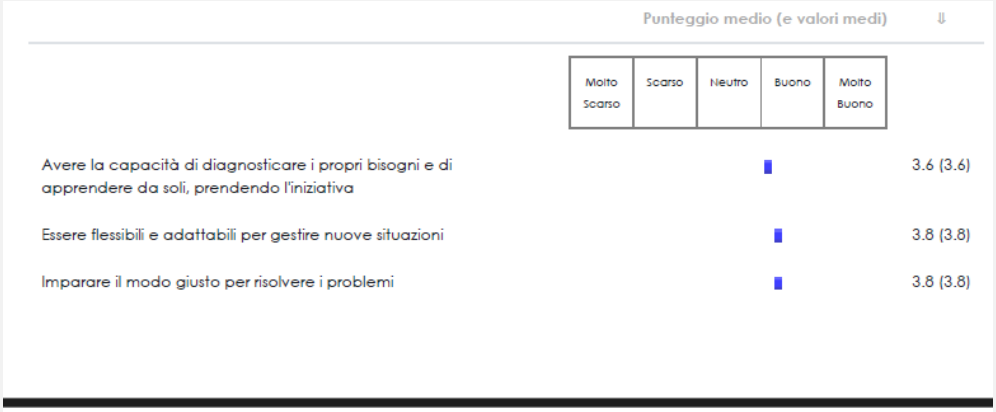
Where → 1: Yes / 5: Partially

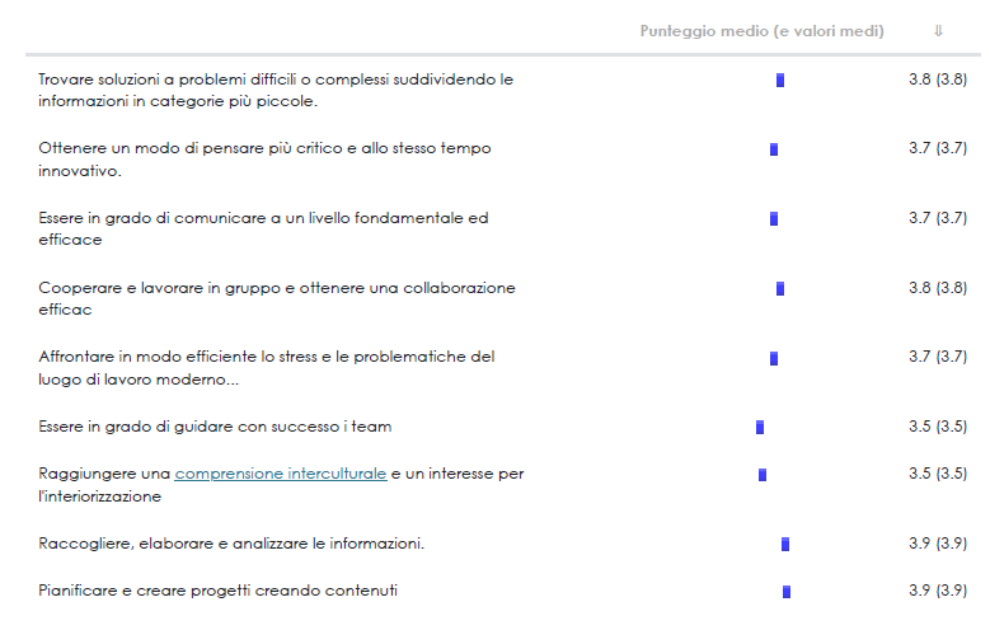
The greater part of the participants (75%) voted that their initial expectations were met, and the remaining 21% are unsure and voted partially.

Evaluation of level of competences

Pre-course: Module C – Transversal Skills

If you plan to participate in the transversal skills module, assess your current level of the following skills





Where → 1: Very poor 2: Poor 3: Neutral 4: Good 5: Very good / 1. Having the ability to diagnose one's own needs and to learn on one's own, taking the initiative 2. Being flexible and adaptable to handle new situations 3. Learning the right way to solve problems 4. Finding solutions to difficult or complex problems by breaking down information into smaller categories. 5. Achieving a more critical and at the same time innovative way of thinking. 6. Being able to communicate at a fundamental and effective level 7. Co-operating and working in a team and achieving effective collaboration 8. Dealing efficiently with the stress and problems of the modern workplace... 9. Being able to successfully lead teams 10. Achieving an intercultural

understanding and an interest in internalizing 11. Gathering, processing and analysing information 12. Planning and creating projects by creating content

Concerning the first section, having the ability to diagnose one's own needs and to learn on one's own, taking the initiative, 46% voted that they had a good level, with 14% that had a very good level. On the other hand, 25% voted neutral, 11% poor and 1% very poor. Then, in the being flexible and adaptable to handle new situations section, 46% of students had a good level, plus 18% that had a very good level and a 29% neutral, with the remaining 7% that had poor level. In the third section, learning the right way to solve problems, 39% of them were good and 21% very good. 32% were neutral and 7% poor. In the finding solutions to difficult or complex problems by breaking down information into smaller categories section the 46% of participants voted that they had a good level, 25% had a very good level, 18% neutral, 7% poor and 4% very poor. In the next section, achieving a more critical and at the same time innovative way of thinking, half of the students voted good, plus 18% that voted very good. Then, 21% stayed neutral, and 7% voted poor with 4% voting very poor. In being able to communicate at a fundamental and effective level, 46% had a good level, 14% very good, 36% neutral and 4% poor. 54% stated that they had good level in co-operating and working in a team and achieving effective collaboration, and 18% that they had very good level. Then, 21% remained neutral and 7% had a poor level. In dealing efficiently with the stress and problems of the modern workplace, 39% had good level, 25% very good, 21% neutral, 11% poor and 4% very poor. 46% had a good level in being able to successfully lead teams, 14% a very good level, 25% neutral, 4% poor and the remaining 11% very poor. In the 10^{th} section, achieving an intercultural understanding and an interest in internalizing, 43% of students voted they had good level, plus 11% having very good level. 36% remained neutral and 11% voted poor. In the gathering, processing and analysing information section, 43% of participants had good level, 25% very good, 29% neutral and 4% poor. Finally, in the last section, planning and creating projects by creating content, 36% had good level, with 29% that voted very good and another 36% neutral.

After attending the introductory module, please assess your current level of the following skills

Where → 1: Very poor 2: Poor 3: Neutral 4: Good 5: Very good / 1. Having the ability to diagnose one's own needs and to learn on one's own, taking the initiative 2. Being flexible and adaptable to handle new situations 3. Finding solutions to difficult or complex problems by breaking down information into smaller categories. 4. Achieving a more critical and at the same time innovative way of thinking. 5. Being able to communicate at a fundamental and effective level 6. Co-operating and working in a team and achieving effective collaboration

In the first section, having the ability to diagnose one's own needs and to learn on one's own, taking the initiative, students voted 39% very good, 35% good, 22% neutral and 4% very poor. In the second section, being flexible and adaptable to handle new situations, again 39% voted very good, then, 26% good, another 26% neutral and the remaining 9% very poor. In the section finding solutions to difficult or complex problems by breaking down information into smaller categories, 35% of the participants voted very good, another 35% voted good, 22% neutral, 4% poor and another 4% very poor. Then, in the section achieving a more critical and at the same time innovative way of thinking, 39% of students had very good level, 35% good, 22% neutral and 4% very poor. In section 5, being able to communicate at a fundamental and effective level, 43% had very good level, plus 30% having good level. Then, 17% stayed neutral, 4% voted poor and 4% very poor. Finally, in the last section, co-operating and working in a team and achieving effective collaboration, 48% had a very good level, 17% good, 26% neutral, 4% poor and another 4% very poor.

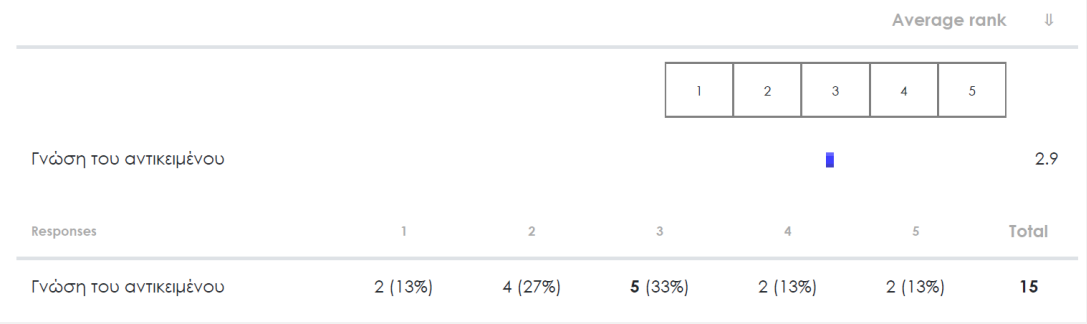
From the initial assessment to the final evaluation, students displayed impressive growth across several domains. They transitioned from a 14% rating to a 35% rating in the very good category for having the ability to diagnose one's own needs and to learn on one's own, taking the initiative. Similarly, their flexibility and adaptability to handle new situations soared from 18% to 39% in the very good category. When finding solutions to difficult or complex problems by breaking down information into smaller categories, there was a rise from 25% to 35% in the very good tier. In achieving a more critical and at the same time innovative way of thinking, there was an increase from 18% to 39% in the very good realm. Moreover, their capacity for effective communication exhibited a remarkable boost from 14% to 43% in the very good domain. Lastly, their teamwork and collaboration abilities improved significantly, advancing from 18% to 48% in the very good spectrum.

Learners from University of Patras (EL): Module Big Data

Evaluation of the impact on student's competence before and after the module Big Data

Pre-Evaluation:

How would you evaluate your competence right now, regarding the following training modules of the learning program?

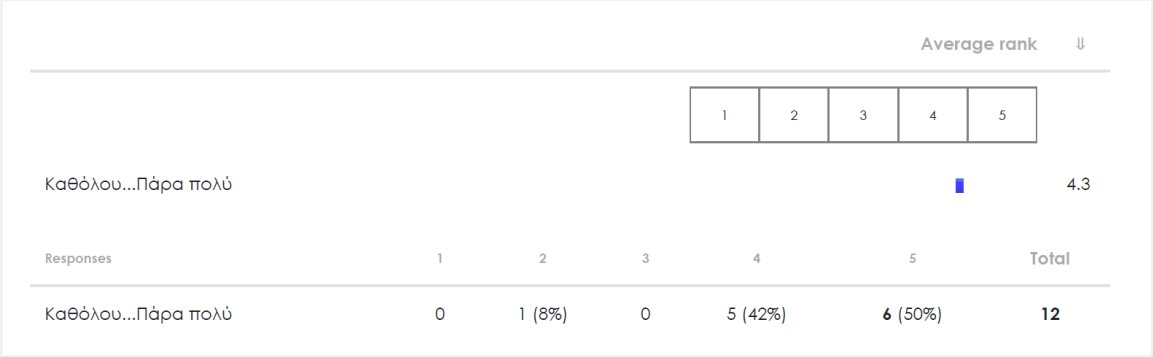


Responses	1	2	3	4	5	Total
Γνώση του αντικειμένου	2 (13%)	4 (27%)	**5** (33%)	2 (13%)	2 (13%)	**15**

Where → 1: No knowledge at all 2: I have some understanding 3: Neutral 4: I understand a lot 5: I am an expert / 1. Big Data

33% of students had neutral understanding of Big Data, 27% had some, 13% understood a lot, another 13% were experts and 13% had no knowledge.

Did you find the module useful for your professional development?



Responses	1	2	3	4	5	Total
Καθόλου...Πάρα πολύ	0	1 (8%)	0	5 (42%)	**6** (50%)	**12**

Where → 1: Not at all useful 5: Extremely useful

Half of the participants found the module extremely useful for their professional development. With 42% finding it very useful and 8% not useful.

After your participation, were your initial expectations met?

Response	Average	Total
Ναι	75%	9
Μερικώς	25%	3
Total responses to question	100%	12/12

Where → 1: Yes 2: partly

75% of students assure that their expectations after their participation were met and 25% have doubts about that.

If you are going to participate in the Module Big Data rate your current level of the following competences

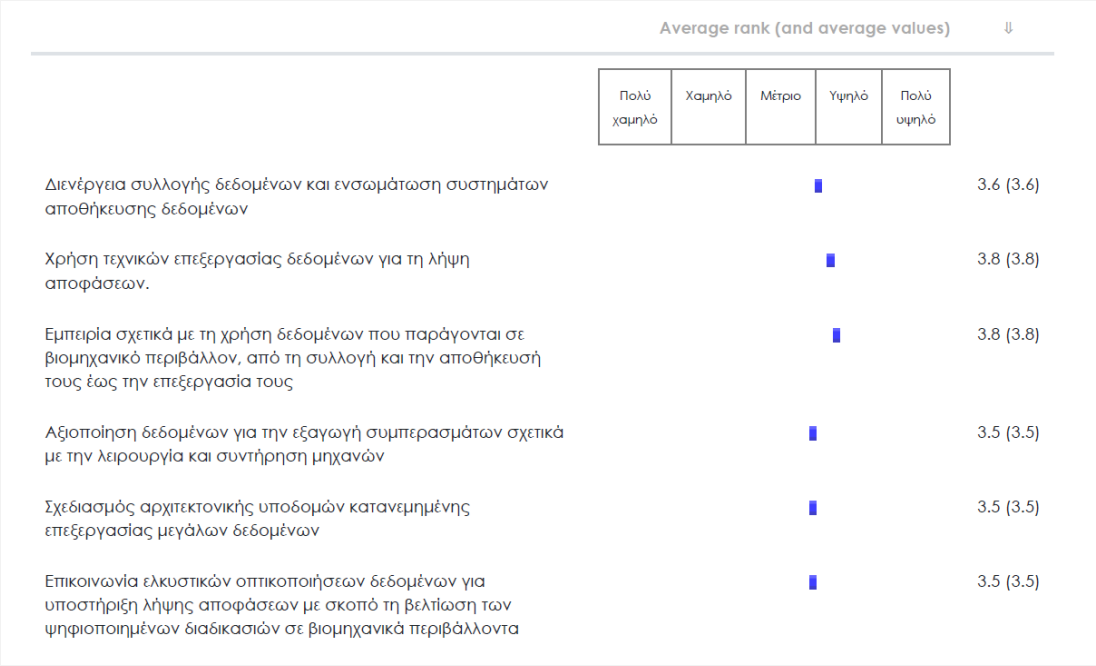
Responses	Πολύ Χαμηλό	Χαμηλό	Μέτριο	Υψηλό	Πολύ υψηλό	Total
Διενέργεια συλλογής δεδομένων και ενσωμάτωση συστημάτων αποθήκευσης δεδομένων	3 (20%)	4 (27%)	**5** (33%)	3 (20%)	0	**15**
Χρήση τεχνικών επεξεργασίας δεδομένων για τη λήψη αποφάσεων.	4 (27%)	2 (13%)	**6** (40%)	2 (13%)	1 (7%)	**15**
Εμπειρία σχετικά με τη χρήση δεδομένων που παράγονται σε βιομηχανικό περιβάλλον, από τη συλλογή και την αποθήκευσή τους έως την επεξεργασία τους	**5** (33%)	4 (27%)	2 (13%)	4 (27%)	0	**15**
Αξιοποίηση δεδομένων για την εξαγωγή συμπερασμάτων σχετικά με την λειτουργία και συντήρηση μηχανών	**5** (33%)	3 (20%)	**5** (33%)	1 (7%)	1 (7%)	**15**
Σχεδιασμός αρχιτεκτονικής υποδομών κατανεμημένης επεξεργασίας μεγάλων δεδομένων	**5** (33%)	**5** (33%)	3 (20%)	0	2 (13%)	**15**
Επικοινωνία ελκυστικών οπτικοποιήσεων δεδομένων για υποστήριξη λήψης αποφάσεων με σκοπό τη βελτίωση των ψηφιοποιημένων διαδικασιών σε βιομηχανικά περιβάλλοντα	4 (27%)	**6** (40%)	2 (13%)	1 (7%)	2 (13%)	**15**

Where → 1: Very poor 2: Poor 3: Neutral 4: Confident 5: Very confident / 1. Carrying out data collection and integrating data storage systems 2. Use data processing techniques for decision making. 3. Work with data generated within the industrial environment, from its capture and storage to its exploitation through data processing methods. 4. Exploit data to derive insights regarding the operation and maintenance of machines. 5. Design the architecture of an infrastructure for the distributed processing of big data. 6. Communicate engaging data visualizations to support decisions towards the improvement of the digitized processes in industrial environments

Before starting the course, students rated their competences in carrying out data collection and integrating data storage systems, with 33% of votes in neutral, 20% in confident, 27% in poor and 20% in very poor. In use data processing techniques for decision making 40% of students had neutral knowledge about it, with 13% being confident and 7% being very confident. On the contrary, 13% rated their level as poor and 27% as very poor. In the third category, work with data generated within the industrial environment, from its capture and storage to its exploitation through data processing methods, 33% of participants had a very poor level, 27% just poor, 13% neutral and 27% were confident. Regarding exploit data to derive insights regarding the operation and maintenance of machines, 33% of the students had very poor level, 20% poor, 33% neutral, 7% confident and 7% very confident. Then, in design the architecture of an infrastructure for the distributed processing of big data, 33% had very poor level, another 33% had poor level, 20% neutral and 13% were very confident. Finally, in the communicate engaging data visualizations to support decisions towards the

improvement of the digitized processes in industrial environments section, 40% of students had poor knowledge and 27% had very poor level. On the other hand, 13% were neutral, with 7% confident and 13% very confident.

Post-Evaluation: After your participation in the Module Big Data, please rate your current level of the following competences



Where → 1: Very poor 2: Poor 3: Neutral 4: Confident 5: Very confident / 1. Carrying out data collection and integrating data storage systems 2. Use data processing techniques for decision making. 3. Work with data generated within the industrial environment, from its capture and storage to its exploitation through data processing methods. 4. Exploit data to derive insights regarding the operation and maintenance of machines. 5. Design the architecture of an infrastructure for the distributed processing of big data. 6. Communicate engaging data visualizations to support decisions towards the improvement of the digitized processes in industrial environments

Concerning carrying out data collection and integrating data storage systems 67% of students now consider that they are confident with their level in this subject, 25% stay neutral and 8% consider they have poor level. In use data processing techniques for decision making 67% of students voted as confident, plus 8% as very confident. Then, 17% stay neutral and 8% voted as poor. 67% rated their level in work with data generated within the industrial environment, from its capture and storage to its exploitation through data processing methods as confident, with 17% rating it as very confident and another 17% as poor. Then, in exploit data to derive insights regarding the operation and maintenance of machines, 75%

consider they are confident while 25% think they are poor. In the fifth section, design the architecture of an infrastructure for the distributed processing of big data, 58% voted for confident, 33% neutral and 17% poor. In the last place, communicate engaging data visualizations to support decisions towards the improvement of the digitized processes in industrial environments, 67% of students see themselves as very confident, with 17% neutral and 17% poor.

Initially, in data collection and storage integration, a majority held neutral or poor confidence, but in the post-evaluation, 67% felt confident. Similarly, in using data processing techniques, the majority transitioned from neutral or poor to confident levels, with 67% expressing confidence. Work with industrial data also saw an improvement, with 67% now confident. In exploiting data for machine insights, 75% became confident compared to 33% in the pre-evaluation. When designing big data infrastructure, there was a shift from poor levels to 58% being confident. Lastly, in communicating data visualizations, 67% now feel very confident, contrasting with a higher percentage of poor and neutral levels before the course. In sum, the students' competencies markedly improved across all areas.

Conclusion

In summary, the assessment of the course demonstrates a distinct and positive progression in the development of students' competences across diverse modules and partner organizations. The modules have proven exceptionally beneficial for professional growth, as a majority of students express satisfaction with the program meeting their expectations.

Significantly, a notable proportion of students exhibited substantial improvements in their self-assessed competence levels. The shift from initial neutral or poor ratings to confident and very confident levels, particularly in areas such as data collection, data processing, and industrial data handling, underscores the course's effectiveness. It should be also highlighted that very high scores were achieved for the module Transversal Skills, which inclusion in the course was innovative for technical operators and a challenge at the same time. The results revealed that its inclusion was effective and valuable for the students.

Moreover, the overwhelmingly positive endorsement of the course, with over 90% of students willing to recommend it, signifies a high level of satisfaction with the educational experience. These findings collectively underscore the course's pivotal role in augmenting both knowledge and skills, closely aligning with the professional development needs of the students.

Chapter 2: Impact on CVET

This chapter is dedicated to the comprehensive evaluation of the course's influence on both trainers and, indirectly, on the students, considering that the trainers have played a pivotal role in imparting the course content to the students. The trainers were selected to give feedback for CVET as they were upskilled and reskilled through their training in the pilots and through studying the project results of DTAM project.

The chapter is structured to delve into the responses and insights provided by the trainers post-course, shedding light on their observations and assessments. Additionally, it encompasses certain aspects of students' responses obtained through the trainers. The principal objective is to gauge the effects of the course on trainers and indirectly, on students, achieved through a comparative analysis of pre-evaluation and post-evaluation data.

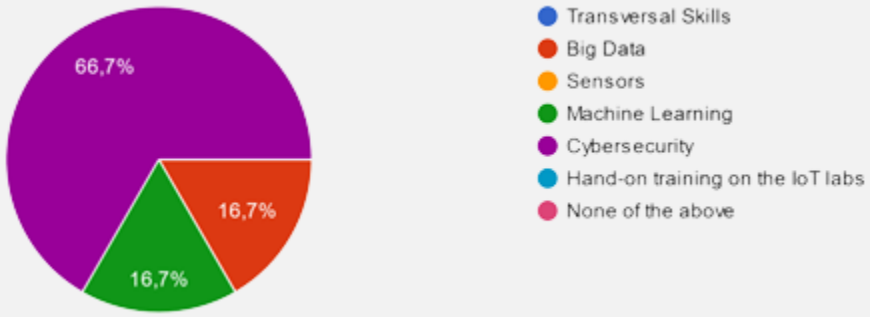
Impact on VET trainers

This section takes a closer look at the thorough assessment of the DTAM course, situated within the second chapter. It primarily focuses on the responses from trainers representing each partner organization that participated in the pilots, considering their central role in course delivery. By utilizing a questionnaire, trainers have contributed invaluable insights and feedback. This collective input encompasses both general assessments and module-specific perspectives, offering a holistic view of the course's effectiveness. Additionally, this section includes an analysis of the course's impact on the trainers.

Overall Evaluation of the e-learning programme.

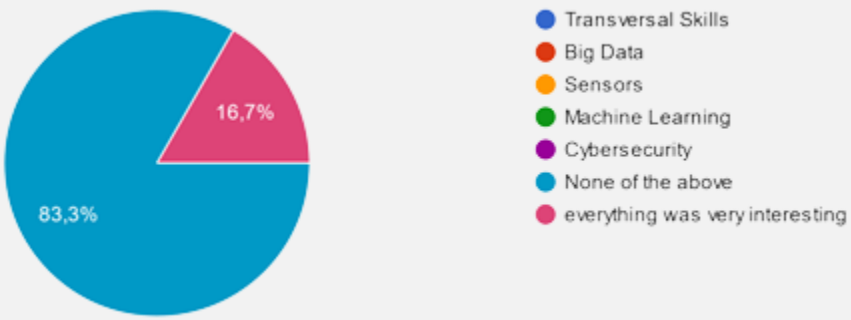
Trainers from Politeknika Ikastegia Txorierri (ES)

After piloting the course, please let us know which part was the most interesting for the students?



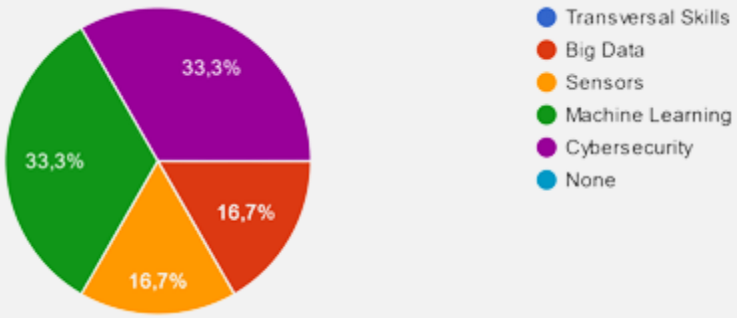
The greater part of the teachers (66.7%) assure that for students the Cybersecurity topic was the most interesting. Then a 16.7% of them say that the Machine Learning part was the best for students and another 16.7% say that the Big Data was.

After piloting the course, please let us know which part you think it was the least interesting for the students?



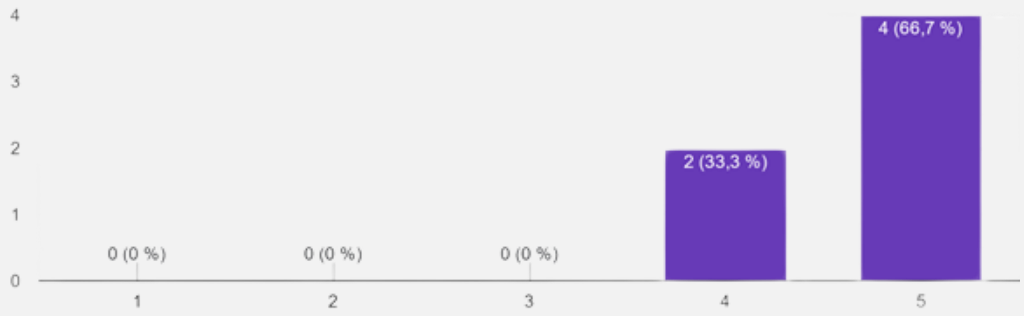
According to trainers, students did not find anything not interesting, with an 83.3% of them saying that none of the options were not interesting for participants and 16.7% saying that everything was very interesting for students.

Which of the following modules did you find the most challenging for a trainer ?



33.3% of the trainers found the Cybersecurity module the most challenging one, another 33.3% of them have a different opinion, stating that the Machine Learning module was the most challenging one. Then, a 16,7% of trainers voted for Sensors and another 16,7% for Big Data. None of them voted for Transversal Skills as the most challenging module for a trainer.

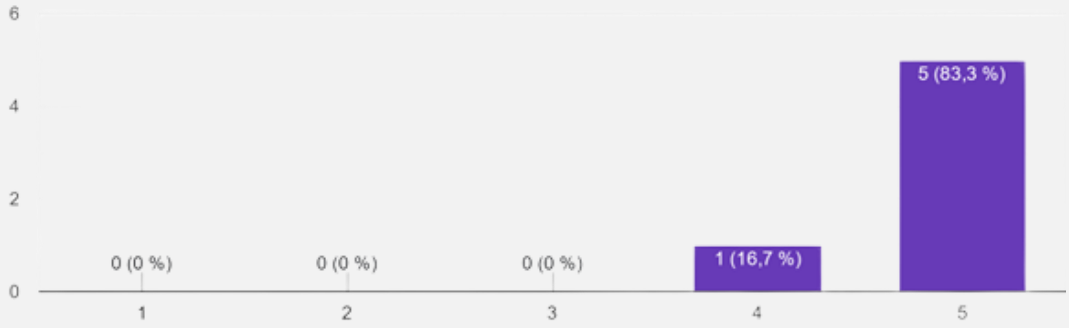
How would you evaluate the overall learning experience of DTAM e-learning programme ?



Where → 1: Very poor / 5: Excellent

All teachers evaluated the experience as positive, with 4 (66.7%) voting it as excellent and 2 (33.3%) voting it as very good. None voted the experience as neutral or negative.

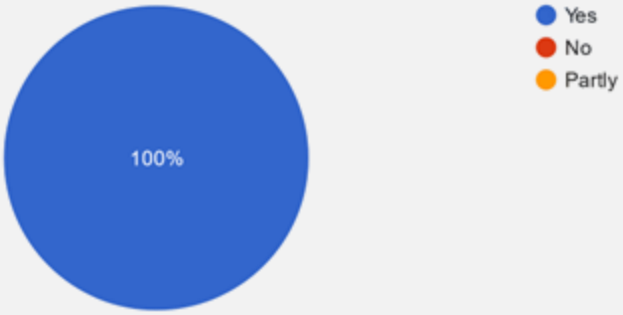
- **How would you evaluate the overall learning experience of DTAM Hand-on training on the IoT labs ?**



Where → 1: Very poor / 5: Excellent

All trainers have had a good teaching experience as 5 (83.3%) have voted excellent and 1 (16.7%) has voted very good. None had a neutral or negative experience.

Does the DTAM curriculum address the needs of students in Advanced Manufacturing?

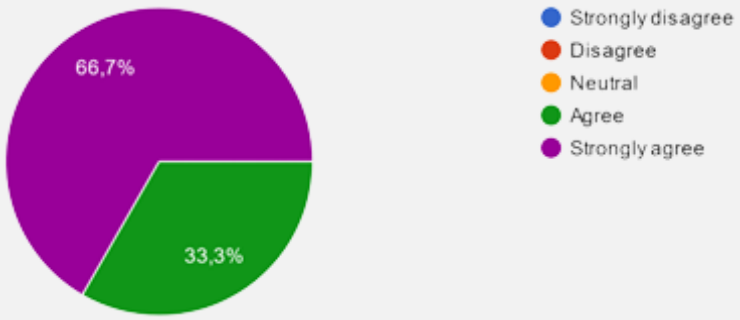


All trainers claim that the DTAM curriculum addresses the needs of students in that field.

Which needs do you consider that they are not effectively addressed, if any?

Again, all teachers agree, claiming that there is no need that has not been effectively addressed.

Was the training material practical and easy-to-follow?



None of the trainers disagreed with the question, all said that the material was practical and easy to follow.

Which part of the training material did you find the most interesting?

Five teachers said that Cybersecurity was the most interesting part, while one voted for Big Data and one for Sensors.

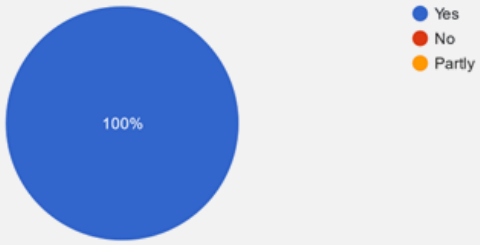
Which part of the training material did you find the less interesting?

One trainer commented that everything was interesting and two voted the transversal skills as the least interesting part of the course. The others abstained from answering.

Please share your comments and suggested improvements

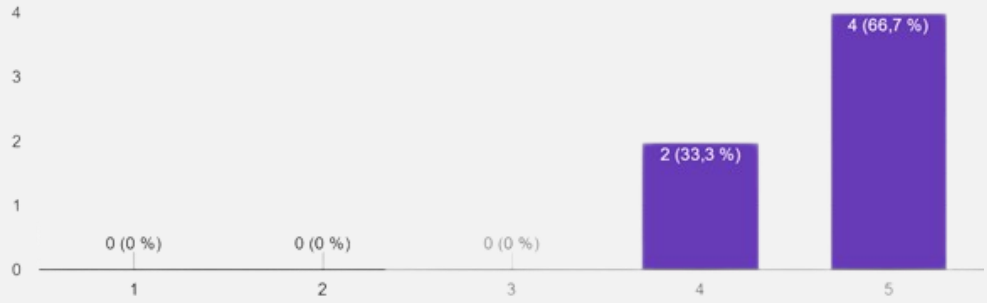
3 (50%) of the teachers refrained from commenting and one (16.7%) said that he had no comments, in addition to another (16.7%) who said that everything was fine. However, 1 commented that there should be more practical exercises.

Was this training motivational for you?



All participants say that the course was motivational for them.

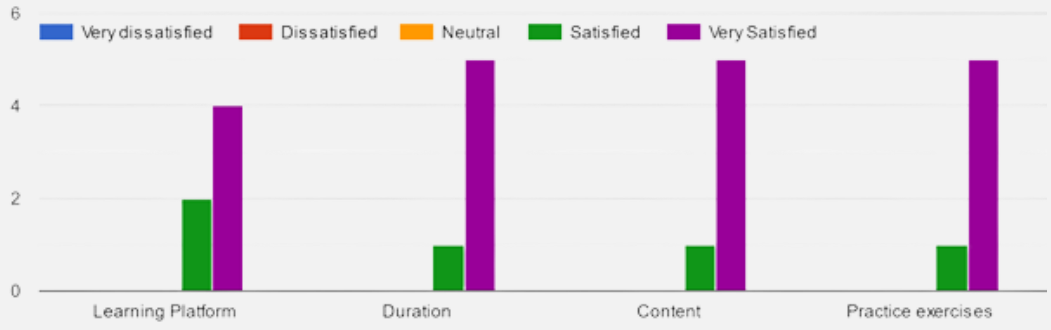
Did the quality of the course met your expectations?



Where → 1: Not at all / 5: Absolutely

All the teachers say that the quality of the course met their expectations. None of them voted otherwise.

Please rate your satisfaction regarding the course' s ...

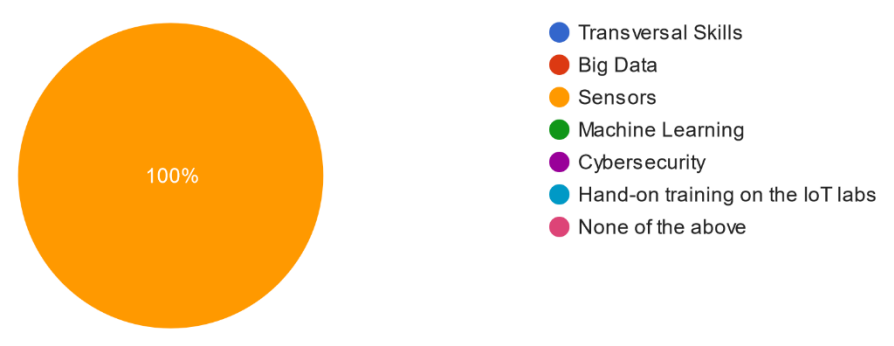


Overall, all trainers are either satisfied or very satisfied with all parts of the course. 5 voted very satisfied to duration, content and practice exercises while one voted for satisfied. The first option changes a little bit with 2 voting for satisfied and 4 for very satisfied. None of them voted negatively.

Trainers from DaVinci College (NL)

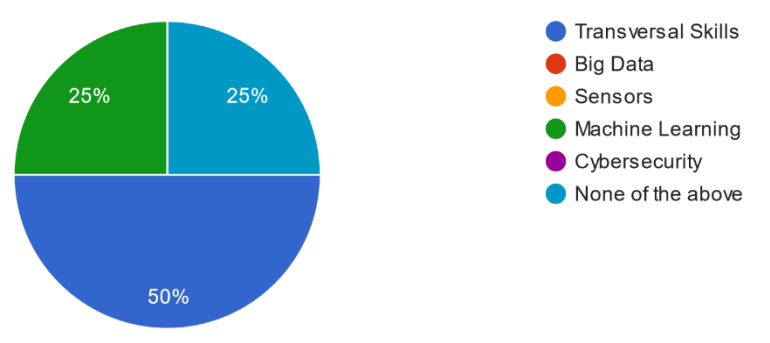
Overall Evaluation of the e-learning programme.

After piloting the course, please let us know which part was the most interesting for the students?



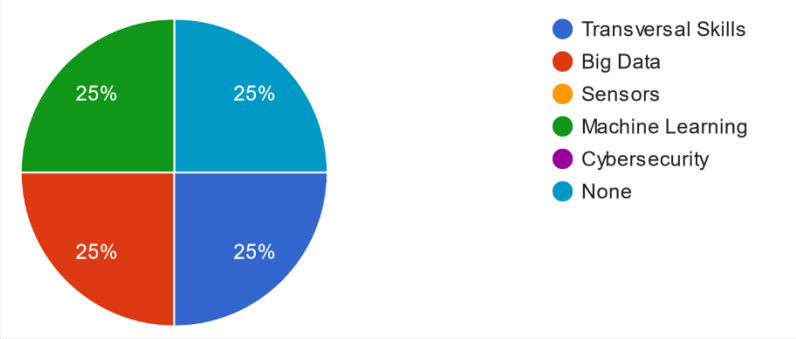
All participants agree that the most interesting part for students was Sensors.

After piloting the course, please let us know which part you think it was the least interesting for the students?



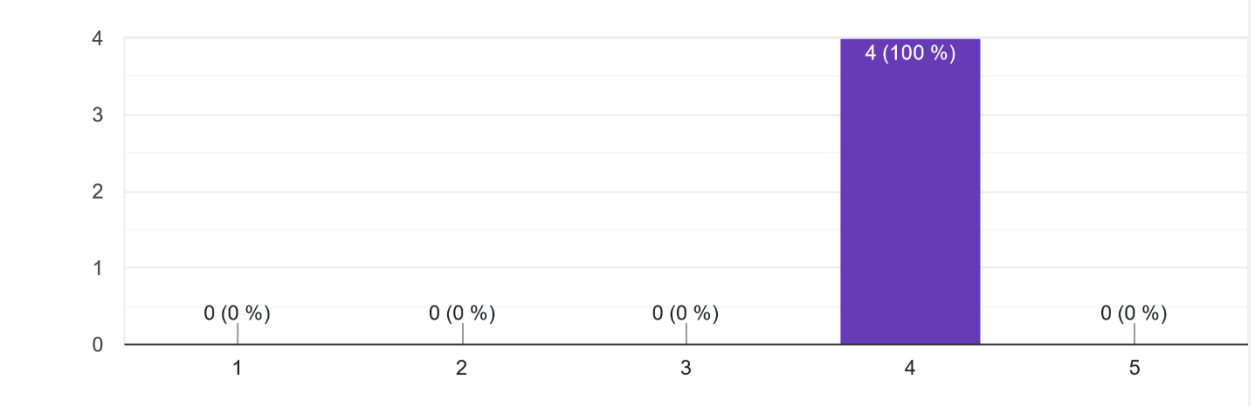
Half of respondents voted for Transversal Skills as the least interesting part for students, 25% for Machine Learning and the 25% left for none of the options.

Which of the following modules did you find the most challenging for a trainer ?



Each of the trainers voted for a different option: Transversal Skills, Big Data, Machine Learning and none.

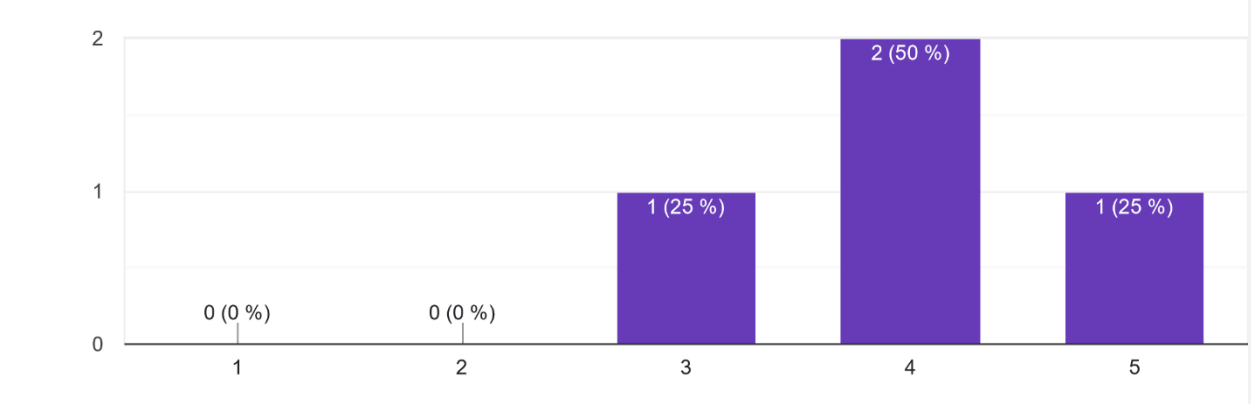
How would you evaluate the overall learning experience of DTAM e-learning programme ?



Where → 1: Very poor / 5: Excellent

All trainers evaluated the learning experience as very good.

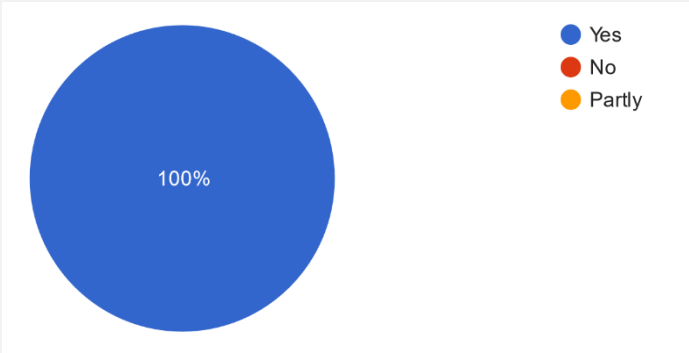
How would you evaluate the overall learning experience of DTAM Hand-on training on the IoT labs ?



Where → 1: Very poor / 5: Excellent

Two of the participants evaluated the experience as very good, with one voting excellent and one neutral.

Does the DTAM curriculum address the needs of students in Advanced Manufacturing?

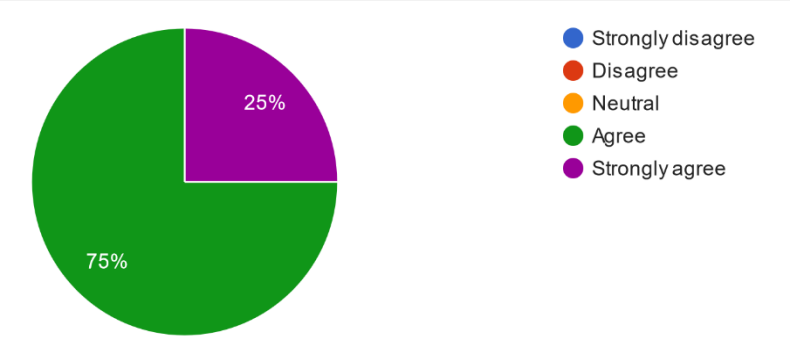


All participants agree that the DTAM curriculum address the need of students in Advanced Manufacturing.

Which needs do you consider that they are not effectively addressed, if any?

Three of them have no comments and one suggested that some more PLC Labs could be added to the curriculum, although not every lab has the necessary hardware.

Was the training material practical and easy-to-follow?



Three trainers agree that the training material was practical and easy-to-follow, with one strongly agreeing.

Which part of the training material did you find the most interesting?

The responses provided indicate that the individual found various aspects of the training material to be interesting. These included the hands-on labs and practical sections, as well as the use of Arduino and Raspberry Pi. Moreover, among the options presented, the practical assignments in chapter 2, which involved tasks like reading RFID RC522 Tags (NFC), controlling an HD44780 LCD display via I2C, and using a distance sensor (ultrasonic sensor HC-SR04), were highlighted as particularly engaging.

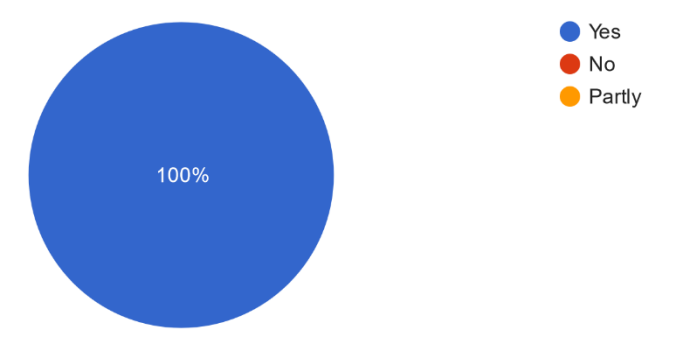
Which part of the training material did you find the less interesting?

The responses provided indicate that the individual found certain aspects of the training material to be less engaging. These aspects included reading theory, some of the reading parts, and specifically, the python theory.

Please share your comments and suggested improvements

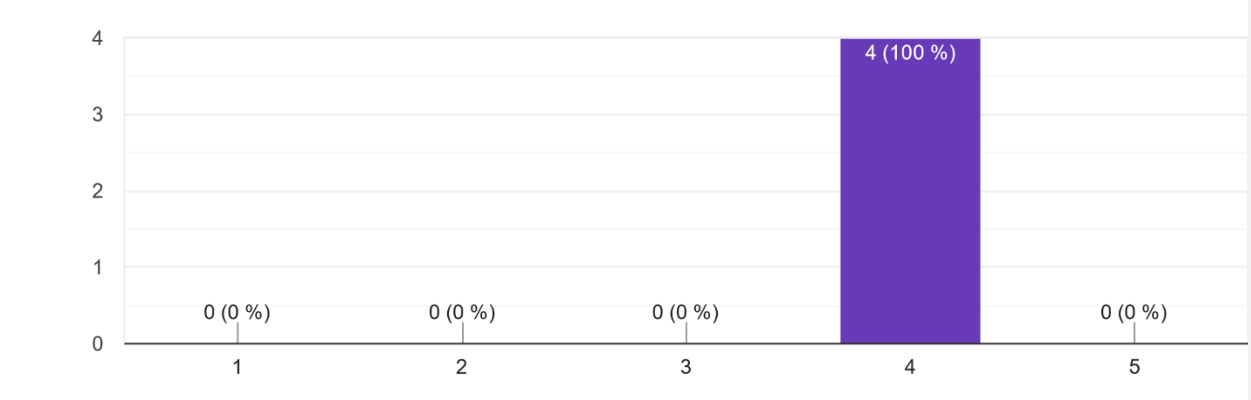
The responses suggest potential areas for improvement in the training material. These suggestions include incorporating more interactive elements like quizzes, increasing the emphasis on practical training, considering the introduction of different microprocessors such as the Pi Pico, and possibly reordering the material to allow students to engage in hands-on activities early in the course.

Was this training motivational for you?



They all agreed that the training was motivational for them.

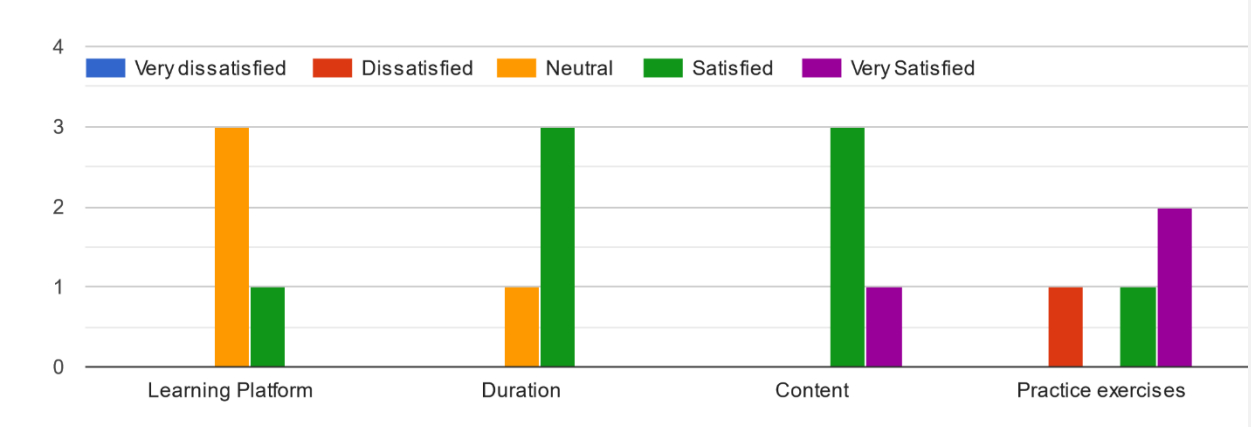
Did the quality of the course met your expectations?



Where → 1: Not at all / 5: Absolutely

All trainers agreed that the course did meet their expectations very well.

Please rate your satisfaction regarding the course' s ...

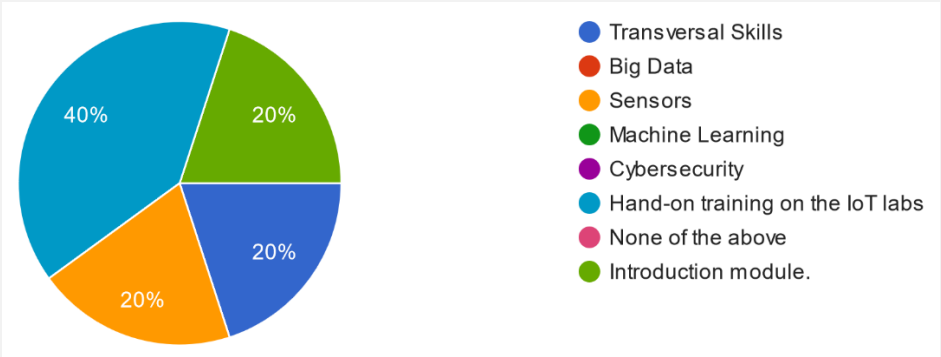


Three trainers voted the learning platform as neutral with one considering it satisfying. Then, concerning the duration, 3 of them found it satisfying and one neutral. In content, 3 voted satisfied and one very satisfied. Finally, practice exercises haver varied answers, with two very satisfied, one satisfied and one dissatisfied.

Trainers from Apro Formazione (IT)

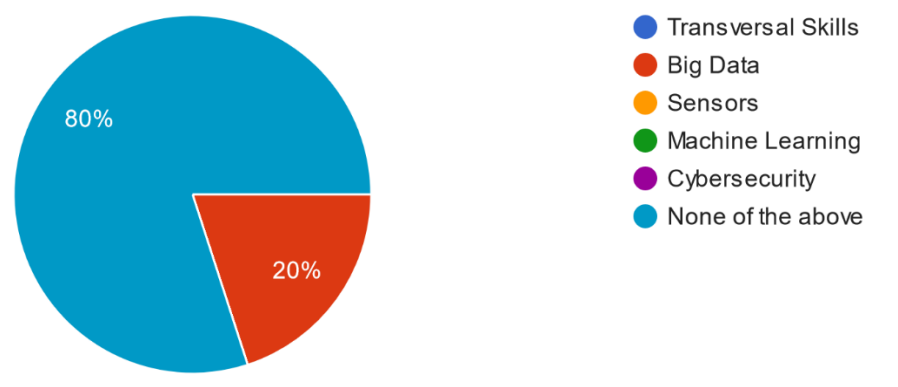
Overall Evaluation of the e-learning programme.

After piloting the course, please let us know which part was the most interesting for the students?



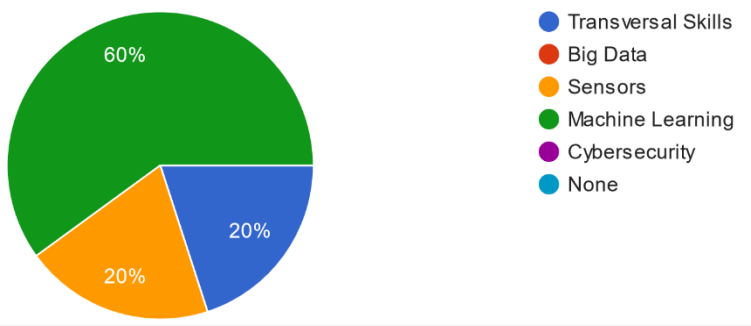
40% of the trainers voted for Hand-on training on the IoT labs as the most interesting for students. Then, 20% voted for Introduction module, another 20% for Transversal Skills, and the remaining 20% for Sensors.

After piloting the course, please let us know which part you think it was the least interesting for the students?



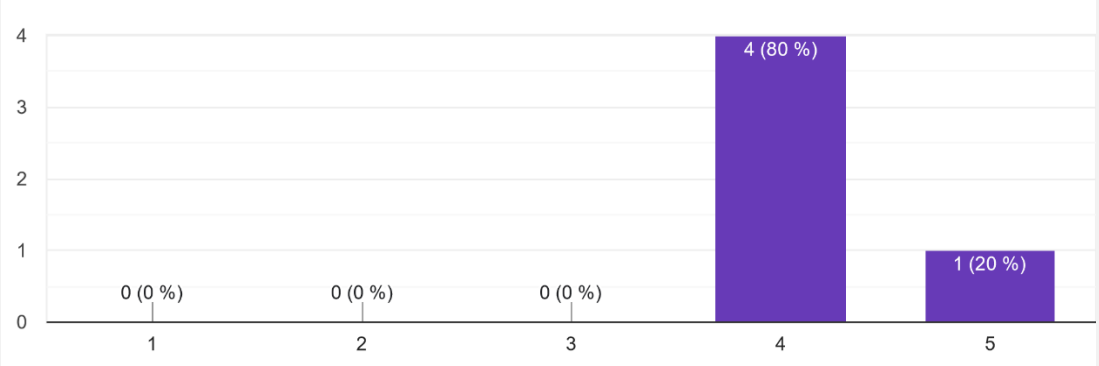
Greater part of the trainers (80%) voted that no particular part was the least interesting for students. Nonetheless, 20% voted for Big Data as the least interesting.

Which of the following modules did you find the most challenging for a trainer ?



More than half of the teachers (60%) found Machine Learning the most challenging module for a trainer. 20% stated that Transversal Skills was the most challenging and another 20% voted for sensors.

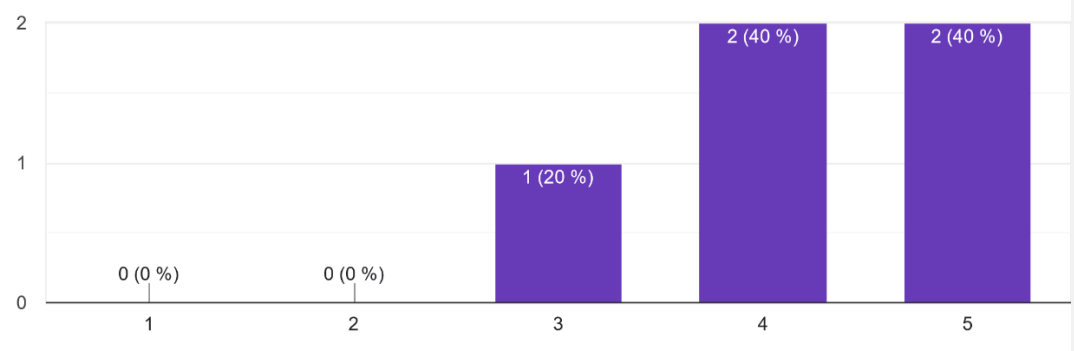
How would you evaluate the overall learning experience of DTAM e-learning programme ?



Where → 1: Very poor / 5: Excellent

The majority of the trainers (80%) evaluated the learning experience as very good, plus a 20% that voted for excellent, having no negative responses.

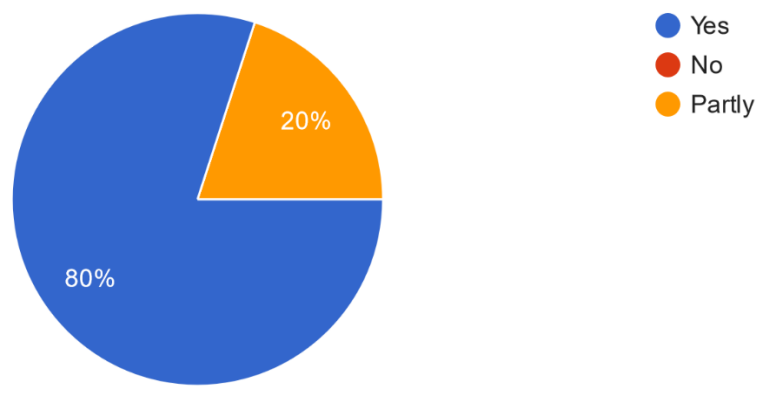
How would you evaluate the overall learning experience of DTAM Hand-on training on the IoT labs ?



Where → 1: Very poor / 5: Excellent

40% of the trainers voted for excellent and other 40% for very good, with 20% that voted neutral and no negative responses.

Does the DTAM curricumum address the needs of students in Advanced Manufactoring?

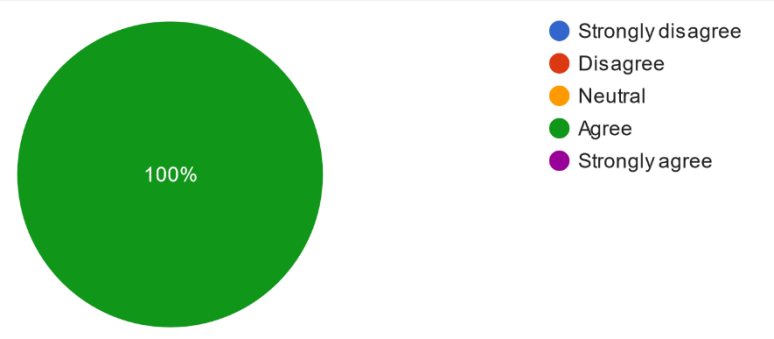


80% of trainers consider that the curriculum does address the needs of students and the remaining 20% voted partly.

Which needs do you consider that they are not effectively addressed, if any?

Some of the trainers consider that there are no needs that have not been effectively addressed. On the other hand, some other trainers suggested to deepen the practical part including exercises that involve all disciplines so learners can have a guide to follow as they can be extremely diverse and this practical part in the IoT lab should be improved because it lacks some things.

Was the training material practical and easy-to-follow?



All trainers agree that the material was practical and easy-to-follow.

Which part of the training material did you find the most interesting?

Some trainers found all the material interesting while others pointed out sections such as Electronics Introduction, Leadership, Cybersecurity, Big Data and Machine Learning.

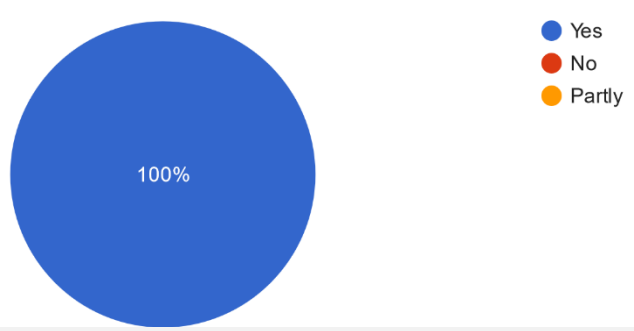
Which part of the training material did you find the less interesting?

Greater part of the trainers found nothing less interesting but some other emphasised Data Base Introduction and Machine Learning as the least interesting topics for them.

Please share your comments and suggested improvements

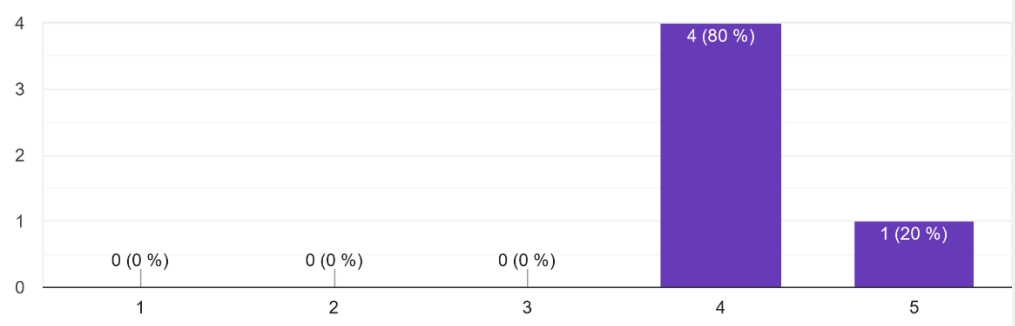
The majority of teachers agreed that there are no comments nor suggestions, but there are also some that mentioned the lack of practical exercises and that those exercises could be guided concerning all disciplines so that students can learn from practical cases.

Was this training motivational for you?



All teachers found the training motivational for them.

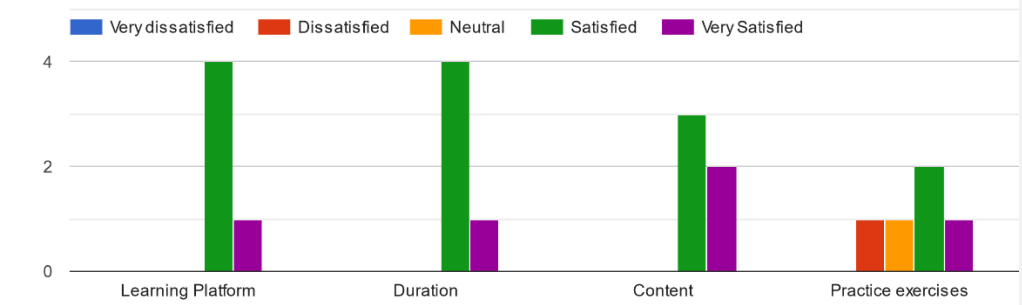
Did the quality of the course met your expectations?



Where → 1: Not at all / 5: Absolutely

The quality of the course met every trainer expectations, with 80% of them voting for yes and 20% voting absolutely.

Please rate your satisfaction regarding the course' s ...

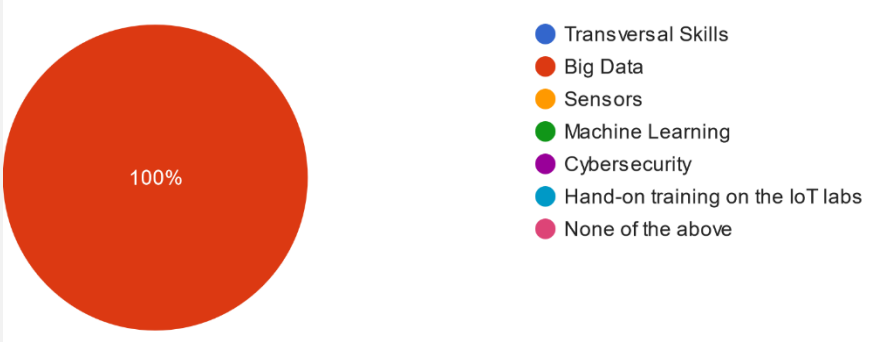


Concerning the learning platform and the duration of the course 4 trainers voted satisfied and 1 very satisfied in each. Then, in content, 3 voted satisfied and 2 very satisfied. Nevertheless, there are varied opinions concerning practice exercises, with 1 voting very satisfied, 2 satisfied, 1 neutral and 1 dissatisfied.

Trainers from University of Patras (EL)

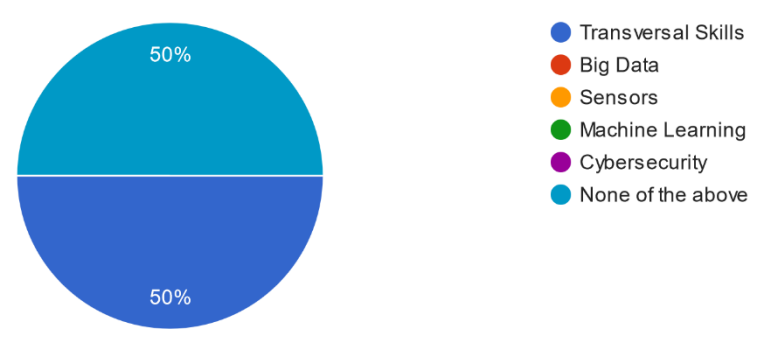
Overall Evaluation of the e-learning programme.

After piloting the course, please let us know which part was the most interesting for the students?



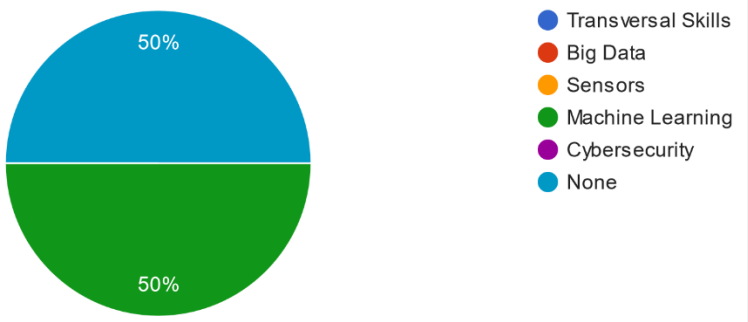
All trainers voted for Big Data as the most interesting section for students.

After piloting the course, please let us know which part you think it was the least interesting for the students?



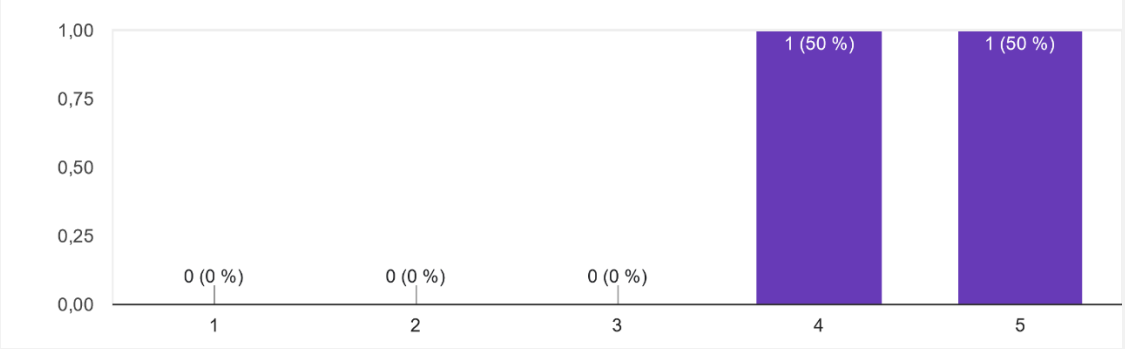
A trainer voted for Transversal Skills as the least interesting for students and the other one for none.

Which of the following modules did you find the most challenging for a trainer ?



A teacher voted for Machine Learning as the most challenging for a trainer, the other one voted for none of the above.

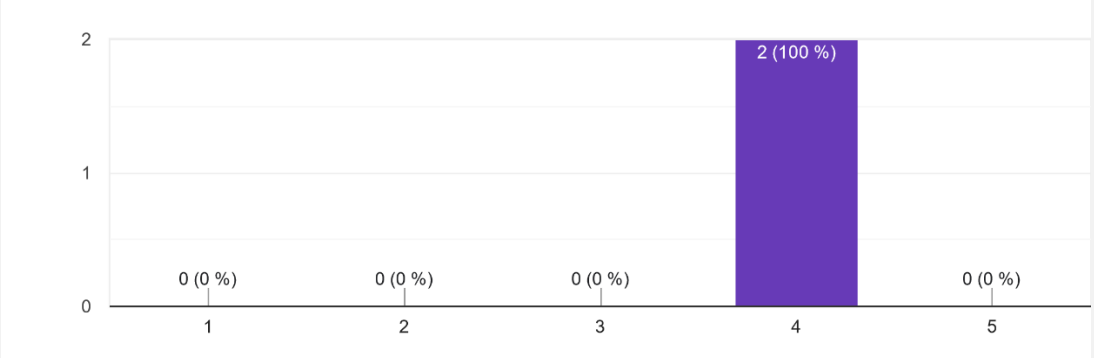
How would you evaluate the overall learning experience of DTAM e-learning programme ?



Where → 1: Very poor / 5: Excellent

One voted the experience as very good and the other one as excellent.

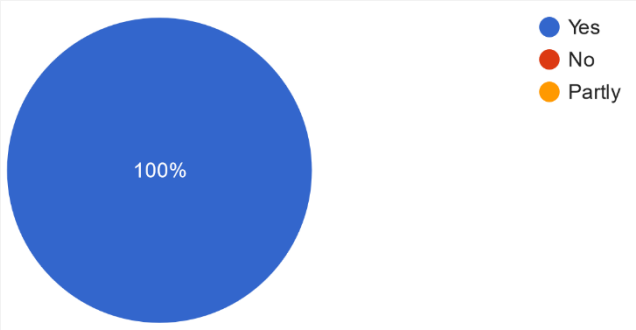
How would you evaluate the overall learning experience of DTAM Hand-on training on the IoT labs ?



Where → 1: Very poor / 5: Excellent

All trainers voted for the learning experience of DTAM Hand-on training on the IoT labs as very good.

Does the DTAM curriculum address the needs of students in Advanced Manufacturing?

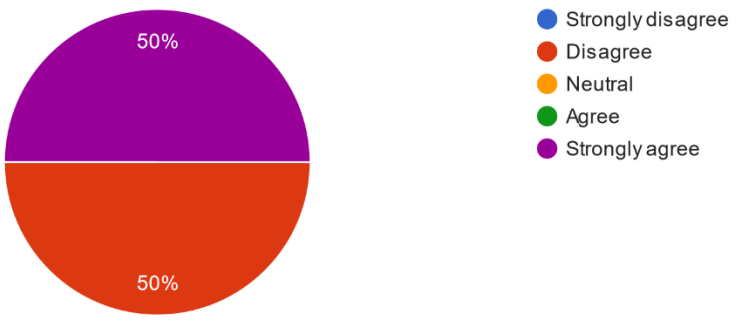


All trainers agree that the DTAM curriculum address the need of students.

Which needs do you consider that they are not effectively addressed, if any?

One of them assure that no needs have not been effectively addressed and the other one thinks that the trainees should have more time to practice.

Was the training material practical and easy-to-follow?



One of them disagree and the other one strongly agree that the material was practical and easy-to-follow.

Which part of the training material did you find the most interesting?

A teacher said Big Data and Machine Learning, plus hands-on work with the sensors, and the other one challenge.

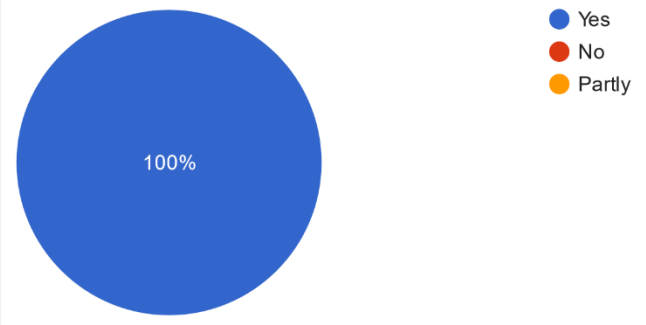
Which part of the training material did you find the less interesting?

One found the reading text part the least interesting, the other one think that no part was not interesting.

Please share your comments and suggested improvements

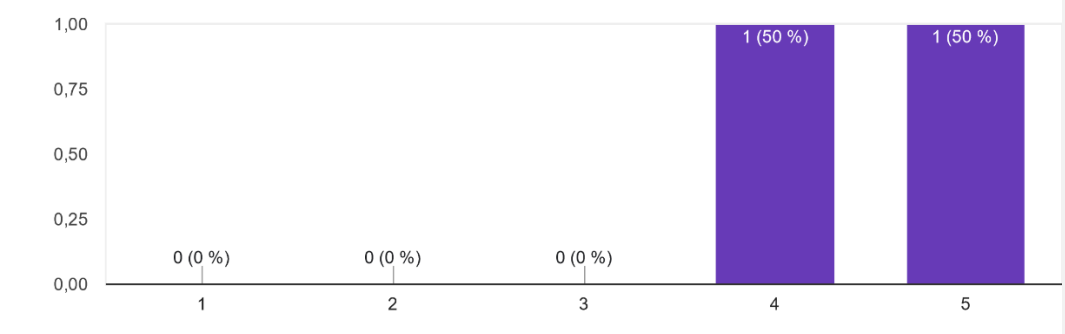
A teacher suggested that the training course should focus more on hands-on training material and the other one thinks that textual information should be shorter.

Was this training motivational for you?



They all agree that the training was motivational.

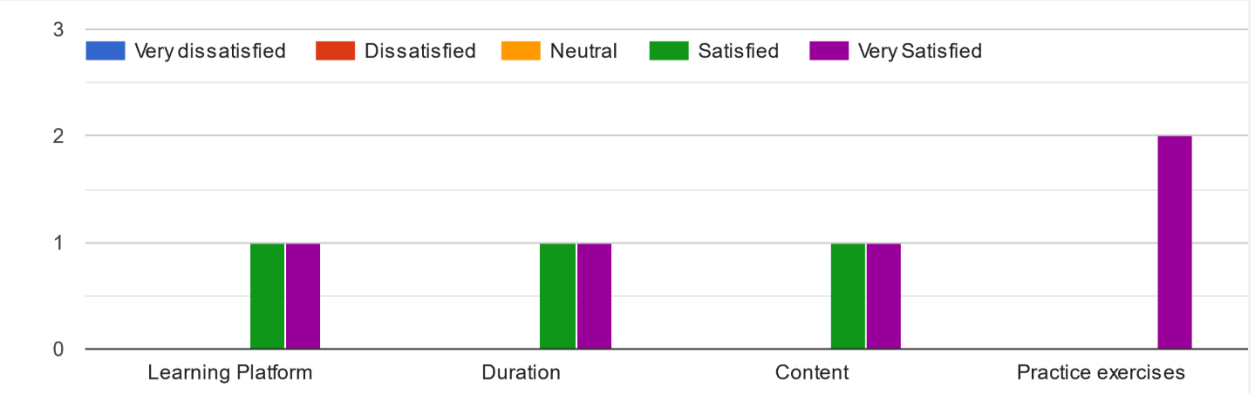
Did the quality of the course met your expectations?



Where → 1: Not at all / 5: Absolutely

A trainer voted that the course absolutely met their expectations and the other one voted yes.

Please rate your satisfaction regarding the course' s ...



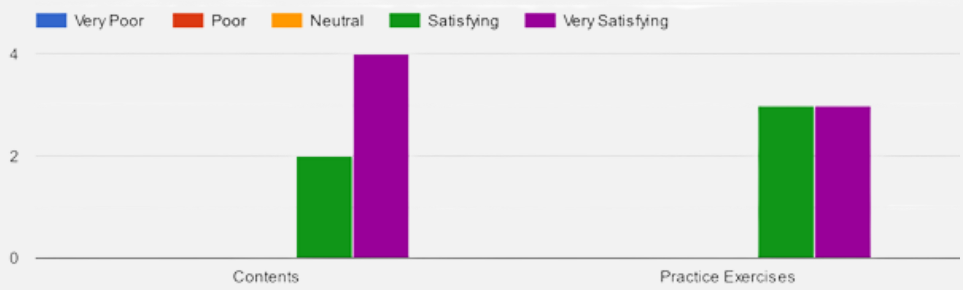
The course's learning platform, duration and content have the same votes, one for very satisfied and another one for satisfied. Practice exercises have both votes in very satisfied.

Modules Evaluation

Module 1: Introduction

Trainers from Politeknika Ikastegia Txorierri (ES)

Please evaluate Module 1 regarding the...



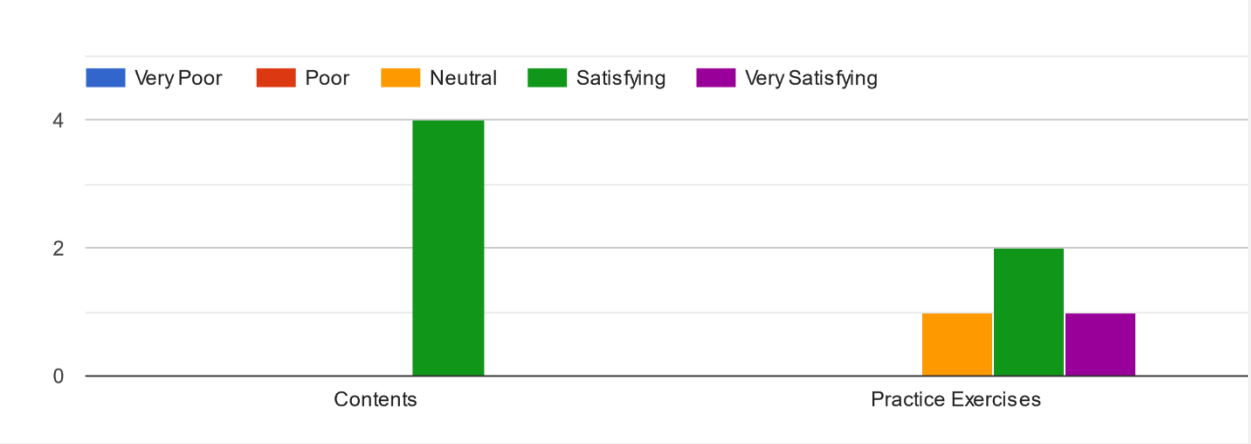
Teachers find module 1 generally satisfactory both in terms of content and practice exercises.

Do you have any suggestions for improvement of Module 1?

None of the teachers have proposed any suggestions to improve module 1, all of them are satisfied and find nothing to correct.

Trainers from DaVinci College (NL)

Please evaluate Module 1 regarding the...



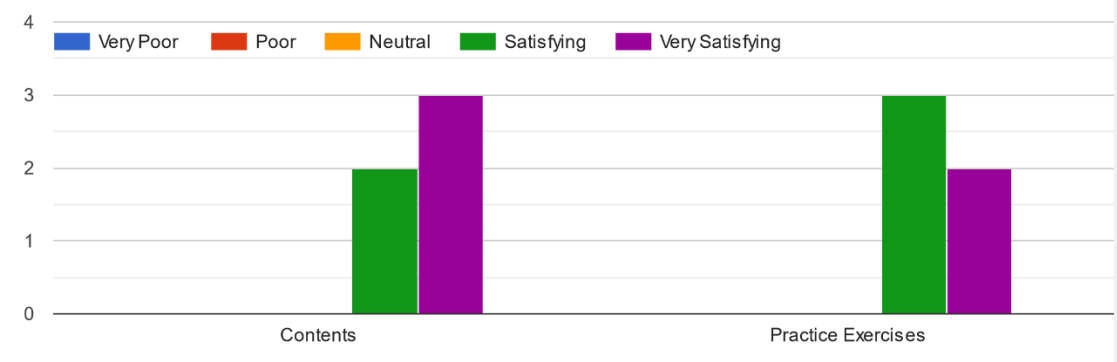
All respondents found the contents satisfying. Then, one of them voted the practice exercises as neutral, another as very satisfying and two as satisfying.

Do you have any suggestions for improvement of Module 1?

The responses offer suggestions for enhancing Module 1 of the course. These include a desire for more hands-on and interactive elements, potentially introducing the Pi Pico as an alternative to Raspberry Pi, incorporating more practical cases, and considering the introduction of other microprocessors, such as the Pi Pico, to diversify the learning experience.

Trainers from Apro Formazione (IT)

- **Please evaluate Module 1 regarding the…**



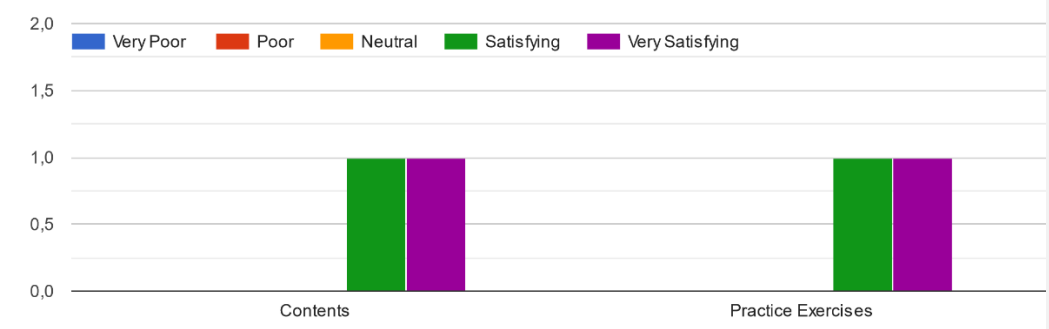
Concerning contents, 3 teachers voted for it as very satisfying and 2 as satisfying. Then, in Practice exercises 2 voted very satisfying and 3 satisfying, with no negative votes.

- **Do you have any suggestions for improvement of Module 1?**

There are no suggestions for improvement.

Trainers from University of Patras (EL)

- **Please evaluate Module 1 regarding the…**



Both sections have the same votes, one for very satisfying and one for satisfying.

- **Do you have any suggestions for improvement of Module 1?**

There are no suggestions for this module.

In conclusion for Module 1 the evaluation was very positive reaching over 90% satisfaction. There were some suggestions from the trainers of one partner for more hands-on and interactive elements, introducing the Pi Pico as an alternative to Raspberry Pi and also there were some doubts regarding the practice exercises.

Module 2: Big Data

Trainers from Politeknika Ikastegia Txorierri (ES)

- **Please evaluate Module 2 regarding the…**

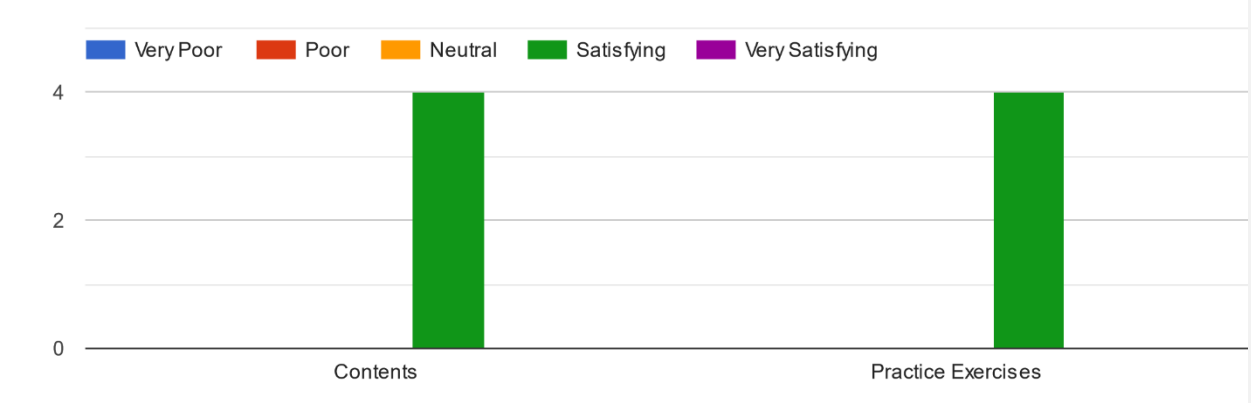
As with Module 1, all agreed that it was satisfactory overall.

- **Do you have any suggestions for improvement of Module 2?**

Trainers also have no suggestions regarding this module of the course.

Trainers from DaVinci College (NL)

- **Please evaluate Module 2 regarding the…**



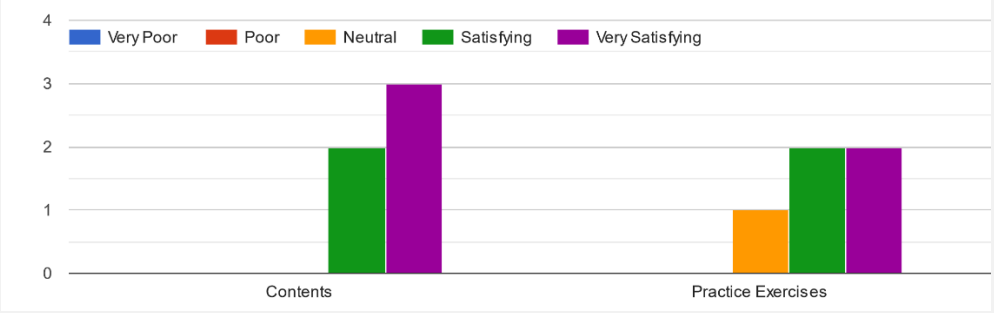
Once again, they agree with contents, voting it as satisfying, as well as with practice exercises.

- **Do you have any suggestions for improvement of Module 2?**

The responses vary, with one respondent indicating no specific suggestions for improvement. Another suggestion is to include more practical cases within Module 2. Additionally, there is a recommendation to consider introducing other microprocessors, such as the Pi Pico, to enhance the module.

Trainers from Apro Formazione (IT)

Please evaluate Module 2 regarding the…



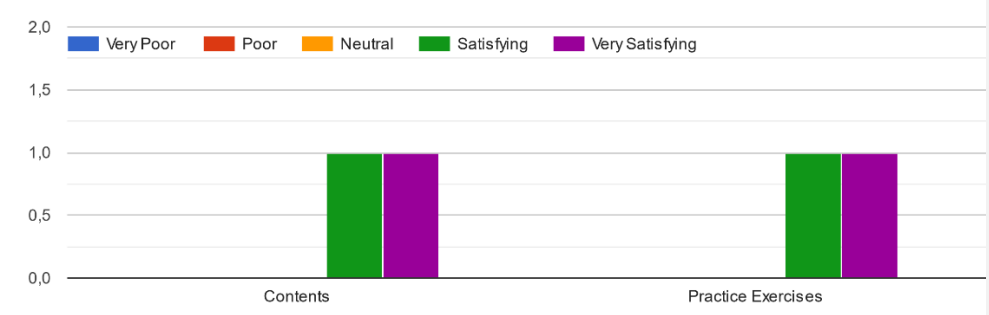
2 trainers voted for the module's content as very satisfying with 2 voting satisfying. Concerning practice exercises, 2 voted very satisfying, other 2 voted satisfying and 1 neutral. There are no negative votes.

Do you have any suggestions for improvement of Module 2?

Greater part of the trainers have no suggestions, except for one who suggested more guided exercises.

Trainers from University of Patras (EL)

Please evaluate Module 2 regarding the...



Do you have any suggestions for improvement of Module 2?

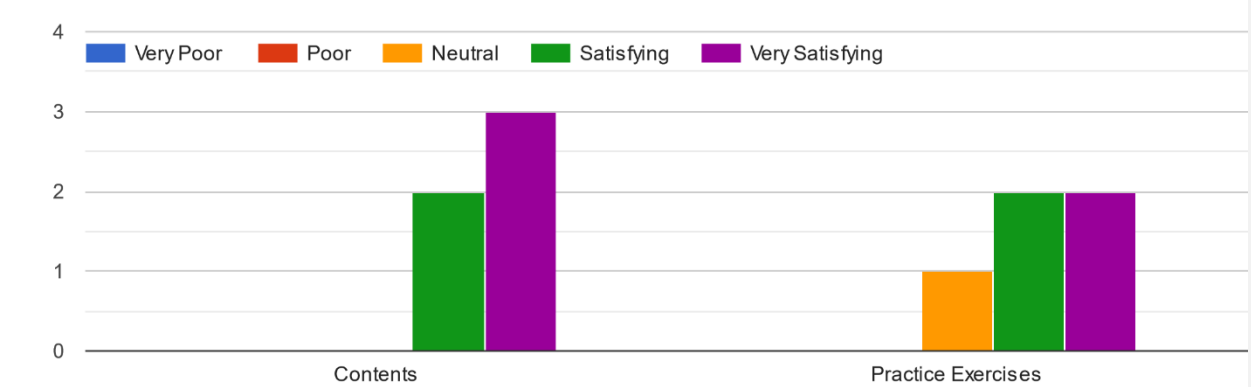
There are no suggestions.

In conclusion the evaluation of Module 2 was also very positive and reached over 90% satisfaction. There were suggestions from one partner for considering introducing other microprocessors to make the Module more attractive and from another one for guided exercises.

Module 3: Machine Learning

Trainers from Politeknika Ikastegia Txorierri (ES)

- **Please evaluate Module 3 regarding the…**



The contents part have 3 votes in very satisfying and 2 in satisfying, while the practice exercises have 2 in very satisfying and another 2 in satisfying, but also 1 in neutral. Again, there are no negative votes.

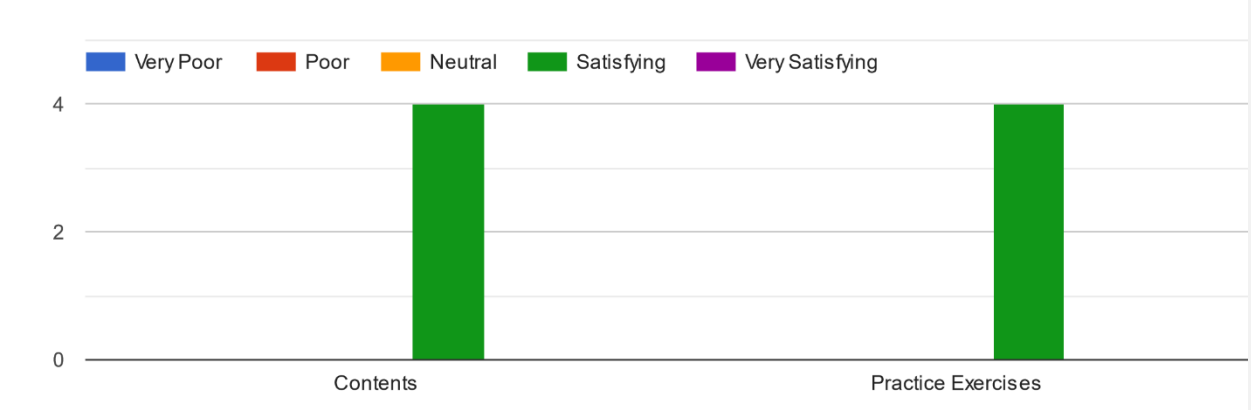
Do you have any suggestions for improvement of Module 3?

There are no suggestions except for one trainer who suggested mode guided exercises.

Trainers from DaVinci College (NL)

Module 3: Machine Learning

Please evaluate Module 3 regarding the...



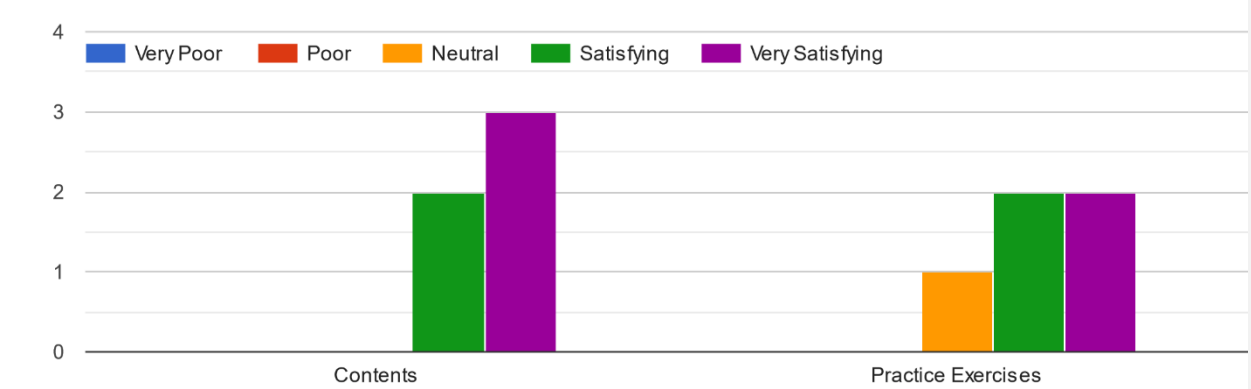
Again, they all agree that contents and practice exercises were satisfying.

Do you have any suggestions for improvement of Module 3?

One respondent indicated no specific suggestions for improvement. Another recommendation is to incorporate more practical cases into Module 3. Additionally, there is a suggestion to consider introducing other microprocessors, potentially including the Pi Pico, to enhance the module.

Trainers from Apro Formazione (IT)

- **Please evaluate Module 3 regarding the…**



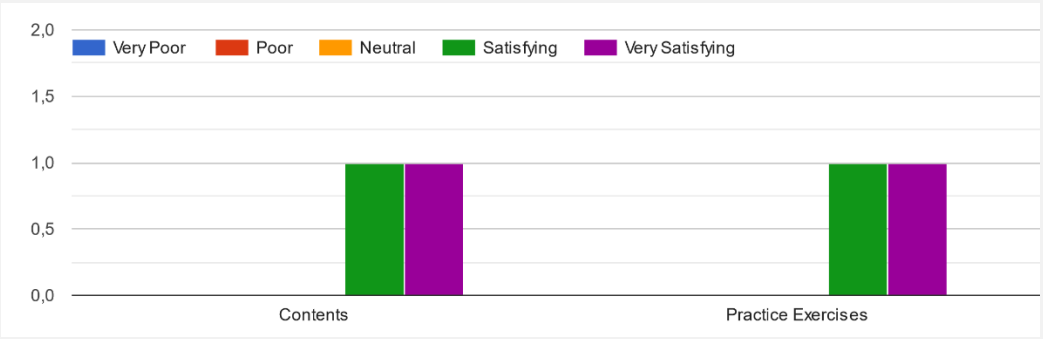
The contents part have 3 votes in very satisfying and 2 in satisfying, while the practice exercises have 2 in very satisfying and another 2 in satisfying, but also 1 in neutral. Again, there are no negative votes.

Do you have any suggestions for improvement of Module 3?

As in module 2, there are no suggestions except for one trainer who suggested mode guided exercises.

Trainers from University of Patras (EL)

Please evaluate Module 3 regarding the…



Both sections have the same voted, one for very satisfying and one for satisfying.

- **Do you have any suggestions for improvement of Module 3?**

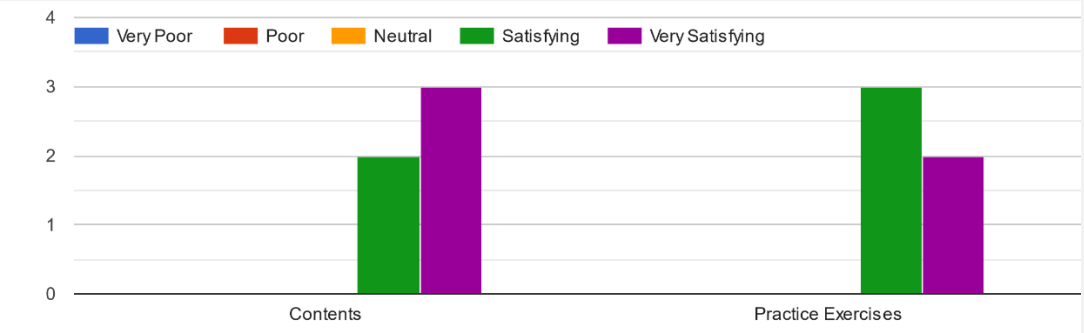
There are no suggestions.

In conclusion, Module 3 received very high evaluation scores and the suggestions for guided exercises and introduction of microprocessors were repeated.

Module 4: Advanced Sensors

Trainers from Politeknika Ikastegia Txorierri (ES)

- **Please evaluate Module 4 regarding the…**



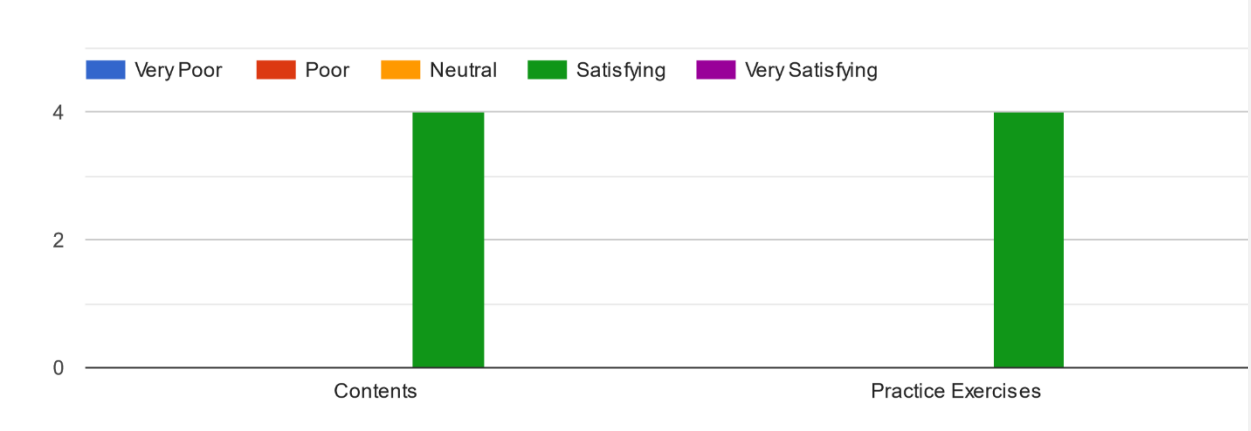
Three teachers voted very satisfying and two satisfying for contents, and the opposite for practical exercises, 3 teachers voted for satisfying and two for very satisfying, with no negative votes.

Do you have any suggestions for improvement of Module 4?

There are no suggestions for improvement of Module 4.

Trainers from DaVinci College (NL)

Please evaluate Module 4 regarding the…



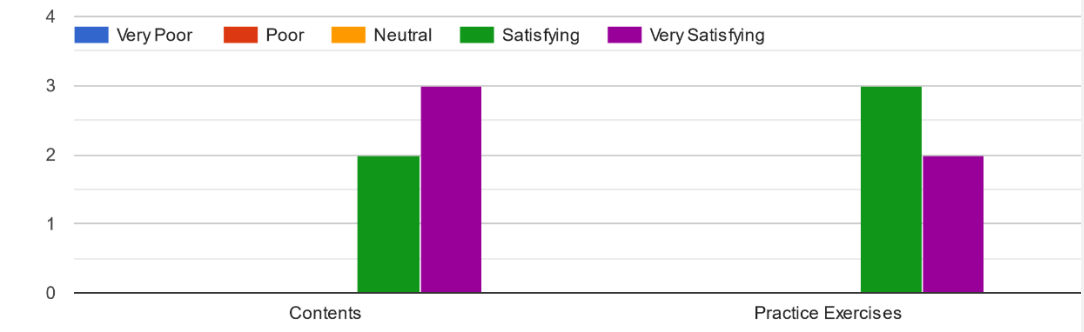
The answers are the same as in the previous module.

- **Do you have any suggestions for improvement of Module 4?**

One respondent did not provide any specific suggestions for improvement. Another suggestion is to include more practical cases within Module 4. Additionally, there is a recommendation to consider introducing other microprocessors, potentially including the Pi Pico, to enhance the module.

Trainers from Apro Formazione (IT)

- **Please evaluate Module 4 regarding the…**



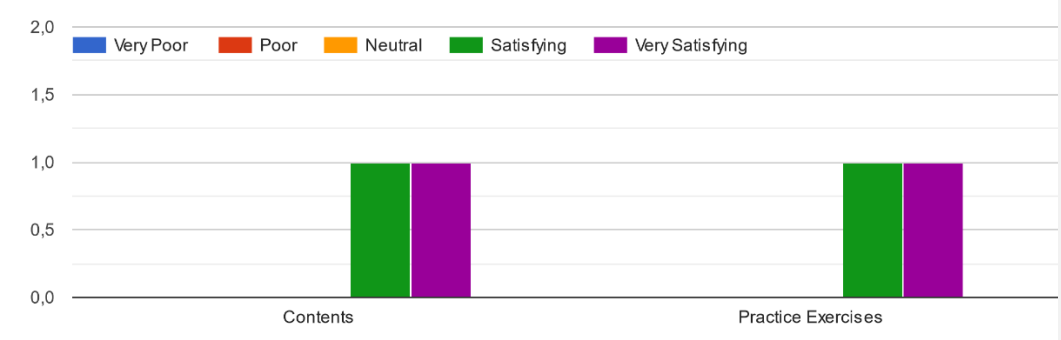
Three teachers voted very satisfying and two satisfying for contents, and the opposite for practical exercises, 3 teachers voted for satisfying and two for very satisfying, with no negative votes.

- **Do you have any suggestions for improvement of Module 4?**

There are no suggestions for improvement of Module 4.

Trainers from University of Patras (EL)

Please evaluate Module 4 regarding the...



Again, both sections have the same votes.

Do you have any suggestions for improvement of Module 4?

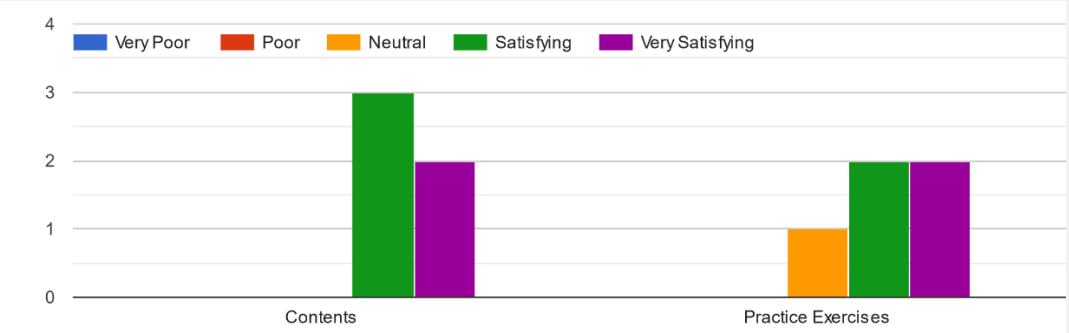
There are no suggestions, trainers find everything correct.

Module 4 also received high evaluation scores by the trainers of the participating organisations. There were only recommendations for more practical cases and for the introduction of microprocessors.

Module 5: CyberSecurity

Trainers from Politeknika Ikastegia Txorierri (ES)

Please evaluate Module 5 regarding the...



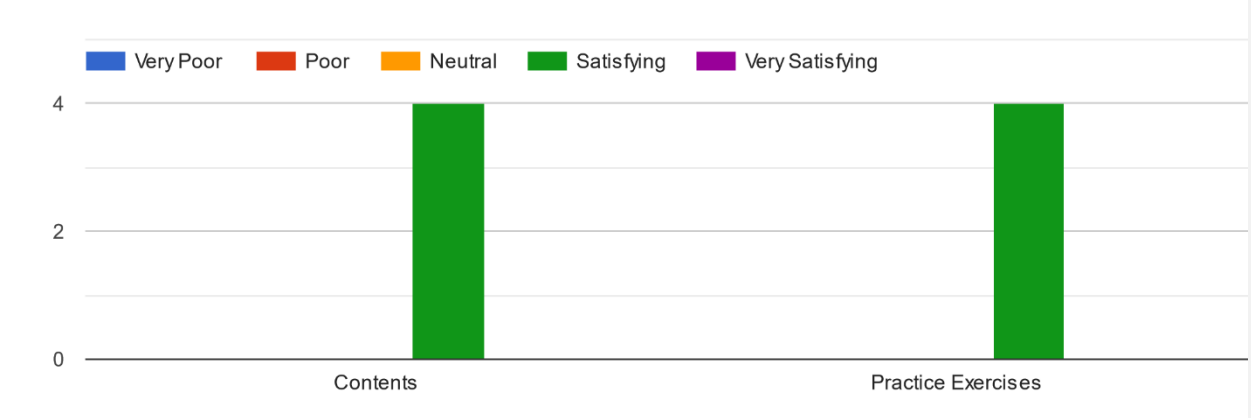
Concerning the contents, 3 trainers evaluated them as satisfying and two as very satisfying. In practical exercises there are 2 votes for very satisfying, 2 for satisfying and 1 for neutral.

- **Do you have any suggestions for improvement of Module 5?**

Only one trainer had a suggestion, to add some guided exercises, as theoretical parts are sometimes redundant.

Trainers from DaVinci College (NL)

- **Please evaluate Module 5 regarding the…**



Once again, the responses are the same as the previous module.

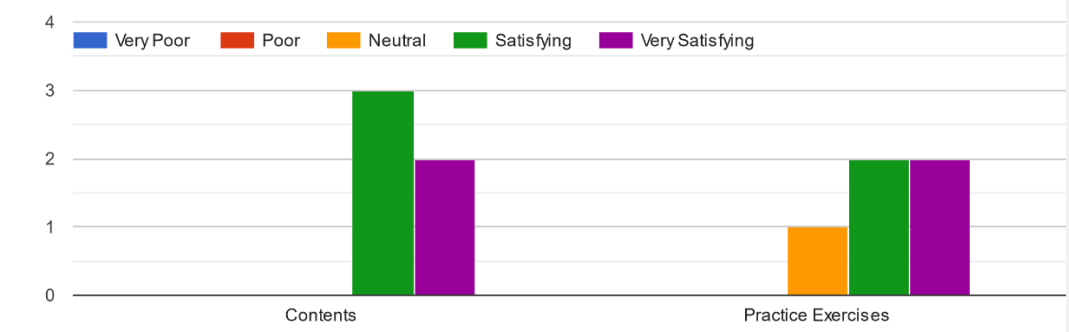
- **Do you have any suggestions for improvement of Module 5?**

One respondent did not offer any specific suggestions for improvement. Another recommendation is to incorporate more practical cases into Module 5. Additionally, there is a suggestion to consider introducing other microprocessors, potentially including the Pi Pico, to enhance the module.

Trainers from Apro Formazione (IT)

Module 5: Cybersecurity

Please evaluate Module 5 regarding the...



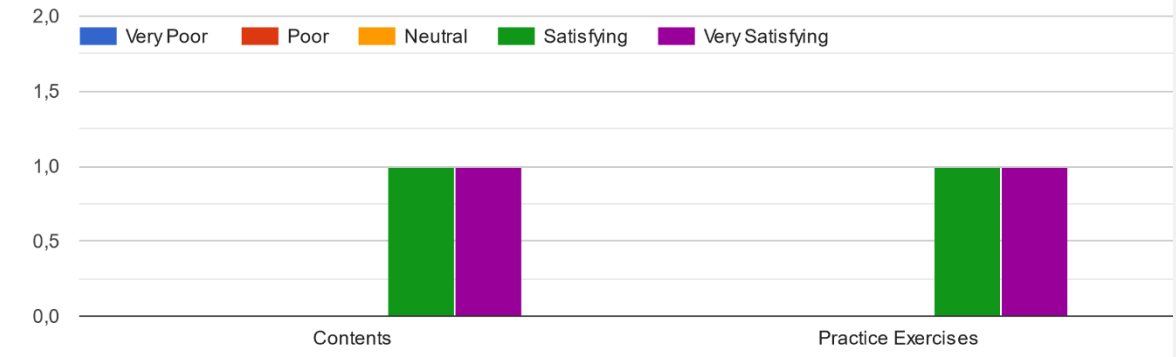
Concerning the contents, 3 trainers evaluated them as satisfying and two as very satisfying. In practical exercises there are 2 votes for very satisfying, 2 for satisfying and 1 for neutral.

Do you have any suggestions for improvement of Module 5?

Only one trainer had a suggestion, to add some guided exercises, as theoretical parts are sometimes redundant.

Trainers from University of Patras (EL)

Please evaluate Module 5 regarding the...



Both teachers voted again the same in both sections.

Do you have any suggestions for improvement of Module 5?

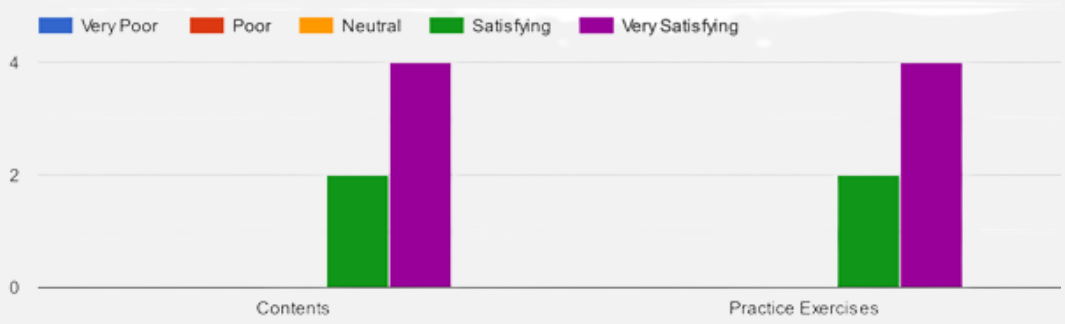
There are no suggestions.

Module 5 reached very high levels of satisfaction, over 90%. The recommendations are the same with the previous module, i.e. more practical cases and introduction of microprocessors.

Module 6: Transversal Competences

Trainers from Politeknika Ikastegia Txorierri (ES)

Please evaluate Module 6 regarding the...



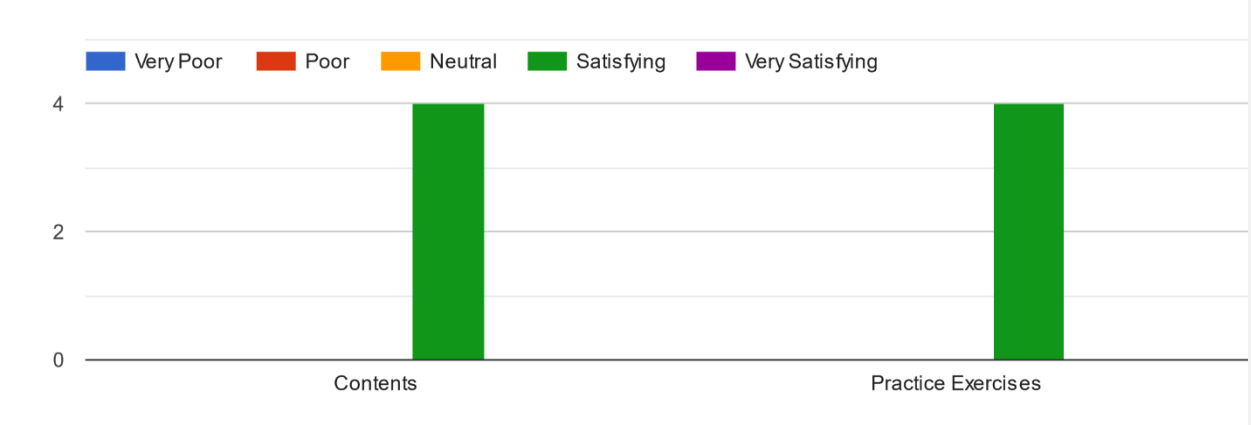
In the last module we get the same results as in the previous ones, everybody is satisfied with the contents as well as with the practical exercises.

Do you have any suggestions for improvement of Module 6?

Again, no one has any suggestions to improve the module as they all consider the module to be integrated.

Trainers from DaVinci College (NL)

Please evaluate Module 6 regarding the...



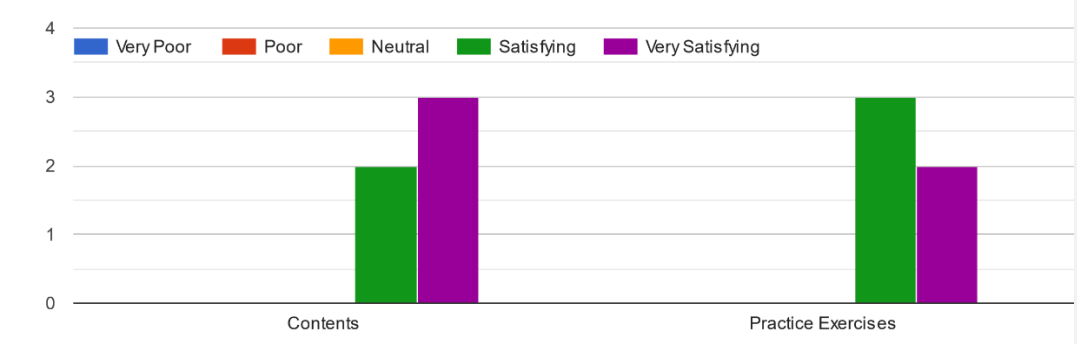
Participants voted for both as satisfying once again.

Do you have any suggestions for improvement of Module 6?

One respondent did not provide specific suggestions for improvement. Another suggestion is to incorporate more practical cases into Module 6.

Trainers from Apro Formazione (IT)

Please evaluate Module 6 regarding the...



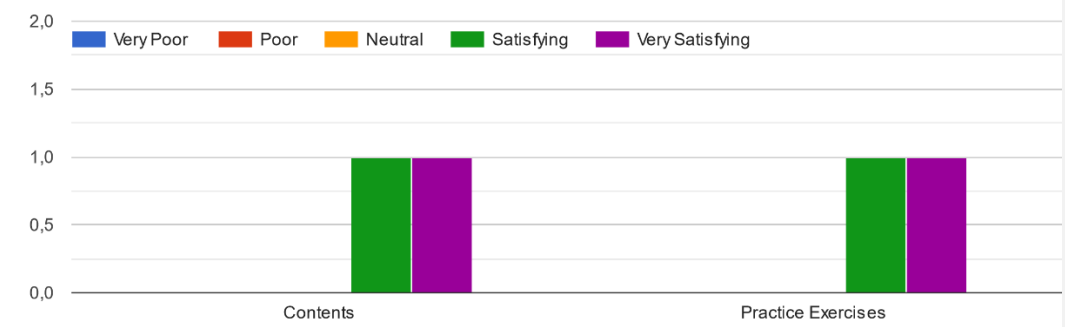
3 trainers voted for the contents as very satisfying and 2 as satisfying. In practical exercises 3 voted satisfying and 2 very satisfying.

Do you have any suggestions for improvement of Module 6?

There are no suggestions for this module.

Trainers from University of Patras (EL)

- **Please evaluate Module 6 regarding the…**



One vote for very satisfying and one for satisfying in both sections.

- **Do you have any suggestions for improvement of Module 6?**

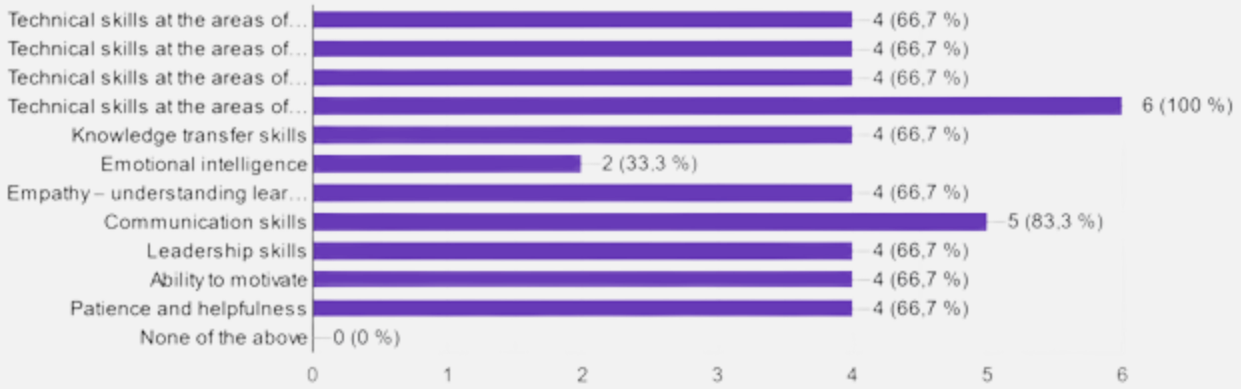
There are no suggestions.

Module 6 received the highest evaluation rates and validated the choice of the partners to include this module in course designed for technical operators.

Impact on Trainer's skills and professional life.

Trainers from Politeknika Ikastegia Txorierri (ES)

- **Which of the following skills were further developed after the implementation of the pilots?**



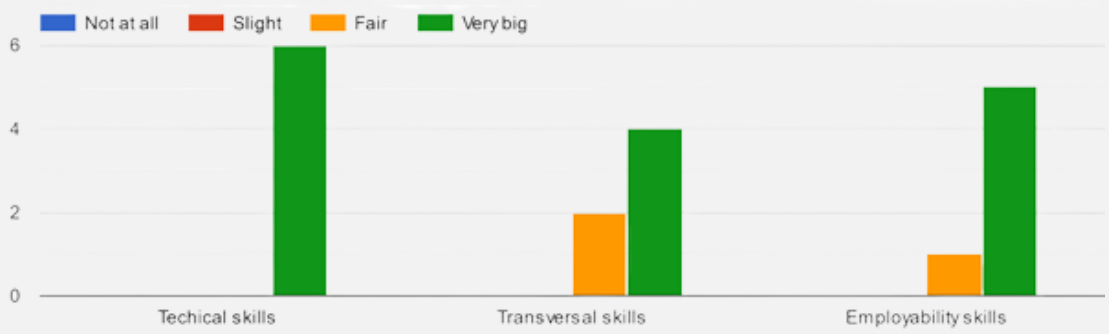
1.Technical skills at the areas of Big Data 2. Technical skills at the areas of Machine Learning 3. Technical skills at the areas of Sensors 4. Technical skills at the areas of Cybersecurity. 5. Knowledge transfer skills 6. Emotional intelligence 7. Empathy – understanding learners' points of view 8. Communication skills 9. Leadership skills 10. Ability to motivate 11. Patience and helpfulness 12. None of the above

In response to the inquiry regarding skill development after the pilot implementation, the collected data provides valuable insights. Notably, technical skills in specific domains such as Big Data, Machine Learning, Sensors, and Cybersecurity exhibited substantial growth, with an impressive 66.7% or more of the respondents attesting to improvements in these areas.

Furthermore, the significance of soft skills, including communication, leadership, and the ability to motivate, was underscored, with an encouraging 83.3% or more of the respondents acknowledging enhancements in these vital competencies.

This comprehensive approach to skill development contributed to a well-rounded educational experience, ensuring that learners received comprehensive support for their growth and development.

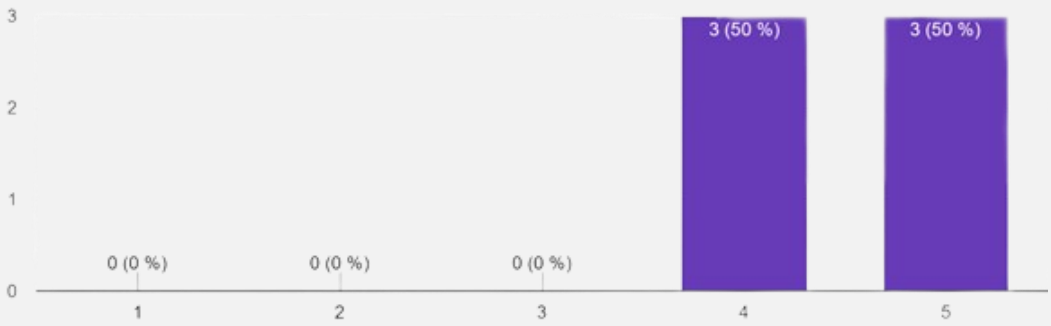
- **Please rate the impact on the following categories of skills for the students:**



All teachers believe that the technical skills category has had the greatest impact on students. The next most impactful was employability skills, with 5 votes in very big and only one in big. Finally, we have transversal skills with 4 votes in very big and two in big.

In general, they all consider that the three categories have had a great impact on the students.

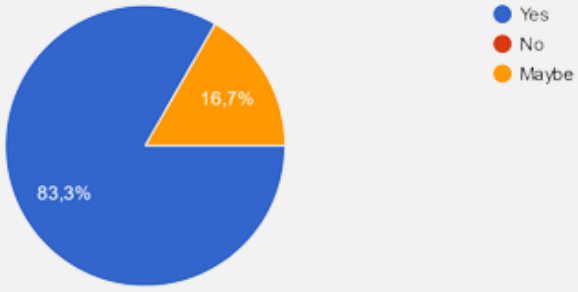
Did you find the programme useful for your profession?



Where → 1: Not at all useful / 5: Extremely useful

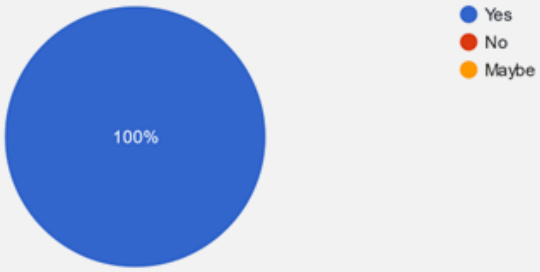
In general all teachers have voted the programme as useful, with half of the votes being extremely useful and the other half one category below.

Will you use any information/technique/tool in your professional life?



The majority of teachers, 83.3%, would use some information from the course in their professional life, however, 16.7% are not sure if they would.

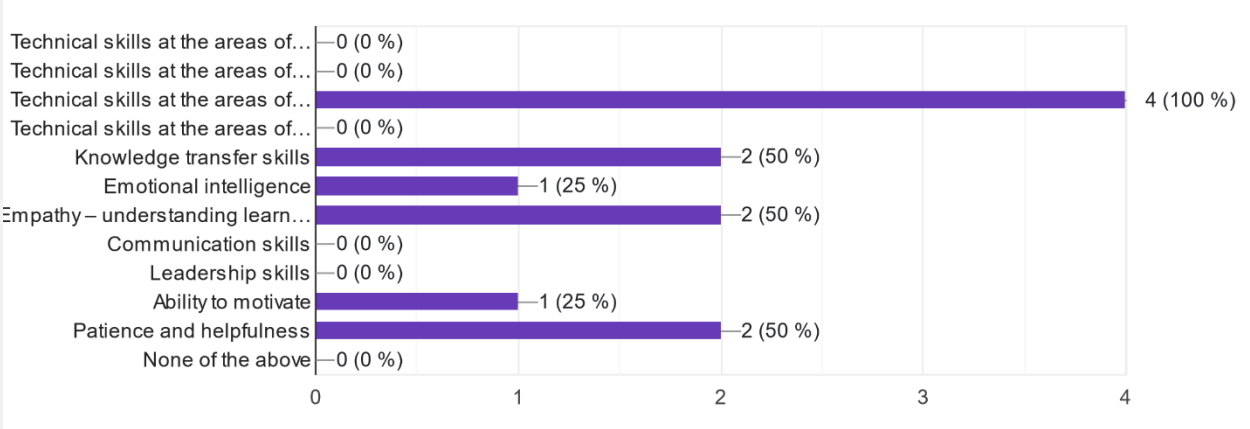
Are you going to suggest the course to other people?



All trainers are willing to suggest the course to others.

Trainers from DaVinci College(NL)

- **Which of the following skills were further developed after the implementation of the pilots?**



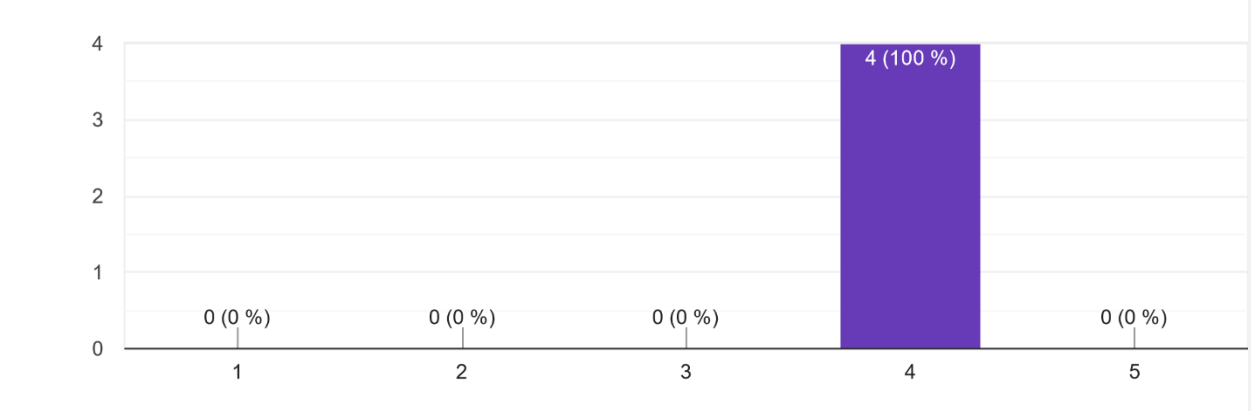
1.Technical skills at the areas of Big Data 2. Technical skills at the areas of Machine Learning 3. Technical skills at the areas of Sensors 4. Technical skills at the areas of Cybersecurity. 5. Knowledge transfer skills 6. Emotional intelligence 7. Empathy – understanding learners' points of view 8. Communication skills 9. Leadership skills 10. Ability to motivate 11. Patience and helpfulness 12. None of the above

All trainers agreed that the technical skills at the areas of Sensors were the most developed. Continuing with knowledge transfer skills, empathy-understanding learners' points of view and patience and helpfulness. And lastly, emotional intelligence and ability to motivate.

Please rate the impact on the following categories of skills for the students:

Technical skills was voted fair by two trainers and very big by the other two. Then, transversal skills' impact was considered slight by two of them and fair by other two, as well as employability skills.

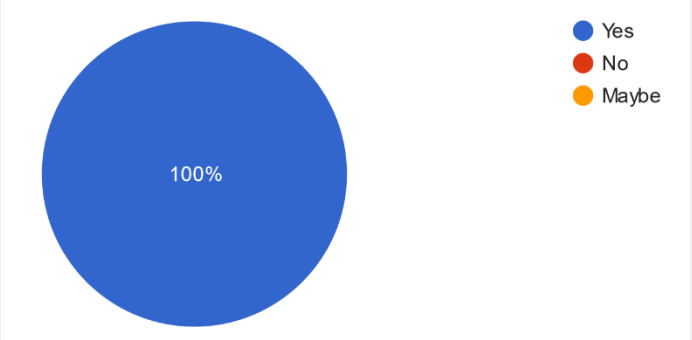
Did you find the programme useful for your profession?



Where → 1: Not at all useful / 5: Extremely useful

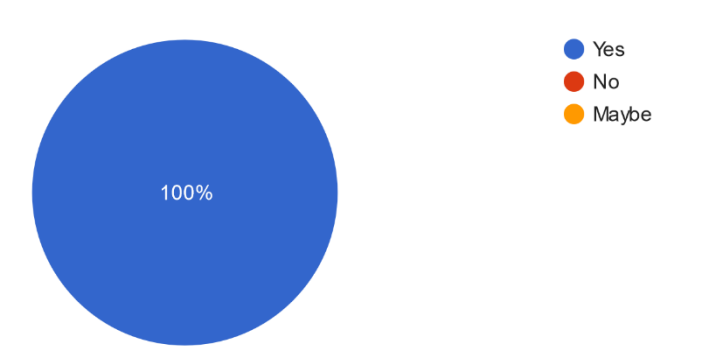
All trainers agree that the programme was very useful for their profession.

Will you use any information/technique/tool in your professional life?



All of them agree that they will use it in their professional life.

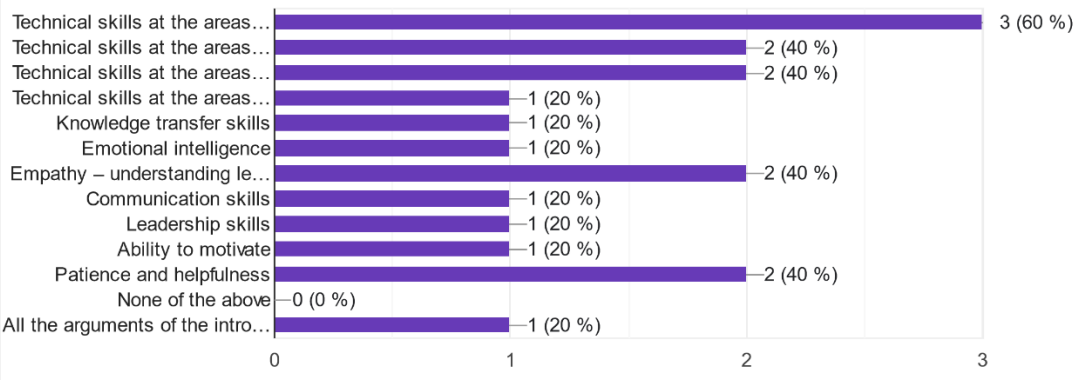
Are you going to suggest the course to other people?



All respondents will suggest the course to other people.

Trainers from Apro Formazione (IT)

- **Which of the following skills were further developed after the implementation of the pilots?**



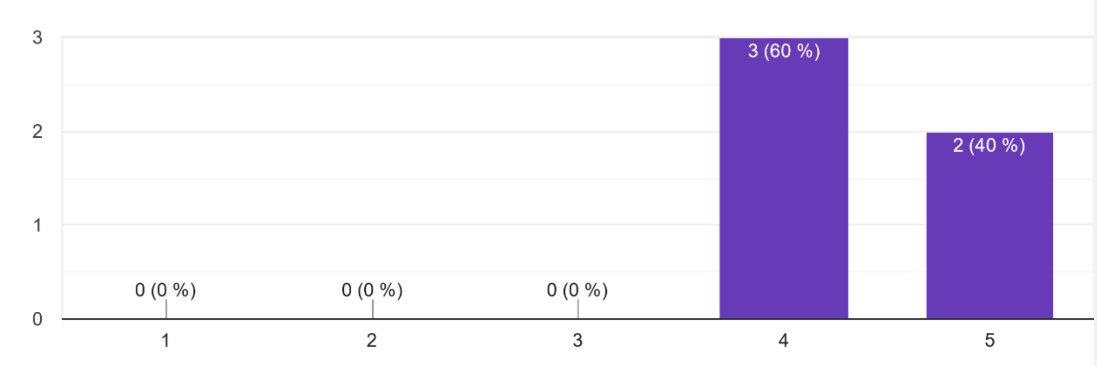
1.Technical skills at the areas of Big Data 2. Technical skills at the areas of Machine Learning 3. Technical skills at the areas of Sensors 4. Technical skills at the areas of Cybersecurity. 5. Knowledge transfer skills 6. Emotional intelligence 7. Empathy – understanding learners' points of view 8. Communication skills 9. Leadership skills 10. Ability to motivate 11. Patience and helpfulness 12. None of the above 13. All the arguments of the introduction module

60% of the trainers think that the technical skills in Big Data were the most developed after the implementation of the pilots. Followed by technical skills in Machine Learning and Sensors, Empathy and patience and helpfulness which have 40% of votes each. Then, with 20% of votes from the trainers each, technical skills in Cybersecurity, knowledge transfer skills, emotional intelligence, communication skills, leadership skills, ability to motivate and all the arguments of the introduction module.

Please rate the impact on the following categories of skills for the students:

All trainers agree that the impact for the students in transversal skills and employability skills are fair. Nevertheless, concerning technical skills there are varied opinions, 3 voted fair, 1 very big and 1 slight.

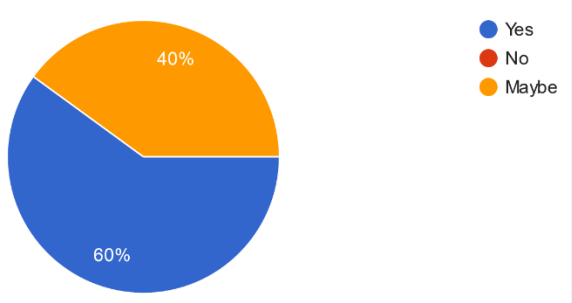
Did you find the programme useful for your profession?



Where → 1: Not at all useful / 5: Extremely useful

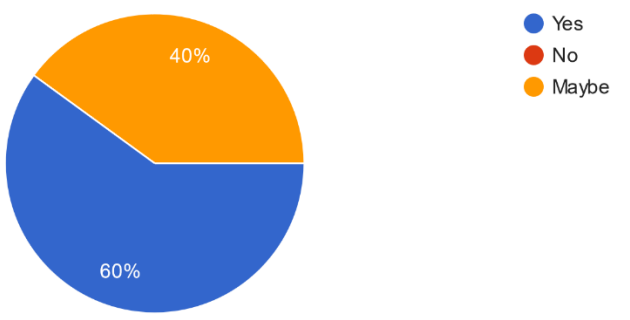
60% of the trainers consider that the programme was useful for their profession and 40% that it was extremely useful.

Will you use any information/technique/tool in your professional life?



More than half of the trainers (60%) assure that they will use information in their professional life, and 40% are not sure.

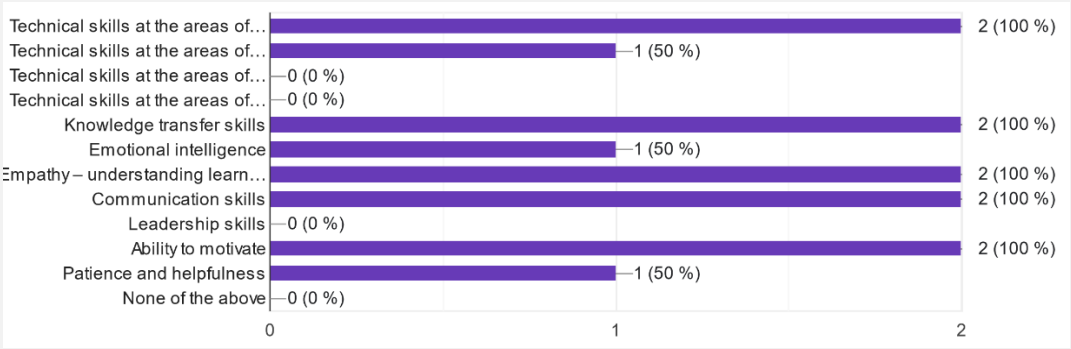
Are you going to suggest the course to other people?



60% of the teachers are sure that they will suggest the course to other people and 40% are not sure.

Trainers from University of Patras (EL)

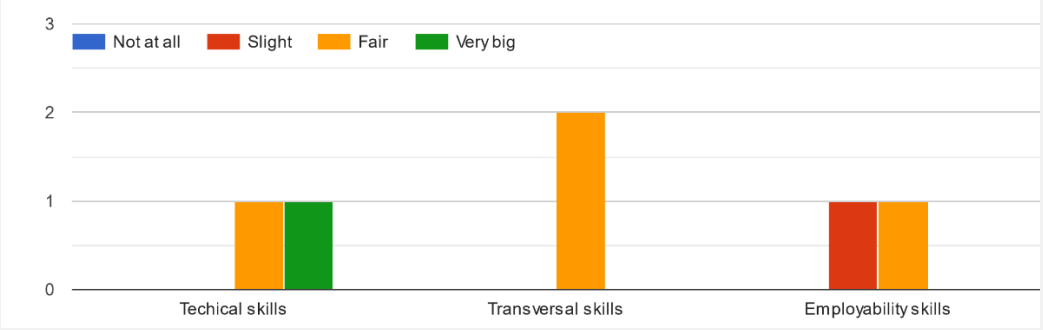
- **Which of the following skills were further developed after the implementation of the pilots?**



1.Technical skills at the areas of Big Data 2. Technical skills at the areas of Machine Learning 3. Technical skills at the areas of Sensors 4. Technical skills at the areas of Cybersecurity. 5. Knowledge transfer skills 6. Emotional intelligence 7. Empathy – understanding learners' points of view 8. Communication skills 9. Leadership skills 10. Ability to motivate 11. Patience and helpfulness 12. None of the above

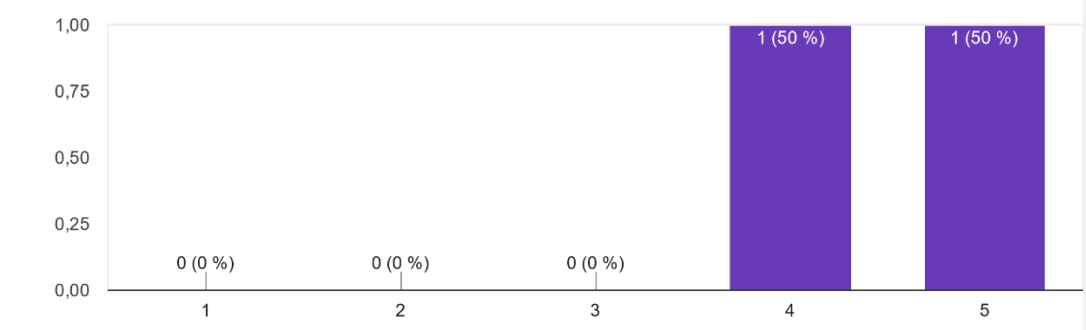
Trainers agree that technical skills in Big Data, knowledge transfer skills, empathy and understanding learners' point of view, communication skills and ability to motivate are the sections that were further developed after the pilots. Then, technical skills in Machine Learning, emotional intelligence and patience and helpfulness were less developed. Lastly, technical skills in Sensors and Cybersecurity, and leadership skills are not developed.

Please rate the impact on the following categories of skills for the students:



Trainers agree that the impact of transversal skills in students was fair. Then, one voted fair in technical skills and the other one very big. And lastly, in employability skills one voted fair and the other one slight.

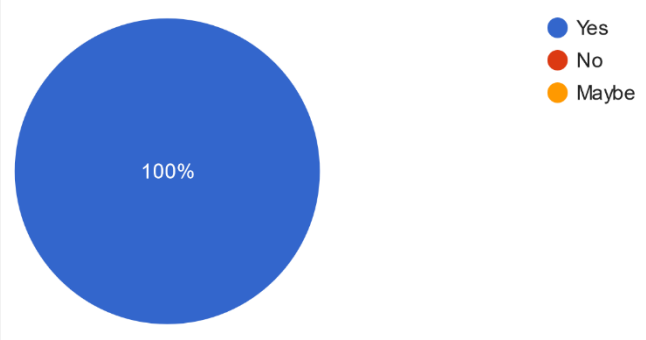
Did you find the programme useful for your profession?



Where → 1: Not at all useful / 5: Extremely useful

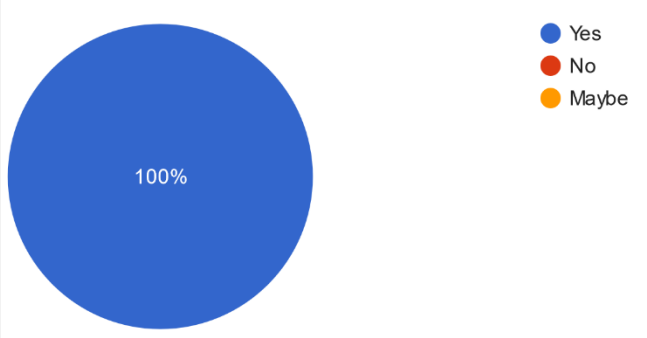
One considered the program useful and the other one extremely useful.

Will you use any information/technique/tool in your professional life?



Both teachers will use some information in their professional life.

Are you going to suggest the course to other people?



They both will suggest the course to other people.

Conclusion

In conclusion, insights gleaned from trainers across diverse partner organizations offer a valuable perspective on the impact and efficacy of the pilot program. The evaluation of skills development reveals a significant positive influence on both technical and soft skills, with notable advancements in technical areas such as Big Data, Machine Learning, Sensors, and Cybersecurity unanimously recognized by trainers from various organizations

The noteworthy emphasis on soft skills, encompassing communication, leadership, and motivational abilities, underscores their acknowledged importance and improvement among students. This holistic approach to skills development indicates the program's success in effectively addressing the requirements of both technical and soft skills, culminating in a comprehensive and enriching educational experience.

Moreover, the widespread recognition of the program's utility by trainers, with a majority rating it as either extremely useful or very useful, reinforces its practicality and relevance in their professional lives. The unanimous agreement among trainers to incorporate the acquired knowledge, techniques, and tools further underscores the program's applicability.

Lastly, the unanimous willingness of trainers to recommend the course reflects their confidence in its effectiveness and its potential to impact positively a broader audience. In summary, the pilot program emerges as a valuable and effective initiative, enhancing both technical and soft skills, and earning strong support and endorsement from the involved trainers.

The biggest success of the DTAMs pilot in terms of impact was the inclusion to their curricular offer by DaVinci College. In the Netherlands, all vocational education centers offering EQF-4 courses need to offer their students 3 modules of choice. In specific the module “K0730 programming microcontrollers” is one of those nationally

recognized modules, in which the college used the Sensors module of the DTAM curriculum in our K0730 course. Many students choose this module and we do two courses every schoolyear. The grade that the students achieve is printed on their EQF-4 grade “software development” and is therefore nationally recognized. To this great success the signing of 8 MoUs with VET Institutions that express their interest in joining the DTAM International Network should be added, maximizing the impact of DTAMs results on VET providers.

Chapter 3: Impact on Companies

In this chapter, we delve into the insights gained from interviews conducted with the companies that actively participated in the DTAM pilots or with companies that were engaged in activities of DTAM project, like Transnational Project Meetings and Multiplier Events. These discussions provide a firsthand perspective on the challenges, successes, and transformative experiences these organisations encountered throughout the training process in case of participation in pilots, an evaluation from the labour market view of the importance of DTAM's curriculum and results and the correspondence to the actual needs of the AM Industry.

Face to face Interviews

The consortium conducted interviews with companies in all partner countries, so as to measure the impact of the DTAM curriculum on the AM sector. In total 10 interviews were implemented in Spain, Italy, Greece, Netherlands.

1st Interview: **ARIZNABARRETA S.A. (ES)**

Description of the company:

The company, operating since 1965, provides personalized precision machining services, specializing in various materials for sectors such as petrochemical, hydraulic, machine tool, and wind power. The company boasts experienced personnel and technical resources tailored to client needs.

Most important skills for an employee in AM sector:

The company has all the machines connected, all the numerical controls connected and providing data. They collect data from them that are used in the office, they have an ERP. In fact, all this management of machine preparation and data collection has been outsourced. They do not currently see the need to have people trained in the skills of big data, sensor technology, cybersecurity and machine learning, as they do it through outsourcing. Perhaps in the longer term it may be, but right now their need is to have machine technicians with knowledge of numerical control.

What they do see as very necessary is to have people with developed transversal competencies. Communication and problem solving are issues that people need to develop.

Importance score:

- Technical skills at the areas of Big Data – Partly Important
- Technical skills at the areas of Machine Learning – Partly Important
- Technical skills at the areas of Sensors – Partly Important
- Technical skills at the areas of Cybersecurity – Partly Important
- Transversal Skills – Absolutely necessary

The company relies on outsourced management for machine preparation, data collection, and employs an ERP system. While they currently outsource skills in big data, sensors, cybersecurity, and machine learning, they prioritize technicians with numerical control knowledge. The emphasis is on developing transversal competencies, particularly in communication and problem-solving, as indicated by their importance score.

Knowledge missing from the AM labour market

According to the company representative, the labor market currently lacks professionals with expertise in big data, machine learning, sensors, and cybersecurity. Finding technicians well-versed in these fields is uncommon. Additionally, there's a need for the development of transversal skills to better equip individuals for the industry's demands.

Knowledge irrelevant for the AM labour market

The company states that all the mentioned topics are important, but companies may choose different approaches, either outsourcing or developing in-house competencies. In this particular case, the company currently leans towards outsourcing.

DTAM course responds to the need of upskilling and reskilling

The representative agreed that the course responds to those needs.

Offer training to employees

This company has plans in developing this skills internally and the transversal skills could be an option.

CONCLUSION

The company prioritizes numerical control knowledge and emphasizes the development of transversal competencies. The labor market lacks professionals in big data, machine learning, sensors, and cybersecurity, with a preference for outsourcing in these areas. The DTAM course aligns with upskilling needs, and the company plans to internally develop relevant skills while considering transversal skills as an important asset.

2nd Interview: ESKUIN (ES)

ESKUIN is a coalition of 22 Spanish companies specializing in the production of hand tools and hardware products, adhering to rigorous quality and safety standards. The interview features insights from ESKUIN's director, Miren Aranburu.

Most important skills for an employee in AM sector

All the topics covered in the DTAM project are very relevant in companies related to advanced manufacturing. Some of the areas are still under development within the companies, so perhaps they are not yet in demand by them. But in any case, all of them are topics that are in the focus of the companies, as they know that they are topics that are being implemented in the industry and that it is necessary to have people with knowledge in those areas.

Importance score:

- Technical skills at the areas of Big Data – Important
- Technical skills at the areas of Machine Learning – Partly Important
- Technical skills at the areas of Sensors – Important
- Technical skills at the areas of Cybersecurity – Important
- Transversal Skills – Absolutely necessary

The company states that the topics covered in the DTAM project are highly relevant to companies in advanced manufacturing, though some areas are still in development. These topics are recognized as crucial by the companies, reflecting the industry's trend, and the need for individuals with knowledge in these areas is acknowledged. The importance score emphasizes the significance of technical skills

in Big Data, Sensors, and Cybersecurity, while Transversal Skills are deemed absolutely necessary.

Knowledge missing from the AM labour market

The company comments the labor market lacks skills in critical areas such as big data and cybersecurity. While there is a gradual integration of knowledge, the deficiency persists. It is crucial for training centers to actively promote the development of these competencies to address this gap.

Knowledge irrelevant for the AM labour market

The company highlighted a skills gap in key areas like big data and cybersecurity, noting a gradual integration of knowledge but persistent deficiencies. Emphasizing the need for training centers to actively foster competency development, the company aims to address this gap.

DTAM course responds to the need of upskilling and reskilling

According to the company, any efforts directed towards equipping individuals with digitalization skills are deemed essential.

Offer training to employees

The company is open to offer training programs to their members, particularly in areas like big data, sensors, and cybersecurity, once the programs are active. Factors such as schedules, training methods, and costs need consideration before offering them to member companies.

Substantial impact of DTAM curriculum

The company acknowledges the significance of transversal competencies, evident in various training and development activities. However, the DTAM Project's major impact lies in enhancing technical skills, emphasizing that a combination of both transversal and technical competencies is crucial for heightened employability.

CONCLUSION

The company recognizes a skills gap in Big Data, Sensors, and Cybersecurity within the advanced manufacturing sector. Emphasizing the importance of technical skills, the DTAM project is considered crucial for addressing deficiencies and enhancing competency. The significance of the transversal skills was also highlighted as an major impact factor especially in conjunction with the technical skills.

3rd Interview: INVEMA (ES)

NVEMA, the Machine Tool Research Foundation, supports the advancement of technology and safety projects in the digital manufacturing sector. Specializing in individual and collaborative projects, NVEMA possesses extensive expertise in implementing new technologies within the sector.

Most important skills for an employee in AM sector

Depending on the size and activity of the company, the relevant skills may vary. For example, companies in the machine tool sector, with a medium size, should have people in their teams with skills in areas such as big data, machine learning, sensor technology and cybersecurity. Companies focused on automation, robotics and digitalization should also have teams well prepared in those branches of knowledge.

However, other types of companies within the advanced manufacturing sector, such as metal mechanical transformation workshops or smaller companies, will be able to outsource many of the activities carried out in these fields, such as cybersecurity or sensor technology. So these companies will not have much interest in developing this skills in the short term. In any case in the long term, they will be also interesting.

In any case, medium to large companies will need people with knowledge in Big Data or Machine Learning, especially in the machine tool sector.

Importance score. All the indicated skills are important. Depending on the specific sector or company size, it will be more or less important:

- Technical skills at the areas of Big Data – Important
- Technical skills at the areas of Machine Learning – Important
- Technical skills at the areas of Sensors – Important
- Technical skills at the areas of Cybersecurity – Important
- Transversal Skills – Important

The company emphasizes that the relevance of skills varies based on company size and activity. For medium-sized machine tool companies, skills in big data, machine learning, sensors, and cybersecurity are crucial, while smaller entities may outsource these activities. However, in the long term, all companies in the advanced manufacturing sector will find these skills important, especially in areas like Big Data and Machine Learning, according to the importance score provided.

Knowledge missing from the AM labour market

The company notes that cybersecurity may be the least understood area for companies. While big data, machine learning, and sensors are developing in the labor market, there's a distinction between the knowledge of different age groups, with new recruits often having basic knowledge. However, mature profiles may lack this expertise, necessitating retraining. Transversal skills are considered crucial but challenging to train, requiring specific attitudes or predispositions beyond traditional training efforts.

Knowledge irrelevant for the AM labour market

All themes are considered relevant, with a potential emphasis on technical skills over transversal skills, though both are welcomed by the company.

DTAM course responds to the need of upskilling and reskilling

The company states that the proposed training activities are particularly valuable for individuals lacking knowledge in these specific areas. This training serves as a valuable starting point, paving the way for further specialization in these topics in the future.

Offer training to employees

The partner emphasizes that ideally, everyone in the company should possess a minimum understanding of the identified topics. This perspective suggests the potential value in offering training to individuals in the advanced and digital manufacturing sector.

Substantial impact

The company recognizes the crucial impact of technical trainings in areas like big data, sensorics, machine learning, and cybersecurity. These courses serve as essential starting points for individuals without prior knowledge, fostering specialization and significantly improving employability.

CONCLUSION

The company highlights the varying importance of skills based on company size in advanced manufacturing. Emphasis on technical skills, particularly in big data and machine learning, is crucial and impact largely specialization and employability. The recognition of cybersecurity gaps, the value of starting points in training, and the emphasis on transversal skills contribute to a comprehensive approach.

Interview 4: Nexmachina (ES)

The interview was held with the general manager of Nexmachina. NEXMACHINA, established in 2013, is a global company specializing in IoT-driven digitalization, leveraging sensors, wireless networks, and connected devices. The organization, classified as an SME with 7 employees, is dedicated to designing comprehensive solutions with a customer-centric approach. NEXMACHINA initially focused on promoting wireless technologies for enhanced communications and has since evolved to prioritize sustainable IoT solutions accessible to diverse individuals and businesses.

The General Manager was asked to rate the importance according to the following scale: Not at all, Partly important, Important, Absolutely necessary.

Technical skills at the areas of Big Data: Partly Important

Technical skills at the areas of Machine Learning: Partly Important

Technical skills at the areas of Sensors: Absolutely necessary

Technical skills at the areas of Cybersecurity: important

Transversal Skills: Important

The manager, based on professional experience, rates the importance of skills for an employee in the AM sector as follows: Technical skills in Sensors are deemed absolutely necessary, technical skills in Big Data and Machine Learning are considered partly important, technical skills in Cybersecurity are important, and transversal skills are seen as important.

When asked which piece of updated knowledge was missing from the AM labour market the manager responded that the labour market demands profiles who know how to manage and exploit data, this is related to the DTAM modules of Big Data and Machine Learning and also profiles expert in Cybersecurity as more and more machines are directly connected to the cloud.

The respondent believes that all the mentioned areas, including Big Data, Sensors, Machine Learning, and Cybersecurity, are relevant to the needs of the AM labor market.

When asked if the DTAM Course responds to the urgent need of upskilling and reskilling low or under-skilled adult workers' / OT technicians of AM sector, she expressed agreement that the DTAM Course adequately fulfills the pressing requirement for enhancing the skills of low or under-skilled adult workers and OT technicians in the AM sector. Therefore the manager indicates motivation to provide this training to their employees with a positive affirmation.

When asked to share with us on which area would you train their employees (Transversal Skills, Big Data, Sensors, Machine Learning, Cybersecurity), the manager expressed a willingness to train employees in various areas, including Transversal Skills, Big Data, Sensors, Machine Learning, and Cybersecurity. They emphasize a particular focus on Cybersecurity and Big Data among these options.

Lastly, regarding the substantial impact of the DTAM course, the manager responded that the DTAM course significantly impacts technical skills, transversal skills, and employability skills. Gaining knowledge in these areas is seen as enhancing employability opportunities for current students or employees.

As the company participated in the pilots of DTAM the manager indicated that both the quality of the course and the IoT Lab met their expectations, expressing a positive assessment.

To the question if there a skill deficit in the course that you consider essential for the AM sector, the manager responded that there is no identified skill deficit in the course for the AM sector indicating that all essential skills are adequately covered.

The respondent expressed interest in utilizing the services of the IoT Labs/Hub, indicating that their company participates in the dual training system, and two of their current trainees have been using the DTAM IoT labs and Hub.

CONCLUSION

The General Manager of Nexmachina, highlights the company's IoT specialization. In the DTAM course interview, he emphasizes the importance of skills in Sensors, rates relevance in Big Data, Machine Learning, and Cybersecurity, expresses satisfaction with the course and IoT Lab quality, and confirms interest in offering training to employees, focusing on Cybersecurity and Big Data. Nexmachina, participating in the pilots through the dual training system, actively uses the DTAM IoT Labs/Hub for their trainees and expressed high satisfaction rate in its engagement.

Interview 5: Mevgal (EL)

The interview was implemented an IT specialist at Mevgal, introduces Mevgal as the largest dairy company in Northern Greece and the third largest producer of fresh dairy products in the country. Established in 1950, Mevgal operates in the heartland of fresh milk, with over 1,600 farms in proximity to its facilities. The company produces and distributes a wide range of dairy products, desserts, and natural juices, ensuring high-quality through state-of-the-art technology and certifications. With a workforce of around 500 employees, the interviewee works in the technical department, overseeing equipment inspection and maintenance processes.

Most important skills for an employee in AM sector

When asked to rate the importance of the skills for an employee in AM sector that would be developed through DTAM course, according to his professional experience the following evaluation was provided:

Technical skills at the areas of Big Data: Important

Technical skills at the areas of Machine Learning: Absolutely necessary

Technical skills at the areas of Sensors: Important

Technical skills at the areas of Cybersecurity: partly important

Transversal Skills: partly important

In the context of the DTAM course focusing on technical skills in Big Data, Machine Learning, Sensors, Cybersecurity, and transversal skills for the Additive Manufacturing (AM) sector, the respondent emphasizes the critical importance of Machine Learning skills, rating them as absolutely necessary. He also highlights the importance of technical skills in Big Data and Sensors, considering them important, while Cybersecurity and transversal skills are rated as partly important.

Knowledge missing from the AM labour market

After reviewing the DTAM course, the respondent identified a gap in the Advanced Manufacturing (AM) labour market, particularly in transversal skills and to some extent in cybersecurity. The absence of hands-on training at IoT Labs was also noted as a potential area for improvement.

Knowledge irrelevant for the AM labour market

He affirms that all the mentioned areas, including Big Data, Sensors, Machine Learning, and Cybersecurity, are considered relevant to the needs of the Additive Manufacturing (AM) labor market.

DTAM course responds to the need of upskilling and reskilling

The respondent believes that the DTAM Course effectively addresses the urgent need for upskilling and reskilling low or under-skilled adult workers/OT technicians in the Additive Manufacturing (AM) sector.

Offer training to employees

The respondent expresses a high likelihood of being motivated to offer this training to their employees.

As he expressed that he feels motivated to offer the training, the respondent would consider training employees in all the specified areas, including Transversal Skills, Big Data, Sensors, Machine Learning, and Cybersecurity.

Substantial impact

The respondent believes that the DTAM course has a substantial impact on both technical and transversal skills, ultimately enhancing overall employability.

Quality

The respondent indicated that both the quality of the course and the IoT Lab met their expectations.

Skill deficit

The respondent states that there is no identified skill deficit in the course for the AM sector.

Services

The respondent expresses interest in exploiting the services of the IoT Labs/Hub.

CONCLUSION

IT specialist from Mevgal stresses the importance of Machine Learning skills in Advanced Manufacturing. He notes a gap in transversal skills and partly in cybersecurity in the AM labor market. Sergio finds all mentioned knowledge areas relevant, believes the DTAM Course addresses upskilling needs effectively, and expresses interest in offering the training to employees. He sees a substantial impact on technical and transversal skills, with positive feedback on course quality and no identified skill deficit. Sergio is interested in exploiting IoT Labs/Hub services.

6th interview: computer repair company in NL

The interview was implemented with the owner of a computer repair company specializing in the maintenance of large networks, including IoT. As the owner and director of the organization, he oversees a team of 16 engineers with expertise in IT, electronics, and machine maintenance.

Most important skills for an employee in AM sector

When asked to rate the importance of the skills for an employee in AM sector that would be developed through DTAM course, according to his professional experience the following evaluation was provided:

Technical skills at the areas of Big Data**: partly important**

Technical skills at the areas of Machine Learning**: partly important**

Technical skills at the areas of Sensors**: Absolutely necessary**

Technical skills at the areas of Cybersecurity**: Absolutely necessary**

Transversal Skills**: Absolutely necessary**

In the AM sector, he emphasizes the importance of technical skills in sensors and cybersecurity, rating them as absolutely necessary. While skills in Big Data and Machine Learning are considered partly important, transversal skills are also deemed absolutely necessary, underscoring the significance of versatile capabilities such as problem-solving and adaptability in the field. He added that more and more customers ask for energy transition engineers, like solar panels, energy storage, warmth pumps and so on. Both for installing new installations, also maintaining existing installations. The demand for energy transition engineers, particularly for installing and maintaining renewable energy installations, further shapes the essential skills landscape in this sector.

Knowledge missing from the AM labour market

After getting familiar with the DTAM course, the respondent was asked which piece of updated knowledge was missing from the AM labour market and responded the following:

The respondent, having reviewed the DTAM course, finds that overall, the course adequately covers transversal skills, Big Data, Sensors, Machine Learning, and Cybersecurity for the AM sector. However, he notes that the coverage of blockchain in relation to cybersecurity could be improved. Hands-on training at IoT labs is considered satisfactory.

Knowledge irrelevant for the AM labour market

Arjan Rutte expresses that, within the context of the AM labor market, some content from machine learning and big data might be considered irrelevant. The specific application of certain aspects from these areas may not align well with the needs of their industry.

DTAM course responds to the need of upskilling and reskilling

The respondent strongly affirms that the DTAM course effectively addresses the pressing need for upskilling and reskilling low or under-skilled adult workers and OT technicians in the AM sector.

Offer training to employees

He expresses a conditional interest in offering the training to his employees, stating that the decision would depend on factors such as costs and time commitment. However, he generally leans towards a positive inclination.

In specific the respondent expressed its interest in training employees, with a specific emphasis on Transversal Skills, Sensors, and Cybersecurity.

Quality

The respondent affirms that both the quality of the DTAM course and the IoT Lab met his expectations.

Skill deficit

The respondent does not perceive a crucial skill deficit in the DTAM course for the AM sector.

Services

The respondent shows interest in leveraging the services provided by the IoT Labs/Hub.

Experience form the Pilots

Regarding the pilots, in which the company participated the respondent was asked if DTAM curriculum corresponded to the needs of his company and if there was something useful for your company missing. He responded that the DTAM curriculum aligns with the needs of the respondent's company, particularly highlighting the value of modules on cybersecurity, sensors, and transversal skills.

A trainee or intern in his company has partially concluded the DTAM training course, specifically in the areas of sensors and cybersecurity. There is motivation to seek additional participants in the future and he feels highly motivated to hire students who have completed the DTAM course. In addition, he acknowledged the course's usefulness for both current and potential future employees, expressing a willingness to extend it to permanent staff.

When asked to rate the impact that DTAM training on the overall performance and efficiency of the employees of his company he replied that the current impact of the DTAM training on the overall performance and efficiency of his company is perceived as limited, given that only one employee has participated. However, it is expected to grow as more employees undergo the training in the future.

Lastly the respondent is motivated to utilize DTAM resources and IoT Labs and is open to recommending the course to other companies, especially if it suits their line of work.

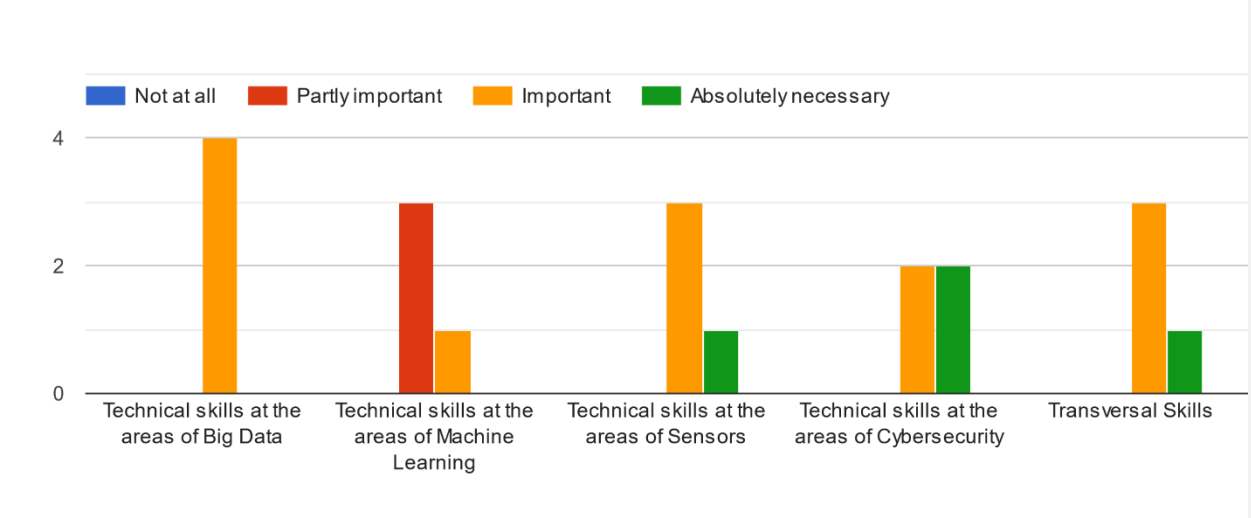
CONCLUSION

In summary, the insights provided suggest a strong emphasis on the importance of technical skills in sensors and cybersecurity within the AM sector. The respondent rates transversal skills as crucial and acknowledges the growing demand for energy transition engineers. While generally satisfied with the DTAM course content, there is a noted desire for enhanced coverage of blockchain in the context of cybersecurity. The respondent expresses interest in providing training to employees, particularly focusing on transversal skills, sensors, and cybersecurity. Despite the perceived limited current impact, there is anticipation of increased influence as more employees participate in the course. Overall, the respondent finds the course valuable, is motivated to utilize associated resources, and is open to recommending it to other relevant companies.

Remote interviews

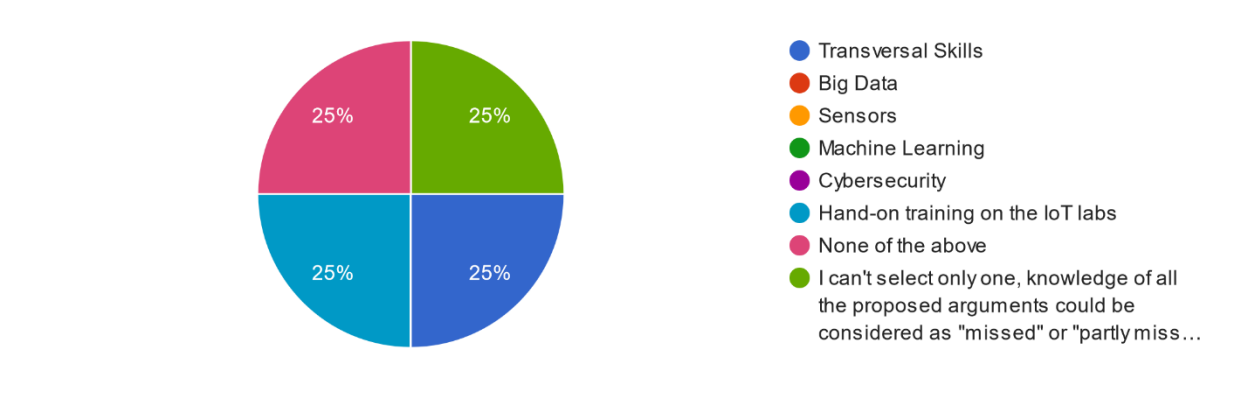
4 remote interviews were implemented in Italy with the support of Google forms, developed by IDEC. The results are the following:

1. **Please rate how important is the acquisition of the following skills for an employee of an Advanced Manufacturing (AM) company?**



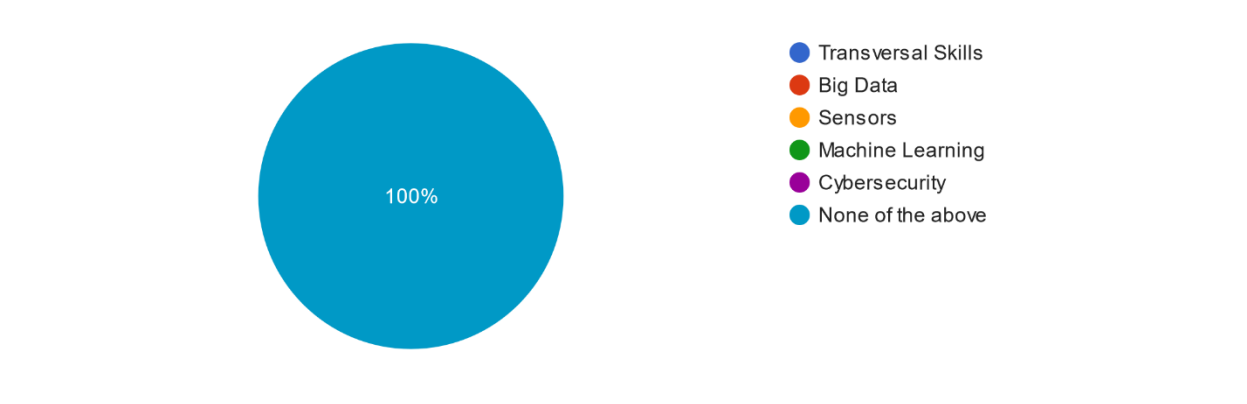
In general, the Italian AM Companies consider that all skills are important, except for technical skills in the areas of Machine Learning, which they deem slightly less crucial.

1. **After getting familiar with the DTAM course, please let us know which piece of knowledge was missing from the AM labour market?**



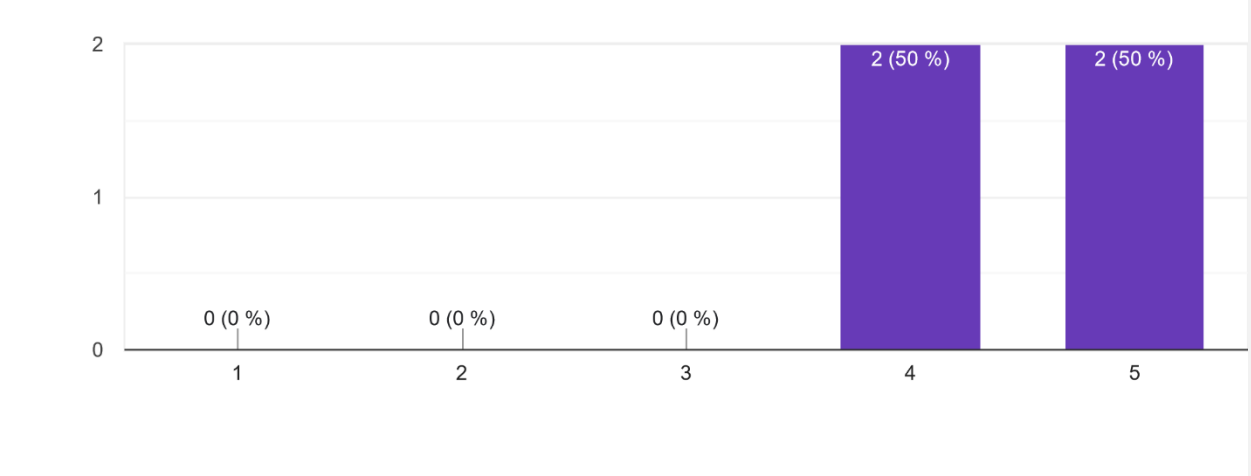
All sections have received the same score, encompassing: "I can't select only one" where knowledge of all the proposed arguments could be considered as 'missed' or 'partly missed'; 'none of the above'; Transversal Skills; and Hands-on training on the IoT labs.

2. **After getting familiar with the DTAM course, please let us know which piece of knowledge was missing from the AM labour market?**



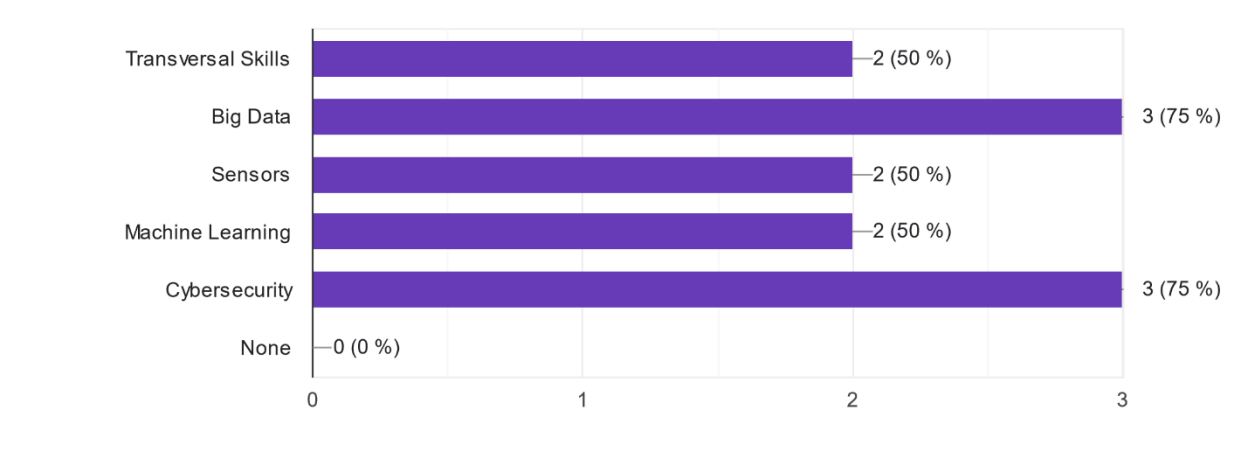
All companies agree that none of the pieces of knowledge are irrelevant in the course.

3. Did the quality of the course met your expectations?



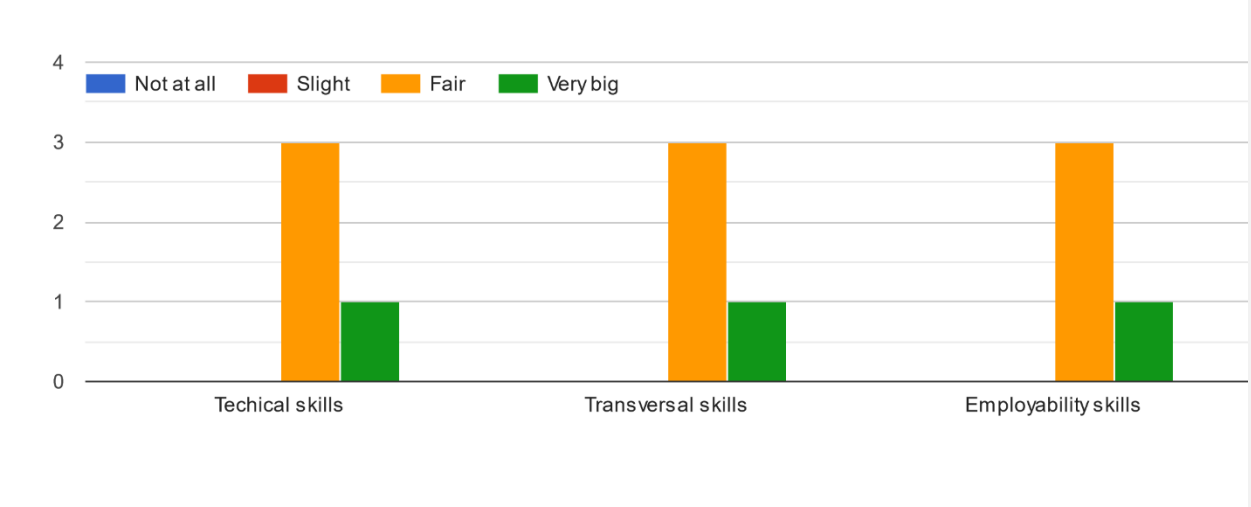
Overall, the course quality met the partners' expectations very well.

4. Which of the following modules would you advise your employees to attend?



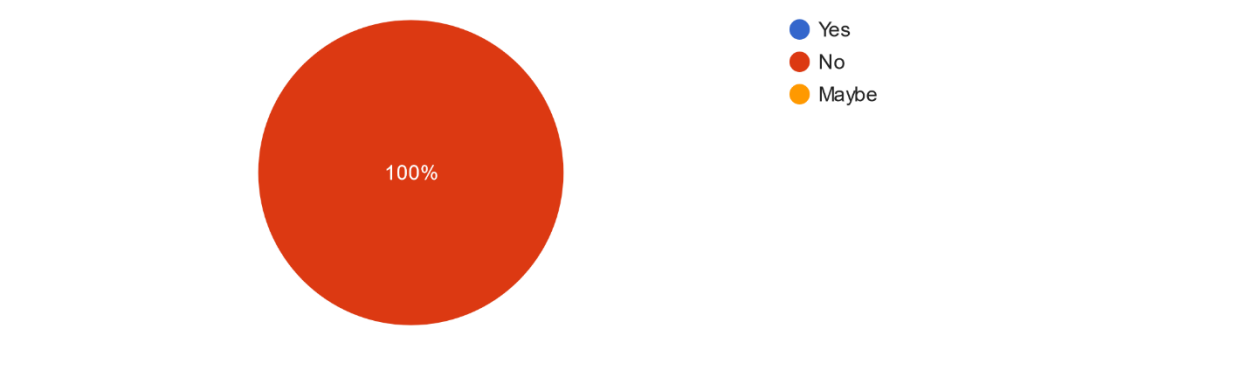
Companies would highly recommend the courses on Big Data and Cybersecurity, followed by Transversal Skills, Sensors, and Machine Learning.

5. **Please rate the impact of the course on the following categories of skills for AM employees:**



Overall, all companies agree that all categories have had a significant impact.

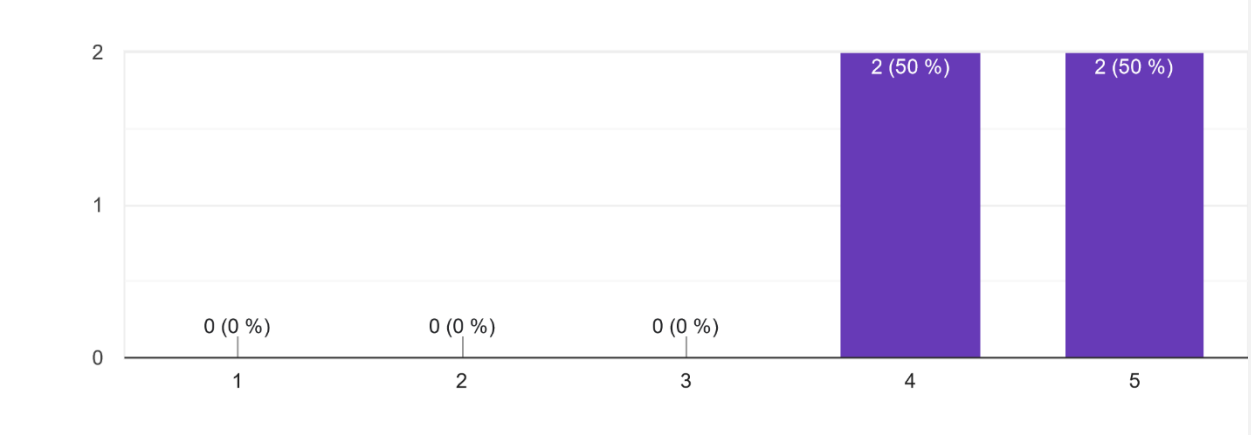
6. **Is there a skill deficit in the course that you consider essential for the AM sector?**



No company perceives any skill deficit in the course.

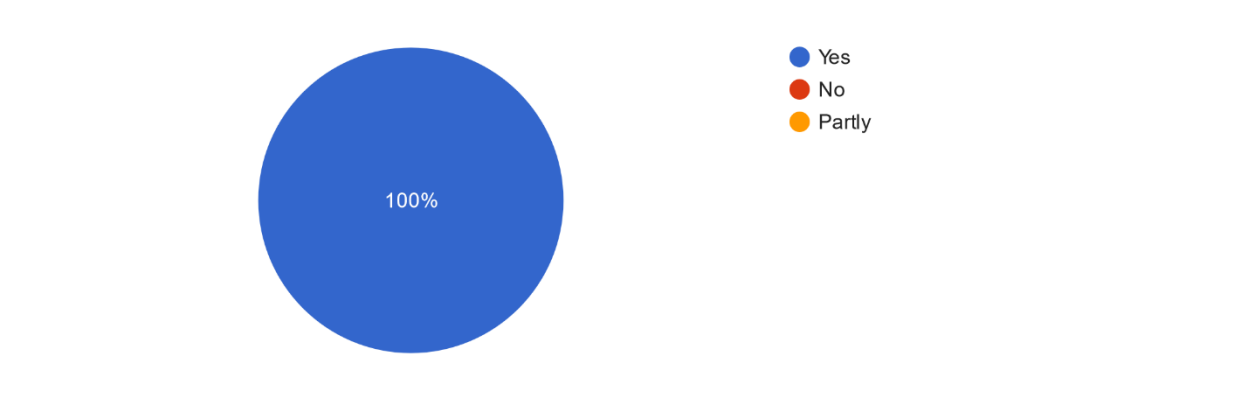
Impact of DTAMs Training Course on your Company

1. **Did you find the programme useful for your company?**



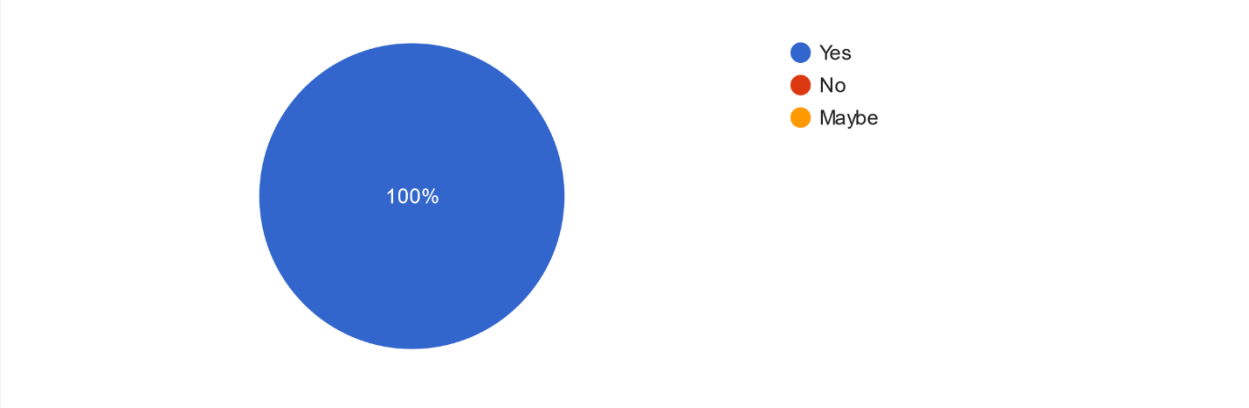
Yes, all partners consider that the program has been beneficial for their companies.

2. **Does the DTAM curriculum address the needs of the Advanced Manufacturing Industry?**



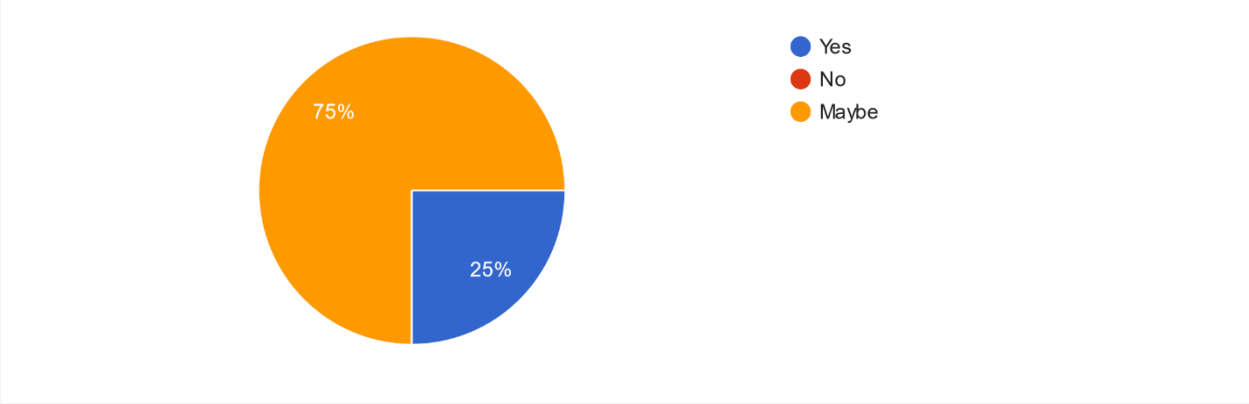
All consider that the DTAM curriculum meets the needs of the industry.

3. **Are you motivated to employ students that have completed the DTAM course?**



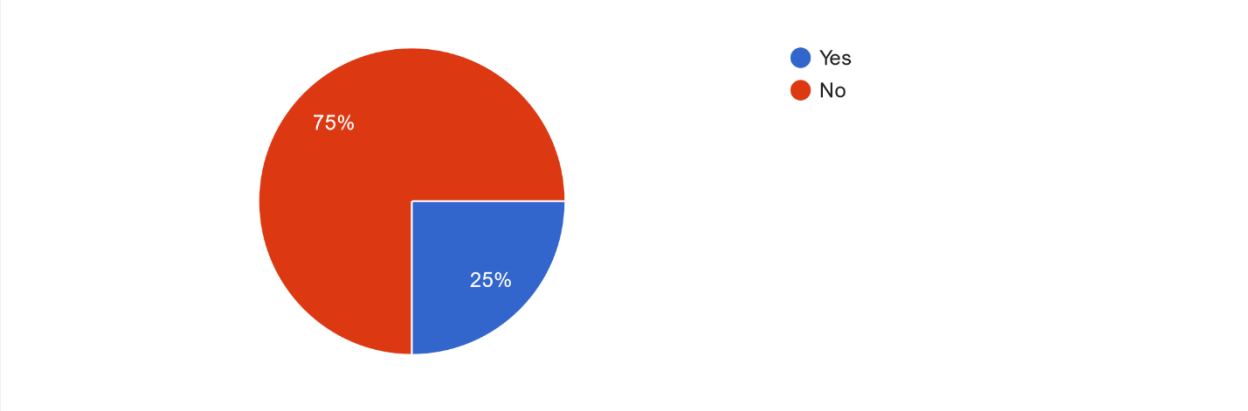
Yes, all would hire students who have completed the course.

4. **Are you motivated to engage some of your employees in the DTAM training course?**



The majority is uncertain about engaging their employees in the course, but another partner is confident that they would do so.

5. **Is there an employee (trainee, intern etc) in your company that has concluded the DTAM training course?**

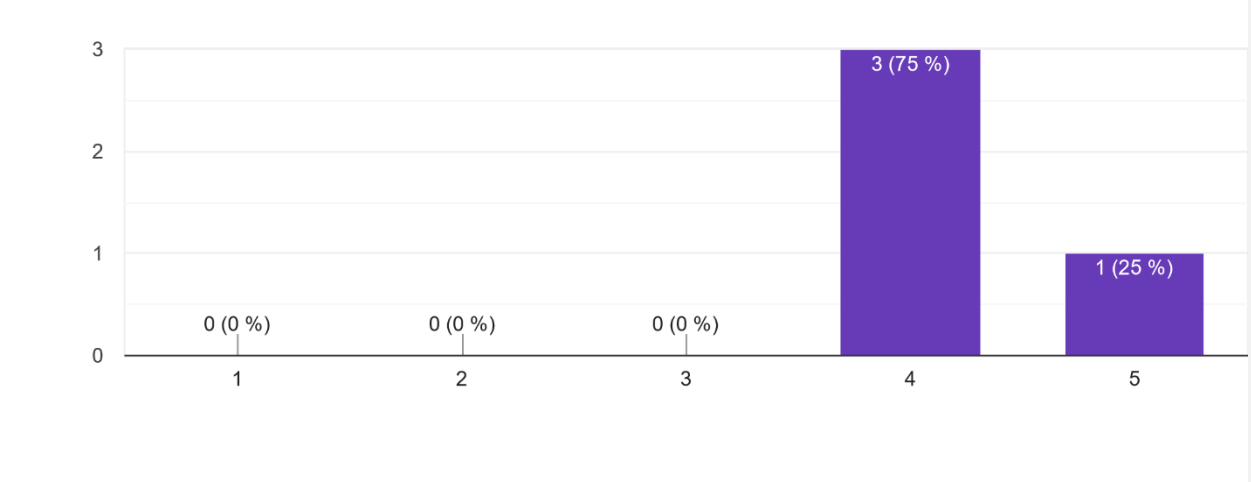


There is only one company whose employee has completed the DTAM course; in the others, there is none.

6. **If yes, did you identify a measurable impact on the performance of the employee? Please describe**

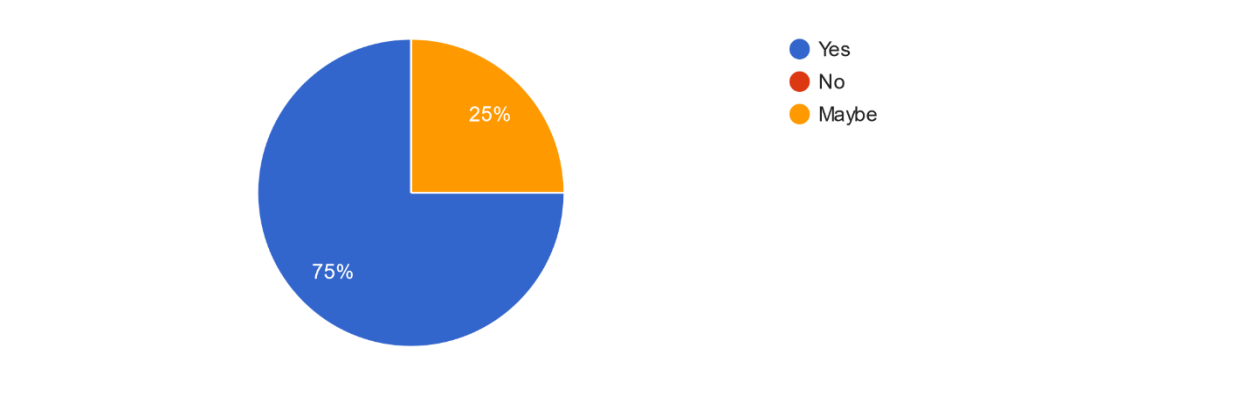
The employee's skills have significantly improved, although there has not been practical application to measure the impact on performance yet.

7. **Please rate the impact that DTAM training would have on the overall performance and efficiency of the employees of your company.**



All affirm that the course has had an impact on their company's employees.

8. Are you going to suggest the course to other people?



Some are hesitant about recommending it, but the vast majority assures that they would indeed recommend it.

CONCLUSION

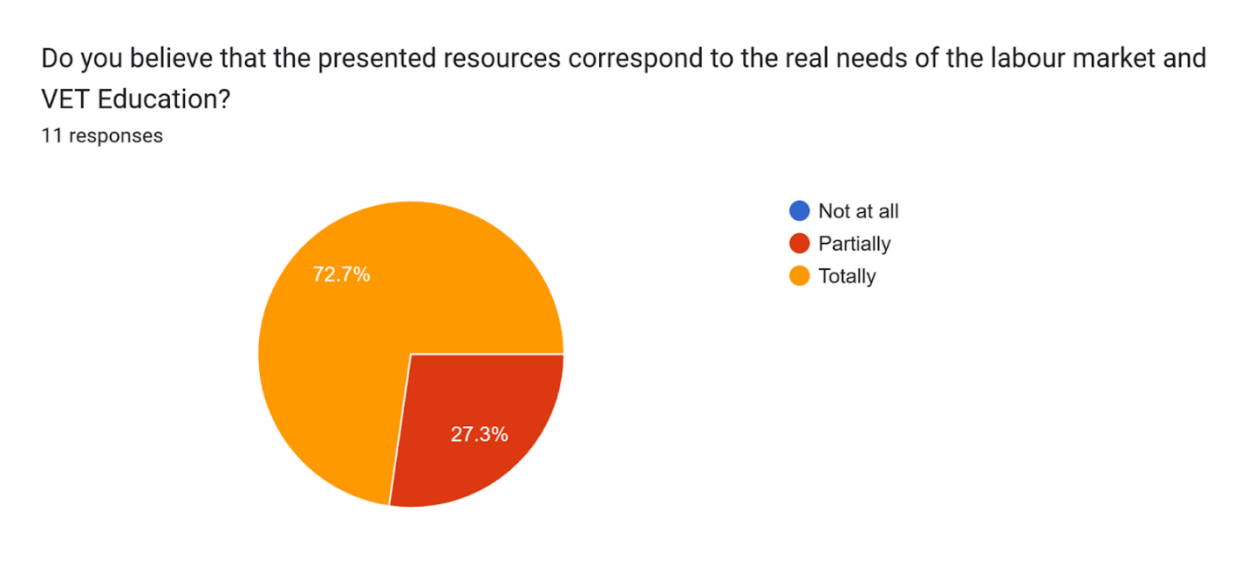
Italian companies consider all skills important for Advanced Manufacturing except for Machine Learning. They find no knowledge missing from the DTAM course, rate its quality positively, and recommend modules on Big Data and Cybersecurity. Partners see a significant impact on various skills categories, with no perceived deficits. The program is deemed beneficial, meeting industry needs, and partners express motivation to employ course graduates. One company reports improved employee skills post-course completion. Overall, partners affirm the positive impact on employee performance and express varying degrees of willingness to recommend the course.

Multiplier Events

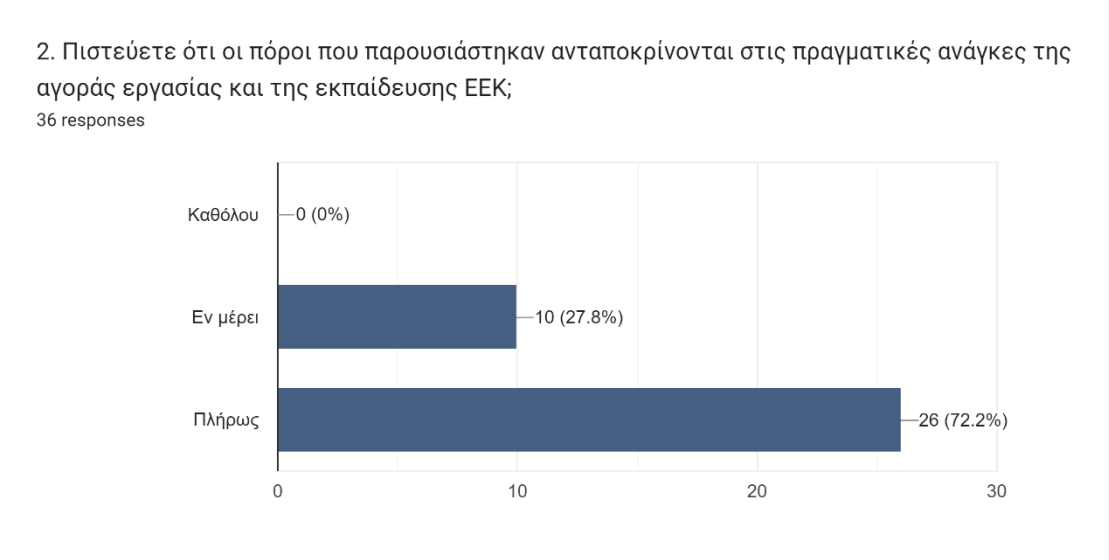
One of the main objectives of DTAM was to bridge the skills mismatch between VET education and AM Industry. Therefore throughout the implementation of the project we kept measuring the impact of the DTAM curriculum on the AM sector. In addition to the interviews and to the engagement of AM companies in the official meetings we examined the impact through the evaluation questionnaires distributed during the ME that took place in all partner countries.

Correspondence of the presented resources to work/area of activity:

BG



EL

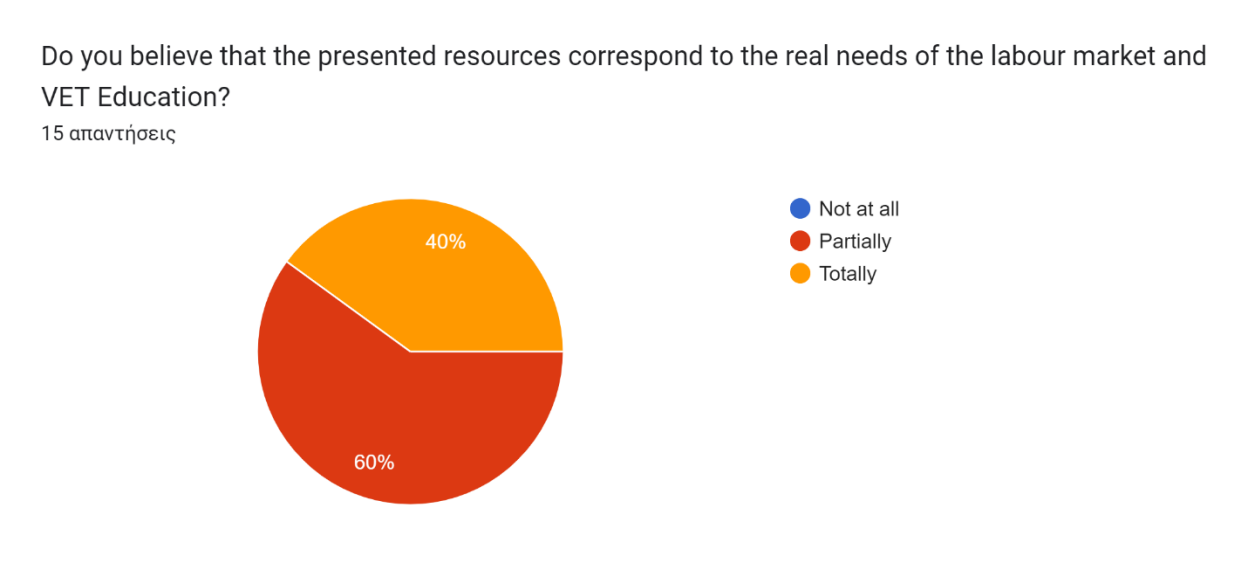


Translation:

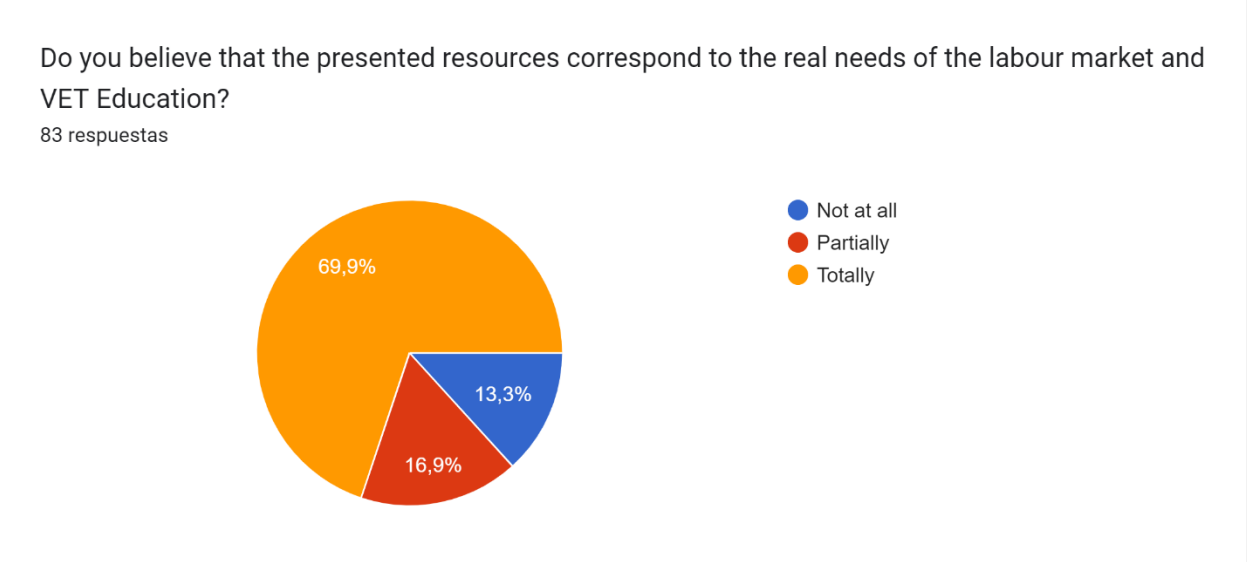
The resources presented correspond to the real needs of the labour market and education in the EU?

1. No
2. Partially
3. Yes

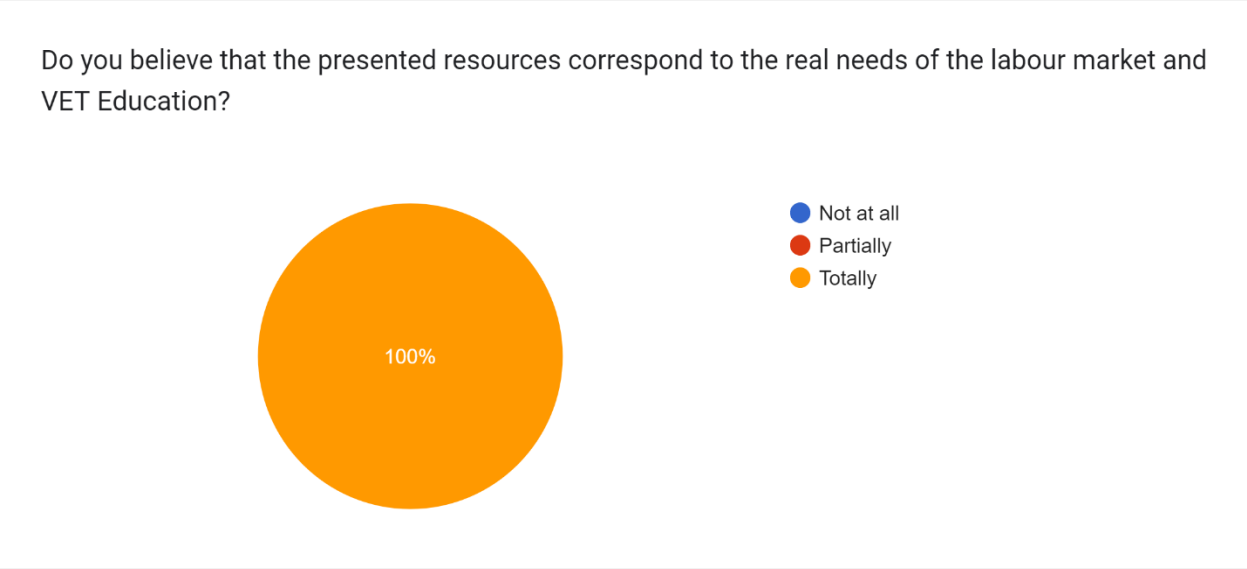
NL



ES



IT



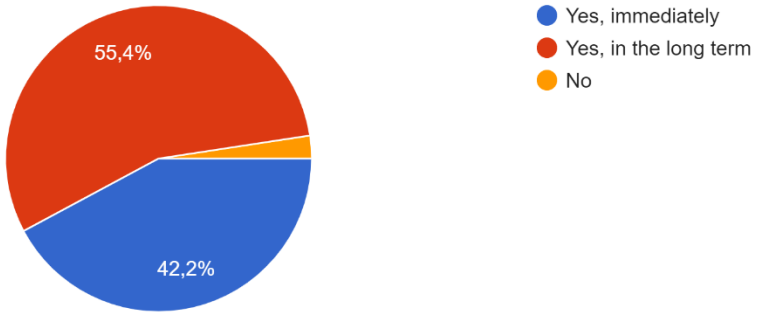
In regards to the adequacy of the resources in response to today's needs of the labor market, the results in all countries the results were very positive. The vast majority of the

respondents stated that the results correspond totally or partially to the needs of the labour market.

Impact on employability of trained employees at DTAM course

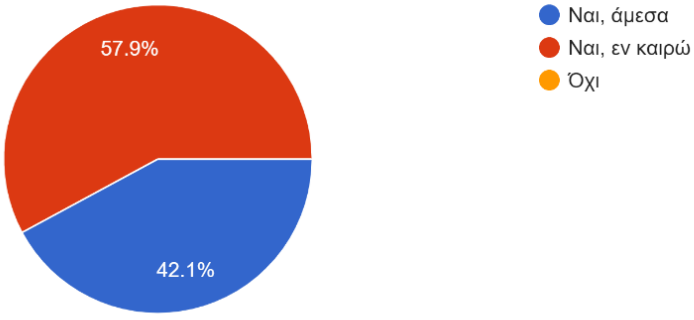
ES

If you are a business owner/ HR Manager, would you seek to hire employees that are trained on the thematics of the DTAM course?
83 respuestas



EL

3. Εάν είστε ιδιοκτήτης επιχείρησης/ διευθυντής Ανθρωπίνου Δυναμικού, θα επιδιώκατε να προσλάβετε εργαζόμενους που έχουν λάβει κατάρτιση στη θεματολογία του προγράμματος DTAM;
19 responses



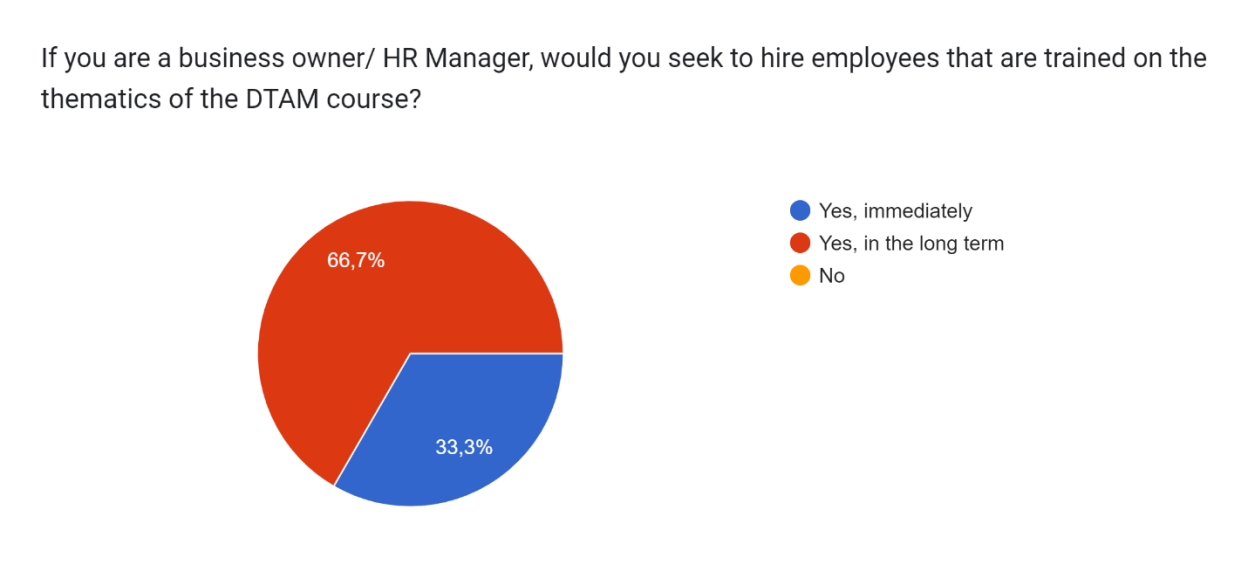
Translation:
If you are a business owner/HR manager, would you seek to hire employees who have received training on DTAM's topics?

1. Blue: Immediately

2. Red: In the future

3. Orange: No

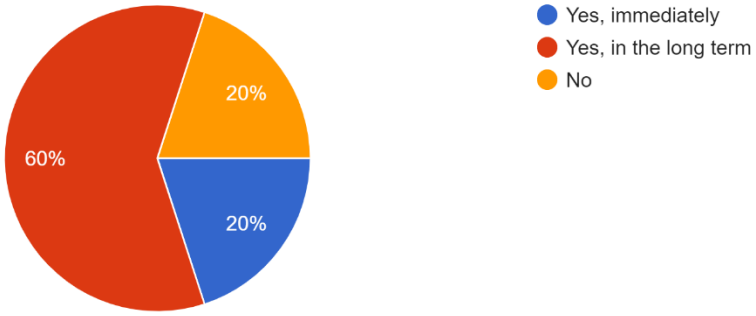
IT



NL

If you are a business owner/ HR Manager, would you seek to hire employees that are trained on the thematics of the DTAM course?

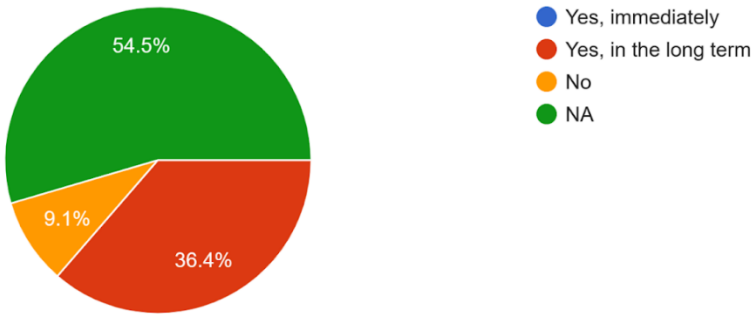
15 απαντήσεις



BG

If you are a business owner/ HR Manager, would you seek to hire employees that are trained on the thematics of the DTAM course?

11 responses



When HR Managers/ Business owners were asked if they would seek to hire employees that have received training in the topics that were presented during the DTAM event, the responses were positive, stating that they would engage in this hiring process in time.

Interest in exploitation of DTAMs project results in work/ activity area

EL

Translation:

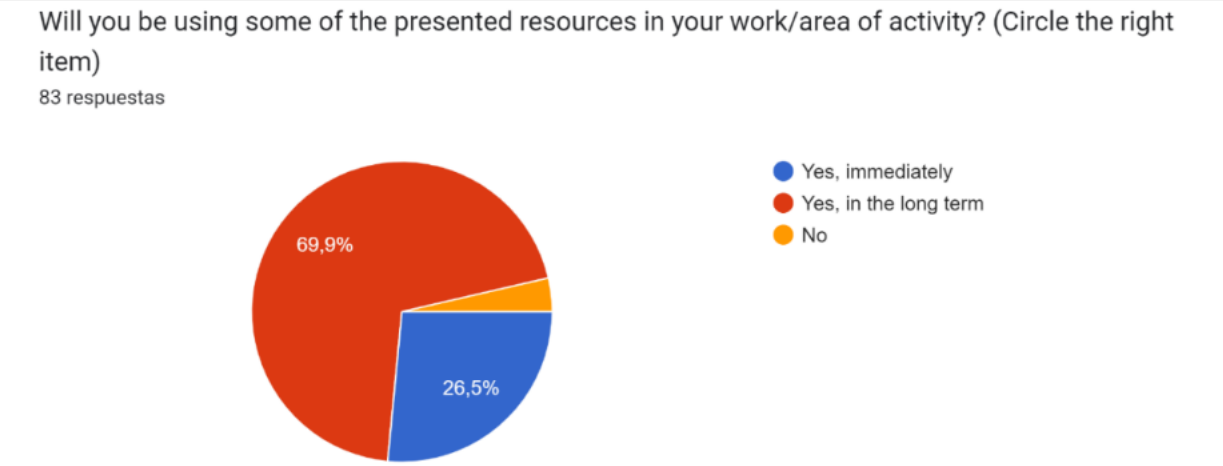
Digital upskilling-reskilling for Industries

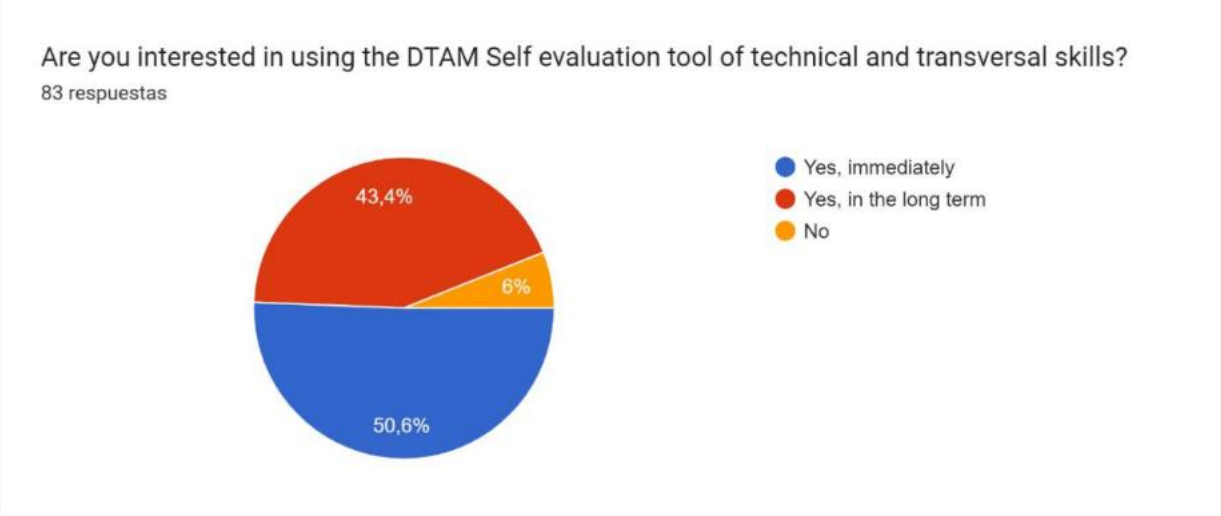
1. Will you integrate some of the resources presented into your work/activity area?
2. Do you think that the resources presented meet the real needs of the labour market and VET education?
3. Are you interested in using the DTAM technical and transversal skills self-assessment tool?

4. Interested in joining DTAM's international network of IoT labs?

Concerning the use and applicability of the resources presented in the respondents' businesses, the majority stated that the material met their requirements and will be likely used by them in the future, while some also stated their preference in using the self-evaluation skills tool of project DTAM. Many participants also showed their interest in being a part of the international Iot Hub of the project.

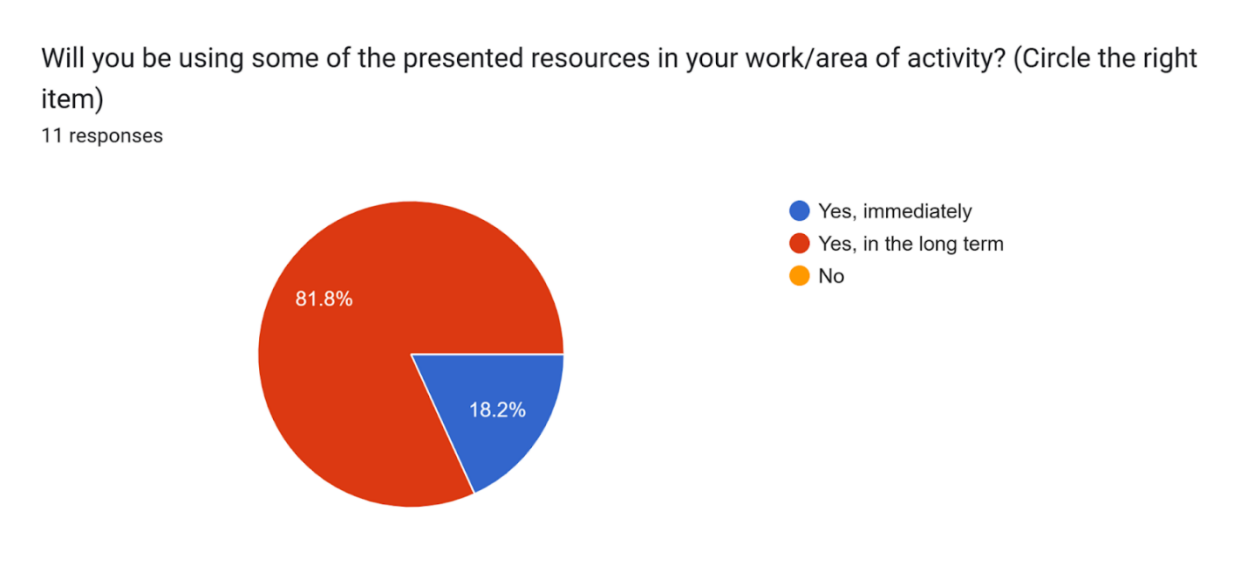
ES

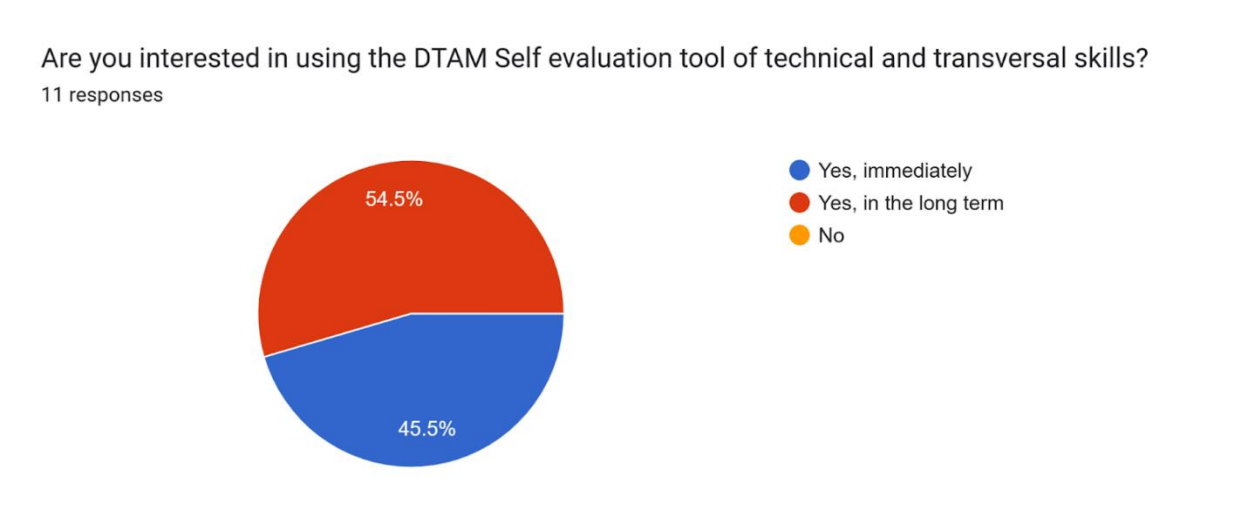




Concerning the interest of joining the DTAM International Network of IoT labs, diverse comments were gathered. Among them, many expressed that they would like to enter the team in the future, after revising the training materials provided in the event. Some stated that they did not know the implications or use of the mentioned network. However, the most interesting comment comes from a teacher from the VET center Zulaibar, who even wrote his email specifically on this part so he could be added as soon as possible in the network.

BG

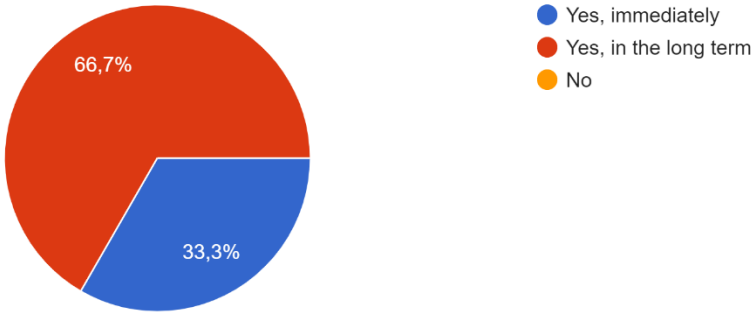




To the question *"Are you interested in joining DTAM International Network of IoT labs?"* participants have mostly answered with a yes.

IT

Will you be using some of the presented resources in your work/area of activity? (Circle the right item)



Are you interested in using the DTAM Self evaluation tool of technical and transversal skills?

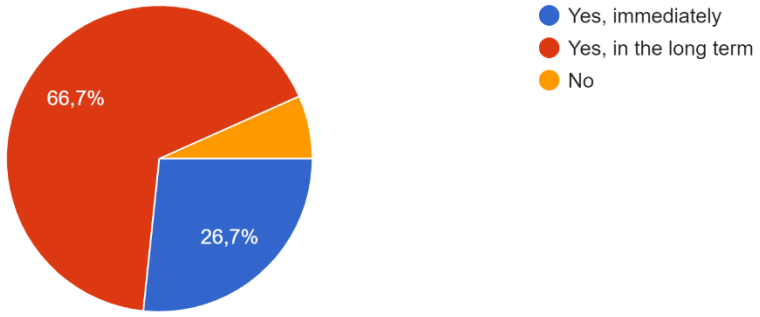
3 απαντήσεις

To the question *"Are you interested in joining DTAM International Network of IoT labs?" all* participants answered with a yes.

NL

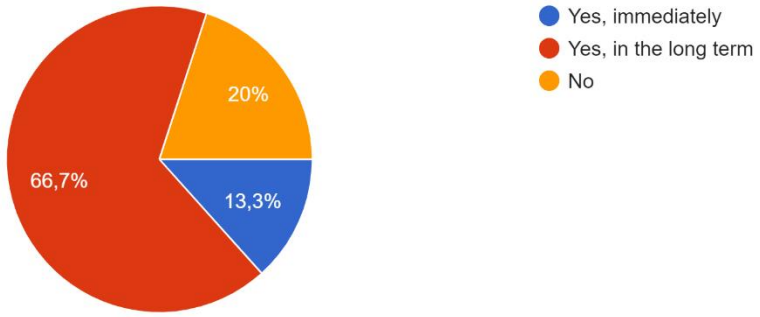
Will you be using some of the presented resources in your work/area of activity? (Circle the right item)

15 απαντήσεις



Are you interested in using the DTAM Self evaluation tool of technical and transversal skills?

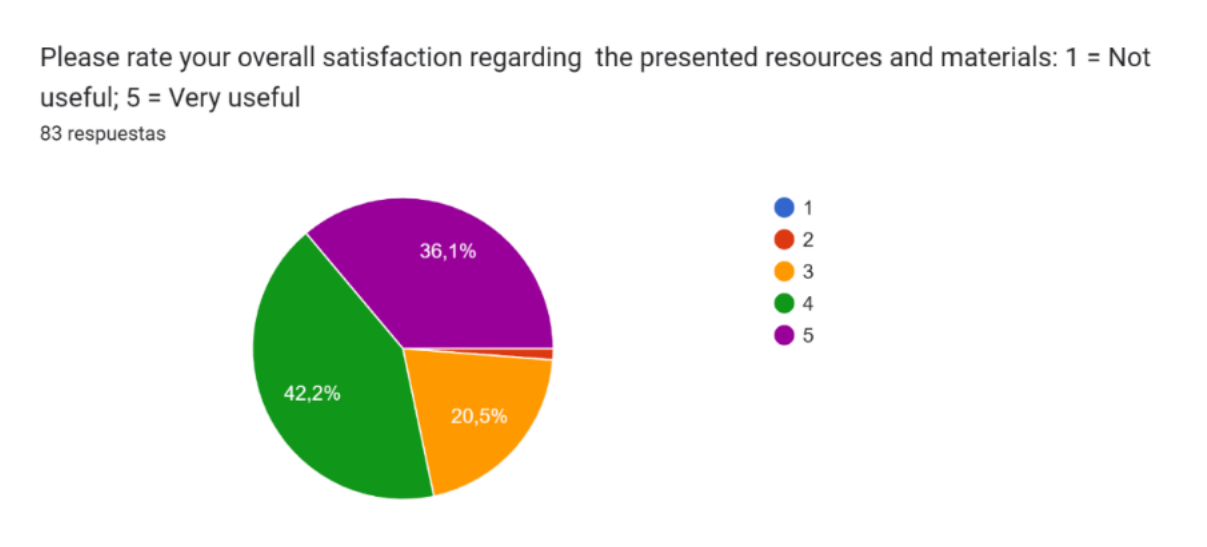
15 απαντήσεις



To the question *"Are you interested in joining DTAM International Network of IoT labs?"* the majority participants answered with a yes, or yes in the long term.

Overall sarisfaction regarding the presented results and services

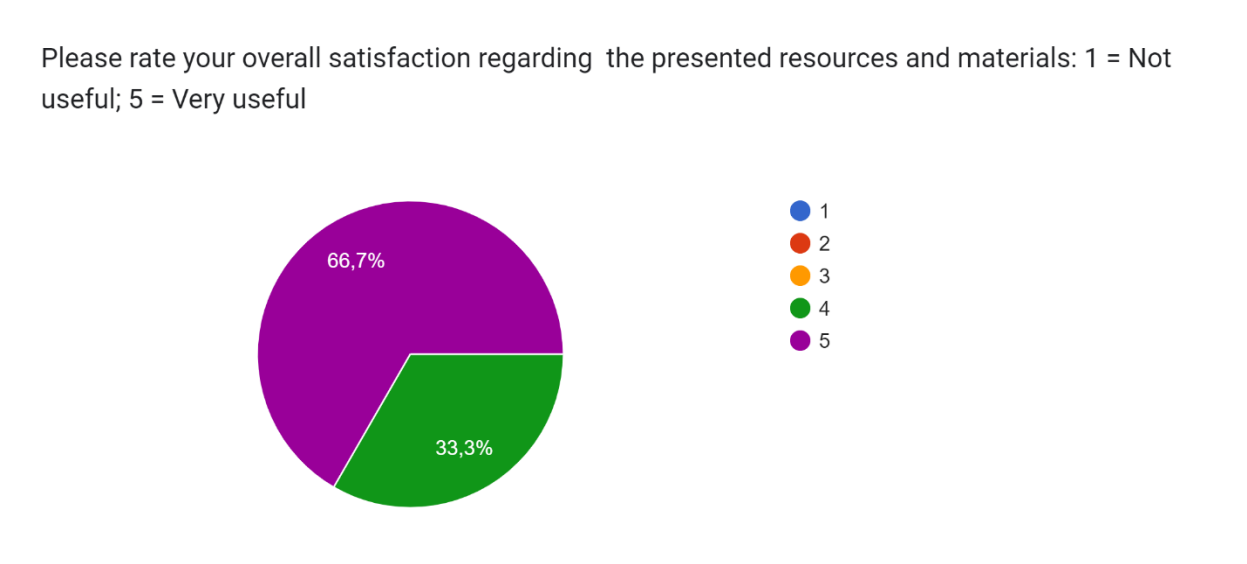
ES



As it can be appreciated in the graph, the majority of respondents were satisfied with the materials. More than two-thirds of the participants were pleased with the resources and the explanations provided along them. A 20.5% disregarded the question and only the 1.2% of the attendees considered them to be not useful.

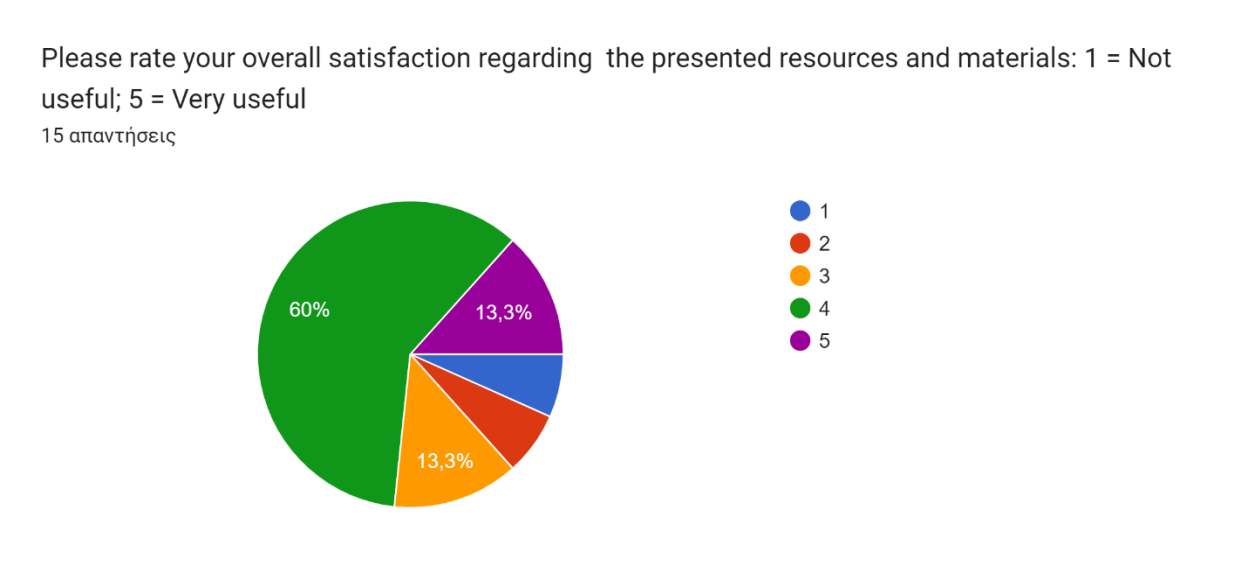
Regarding the overall satisfaction with the event, once again, two-thirds of the participants were either very satisfied or satisfied, while the 22.9% of the attendees maintained a neutral tone about it. Only a 3.6% of the attendees were not satisfied with the event.

IT



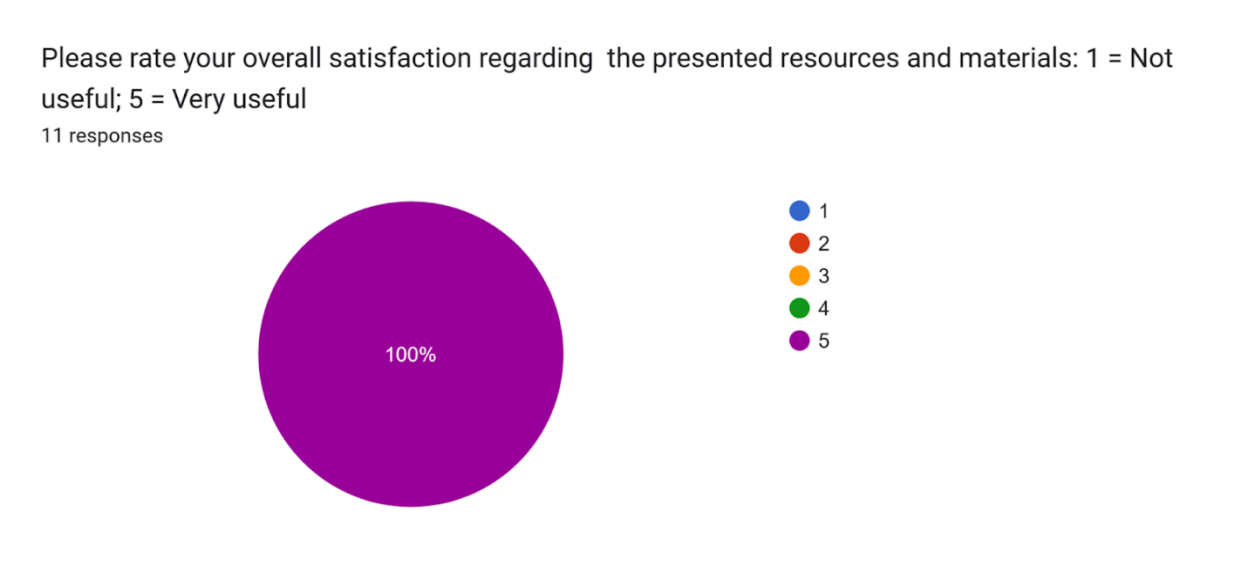
In Italy, the companies seemed very satisfied with the quality of the resources and their exploitation potential.

NL



In the Netherlands, the majority was very satisfied with the

BG



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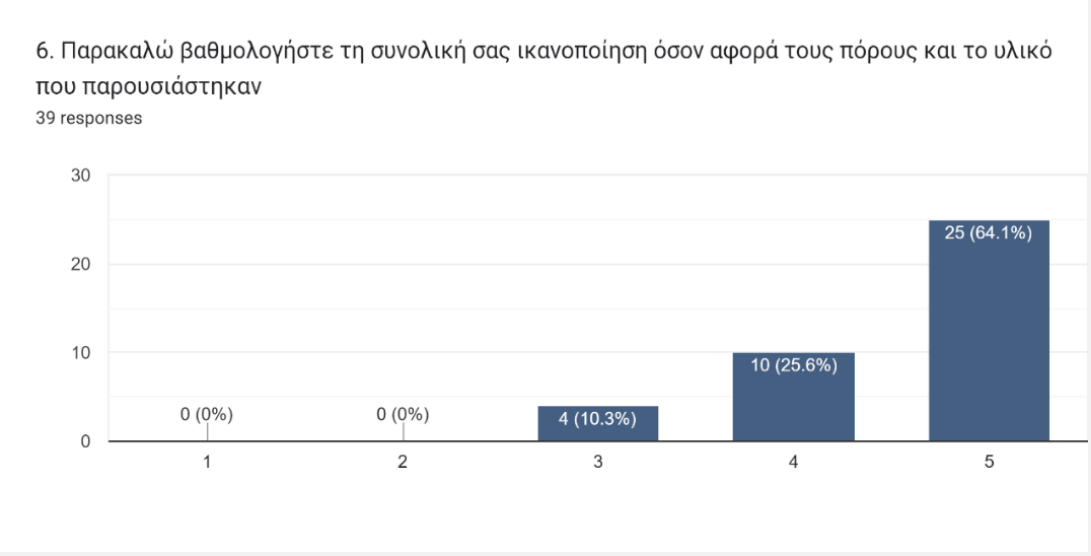

Translation: **Rate your overall satisfaction with the resources and material presented**

The overall satisfaction was very positive even to companies that were not acquainted with the project results and were introduced to them through the Multiplier evnets. In all countries the majority of respondents were satisfied with the materials. More than two-thirds of the participants were pleased with the resources and the explanations provided along them. This fact also validates the strong impact of the project results on the AM sector and the correspondence to the needs of the labour market.

The DTAM course survey revealed positive reception, with strong confidence in long-term material use and high hiring interest. Privacy concerns and some skepticism about cost-effectiveness were noted. The Self-evaluation tool garnered widespread interest, while opinions on joining the DTAM Network varied. Personal benefits cited included information gathering, skill improvement, and potential student employment.

In conclusion, the survey reflects overall positive sentiments regarding the alignment of DTAM resources with EU labor market needs. Both HR Managers and VET educators express readiness to embrace DTAM-trained individuals, indicating a potential impact on employment and educational programs in the future.

Conclusion

The impact of the Digital Transformation in Advanced Manufacturing (DTAM) curriculum on companies within the Advanced Manufacturing (AM) sector reveals significant insights into the evolving needs of the industry. One notable observation is the widespread recognition of a skills gap, particularly in critical areas such as Big Data, Sensors, Machine Learning, and Cybersecurity. Companies within the AM sector are prioritizing the development of numerical control knowledge and emphasizing the importance of transversal competencies.

Emphasizing the significance of technical skills, the DTAM curriculum is identified as a crucial tool for addressing deficiencies and enhancing competency within the workforce. The emphasis on technical skills, particularly in Big Data and Machine Learning, is deemed essential for specialization and heightened employability. Notably, companies acknowledge the existing gaps in cybersecurity and express a preference for outsourcing in these specific areas.

The alignment between the DTAM course and upskilling needs within the industry is a key finding. The curriculum is viewed as addressing both technical and transversal skills, providing a comprehensive approach to meet the demands of the AM sector. Italian companies, in particular, find all skills important for Advanced Manufacturing and report positive impacts on various skills categories.

Testimonials from industry players, such as Nexmachina, emphasize the practical relevance of the DTAM course. The General Manager highlights the importance of skills in Sensors, rates the relevance of Big Data, Machine Learning, and Cybersecurity, and expresses satisfaction with the course and IoT Lab quality. The active utilization of the DTAM IoT Labs/Hub for trainees underscores the practical application and positive engagement of companies in the DTAM initiative.

The positive reception is further validated by survey results, indicating confidence in the long-term utility of DTAM materials and high interest in hiring individuals with DTAM training. While privacy concerns and cost-effectiveness skepticism are noted, personal benefits, such as information gathering and skill improvement, are highlighted. The readiness of HR managers and Vocational Education and Training (VET) educators to embrace DTAM-trained

individuals suggests a potential impact on employment and educational programs in the future.

The transformative impact of the DTAM project extends beyond individual companies to benefit the entire VET community. The observed advancements in competences, both technical and soft skills, highlight the success of the initiative in delivering tangible benefits to students, trainers, and companies. The positive changes underscore the project's role in closing skill gaps, enhancing competences, and positioning companies to meet the evolving requirements of the AM sector.

In conclusion, the DTAM project emerges as a valuable and transformative initiative that not only addresses current skills gaps but also prepares the workforce for the future needs of the Advanced Manufacturing sector. The positive feedback from companies, coupled with the commitment of educators and the demonstrated impact on employability, positions DTAM as a model for effective collaboration between academia and industry, fostering a skilled workforce and driving innovation in the AM sector.

Chapter 4: Conclusion

The impact assessment of the Digital Transformation in Advanced Manufacturing (DTAM) course provided a comprehensive overview of its influence on various stakeholders, focusing on Initial Vocational Education and Training (IVET) students, Continuous Vocational Education and Training (CVET) trainers, and companies within the Advanced Manufacturing (AM) sector with remarkable results.

Regarding the Impact on IVET the assessment highlights a positive trajectory in students' competences across diverse modules and partner organizations. The modules are deemed exceptionally beneficial for professional growth, with a majority of students expressing satisfaction and meeting their expectations. A noteworthy finding is the substantial improvement in self-assessed competence levels, particularly in critical areas like data collection, data processing, and industrial data handling. The successful inclusion of the Transversal Skills module, challenging for technical operators, further adds to the program's effectiveness. The overwhelming endorsement of the course, with over 90% of students willing to recommend it, reflects high satisfaction and underscores the program's pivotal role in augmenting both knowledge and skills, aligning closely with students' professional development needs.

As for the impact on CVET insights from trainers across partner organizations reveal a significant positive influence on both technical and soft skills. Advancements in technical areas, including Big Data, Machine Learning, Sensors, and Cybersecurity, are unanimously recognized by trainers. The emphasis on soft skills, such as communication and leadership, indicates a holistic approach to skills development, resulting in a comprehensive and enriching educational experience. The widespread recognition of the program's utility by trainers, with a majority rating it as extremely or very useful, reinforces its practicality and relevance. The unanimous willingness of trainers to recommend the course reflects confidence in its effectiveness and potential positive impact on a broader audience, establishing the pilot program as a valuable and effective initiative.

Regarding the impact on VET Providers the DTAM pilot program's significant impact is exemplified by its inclusion in the curricular offer by DaVinci College, marking a substantial success. The national recognition of the Sensors module within the EQF-4 course further underscores the program's influence on Vocational Education and Training (VET) providers. The signing of 8 Memorandums of Understanding (MoUs) with VET institutions and other stakeholders expressing interest in joining the DTAM International Network and in exploiting

the project results amplifies the program's impact, maximizing its reach and influence on VET providers.

Last but not least the impact of the DTAM curriculum on companies within the AM sector sheds light on the industry's evolving needs. The recognition of a skills gap in critical areas like Big Data, Sensors, Machine Learning, and Cybersecurity highlights the program's relevance. The DTAM curriculum is identified as a crucial tool for addressing deficiencies and enhancing competency within the workforce, particularly in technical skills. The positive reception by Italian companies, coupled with testimonials from industry players like Nexmachina, emphasizes the practical relevance and engagement of companies in the DTAM initiative. Despite some noted concerns, the overall positive impact on employability and readiness of HR managers and VET educators to embrace DTAM-trained individuals indicates potential positive effects on employment and educational programs in the future.

In conclusion, the comprehensive evaluation of the DTAM course reveals a consistent and positive impact across students, trainers, and companies. The program's success in enhancing competences, technical and soft skills, and employability underscores its effectiveness in meeting the evolving demands of the AM sector. Between the critical impact factors of the project, the high evaluation rates for the transversal skills module stand out, given that its integration into technical occupations was both innovative and challenging. The DTAM course emerges as a valuable and transformative initiative, playing a crucial role in strengthening both the VET community and the industry. The positive feedback from students, trainers, and companies positions DTAM as a model for effective collaboration between academia and industry, driving innovation and fostering a skilled workforce for the future of Advanced Manufacturing.

Visit www.dtamproject.eu to learn more!