DELIVERABLE 1.2
Identifying training and teaching needs

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LIST OF CHANGES

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TABLE OF CONTENTS

1. INTRODUCTION

1.1 Scope and Objectives

In the context of IREEDER project, this report describes the teaching and training needs for IoT, CS and RE, and it is elaborated based on a questionnaire distributed among all IREEDER partners, other stakeholders such universities, students, trainees, private companies, and public administrations. Specific attention is paid to the Jordanian stakeholders.

1.2 Structure of the Document

The present document is organized as follows:
- The current section describes the scope, objectives and structure of the document
- Section 2 provides a description of the questionnaires used to gather information on the teaching and training needs in the different areas covered by IREEDER project: Internet of Things, Cyber Security and Renewable Energy
- Section 3 provides an analysis of the results of the surveys
- Section 4 concludes the document and provides some comments on the results.

2. THE SURVEYS

A total of three surveys were prepared and disseminated. Each survey was organized in such a way to collect information about one of the topics of the project (IoT, Cyber Security, Renewable Energy). Depending on the profile of the person answering the survey (student, academic, industry), different questions, focusing on each profile and its relevant expertise, were posed.

As an example, the following questions formed part of the questionnaire related to Renewable Energy:

In which country are you based?

Please identify your current job

For Students
What is your major field (BSc degree)?

Have you enrolled in Renewable Energy course in your university degree?

To which extent do you evaluate your knowledge in the fundamentals of Renewable Energy?

To which extent do you evaluate your knowledge in Solar Energy principles?

To which extent do you evaluate your knowledge in Wind Energy principles?

To which extent do you evaluate your knowledge in energy management of Renewable Energy systems?

To which extent do you evaluate the need to teach the Renewable Energy for Bachelor students?

For Academic Staff
What is your major field (your highest degree)?

Are you specialist in Renewable Energy?

Have you taught a Renewable Energy course?

If you teach (or have taught) a Renewable Energy course, which learning methods do you use?

If you have not ever taught a Renewable Energy course, which learning methods do you recommend to teach Renewable Energy?

Which of the following topics should be included in a Renewable Energy course for undergraduate students? Please check all apply

Please list other topics that should be included in the Renewable Energy course and not mentioned above

Do you believe that Renewable Energy knowledge will open up more career opportunities for fresh graduate students?

To which extent do you think that students should be involved in Renewable Energy laboratory experiments?

Have you taught a Renewable Energy laboratory?

Which of the following equipment are required for a Renewable Energy laboratory?

For Industrial Sector
Considering your current job, what is your major field?

How much is your current work related to Renewable Energy?

Do you believe that Renewable Energy should be taught in the undergraduate programs?

Do you believe that Renewable Energy knowledge will open more career opportunities for fresh graduate students?

To which extent do you think that Renewable Energy knowledge is required in the labor market?

Which of the following topics should be included in a Renewable Energy course for undergraduate students? Please check all apply

Please list other topics that should be included in the Renewable Energy course and not mentioned above

To which extent do you think that students should be involved in Renewable Energy laboratory experiments?
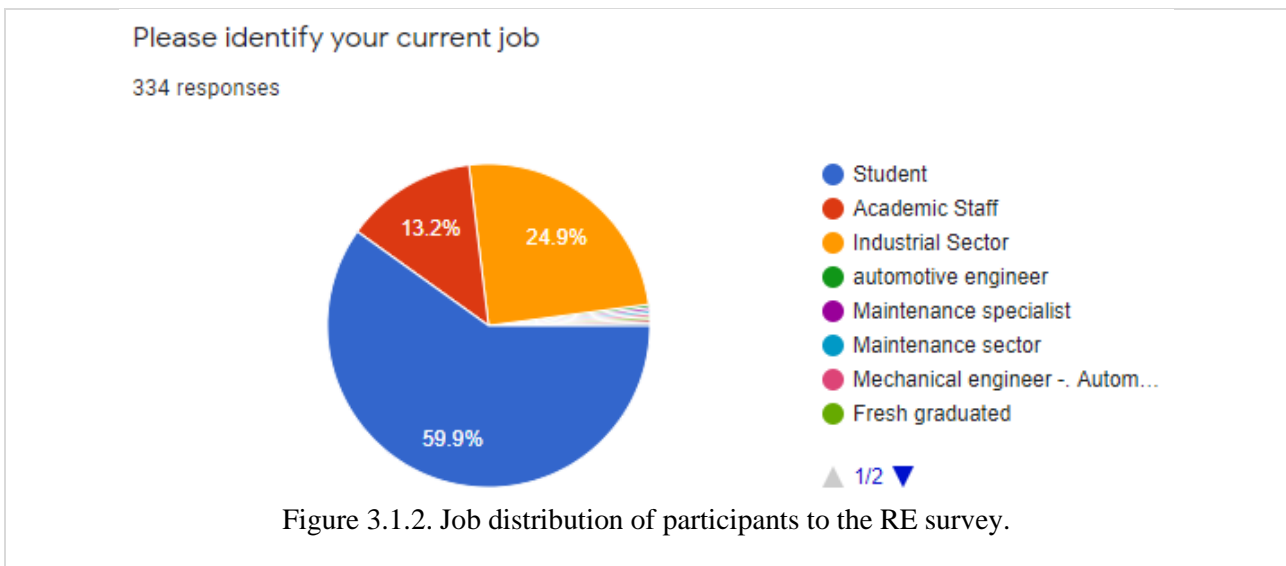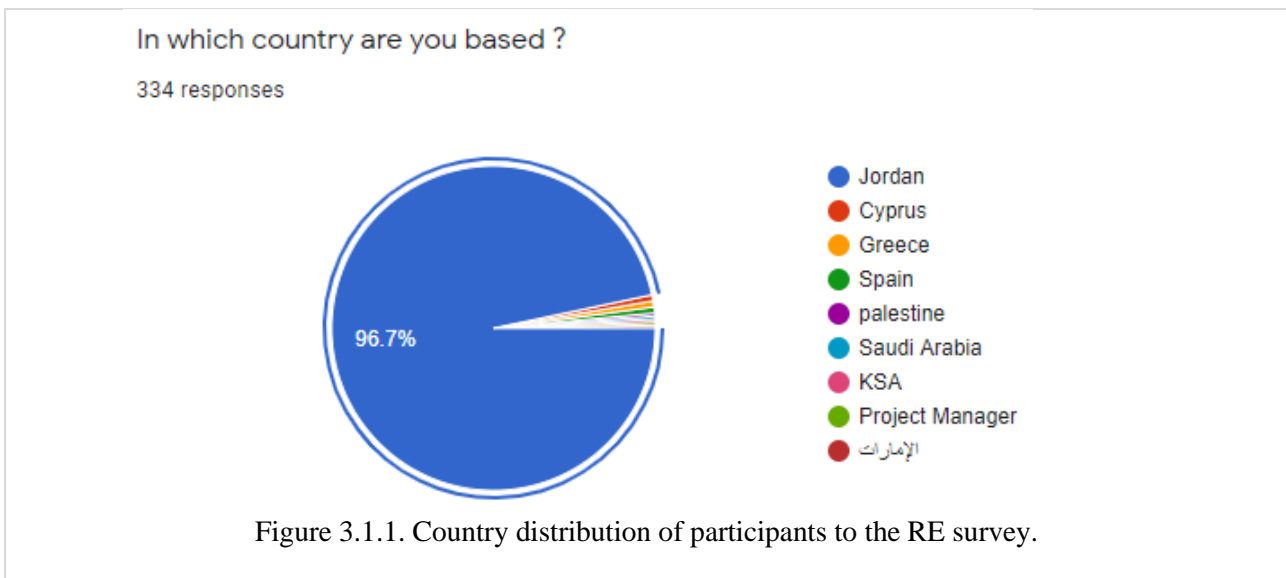
Which of the following equipment are required for a Renewable Energy laboratory?

3. SURVEY ANALYSIS

3.1 Renewable Energy

The following questions serve to contextualize the participants and present the demographics of the respondents of the Renewable Energy (RE) questionnaire. As it is shown in Figures 3.1.1 and 3.1.2, the survey was correctly centered in Jordan and involved a sample made up of 59.9% students, 13.2% academics and 24.9% industry-related experts (total: 334 responses). The complete details about this survey are available online:

https://docs.google.com/forms/d/1ySC1w0lfHLfjAS2TQp-TA-n-n5ZtduNz2Wkysqi0MZE/edit#responses

Figure 3.1.1. Country distribution of participants to the RE survey.

Figure 3.1.2. Job distribution of participants to the RE survey.

The following sections provide an analysis of the answers provided by students, academics and companies, as the survey questions are different based on the job profile of the participants.

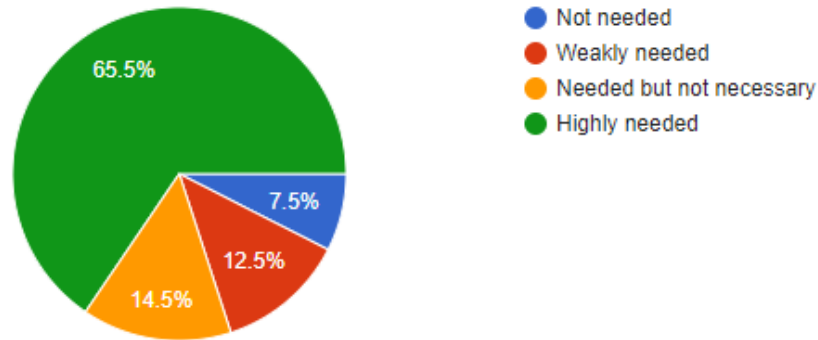### 3.1.1   Renewable Energy: Students

Figure 3.1.3. Relevance of RE topic as judged by students.

The results showcased in Figure 3.1.3 underline the perception by Jordanian students that renewable energy represents a suitable and interesting topic for undergraduate studies, with roughly two-thirds considering RE teaching as a "highly needed" subject. This demonstrates potentially high interest in the RE course foreseen within the IREEDER project.

3.1.2 Renewable Energy: Academic Staff

Figure 3.1.4, on the other hand, presents the preferences by professors teaching RE subjects in terms of learning methods. Roughly 36% of the interviewed professors taught or are currently teaching RE, with opinions including different learning methods, among them learning by practice. The usage of web platforms is only mentioned by a minority (2) of the 44 participants. Statistically, most of them prefer to use presentation slides for the delivery of the course while also believing that practice should be an integral part of the course. The participants also highlight the importance of having media material available in the form of audio and video.

In the case of prospective professors interested in the subject, the statistics are similar (see Fig. 3.1.5), but learning by practice seems to represent a more popular choice than with current staff members.
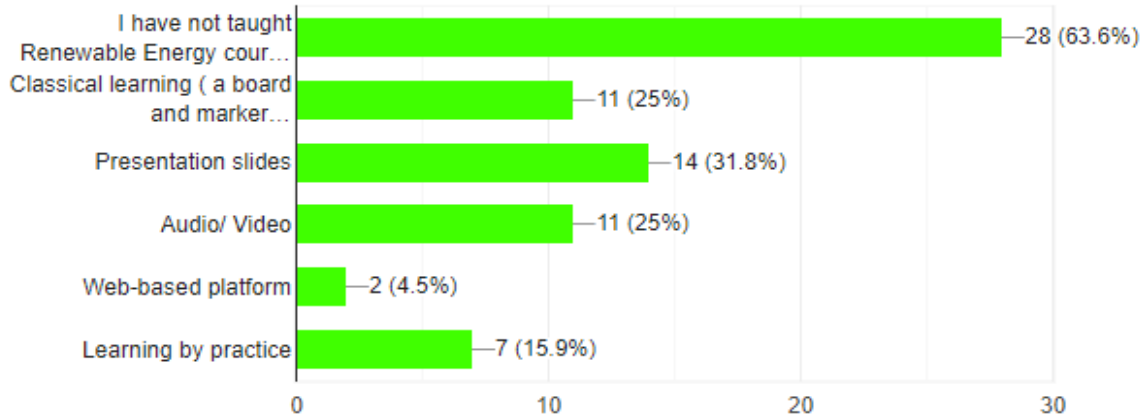
Figure 3.1.4. Different approaches to teaching RE by RE professors.
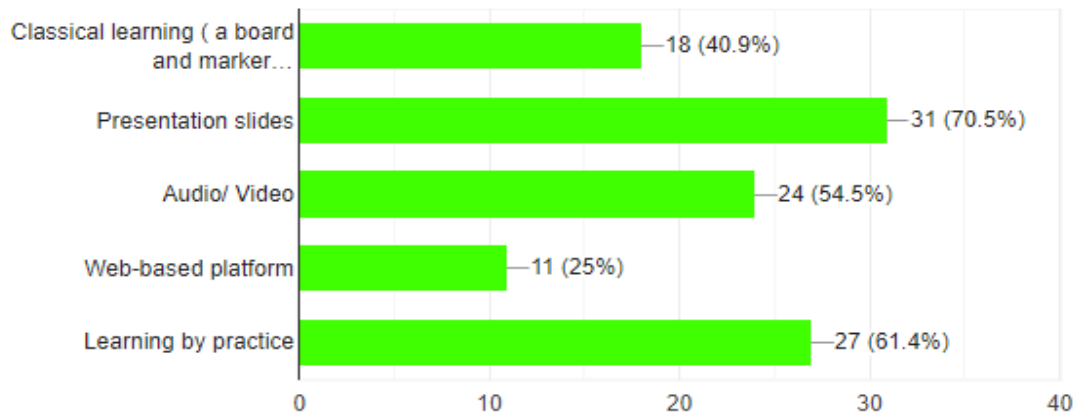
Figure 3.1.5. Different approaches to teaching RE by non-RE professors.

Very interesting considerations can be drawn based on the topics related to renewable energy to include in the B.Sc. degree (Figure 3.1.6) as well as the preferred laboratory equipment (Figure 3.1.7). The highest majority of interviewed professors suggests including solar and wind energy, as well as energy storage and smart grid concepts. Planning and costs are also considered extremely relevant. Regarding laboratory practice, most suggestions point to the usage of photovoltaic and wind training kits, as well as storage devices and simulators.

For additional details, please refer to Figures 3.1.6 and 3.1.7.

Which of the following topics should be included in an Renewable Energy course for undergraduate students ? Please check all apply

44 responses

Topic	Value
Solar energy	39 (88.6%)
Wind energy	36 (81.8%)
Biomass energy	24 (54.5%)
	28 (63.6%)
Costs and evaluation of the economical ...	24 (54.5%)
	25 (56.8%)
DC-based Renewable Systems (off-grid)	16 (36.4%)
	17 (38.6%)
Installation guidelines and installatio...	17 (38.6%)
	11 (25%)
Earthing arrangements and their implica...	9 (20.5%)
	20 (45.5%)
Energy Storage	30 (68.2%)
Smart Grid	27 (61.4%)
	15 (34.1%)
Modeling renewable energy sources	19 (43.2%)
	18 (40.9%)
Microgrids	16 (36.4%)
	14 (31.8%)
Power plants	19 (43.2%)

Figure 3.1.6. Teaching subjects to include into a RE course suggested by professors.
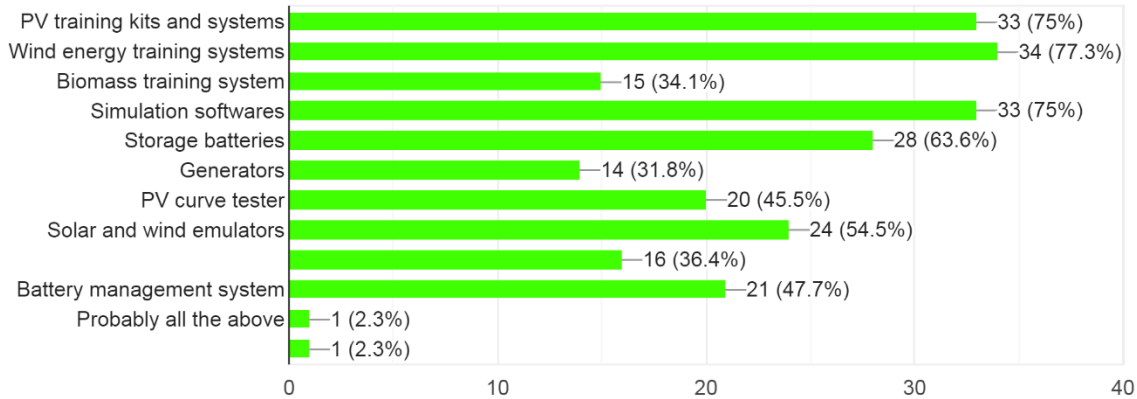
Figure 3.1.7. Laboratory equipment to include into a RE course suggested by professors.

3.1.3   Renewable Energy: Industry

Moving to the feedback received from companies and industry, the first questions were related to the relevance of renewable energy within their work and within a modern B.Sc. degree. In both cases, the feedback is unanimous in favor of introducing RE within the skills of B.Sc. graduates as well as professionals. The corresponding results are provided in Figures 3.1.8, 3.1.9 and 3.1.10.
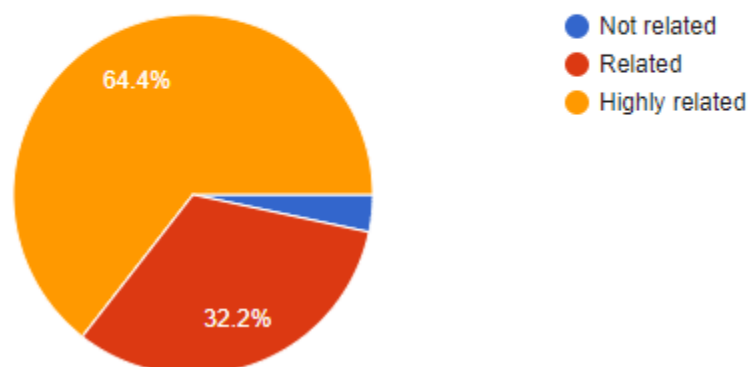

Figure 3.1.8. RE topic relevance within interviewed companies.

Do you believe that Renewable Energy should be taught in the undergraduate programs?
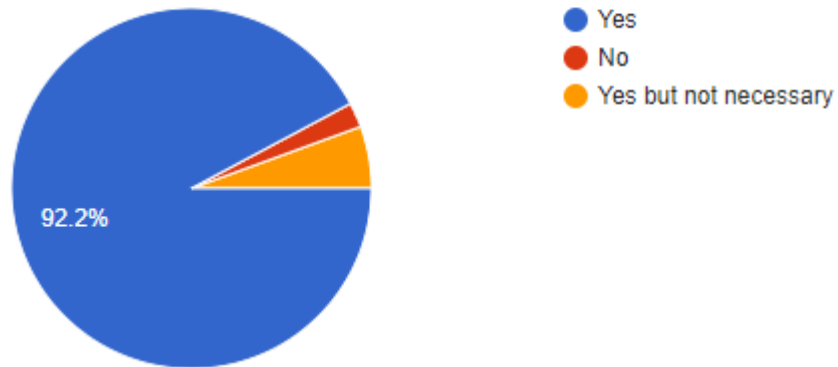
90 responses

Figure 3.1.9. RE topic relevance within B.Sc. studies as reported by companies.

To which extent do you think that Renewable Energy knowledge is required in the labor market ?

90 responses
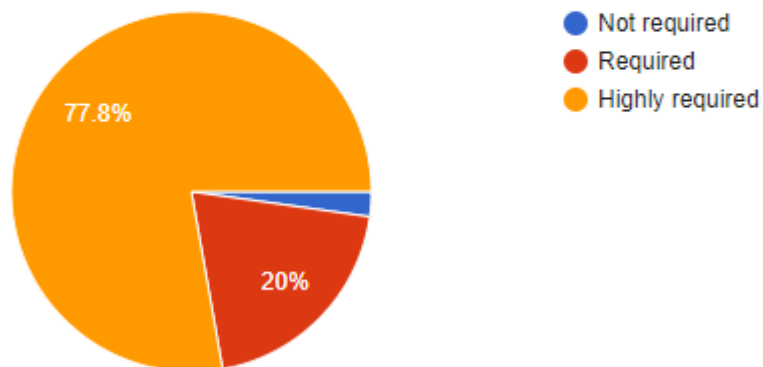
Figure 3.1.10. RE topic relevance within B.Sc. studies as reported by companies.

Participants to the surveys by companies and industry were also interviewed about the possible topics of interest and laboratory equipment to use within a RE course. The feedback is provided in Figures 3.1.11 and 3.1.12. Figure 3.1.11 demonstrates that industry feedback agrees with what was suggested by academics (see Fig. 3.1.6) in terms of considering extremely relevant the topics of solar and wind energy, storage, but shifting slightly more interest than academics to costs and installation processes.

Which of the following topics should be included in an Renewable Energy course for undergraduate students ? Please check all apply

90 responses

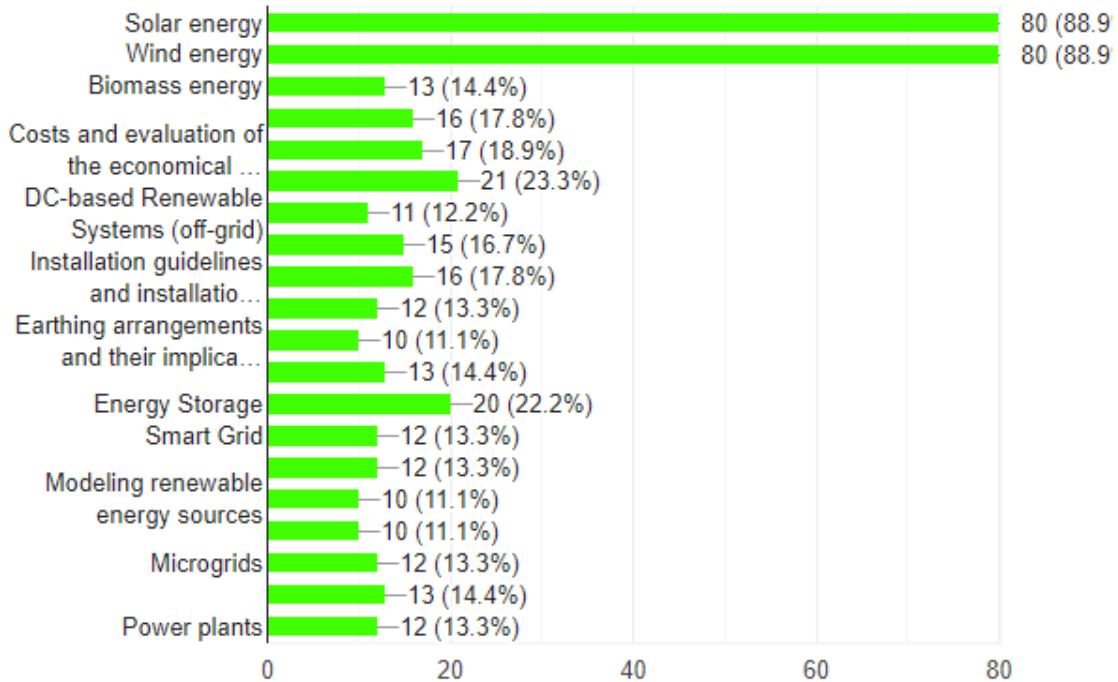| Topic	Responses
Solar energy	80 (88.9
Wind energy	80 (88.9
Biomass energy	13 (14.4%)
	16 (17.8%)
Costs and evaluation of the economical ...	17 (18.9%)
	21 (23.3%)
DC-based Renewable Systems (off-grid)	11 (12.2%)
	15 (16.7%)
Installation guidelines and installatio...	16 (17.8%)
	12 (13.3%)
Earthing arrangements and their implica...	10 (11.1%)
	13 (14.4%)
Energy Storage	20 (22.2%)
Smart Grid	12 (13.3%)
	12 (13.3%)
Modeling renewable energy sources	10 (11.1%)
	10 (11.1%)
Microgrids	12 (13.3%)
	13 (14.4%)
Power plants	12 (13.3%)

Figure 3.1.11. Teaching subjects to include into a RE course suggested by professionals.

The answers about the laboratory equipment seem to be more distributed among the different options, favoring training kits but also management systems and actual devices (batteries, testers, generators).

Which of the following equipment are required for a Renewable Energy laboratory ?
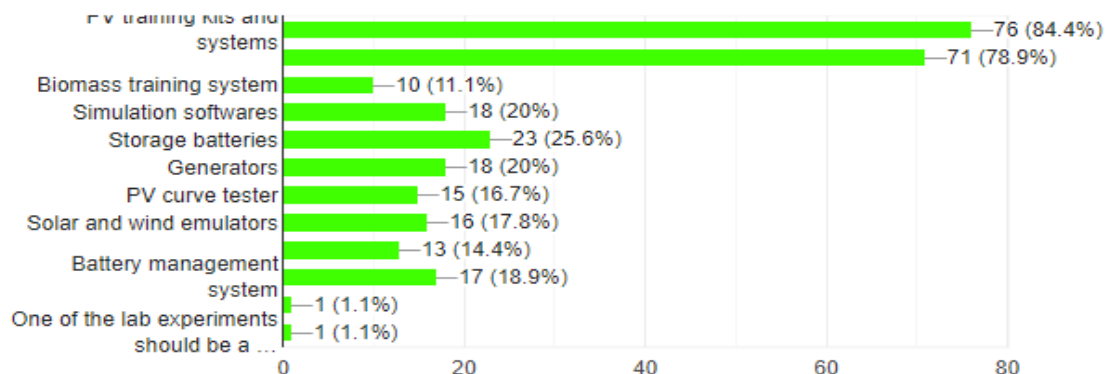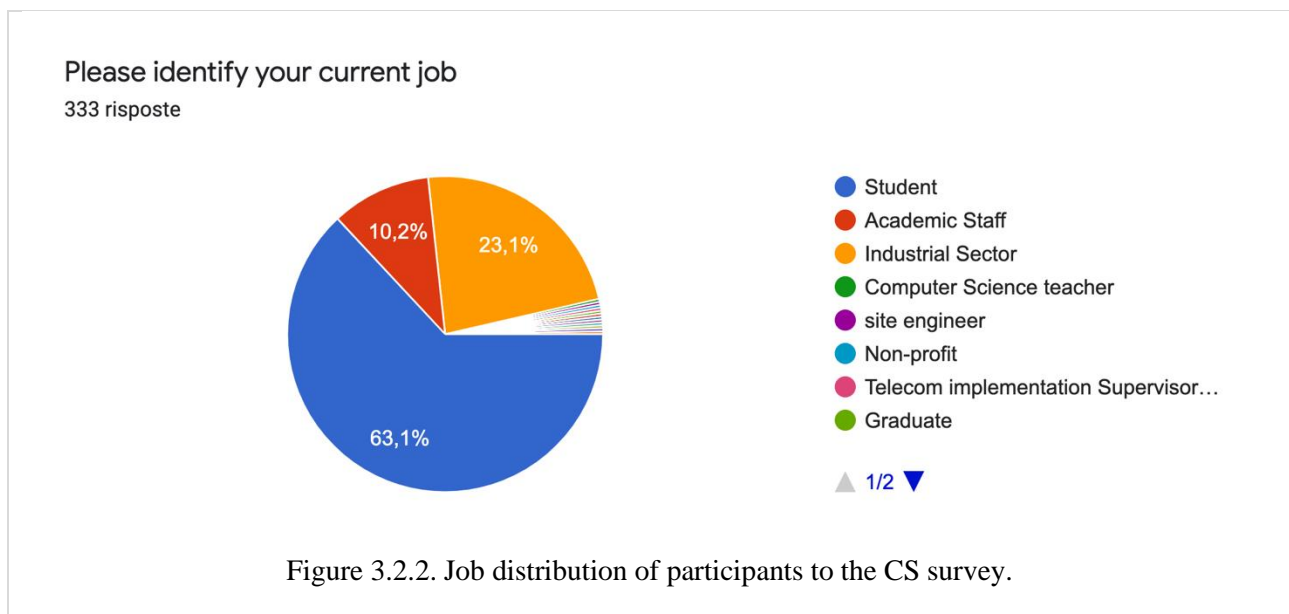
90 responses

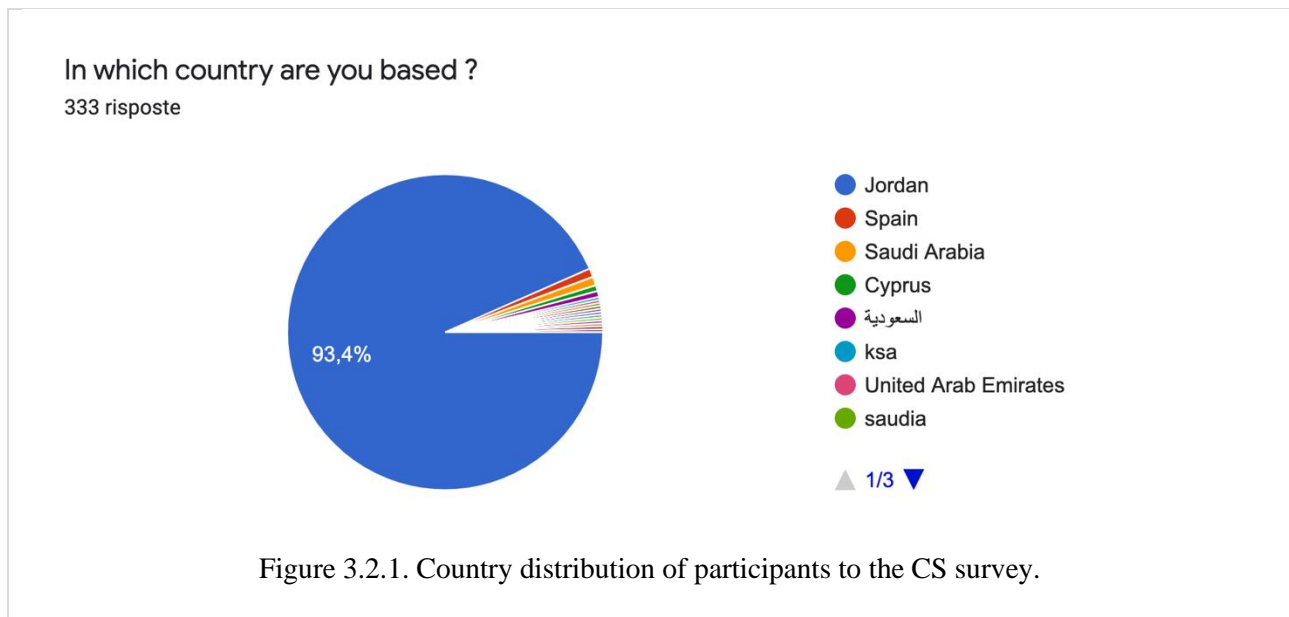| Equipment	Responses
PV training kits and systems	76 (84.4%)
	71 (78.9%)
Biomass training system	10 (11.1%)
Simulation softwares	18 (20%)
Storage batteries	23 (25.6%)
Generators	18 (20%)
PV curve tester	15 (16.7%)
Solar and wind emulators	16 (17.8%)
	13 (14.4%)
Battery management system	17 (18.9%)
One of the lab experiments should be a ...	1 (1.1%)
	1 (1.1%)

Figure 3.1.12. Laboratory equipment to include into a RE course suggested by professionals.

3.2   Cyber Security

The following questions are used to understand the statistical distribution related to the people that answered the Cyber Security (CS) questionnaire. As it is shown in Figures 3.2.1 and 3.2.2, the survey was correctly centered in Jordan and involved 63% students, 10% academics and 27% experts from industry (total: 333 responses). The complete details 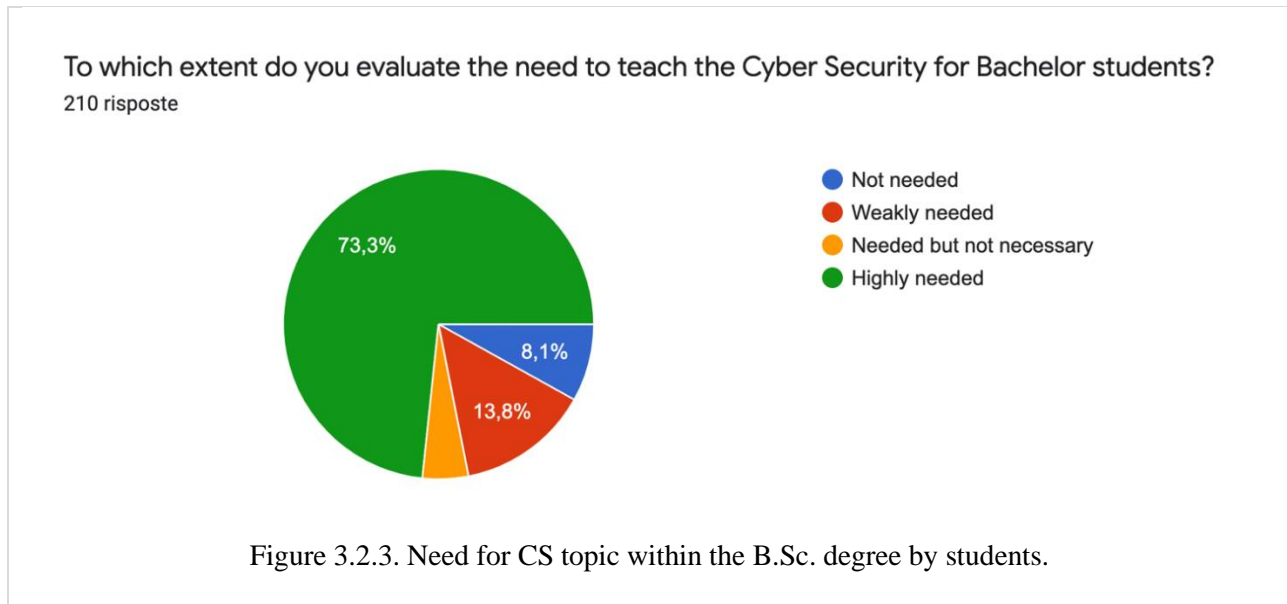about this survey are available online: https://docs.google.com/forms/d/1BUQKHuXBLHsGQHdcxUoIDdxi6-WfoGBZkx_EUGcf5Bo/edit#responses

Figure 3.2.1. Country distribution of participants to the CS survey.

Figure 3.2.2. Job distribution of participants to the CS survey.

The following sections provide an analysis of the answers provided by students, academics and companies, as the survey questions are different based on the job profile of the participants.

3.2.1 Cybersecurity: Students

Figure 3.2.3 underlines that the perception by Jordanian students is that cybersecurity represents a suitable and interesting topic for undergraduate studies. This demonstrates a potential high interest in the CS course foreseen within the IREEDER project.

To which extent do you evaluate the need to teach the Cyber Security for Bachelor students?
210 risposte

- Not needed
- Weakly needed
- Needed but not necessary
- Highly needed

73,3%

8,1%

13,8%

Figure 3.2.3. Need for CS topic within the B.Sc. degree by students.

3.2.2 Cybersecurity: Academic Staff

Figure 3.2.4, on the other hand, provides the preferences by professors teaching CS subjects in terms of learning methods. Roughly 26% of the interviewed professors taught or are currently teaching CS, and indicate a wide selection of learning methods options, such as presentation slides, audio/video, including also learning by practice. The usage of web platforms is mentioned by a minority of the participants.

In the case of prospective professors interested in the subject, the statistics are similar (see Fig. 3.2.5), with the main difference being that but learning by practice seems to be he preferred method.

Moreover, academics strongly believe that cybersecurity represents a suitable subject to open more career opportunities for graduates (see Fig. 3.2.6).

If you teach (or have taught) a Cyber Security course, which learning methods do you use ? Please check all apply

34 risposte

I have not taught Cyber Security course — 25 (73,5%)

— 4 (11,8%)

Presentation slides — 8 (23,5%)

Audio/ Video — 6 (17,6%)

Web-based platform — 2 (5,9%)

Learning by practice — 6 (17,6%)

Presentation slides + Learning by pract... — 1 (2,9%)
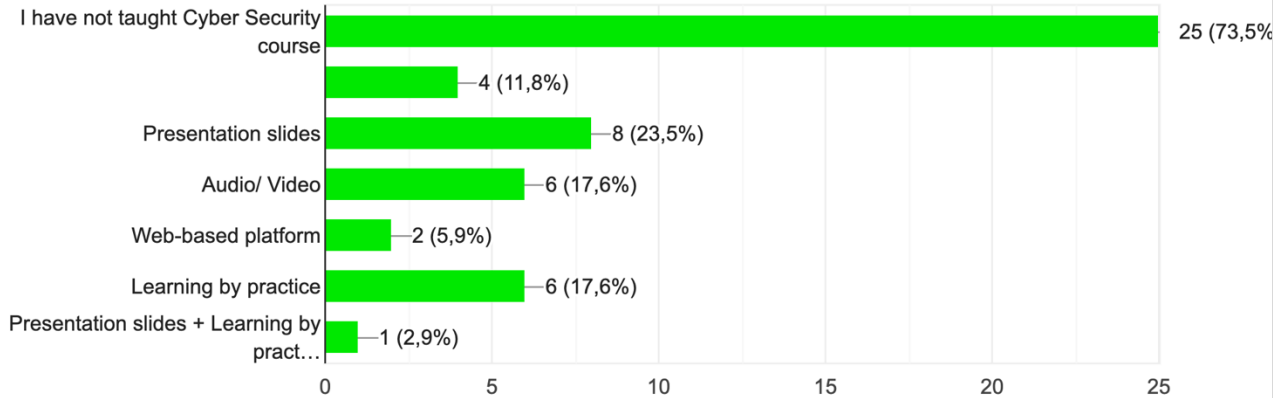
0   5   10   15   20   25

Figure 3.2.4. Learning methods for CS by CS professors.

If you have not ever taught a Cyber Security course, which learning methods do you recommend to teach Cyber Security ? Please check all apply

34 risposte

Classical learning (a board and marker... — 11 (32,4%)

Presentation slides — 20 (58,8%)

Audio/ Video — 11 (32,4%)

Web-based platform — 14 (41,2%)

Learning by practice — 24 (70,6%)

none — 1 (2,9%)

I already taught it, and I think all me... — 1 (2,9%)
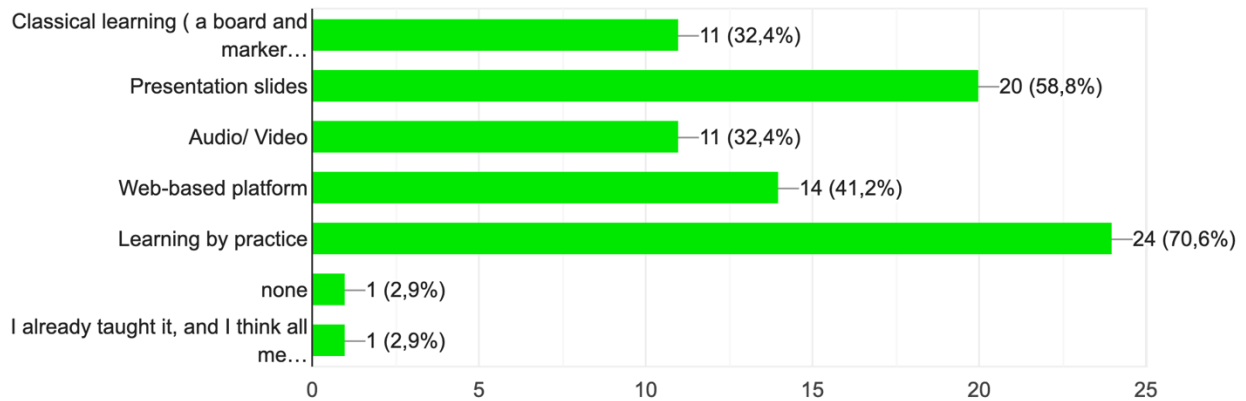
0   5   10   15   20   25

Figure 3.2.5. Learning methods for CS by non-CS professors.

Do you believe that Cyber Security knowledge will open up more career opportunities for fresh graduate students?

34 risposte

- No
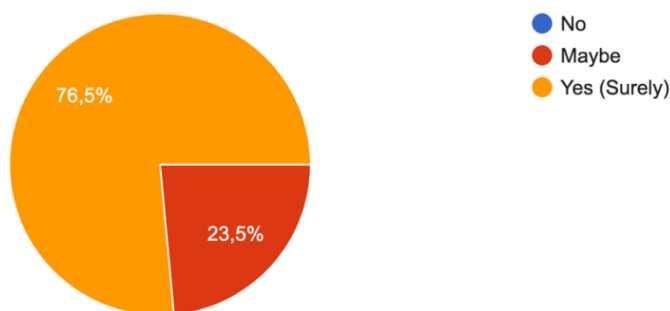- Maybe
- Yes (Surely)

76,5%

23,5%

Figure 3.2.6. Benefits of CS knowledge by academics.

Useful considerations can be drawn based on the topics to include related to cybersecurity within the B.Sc. degree (Figure 3.2.7) as well as the preferred laboratory equipment (Figure 3.2.8). The highest majority of interviewed professors suggests including fundamentals of CS as well as security breaches and prevention techniques. Regarding laboratory practice, most suggestions point to the usage of emulators or simulators to provide hands-on experience on intrusion detection, potential attacks or malware. For additional details, please refer to Figures 3.2.7 and 3.2.8.

Which of the following topics should be included in an Cyber Security course for undergraduate students ? Please check all apply
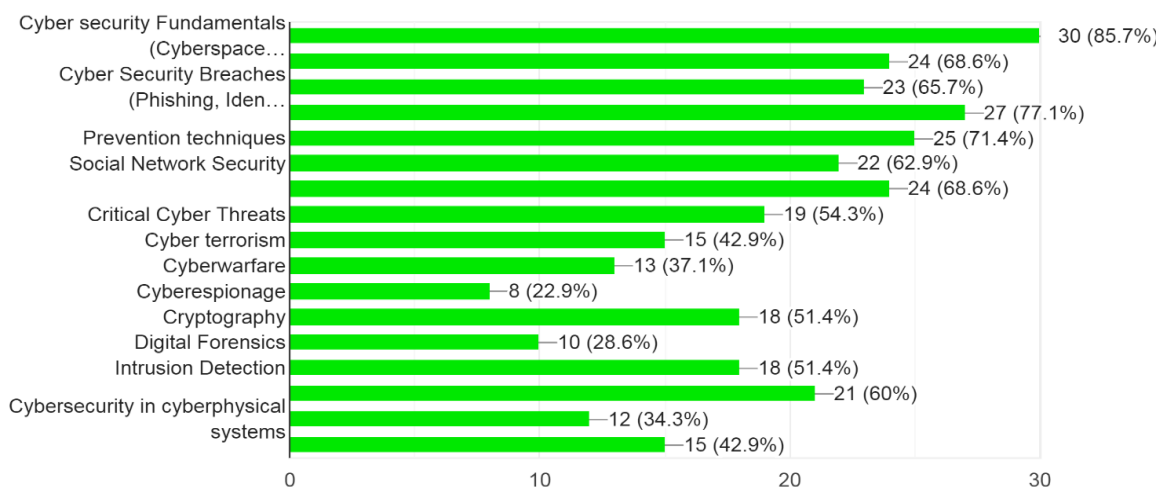
35 responses

Topic	Value
Cyber security Fundamentals (Cyberspace...	30 (85.7%)
	24 (68.6%)
Cyber Security Breaches (Phishing, Iden...	23 (65.7%)
	27 (77.1%)
Prevention techniques	25 (71.4%)
Social Network Security	22 (62.9%)
	24 (68.6%)
Critical Cyber Threats	19 (54.3%)
Cyber terrorism	15 (42.9%)
Cyberwarfare	13 (37.1%)
Cyberespionage	8 (22.9%)
Cryptography	18 (51.4%)
Digital Forensics	10 (28.6%)
Intrusion Detection	18 (51.4%)
	21 (60%)
Cybersecurity in cyberphysical systems	12 (34.3%)
	15 (42.9%)

Figure 3.2.7. Preferred teaching subjects in CS by academics.

Which of the following hardware/software is required for a Cyber Security laboratory ?
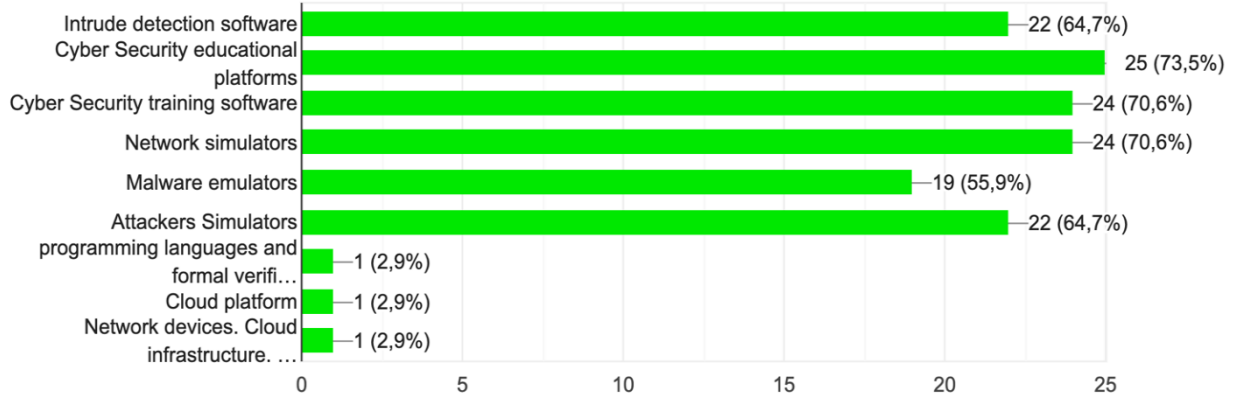
34 risposte

Figure 3.2.8. Suggested CS laboratory equipment by academics.

3.2.3 Cybersecurity: Industry

Moving to the responses received from companies and industry, the feedback is almost unanimous in favor of introducing CS within the skills of B.Sc. graduates in order to make them more competitive in the job market. The corresponding results are provided in Figure 3.2.9.

Do you believe that Cyber Security knowledge will open up more career opportunities for fresh graduate students?
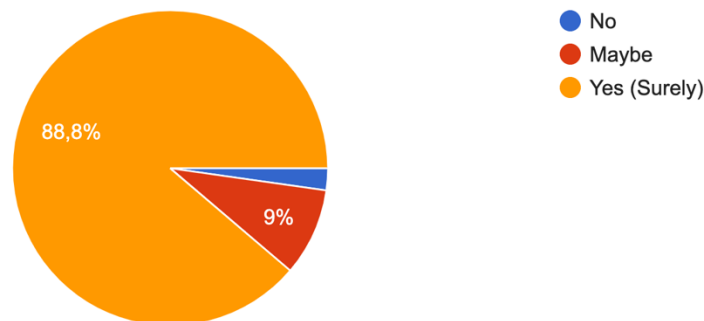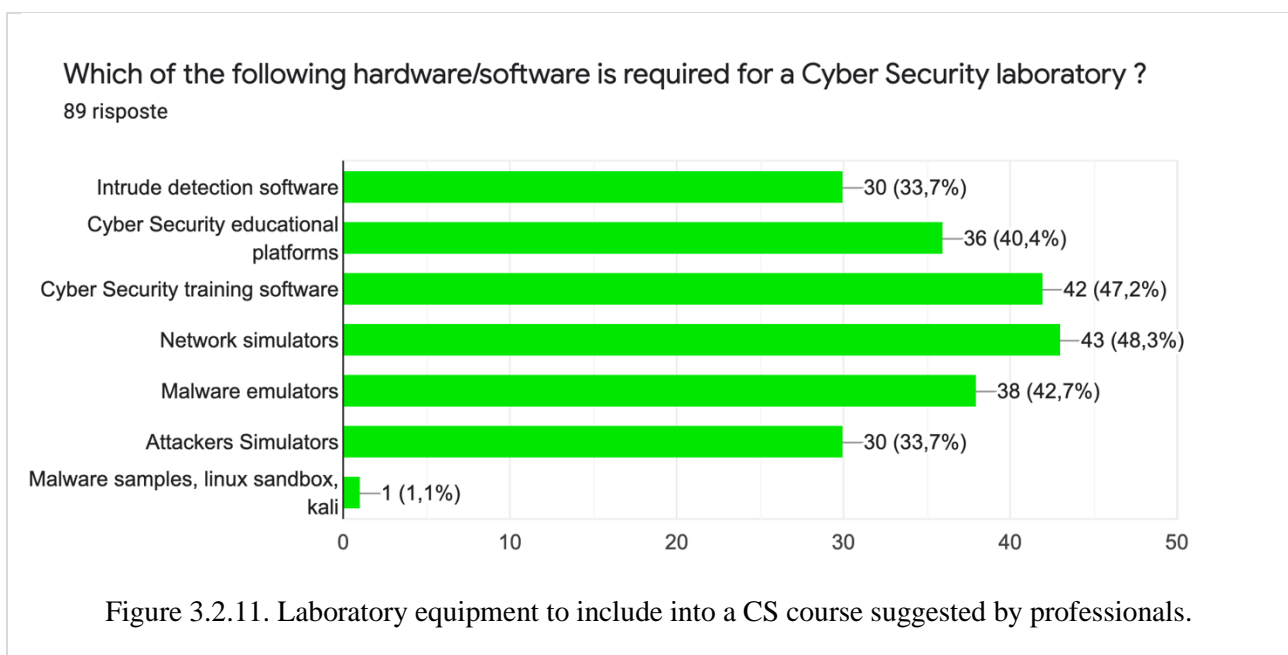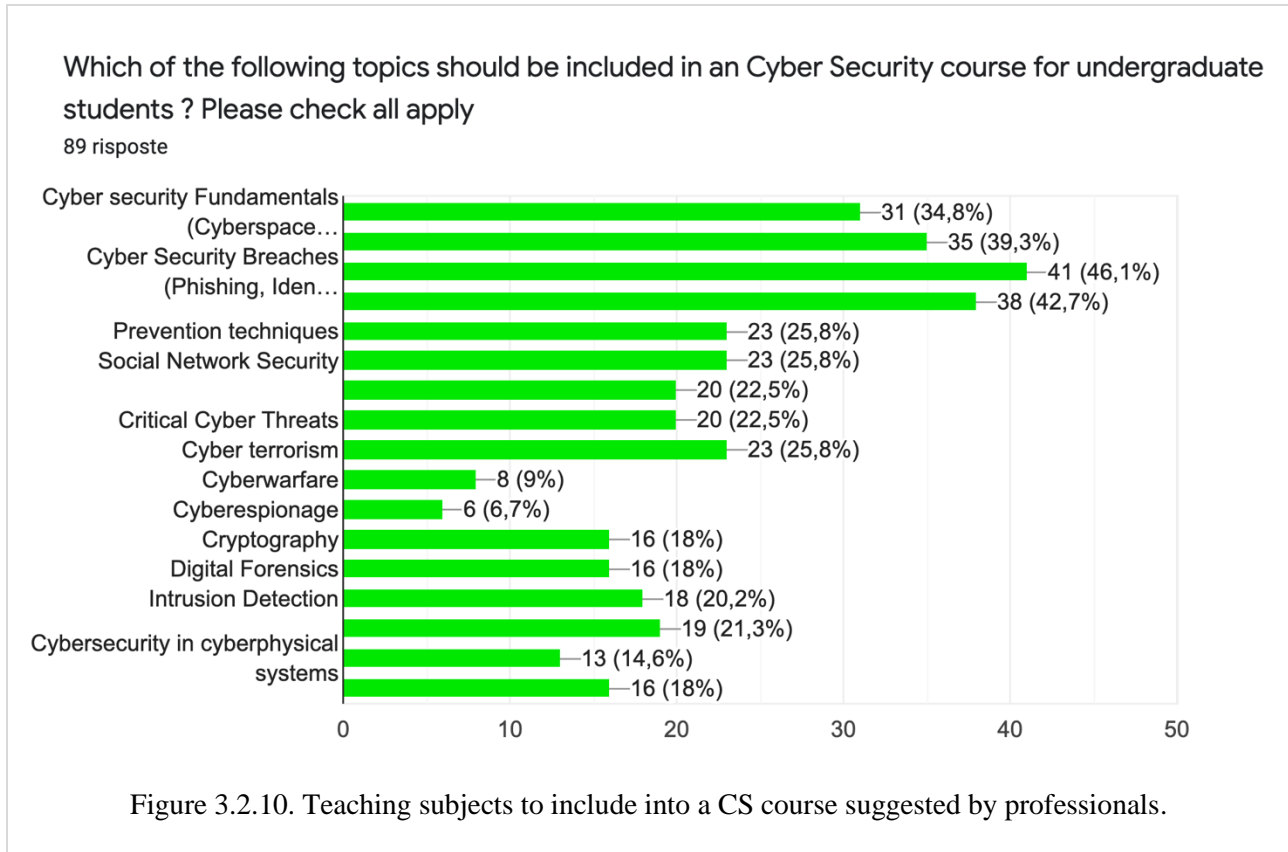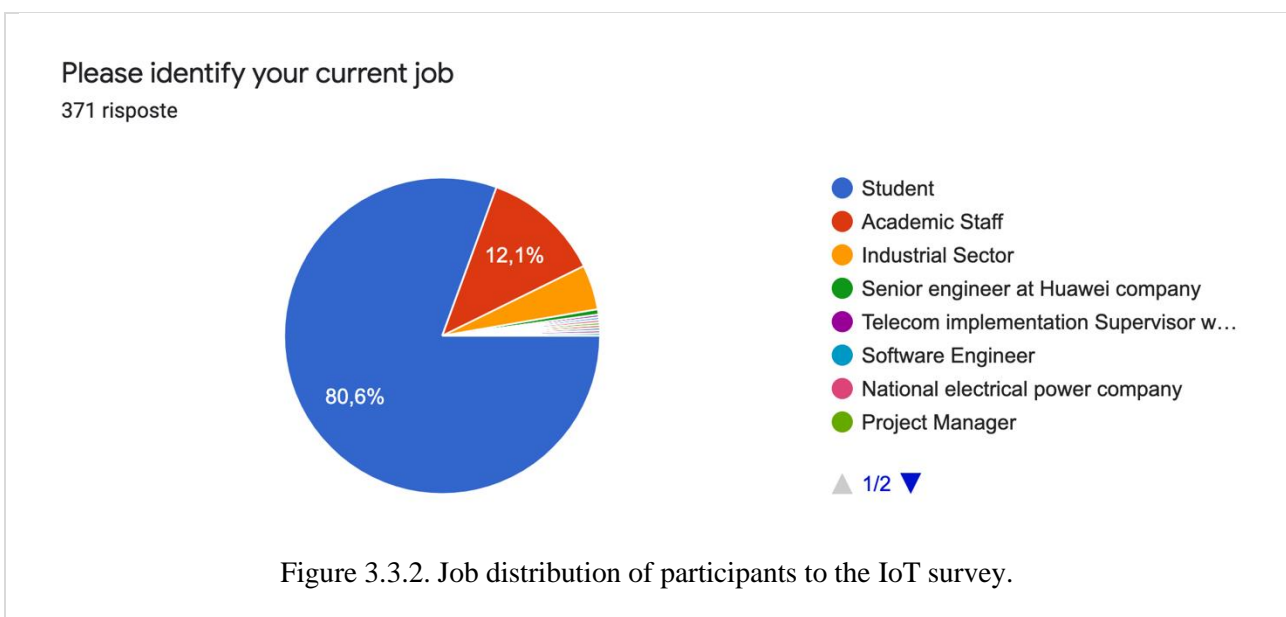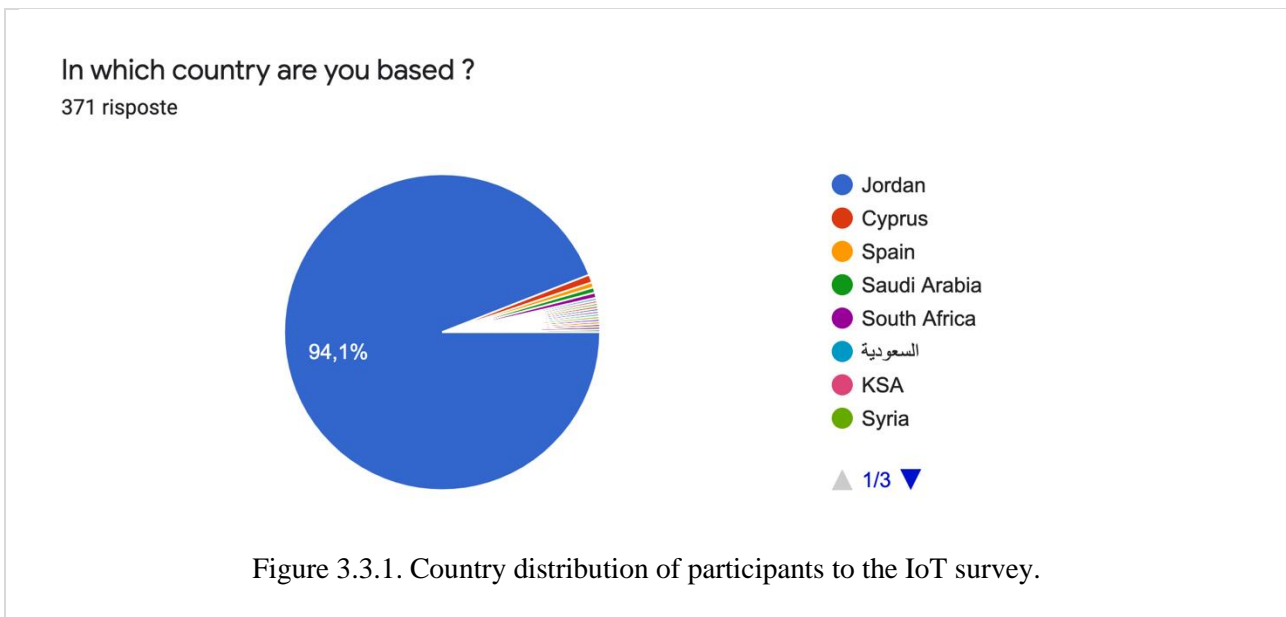
89 risposte

Figure 3.2.9. Relevance of CS for the students' career by professionals.

The next figures (Fig. 3.2.10 and Fig. 3.2.11) illustrate the received feedback by professionals about the topics to include in a cybersecurity course as well as the material to use for hands-on laboratory activities. Overall, the results agree with indications provided by academics (see Fig. 3.2.7 and 3.2.8).

Figure 3.2.10. Teaching subjects to include into a CS course suggested by professionals.

Figure 3.2.11. Laboratory equipment to include into a CS course suggested by professionals.
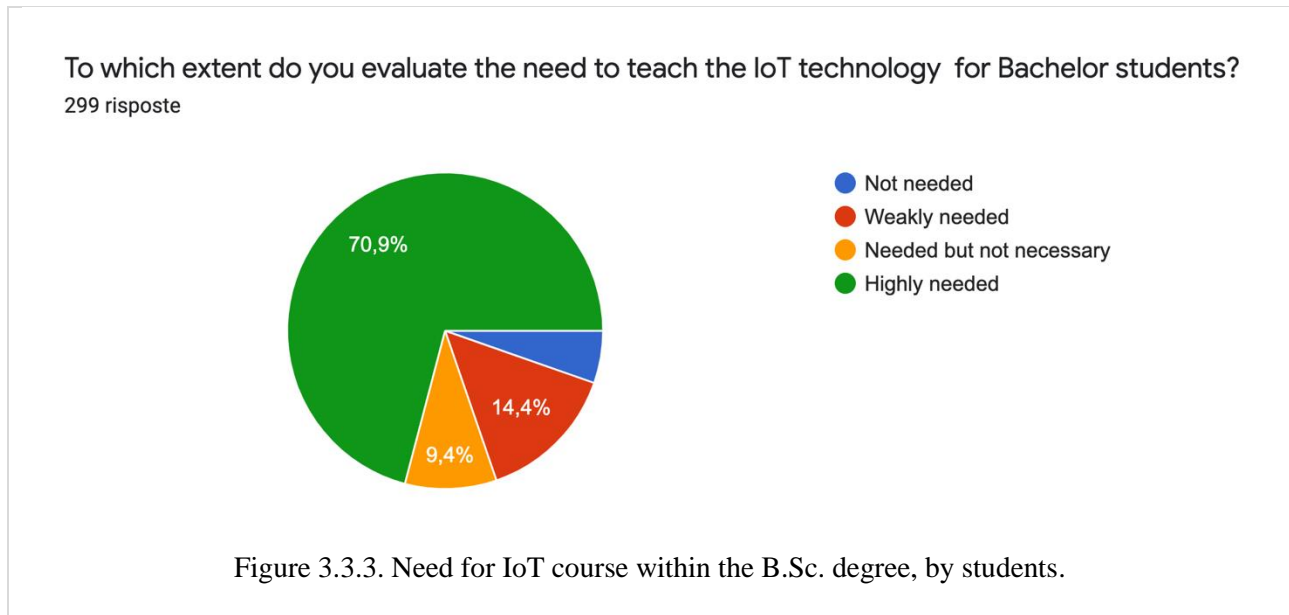
3.3   Internet of Things

The following questions are used to understand the statistical distribution related to the respondents of the Internet of Things (IoT) questionnaire. As it is shown in Figures 3.3.1 and 3.3.2, the survey was correctly centered in Jordan and involved 81% students, 12% academics and 7% experts from industry (total: 371 responses). The complete details about this survey are available online: https://docs.google.com/forms/d/1dW0HFZX4mIBFAAiJZyKzEflFn6_WvVZgfRmFgymX8_8/edit#responses

Figure 3.3.1. Country distribution of participants to the IoT survey.

Figure 3.3.2. Job distribution of participants to the IoT survey.

The following sections provide an analysis of the answers provided by students, academics and companies, as the survey questions are different based on the job profile of the participants.

3.2.1 Internet of Things: Students

Figure 3.3.3 underlines that the perception by Jordanian students is that Internet of Things represents a suitable and interesting topic for undergraduate studies. This demonstrates a potential high interest in the IoT course foreseen within the IREEDER project.

To which extent do you evaluate the need to teach the IoT technology for Bachelor students?
299 risposte

- Not needed
- Weakly needed
- Needed but not necessary
- Highly needed

70,9%
14,4%
9,4%

Figure 3.3.3. Need for IoT course within the B.Sc. degree, by students.

3.2.2 Internet of Things: Academic Staff

Figure 3.3.4 identifies the preferences by professors teaching IoT subjects in terms of learning methods. Roughly 24% of the interviewed professors taught or are currently teaching IoT; there is a wide distribution on the preferred learning methods, including also learning by practice. The usage of web platforms or audio/video records the lowest number of answers.

In the case of perspective professors interested in the subject, the statistics are similar (see Fig. 3.3.5), but learning by practice seems to be preferred, followed closely by presentation slides.

If you teach (or have taught) an IoT course, which learning methods do you use ?
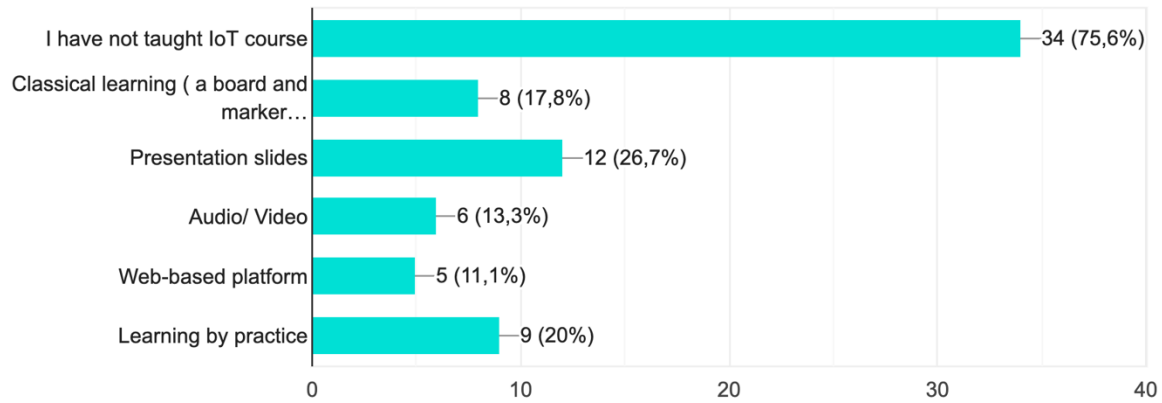
45 risposte

Method	Value
I have not taught IoT course	34 (75,6%)
Classical learning (a board and marker…	8 (17,8%)
Presentation slides	12 (26,7%)
Audio/ Video	6 (13,3%)
Web-based platform	5 (11,1%)
Learning by practice	9 (20%)

Figure 3.3.4. Preferred learning methods for IoT course by IoT professors.

If you have not ever taught an IoT course, which learning methods do you recommend to teach IoT ?

45 risposte

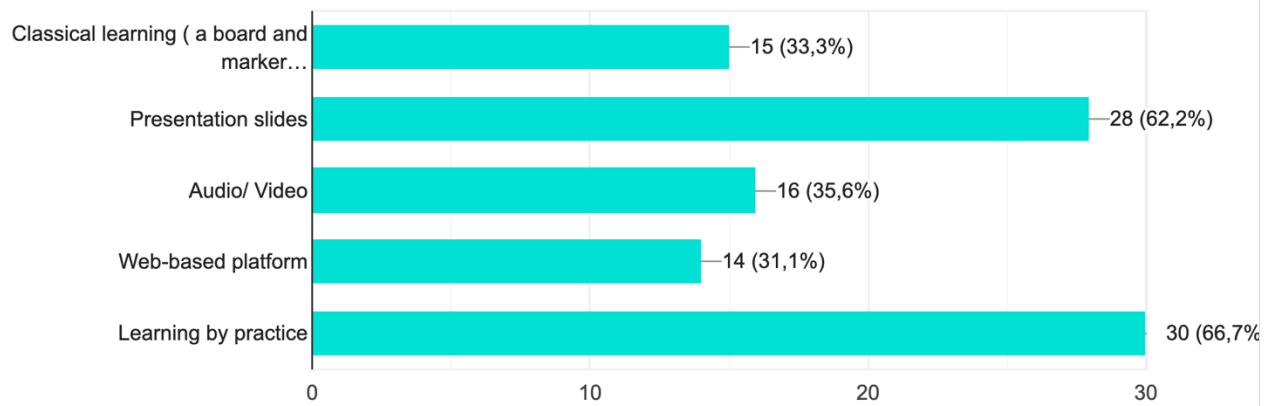| Method	Value
Classical learning (a board and marker…	15 (33,3%)
Presentation slides	28 (62,2%)
Audio/ Video	16 (35,6%)
Web-based platform	14 (31,1%)
Learning by practice	30 (66,7%)

Figure 3.3.5. Suggested learning methods for IoT course by non-IoT professors.

The next figures describe the topics related to IoT that should be included within the B.Sc. degree (Figure 3.3.6) as well as the preferred laboratory equipment (Figure 3.3.7). The highest majority of interviewed professors suggests to address the subject including devices (sensors, actuators), architectures and applications, providing a broad vision of the world of IoT. Regarding laboratory practice, most suggestions point to the usage of training kits, emulators or simulators, i.e. actual devices to provide hands-on experience.

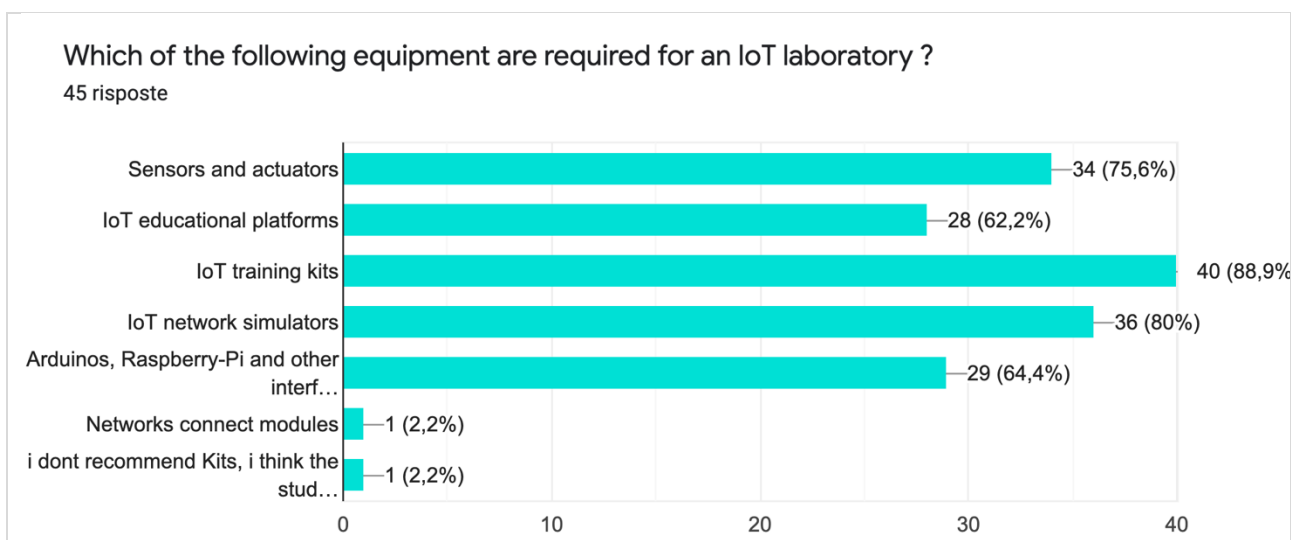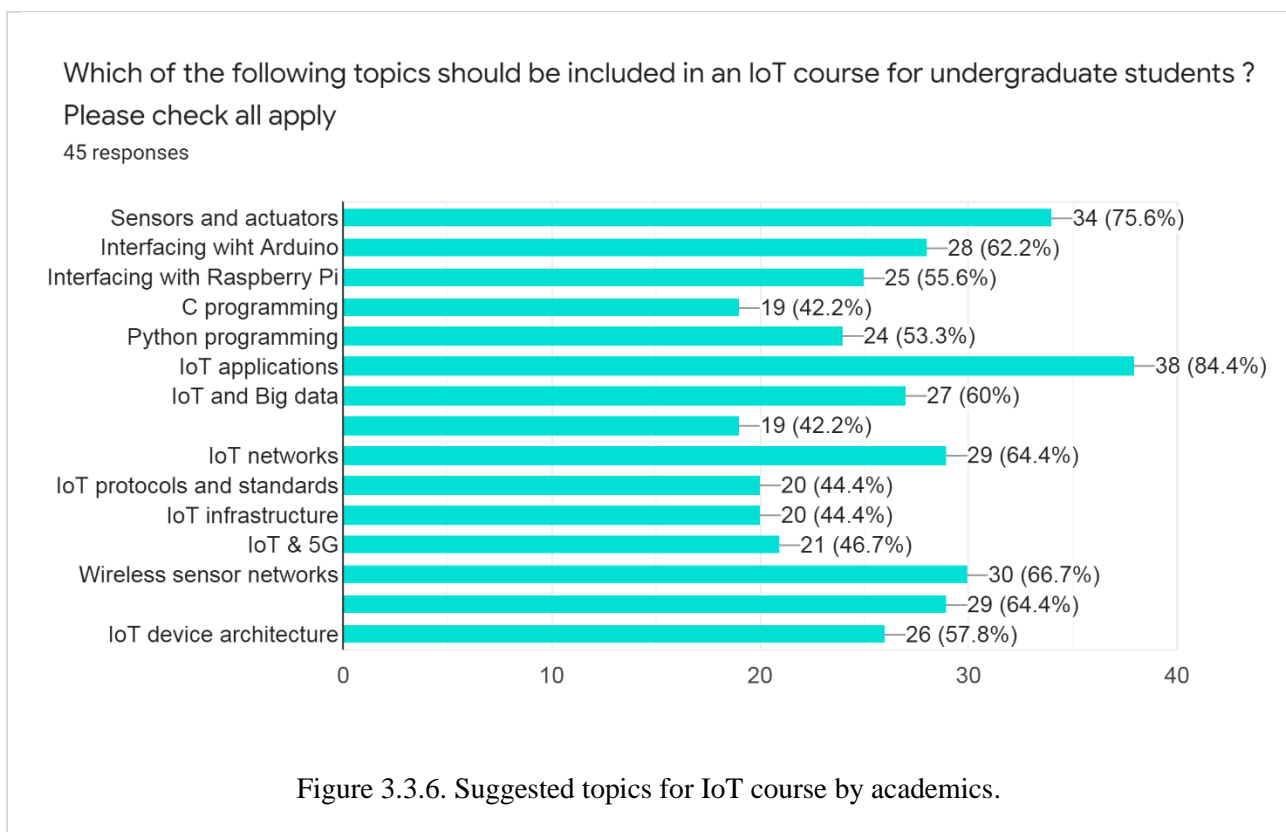For additional details, please refer to Figures 3.3.6 and 3.3.7.

Figure 3.3.6. Suggested topics for IoT course by academics.

Figure 3.3.7. Suggested material for IoT laboratories by academics.

3.2.3   Internet of Things: Industry

On the industry side, the wide consensus on the fact that IoT can open more career opportunities is demonstrated by Figure 3.3.8.

The following figures describe the topics related to IoT to be included within the B.Sc. degree (Figure 3.3.9) as well as the preferred laboratory equipment (Figure 3.3.10). Results are similar to the previous case (Fig. 3.3.6), but industrial participants underline the relevance of Python programming and interaction between IoT and 5G. Regarding laboratory practice, most suggestions point again to training kits, emulators or simulators, and actual devices.

For additional details, please refer to Figures 3.3.9 and 3.3.10.

Do you believe that IoT knowledge will open up more career opportunities for fresh graduate students?

27 risposte
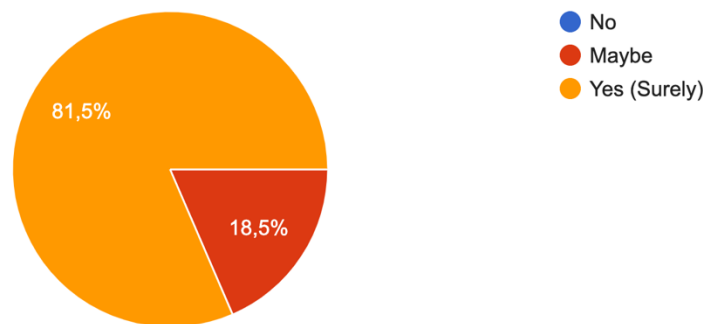
- No
- Maybe
- Yes (Surely)

81,5%

18,5%

Figure 3.3.8. Job perspectives for IoT knowledge in B.Sc. degree by industry.

Which of the following topics should be included in an IoT course for undergraduate students ?
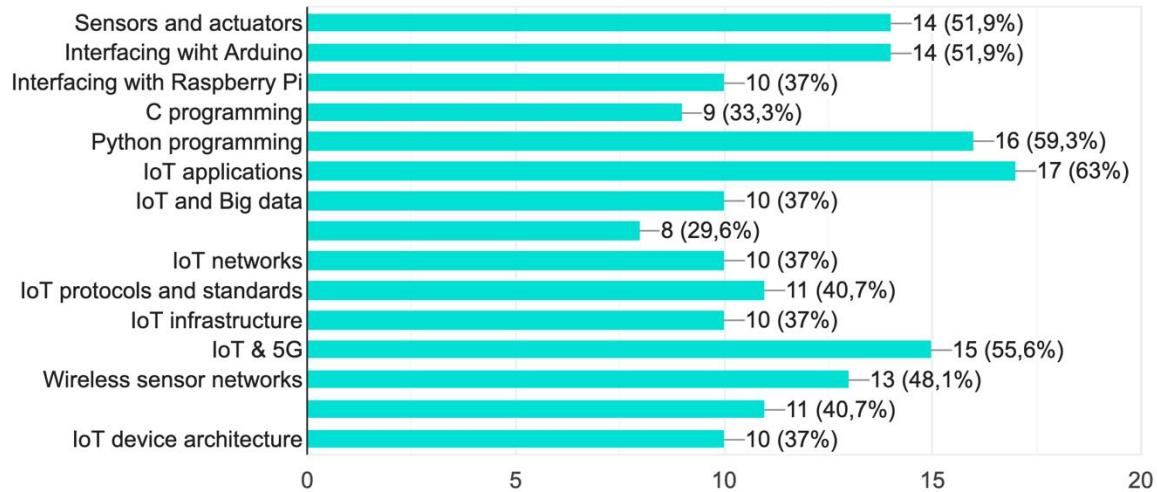### Please check all apply
27 risposte

Topic	Value
Sensors and actuators	14 (51,9%)
Interfacing wiht Arduino	14 (51,9%)
Interfacing with Raspberry Pi	10 (37%)
C programming	9 (33,3%)
Python programming	16 (59,3%)
IoT applications	17 (63%)
IoT and Big data	10 (37%)
	8 (29,6%)
IoT networks	10 (37%)
IoT protocols and standards	11 (40,7%)
IoT infrastructure	10 (37%)
IoT & 5G	15 (55,6%)
Wireless sensor networks	13 (48,1%)
	11 (40,7%)
IoT device architecture	10 (37%)

Figure 3.3.9. Suggested topics for IoT course by industry.

Which of the following equipment are required for an IoT laboratory ?
27 risposte

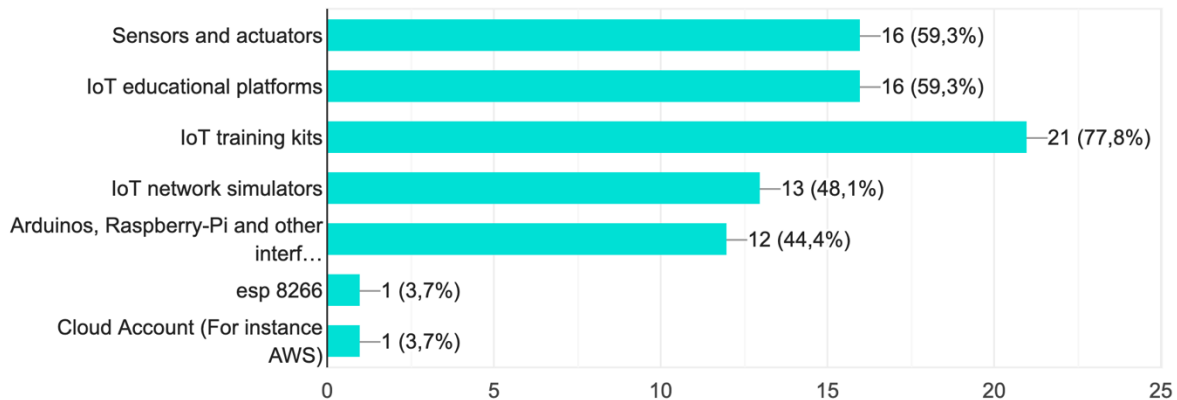| Equipment	Value
Sensors and actuators	16 (59,3%)
IoT educational platforms	16 (59,3%)
IoT training kits	21 (77,8%)
IoT network simulators	13 (48,1%)
Arduinos, Raspberry-Pi and other interf…	12 (44,4%)
esp 8266	1 (3,7%)
Cloud Account (For instance AWS)	1 (3,7%)

Figure 3.3.10. Suggested materials for IoT laboratories by industry.

4. CONCLUSIONS

This deliverable describes the teaching and training needs for IoT, CS and RE, and it is elaborated based on a questionnaire distributed among all IREEDER partners, other stakeholders such as universities, students, trainees, private companies, and public administration. The surveys were completed by around one thousand participants.

Overall, all participants – of all professional fields - undoubtedly underlined the need for the courses proposed by IREEDER. Moreover, they provide some suggestions on the topics to cover in the courses as well as the material to use for developing the corresponding laboratories.

This input will be provided to WP2 and WP3 of the project to be analyzed and filtered by the experts within the IREEDER Consortium in order to define the contents of the courses and their implementation.

Below are the most important findings of this survey which will be used as guidelines when forming the teaching materials in WP2 and the selection of the laboratory equipment in WP3:

- All interviewees believe that the selected topics (RE, CS and IoT) are very important for undergraduate studies in Electrical and Electronic Engineering and that the students' attendance of courses on such topics will increase their employability and boost their professional career.
- Statistically, a majority of academics believe that presentation slides are the most appropriate method for the delivery of the courses while also considering that practice should be an integral part of each course. They also highlight the importance of having material available in the form of media (audio, video).
- With regards to **Renewable energy (RE)** academics believe that this course should include solar and wind energy, as well as energy storage and smart grid concepts as well as operation and control issues like planning and costs. Regarding the laboratory practice of this course, most suggestions point to the usage of photovoltaic and wind training kits, as well as storage devices and simulators. This is in line with the opinion of the interviewees from industry who have have indicated the same topics as being the most important in the course and also have favored training kits for the laboratory sessions although simulators and actual equipment can also be used.
- With regards to **Cybersecurity (CS)** most professors believe that it is more appropriate for this bachelor's degree course to including the fundamentals of CS as well as security breaches and prevention techniques. Regarding laboratory practice, most suggestions point to the usage of emulators or simulators to provide hands-on experience on intrusion detection, potential attacks or malware although various other options are considered as being of equal importance. This is also in agreement with the option of the industry professionals.
- With regards to **Internet of Things (IoT)** professors suggest that it is more important to include topics that have to do with IoT devices like sensors, actuators etc., IoT architectures and protocols, IoT applications, the relevant networks that facilitate IoT as well as providing a broad vision of the world of IoT. Regarding the laboratory practice, most suggestions point to the usage of training kits, emulators or simulators, actual devices to provide hands-on experience. The importance of programing skills is also highlighted but his could be part of another pre-requisite course.
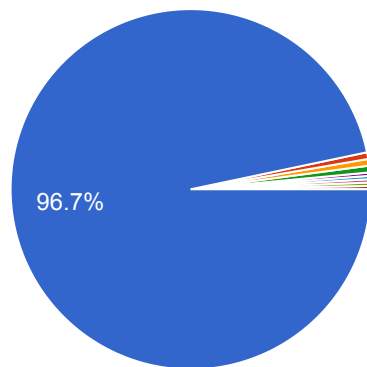
ANNEXES (complete surveys)

iREDDER

A Questionnaire for Teaching and Training Needs in Renewable Energy

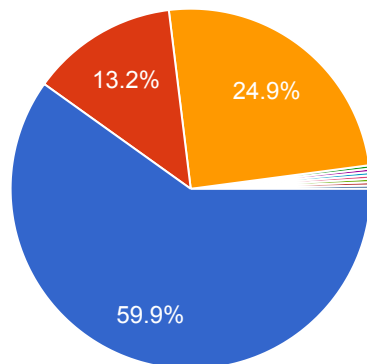334 responses

---

In which country are you based ?

334 responses

- Jordan
- Cyprus
- Spain
- Greece
- Saudi Arabia
- Project Manager
- الإمارات
- palestine
- KSA

96.7%

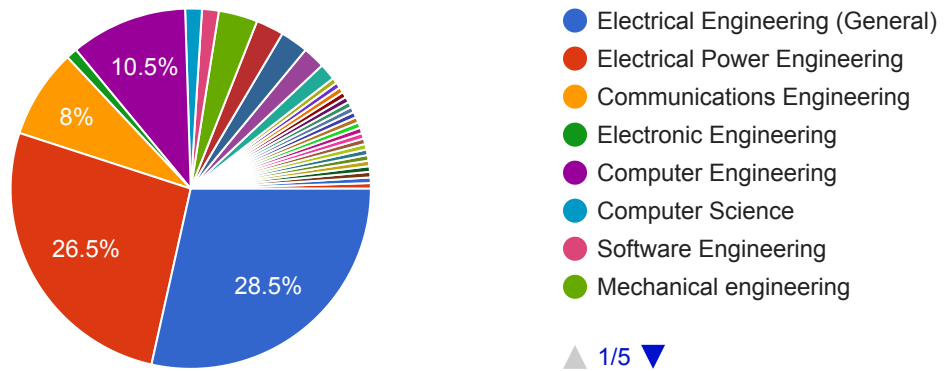---

Please identify your current job

334 responses

- Student
- Academic Staff
- Industrial Sector
- Maintenance sector
- Project manager
- Mechanical engineer -. Autom…
- Telecom implementation Sup…
- automotive engineer

13.2%

24.9%

59.9%

▲ 1/2 ▼

For Students

What is your major field (BSc degree)?

200 responses

- Electrical Engineering (General)
- Electrical Power Engineering
- Communications Engineering
- Electronic Engineering
- Computer Engineering
- Computer Science
- Software Engineering
- Mechanical engineering

▲ 1/5 ▼

28.5%
26.5%
8%
10.5%

Have you enrolled in Renewable Energy course in your university degree ?

200 responses

- Yes
- No

74.5%
25.5%
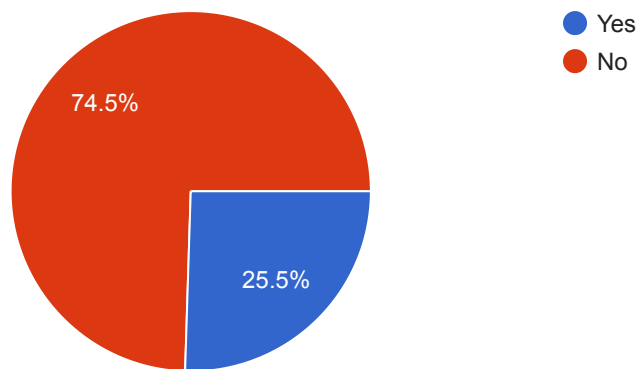
To which extent do you evaluate your knowledge in the fundamentals of Renewable Energy?

200 responses
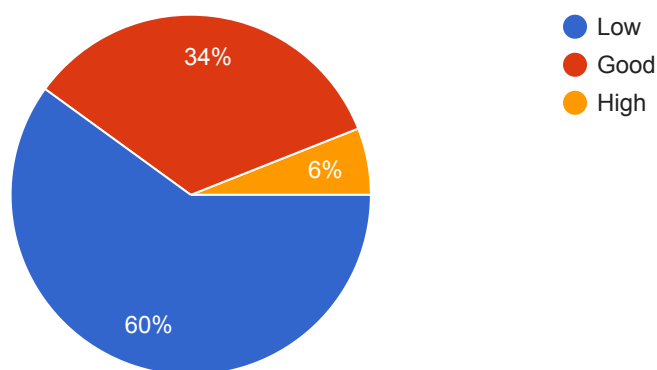
- Low
- Good
- High

34%
6%
60%

To which extent do you evaluate your knowledge in Solar Energy principles?

200 responses

Legend:
- Low
- Good
- High

32.5% — Good
6% — High
61.5% — Low

To which extent do you evaluate your knowledge in Wind Energy principles?

200 responses

Legend:
- Low
- Good
- High

29.5% — Good
6% — High
64.5% — Low
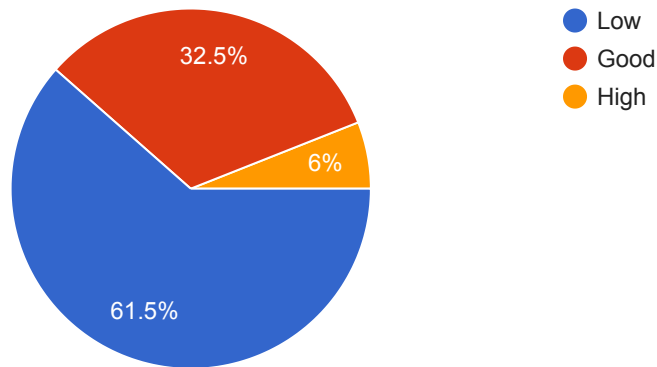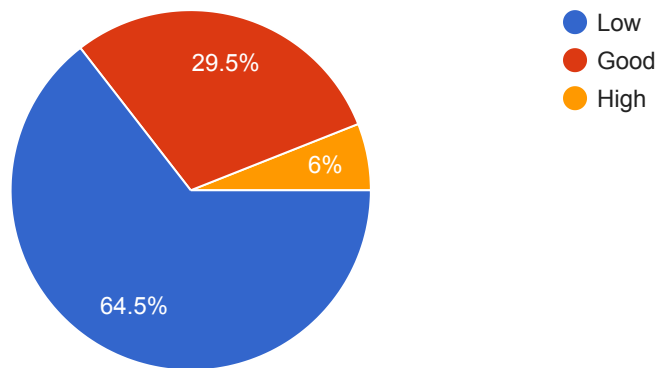
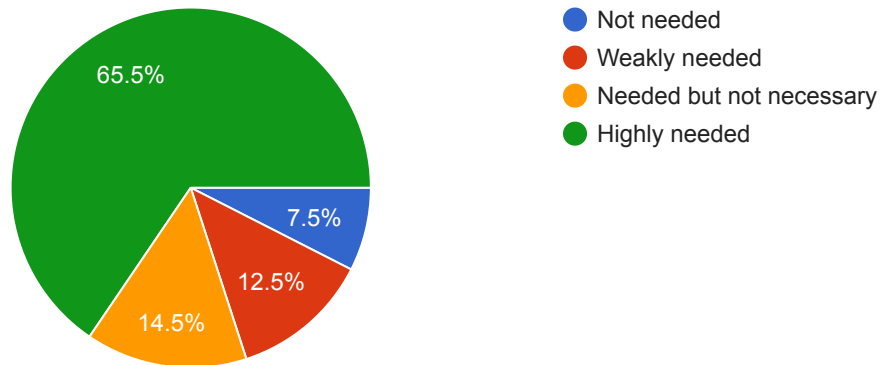## To which extent do you evaluate your knowledge in energy management of Renewable Energy systems?

200 responses
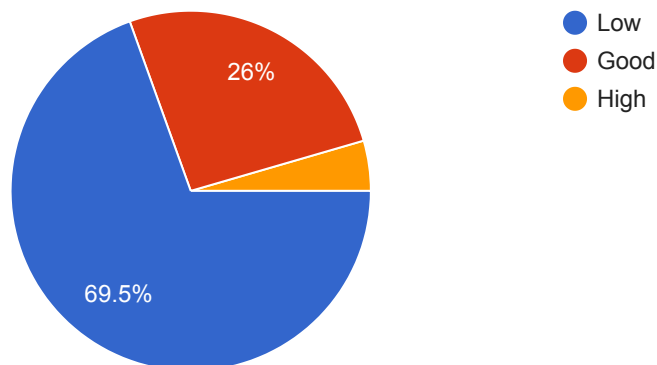
Legend:
- Low
- Good
- High

26% — Good
69.5% — Low

To which extent do you evaluate the need to teach the Renewable Energy for Bachelor students?

200 responses

- Not needed
- Weakly needed
- Needed but not necessary
- Highly needed

65.5%
7.5%
12.5%
14.5%

For Academic Staff

What is your major field (your highest degree)?

44 responses
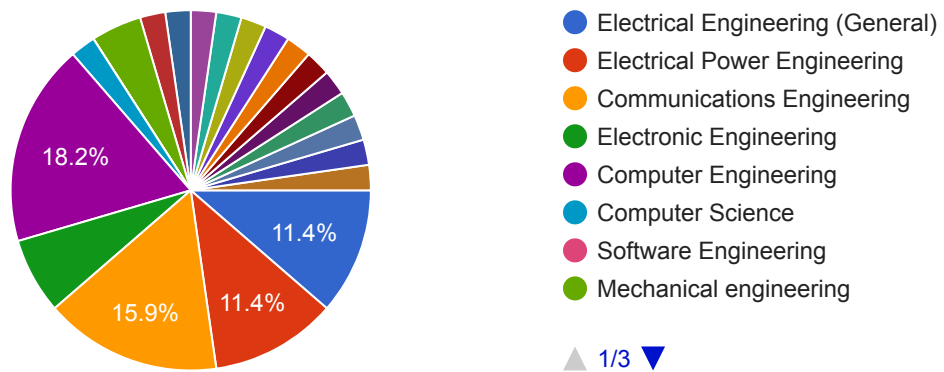
- Electrical Engineering (General)
- Electrical Power Engineering
- Communications Engineering
- Electronic Engineering
- Computer Engineering
- Computer Science
- Software Engineering
- Mechanical engineering

1/3

18.2%
11.4%
11.4%
15.9%

Are you specialist in Renewable Energy ?

44 responses

- Yes
- No

68.2%
31.8%
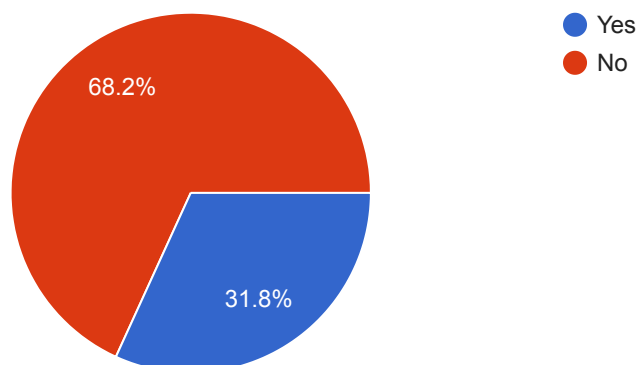
Have you taught a Renewable Energy course ?

44 responses

- Yes
- No

70.5%

29.5%
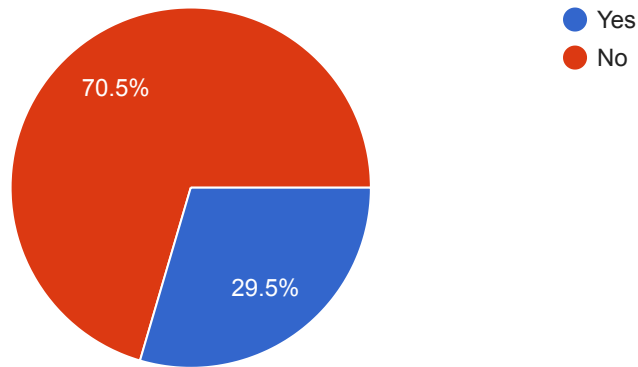
If you teach (or have taught) a Renewable Energy course, which learning methods do you use ?

44 responses
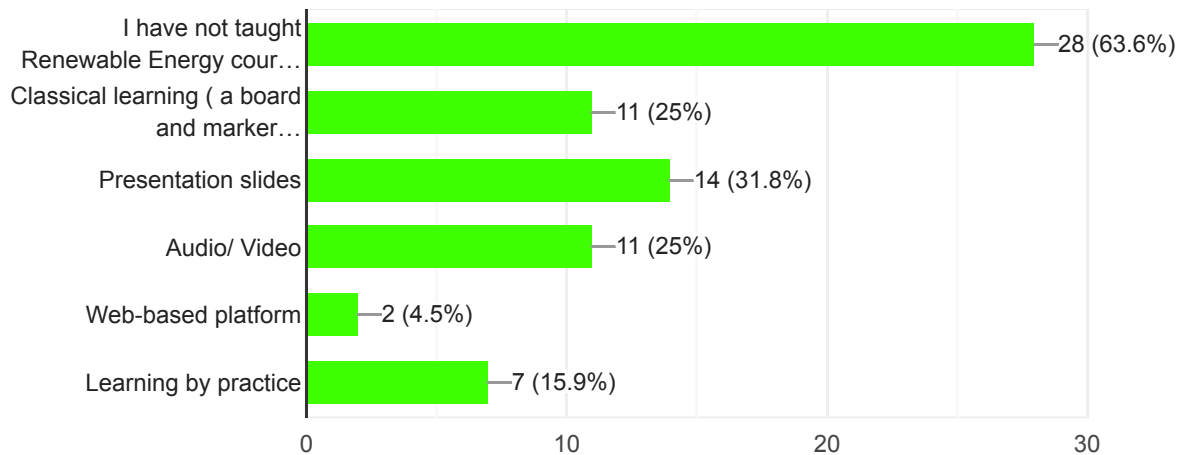
Category	Value
I have not taught Renewable Energy cour…	28 (63.6%)
Classical learning (a board and marker…	11 (25%)
Presentation slides	14 (31.8%)
Audio/ Video	11 (25%)
Web-based platform	2 (4.5%)
Learning by practice	7 (15.9%)

If you have not ever taught a Renewable Energy course, which learning methods do you recommend to teach Renewable Energy ?
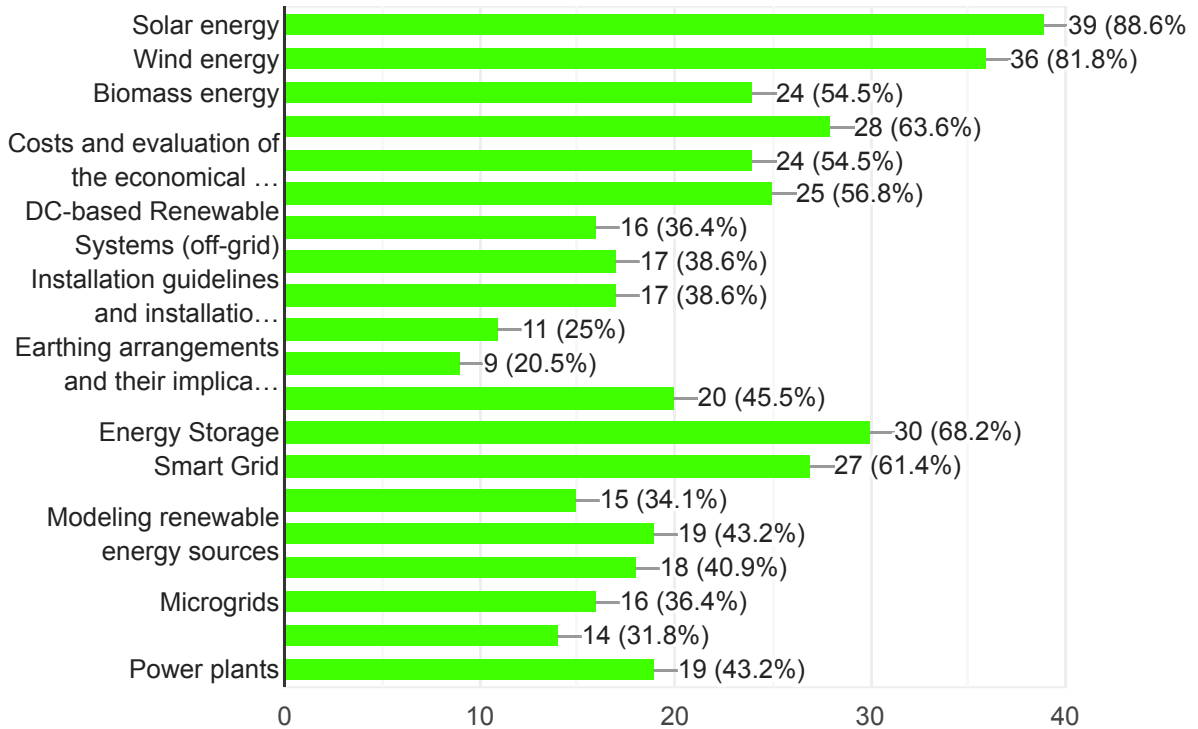
44 responses

Classical learning (a board
and marker

—18 (40.9%)

Which of the following topics should be included in an Renewable Energy course for undergraduate students ? Please check all apply

44 responses

Topic	Value
Solar energy	39 (88.6%)
Wind energy	36 (81.8%)
Biomass energy	24 (54.5%)
Costs and evaluation of the economical …	28 (63.6%)
	24 (54.5%)
DC-based Renewable Systems (off-grid)	25 (56.8%)
	16 (36.4%)
Installation guidelines and installatio…	17 (38.6%)
	17 (38.6%)
Earthing arrangements and their implica…	11 (25%)
	9 (20.5%)
	20 (45.5%)
Energy Storage	30 (68.2%)
Smart Grid	27 (61.4%)
Modeling renewable energy sources	15 (34.1%)
	19 (43.2%)
	18 (40.9%)
Microgrids	16 (36.4%)
	14 (31.8%)
Power plants	19 (43.2%)

Please list other topics that should be included in the Renewable Energy course and not mentioned above

44 responses

Nothing

NA

Green building

Rekated Simulation

•

Fuel Cells
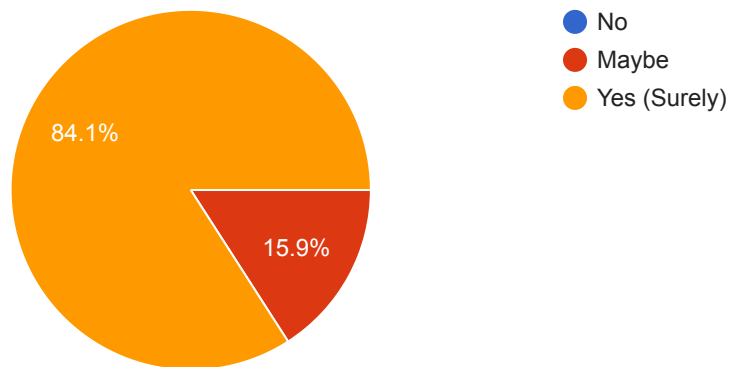
Assessment and analysis of renewable resources

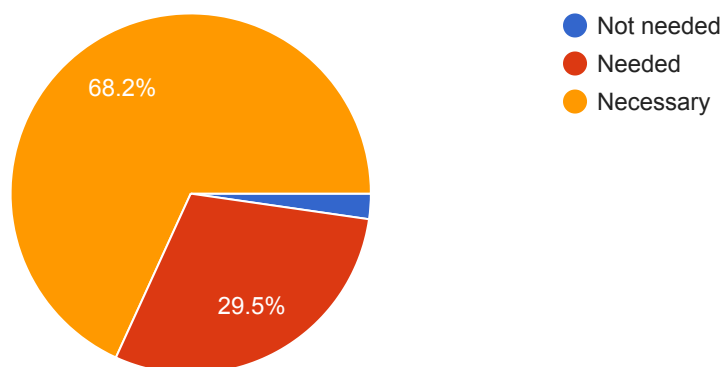How to choose the suitable place for wind and solar energy

Nothing

Do you believe that Renewable Energy knowledge will open up more career opportunities for fresh graduate students?

44 responses

- ● No
- ● Maybe
- ● Yes (Surely)

84.1%

15.9%

To which extent do you think that students should be involved in Renewable Energy laboratory experiments?

44 responses

- ● Not needed
- ● Needed
- ● Necessary

68.2%

29.5%

Have you taught an Renewable Energy laboratory ?
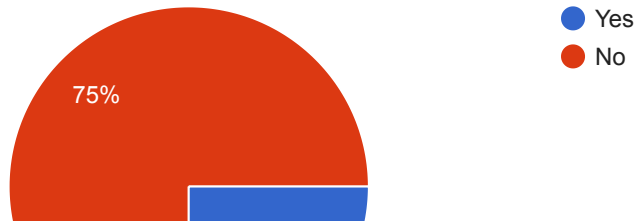
44 responses

● Yes
● No

75%

Which of the following equipment are required for a Renewable Energy laboratory ?
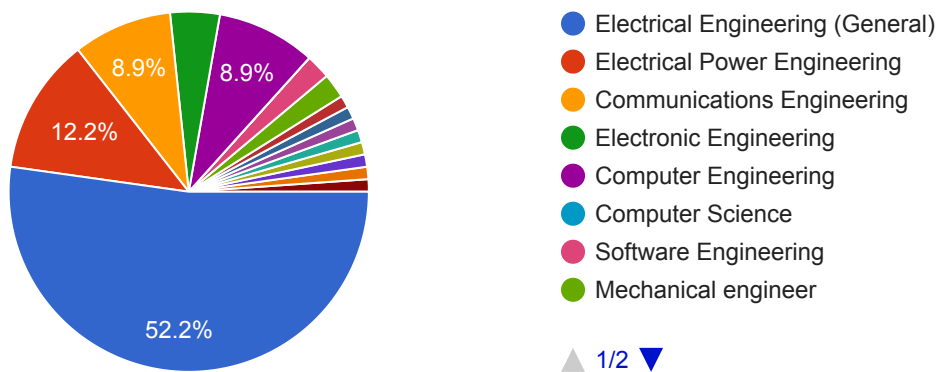
44 responses

PV training kits and systems	33 (75%)
	34 (77.3%)
Biomass training system	15 (34.1%)
Simulation softwares	33 (75%)
Storage batteries	28 (63.6%)
Generators	14 (31.8%)
PV curve tester	20 (45.5%)
Solar and wind emulators	24 (54.5%)
	16 (36.4%)
Battery management system	21 (47.7%)
Since this is not my field, I do not kn…	1 (2.3%)
	1 (2.3%)
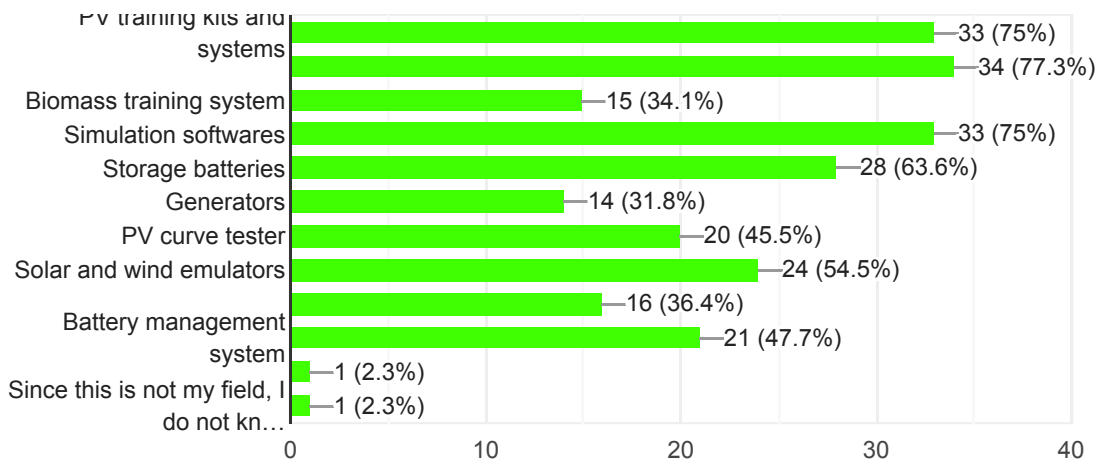
For Industrial Sector

Considering your current job, what is your major field ?

90 responses

● Electrical Engineering (General)
● Electrical Power Engineering
● Communications Engineering
● Electronic Engineering
● Computer Engineering
● Computer Science
● Software Engineering
● Mechanical engineer

8.9%
8.9%
12.2%
52.2%

▲ 1/2 ▼

How much is your current work related to Renewable Energy?

90 responses
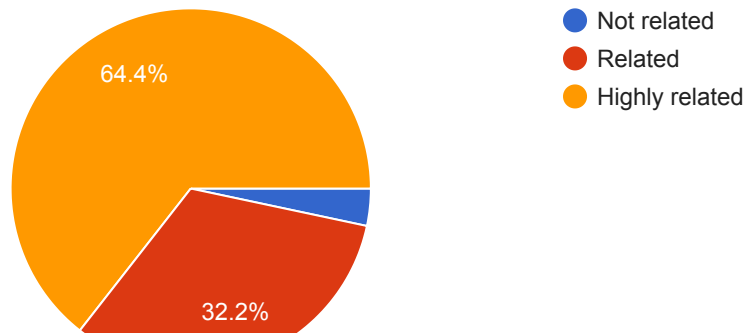
Legend:
- Not related
- Related
- Highly related

64.4%
32.2%

Do you believe that Renewable Energy should be taught in the undergraduate programs?

90 responses

Legend:
- Yes
- No
- Yes but not necessary

92.2%
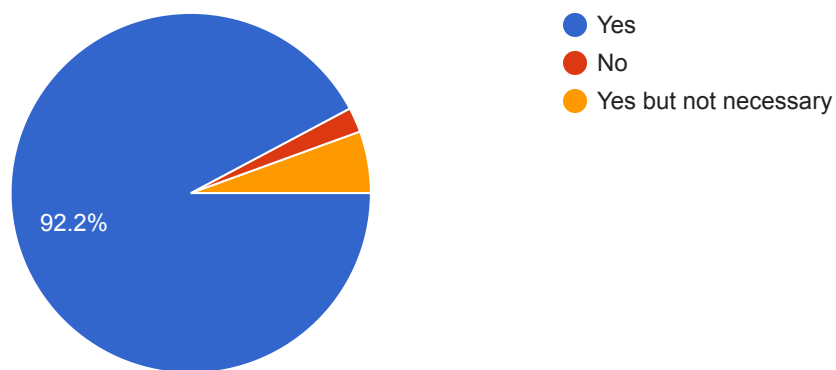
Do you believe that Renewable Energy knowledge will open more career opportunities for fresh graduate students?

90 responses
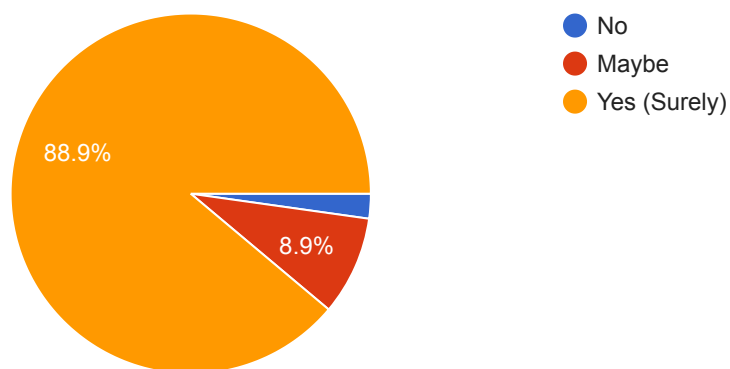
Legend:
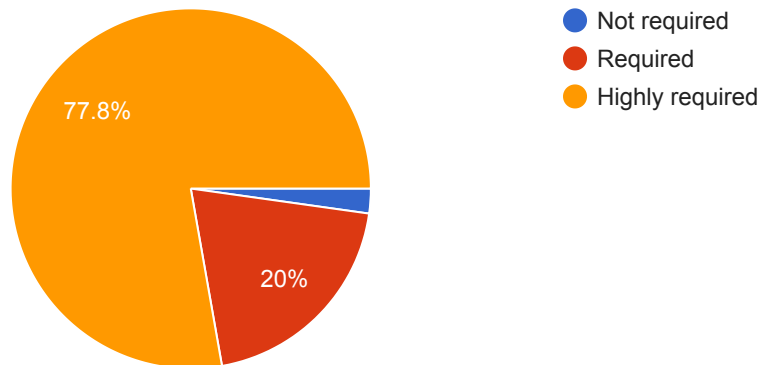- No
- Maybe
- Yes (Surely)

88.9%
8.9%

To which extent do you think that Renewable Energy knowledge is required in the labor market ?

90 responses
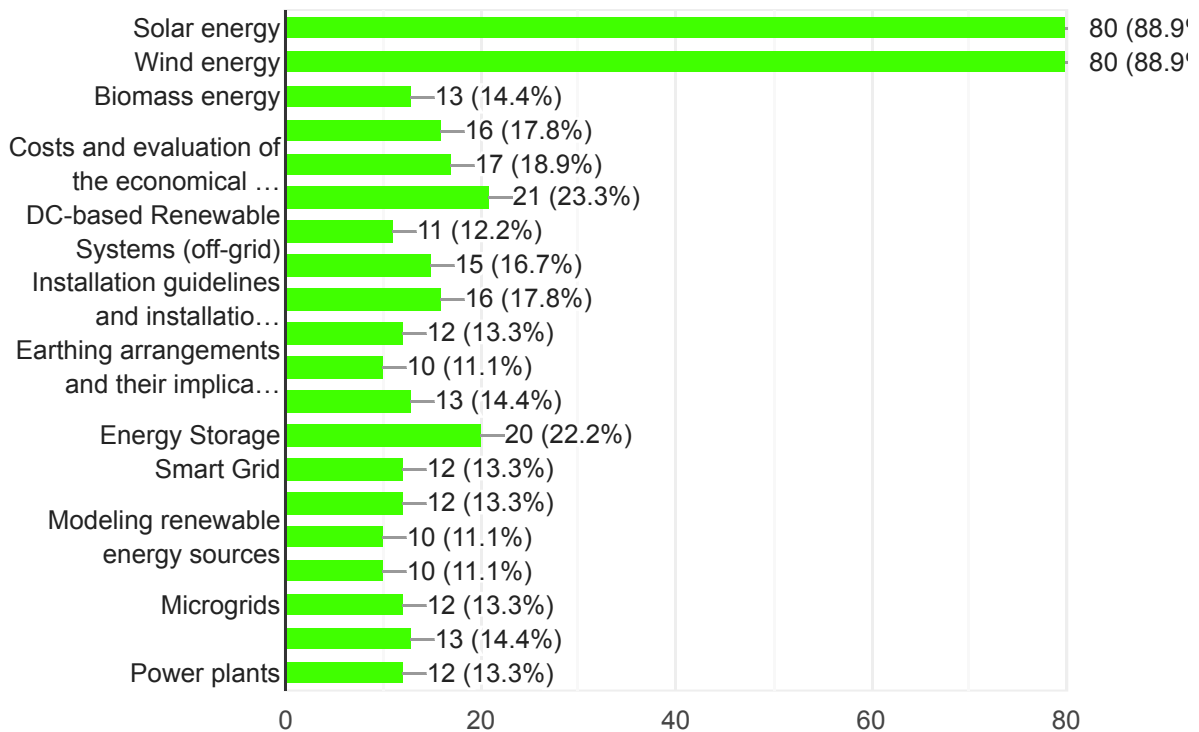
Legend:
- Not required
- Required
- Highly required

77.8%

20%

Which of the following topics should be included in an Renewable Energy course for undergraduate students ? Please check all apply

90 responses

Topic	Responses
Solar energy	80 (88.9%)
Wind energy	80 (88.9%)
Biomass energy	13 (14.4%)
Costs and evaluation of the economical …	16 (17.8%)
	17 (18.9%)
	21 (23.3%)
DC-based Renewable Systems (off-grid)	11 (12.2%)
	15 (16.7%)
Installation guidelines and installatio…	16 (17.8%)
	12 (13.3%)
Earthing arrangements and their implica…	10 (11.1%)
	13 (14.4%)
Energy Storage	20 (22.2%)
Smart Grid	12 (13.3%)
	12 (13.3%)
Modeling renewable energy sources	10 (11.1%)
	10 (11.1%)
Microgrids	12 (13.3%)
	13 (14.4%)
Power plants	12 (13.3%)

Please list other topics that should be included in the Renewable Energy course and not mentioned above
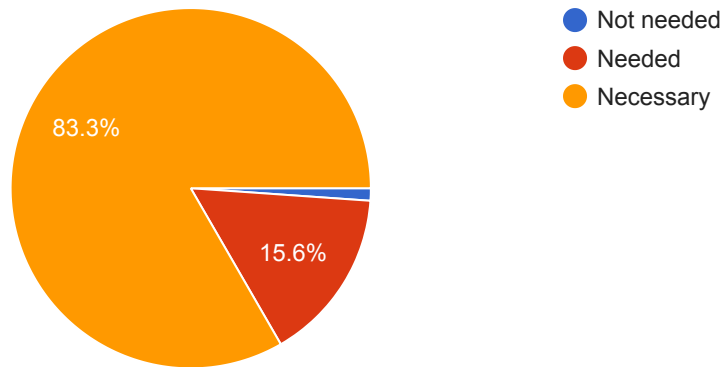
90 responses

..

nothing

....

.

.....

No

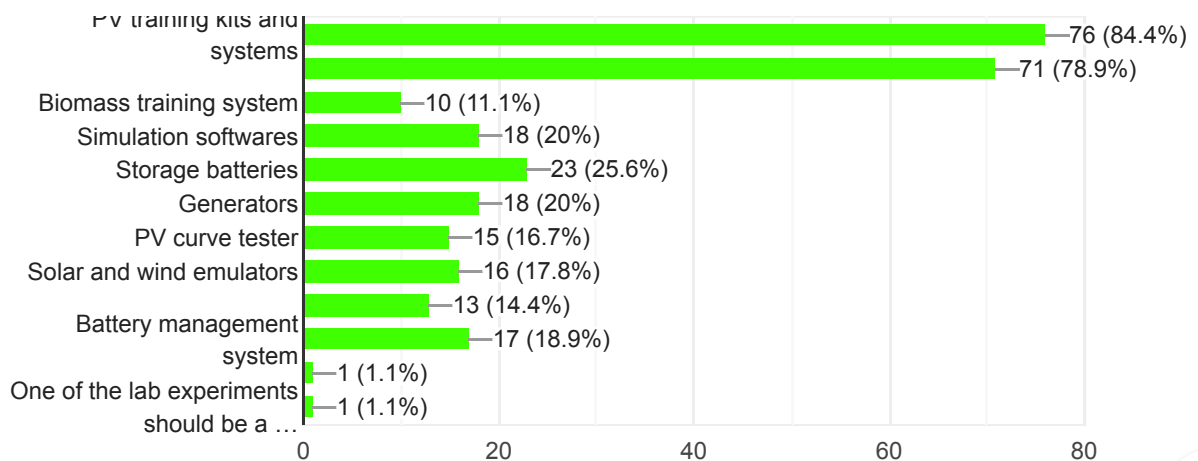If these subjects are studied, they are sufficient

AI

No

To which extent do you think that students should be involved in Renewable Energy laboratory experiments?

90 responses

- Not needed
- Needed
- Necessary

83.3%

15.6%

Which of the following equipment are required for a Renewable Energy laboratory ?

90 responses

PV training kits and systems	76 (84.4%)
	71 (78.9%)
Biomass training system	10 (11.1%)
Simulation softwares	18 (20%)
Storage batteries	23 (25.6%)
Generators	18 (20%)
PV curve tester	15 (16.7%)
Solar and wind emulators	16 (17.8%)
	13 (14.4%)
Battery management system	17 (18.9%)
	1 (1.1%)
One of the lab experiments should be a …	1 (1.1%)

Google Forms

iREADER

A Questionnaire for Teaching and Training Needs in Cyber Security

334 responses

Publish analytics

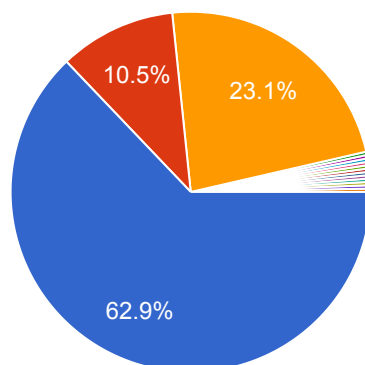### In which country are you based ?
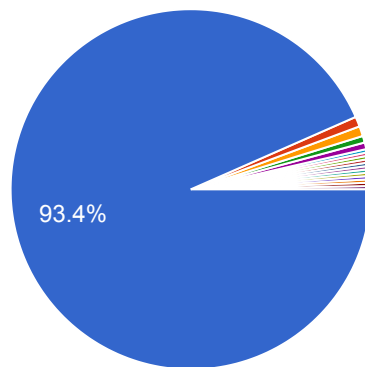
334 responses

- Jordan
- Spain
- Saudi Arabia
- Cyprus
- السعودية
- ksa
- United Arab Emirates
- saudia

△ 1/3 ▽

93.4%

Please identify your current job

334 responses

- Student
- Academic Staff
- Industrial Sector
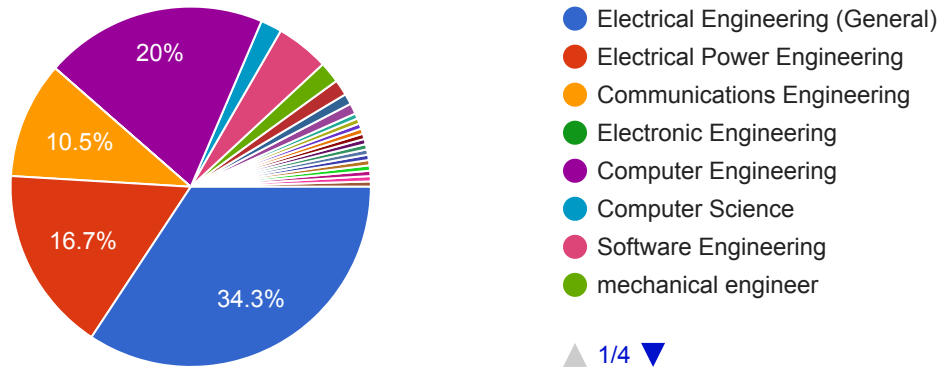- Computer Science teacher
- site engineer
- Non-profit
- Telecom implementation Sup…
- Graduate

△ 1/2 ▽

10.5%   23.1%

62.9%

For Students

What is your major field (BSc degree)?

210 responses

- ● Electrical Engineering (General)
- ● Electrical Power Engineering
- ● Communications Engineering
- ● Electronic Engineering
- ● Computer Engineering
- ● Computer Science
- ● Software Engineering
- ● mechanical engineer

△ 1/4 ▼

34.3%
16.7%
10.5%
20%

Have you enrolled in Cyber Security course in your university degree ?
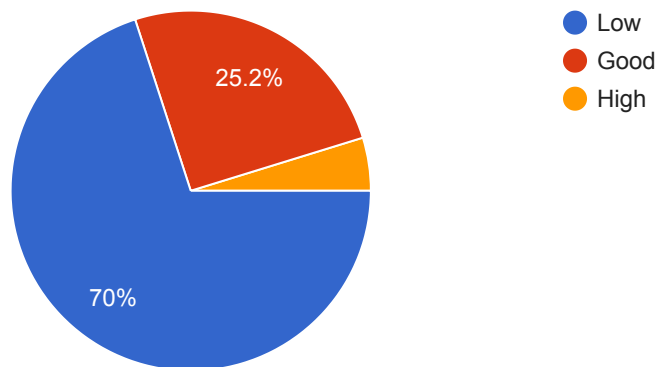
210 responses

- ● Yes
- ● No

80.5%
19.5%
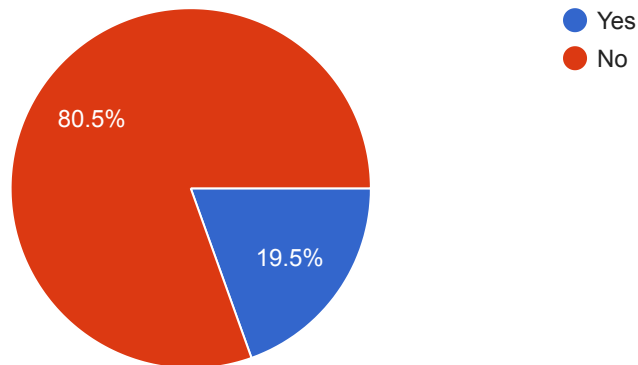
To which extent do you evaluate your knowledge in cyber security fundamentals (cyber space, hacker, ...)?
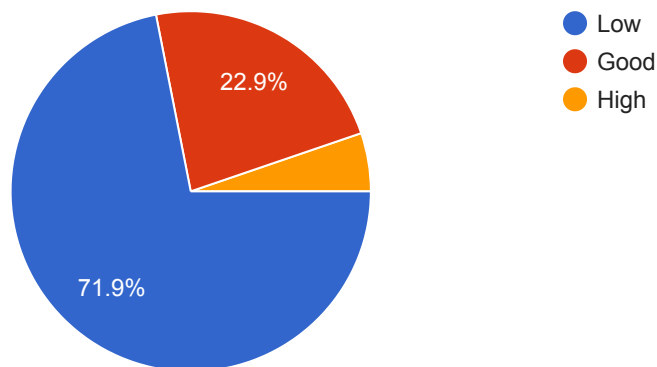
210 responses

- ● Low
- ● Good
- ● High

25.2%
69.5%
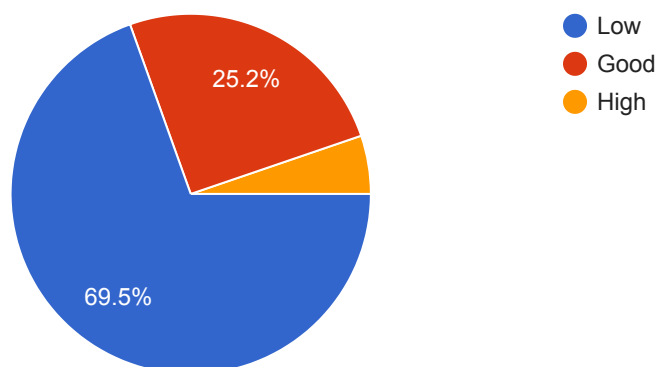
To which extent do you evaluate your knowledge in the types of Malware (Worm, Viruses, Spyware, Trojans,...)?
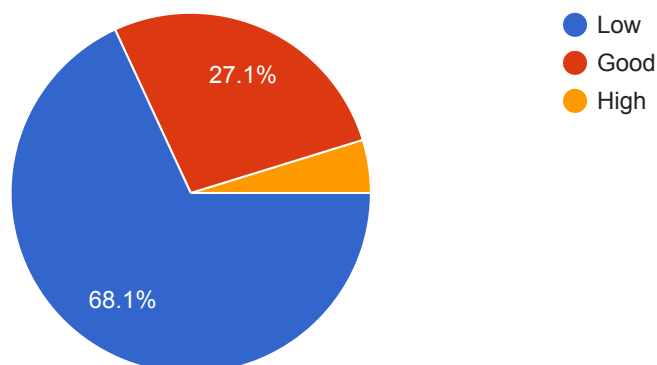
210 responses

- Low
- Good
- High

25.2%

70%

To which extent do you evaluate your knowledge in Cyber Security Breaches (Phishing, Identity Theft, Harassment, Cyberstalking, ...)?

210 responses

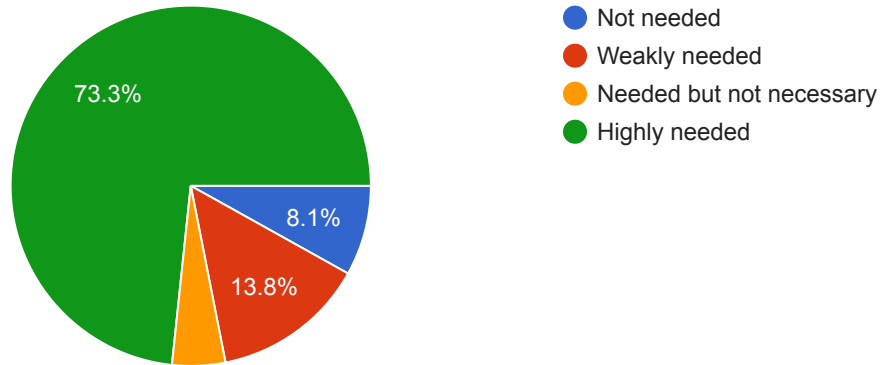- Low
- Good
- High

22.9%

71.9%

To which extent do you evaluate your knowledge in prevention software (Firewalls, Virtual Private Networks, Anti-Virus & Anti-Spyware,...)?

210 responses

- Low
- Good
- High

27.1%

68.1%

To which extent do you evaluate the need to teach the Cyber Security for Bachelor students?

210 responses

- Not needed
- Weakly needed
- Needed but not necessary
- Highly needed

73.3%
8.1%
13.8%

For Academic Staff

What is your major field (your highest degree)?

35 responses

- Electrical Engineering (General)
- Electrical Power Engineering
- Communications Engineering
- Electronic Engineering
- Computer Engineering
- Computer Science
- Software Engineering
- Physics
- Project Engineering Management

20%
14.3%
11.4%
8.6%
31.4%
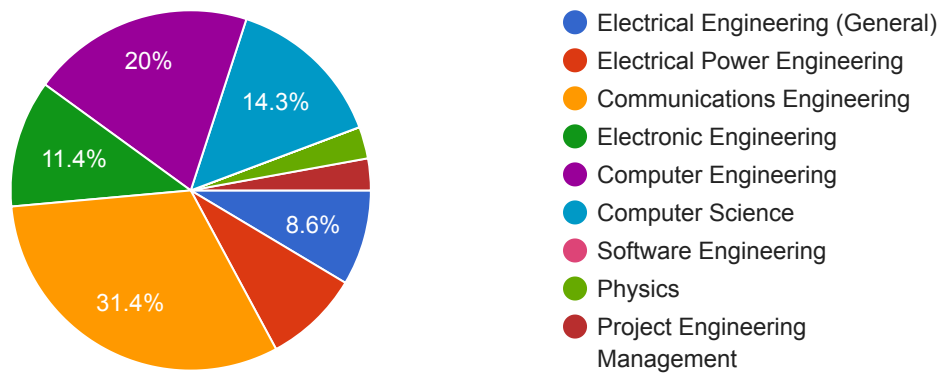
Are you specialist in Cyber Security?

35 responses

Have you taught a Cyber Security course ?

35 responses
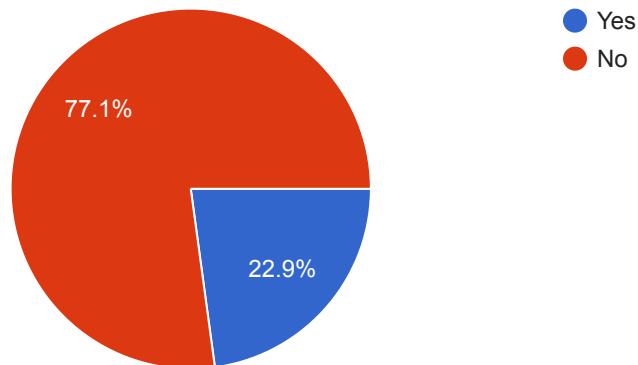
- Yes
- No

77.1%

22.9%

If you teach (or have taught) a Cyber Security course, which learning methods do you use ? Please check all apply

35 responses

I have not taught Cyber Security course	25 (71.4%)
	5 (14.3%)
Presentation slides	9 (25.7%)
Audio/ Video	7 (20%)
Web-based platform	3 (8.6%)
Learning by practice	7 (20%)
Presentation slides + Learning by pract…	1 (2.9%)

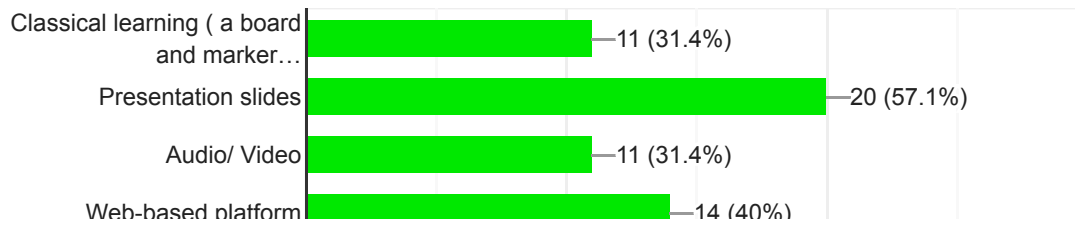## If you have not ever taught a Cyber Security course, which learning methods do you recommend to teach Cyber Security ? Please check all apply

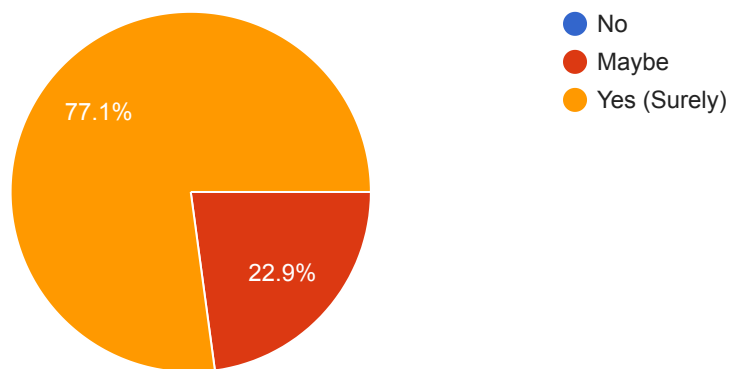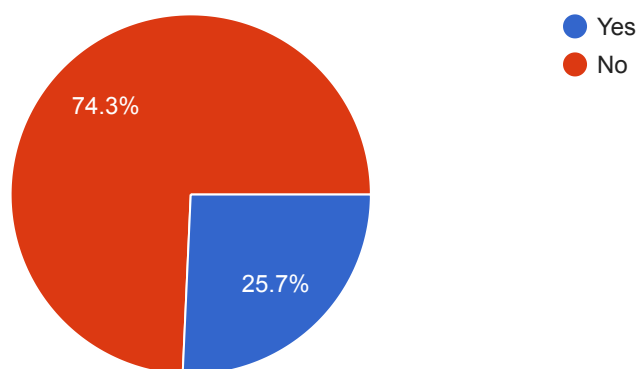35 responses

Classical learning (a board and marker... �— 11 (31.4%)

Presentation slides ▬ 20 (57.1%)

Audio/ Video ▬ 11 (31.4%)

Web-based platform ▬ 14 (40%)
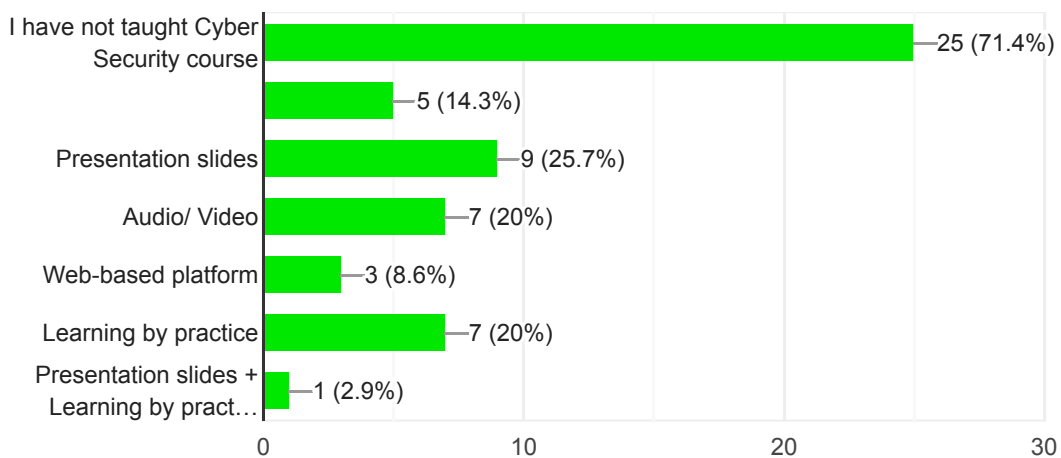
Do you believe that Cyber Security knowledge will open up more career opportunities for fresh graduate students?

35 responses

- ● No
- ● Maybe
- ● Yes (Surely)

77.1%

22.9%

Have you taught a Cyber Security laboratory ?
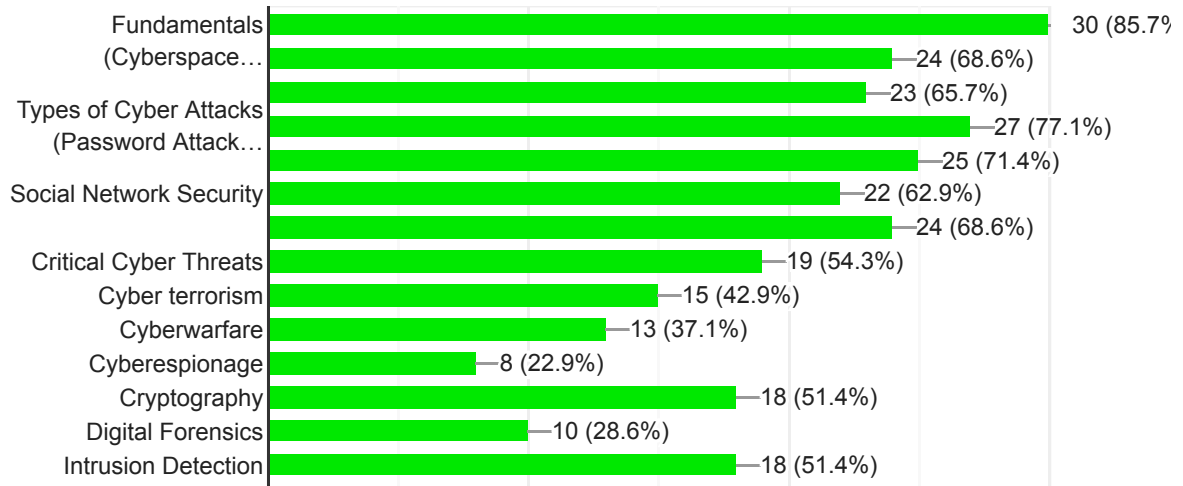
35 responses

- ● Yes
- ● No

74.3%

25.7%

Which of the following topics should be included in an Cyber Security course for undergraduate students ? Please check all apply

35 responses

Fundamentals (Cyberspace…	30 (85.7%)
	24 (68.6%)
Types of Cyber Attacks (Password Attack…	23 (65.7%)
	27 (77.1%)
Social Network Security	25 (71.4%)
	22 (62.9%)
Critical Cyber Threats	24 (68.6%)
Cyber terrorism	19 (54.3%)
Cyberwarfare	15 (42.9%)
Cyberespionage	13 (37.1%)
Cryptography	8 (22.9%)
Digital Forensics	18 (51.4%)
Intrusion Detection	10 (28.6%)
	18 (51.4%)

Please list other topics that should be included in the Cyber Security course and not mentioned above
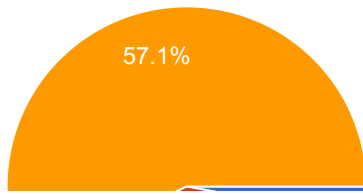
35 responses

NA

Others

Well-known security protocols such as TLS, WPA, etc.

None

no

you should include more courses about network and web

I don't know

encryption and decryption methods

To which extent do you think that students should be involved in Cyber Security laboratory?
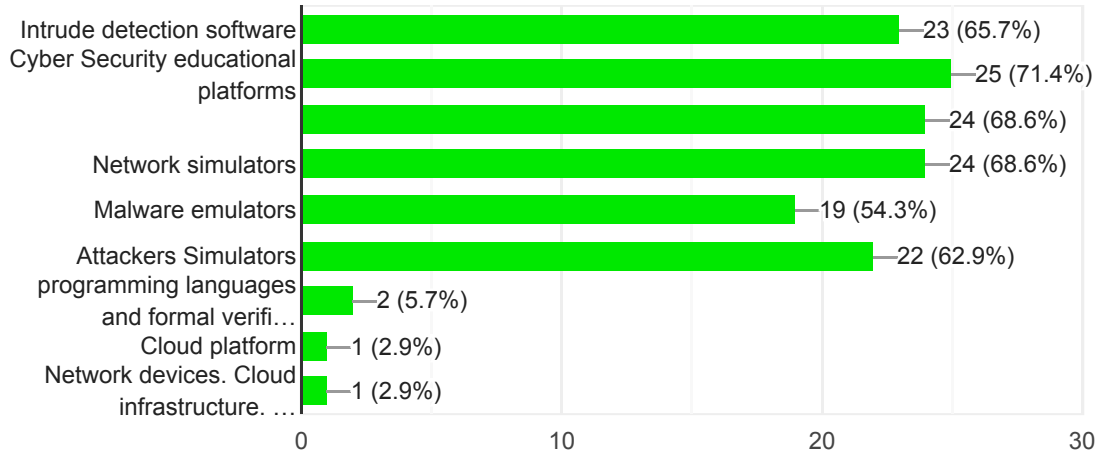
35 responses

57.1%

- ● Not needed
- ● Needed
- ● Necessary

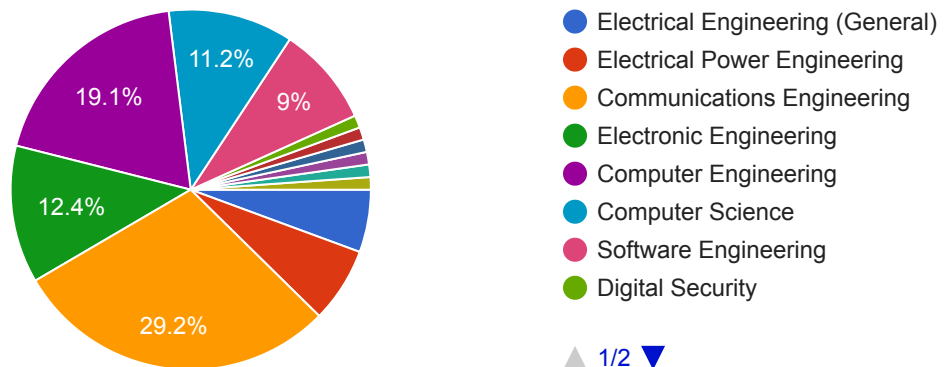## Which of the following hardware/software is required for a Cyber Security laboratory ?

35 responses

Category	Value
Intrude detection software	23 (65.7%)
Cyber Security educational platforms	25 (71.4%)
	24 (68.6%)
Network simulators	24 (68.6%)
Malware emulators	19 (54.3%)
Attackers Simulators	22 (62.9%)
programming languages and formal verifi…	2 (5.7%)
Cloud platform	1 (2.9%)
Network devices. Cloud infrastructure. …	1 (2.9%)

(x-axis: 0, 10, 20, 30)

For Industrial Sector

Considering your current job, what is your major field ?

89 responses

11.2%
9%
19.1%
12.4%
29.2%

- ● Electrical Engineering (General)
- ● Electrical Power Engineering
- ● Communications Engineering
- ● Electronic Engineering
- ● Computer Engineering
- ● Computer Science
- ● Software Engineering
- ● Digital Security

▲ 1/2 ▼

How much is your current work related to Cyber Security?

89 responses

66.3%

- Not related
- Related
- Highly related

10.1%
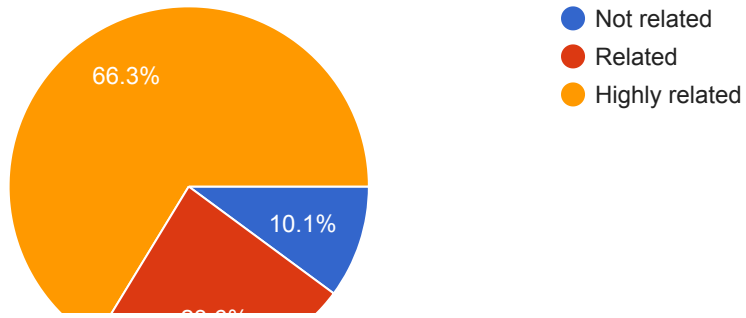
Do you believe that Cyber Security should be taught in the undergraduate programs?

89 responses
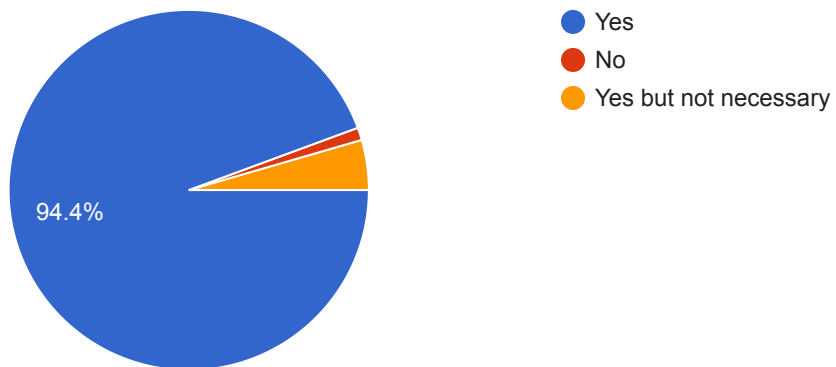
- Yes
- No
- Yes but not necessary

94.4%

Do you believe that Cyber Security knowledge will open up more career opportunities for fresh graduate students?

89 responses

- No
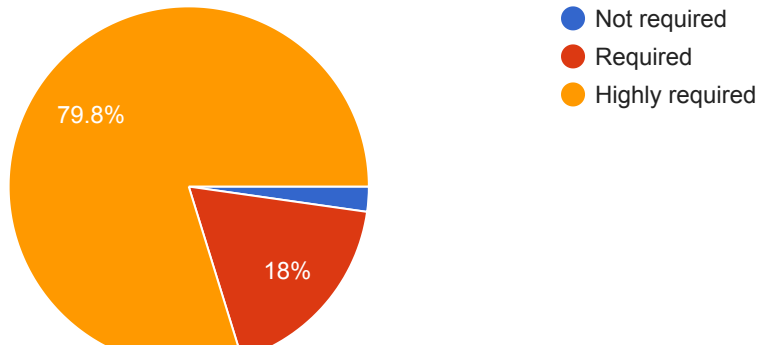- Maybe
- Yes (Surely)

88.8%

9%
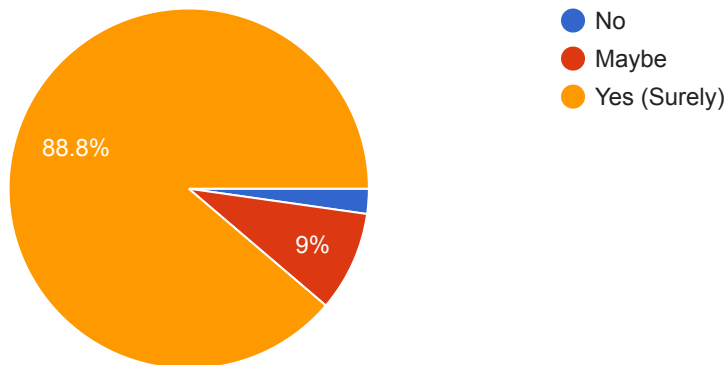
To which extent do you think that Cyber Security knowledge is required in the labor market ?

89 responses

Not required
Required
Highly required

79.8%

18%
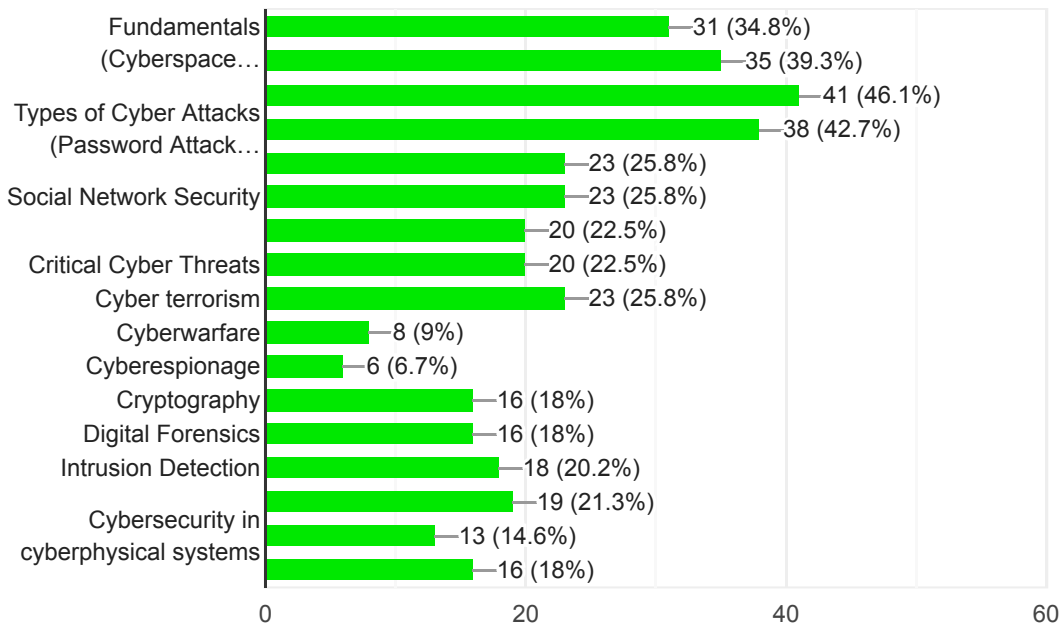
Which of the following topics should be included in an Cyber Security course for undergraduate students ? Please check all apply

89 responses

Topic	Responses
Fundamentals (Cyberspace…	31 (34.8%)
	35 (39.3%)
Types of Cyber Attacks (Password Attack…	41 (46.1%)
	38 (42.7%)
Social Network Security	23 (25.8%)
	23 (25.8%)
Critical Cyber Threats	20 (22.5%)
	20 (22.5%)
Cyber terrorism	23 (25.8%)
Cyberwarfare	8 (9%)
Cyberespionage	6 (6.7%)
Cryptography	16 (18%)
Digital Forensics	16 (18%)
Intrusion Detection	18 (20.2%)
	19 (21.3%)
Cybersecurity in cyberphysical systems	13 (14.6%)
	16 (18%)

Please list other topics that should be included in the Cyber Security course and not mentioned above
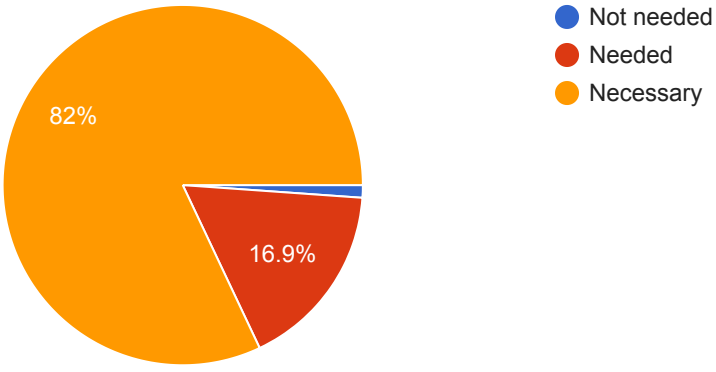
89 responses

....

...

....

Nothing

..

....

.....
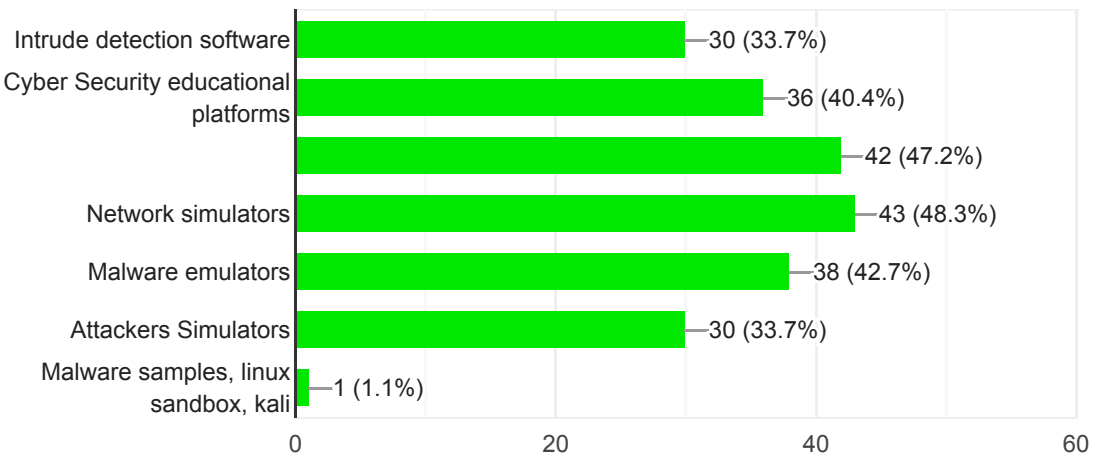
....

None

To which extent do you think that students should be involved in Cyber Security laboratory?

89 responses

- Not needed
- Needed
- Necessary

82%

16.9%

Which of the following hardware/software is required for a Cyber Security laboratory ?

89 responses

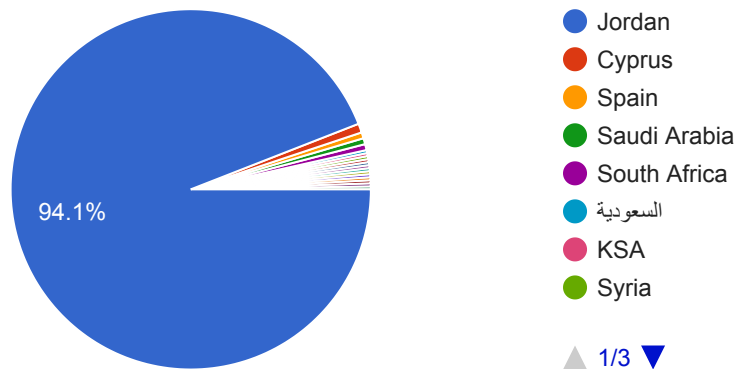| Category	Responses
Intrude detection software	30 (33.7%)
Cyber Security educational platforms	36 (40.4%)
	42 (47.2%)
Network simulators	43 (48.3%)
Malware emulators	38 (42.7%)
Attackers Simulators	30 (33.7%)
Malware samples, linux sandbox, kali	1 (1.1%)

iREADER

A Questionnaire for Teaching and Training Needs in Internet of Things

371 responses

Publish analytics

In which country are you based ?

371 responses

- Jordan
- Cyprus
- Spain
- Saudi Arabia
- South Africa
- السعودية
- KSA
- Syria

94.1%

▲ 1/3 ▼

Please identify your current job

371 responses

- Student
- Academic Staff
- Industrial Sector
- Senior engineer at Huawei co…
- Telecom implementation Sup…
- Software Engineer
- National electrical power com…
- Project Manager

12.1%

80.6%

▲ 1/2 ▼
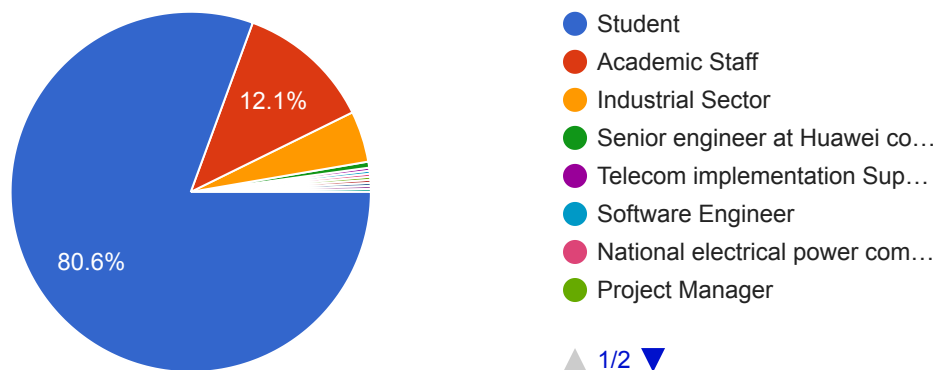
What is your major field (BSc degree)?

299 responses

- Electrical Engineering (General)
- Electrical Power Engineering
- Communications Engineering
- Electronic Engineering
- Computer Engineering
- Computer Science
- Software Engineering
- Industrial engineering

▲ 1/4 ▼

33.4%
22.7%
11.7%
10.4%
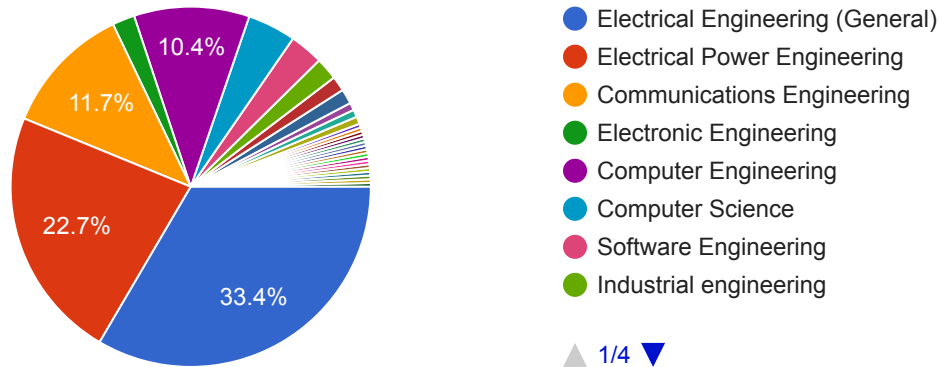
Have you enrolled in IoT course in your university degree ?

299 responses

- Yes
- No

78.9%
21.1%
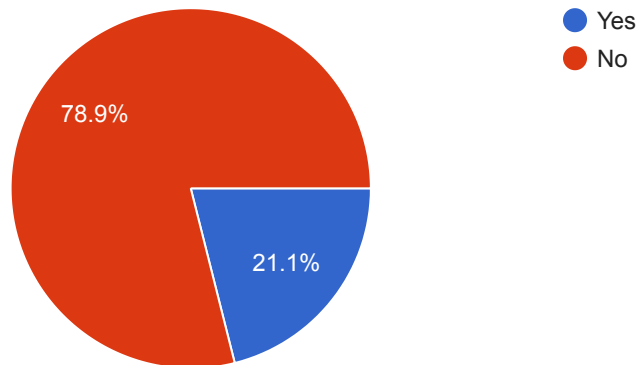
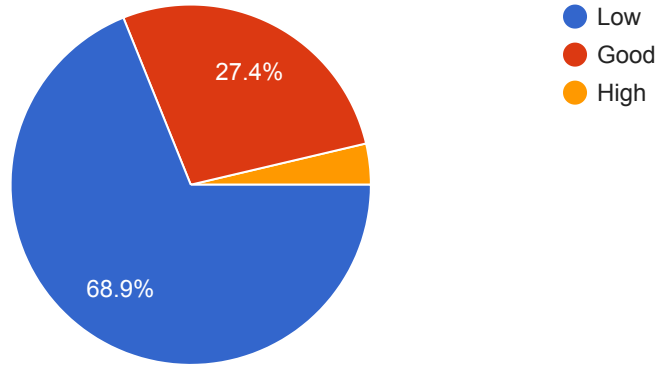## To which extent do you evaluate your knowledge in sensing and actuating devices and their different types ?

299 responses

- Low
- Good
- High

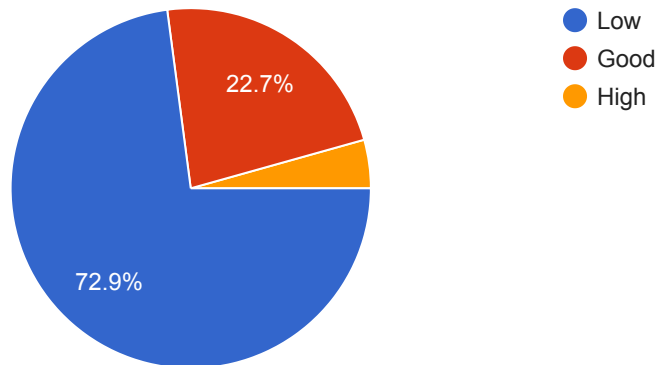33.4%
62.9%
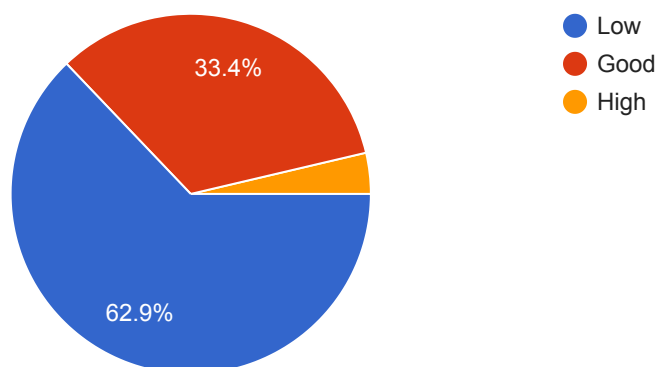
To which extent do you evaluate your knowledge in IoT applications ?
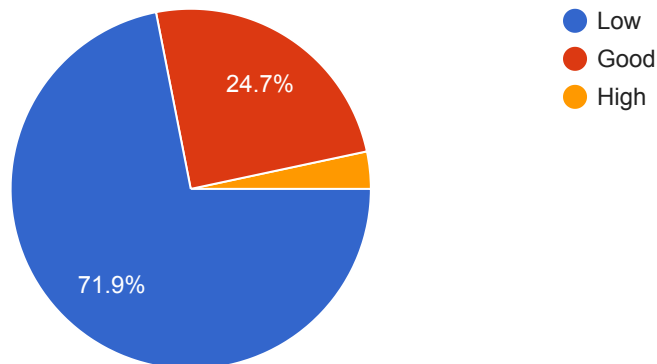
299 responses

- Low
- Good
- High

27.4%

68.9%

To which extent do you evaluate your knowledge in IoT platforms such as Arduino or Raspberry Pi ?
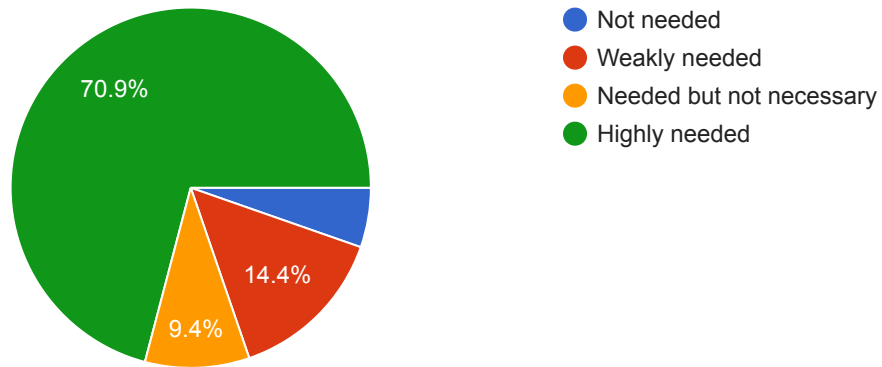
299 responses

- Low
- Good
- High

22.7%

72.9%

To which extent do you evaluate your knowledge in data networks, connection types, layer models and IoT protocols and standards ?

299 responses

- Low
- Good
- High

24.7%

71.9%

To which extent do you evaluate the need to teach the IoT technology for Bachelor students?

299 responses

- 🔵 Not needed
- 🔴 Weakly needed
- 🟠 Needed but not necessary
- 🟢 Highly needed

70.9%
14.4%
9.4%

For Academic Staff

What is your major field (your highest degree)?

45 responses

- 🔵 Electrical Engineering (General)
- 🔴 Electrical Power Engineering
- 🟠 Communications Engineering
- 🟢 Electronic Engineering
- 🟣 Computer Engineering
- 🔵 Computer Science
- 🩷 Software Engineering
- 🟢 Engineering Project Manage…

🔼 1/2 🔽

28.9%
8.9%
8.9%
8.9%
28.9%
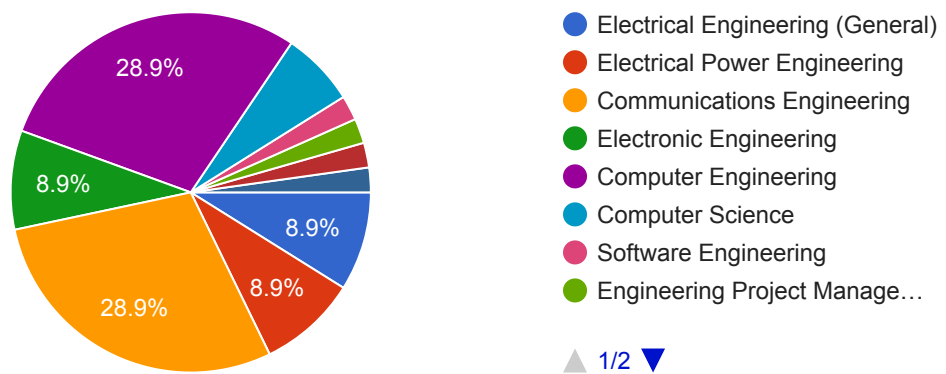
Are you specialist in IoT technology ?

45 responses

- 🔵 Yes
- 🔴 No

57.8%
42.2%
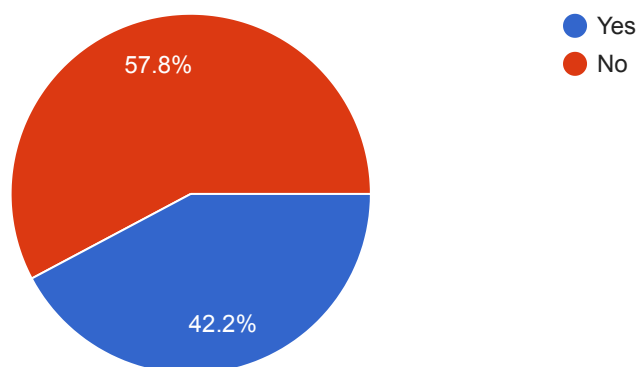
Have you taught an IoT course ?

45 responses

- Yes
- No

73.3%

26.7%
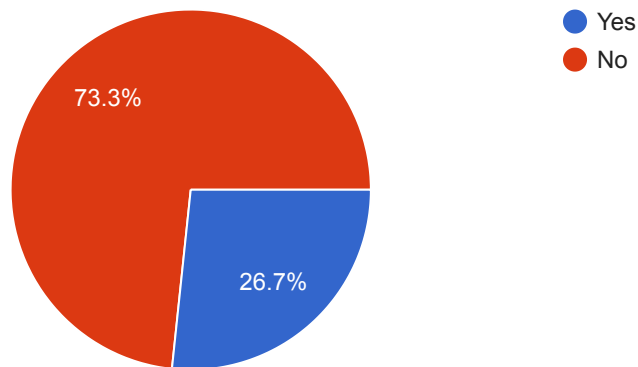
If you teach (or have taught) an IoT course, which learning methods do you use ?

45 responses
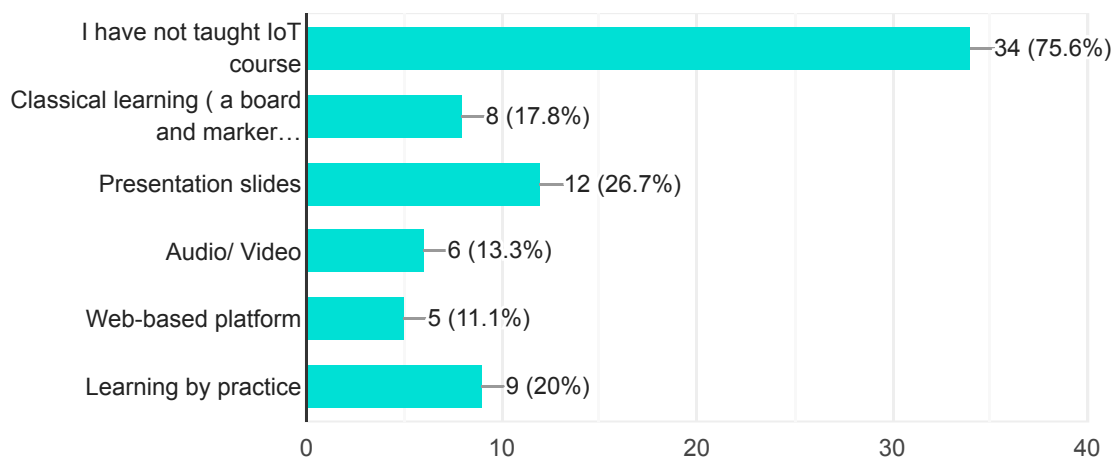
Method	Count
I have not taught IoT course	34 (75.6%)
Classical learning (a board and marker…	8 (17.8%)
Presentation slides	12 (26.7%)
Audio/ Video	6 (13.3%)
Web-based platform	5 (11.1%)
Learning by practice	9 (20%)

If you have not ever taught an IoT course, which learning methods do you recommend to teach IoT ?

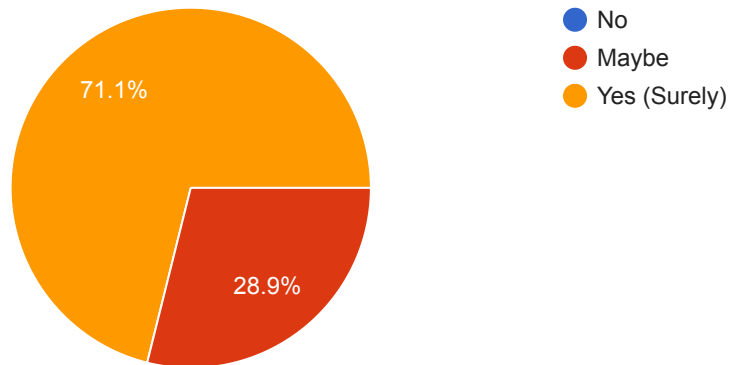45 responses

Classical learning (a board
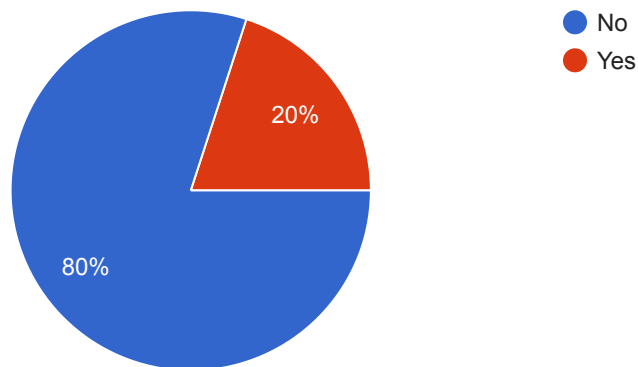and marker...   ████████████████ 15 (33.3%)

Do you believe that IoT knowledge will open up more career opportunities for fresh graduate students?

45 responses

- ● No
- ● Maybe
- ● Yes (Surely)

71.1%

28.9%

Have you taught an IoT laboratory ?

45 responses

- ● No
- ● Yes

20%

80%

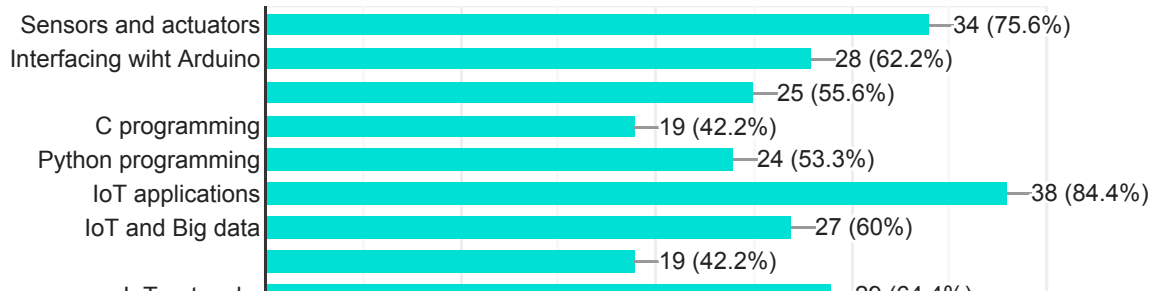## Which of the following topics should be included in an IoT course for undergraduate students ? Please check all apply

45 responses

Topic	Count
Sensors and actuators	34 (75.6%)
Interfacing wiht Arduino	28 (62.2%)
	25 (55.6%)
C programming	19 (42.2%)
Python programming	24 (53.3%)
IoT applications	38 (84.4%)
IoT and Big data	27 (60%)
	19 (42.2%)

Please list other topics that should be included in the IoT course and not mentioned above

11 responses

Yes

Commercial IoT boards

...

Real-time computer control systems

smart phone application programming

Cloud computing for IoT applications

....

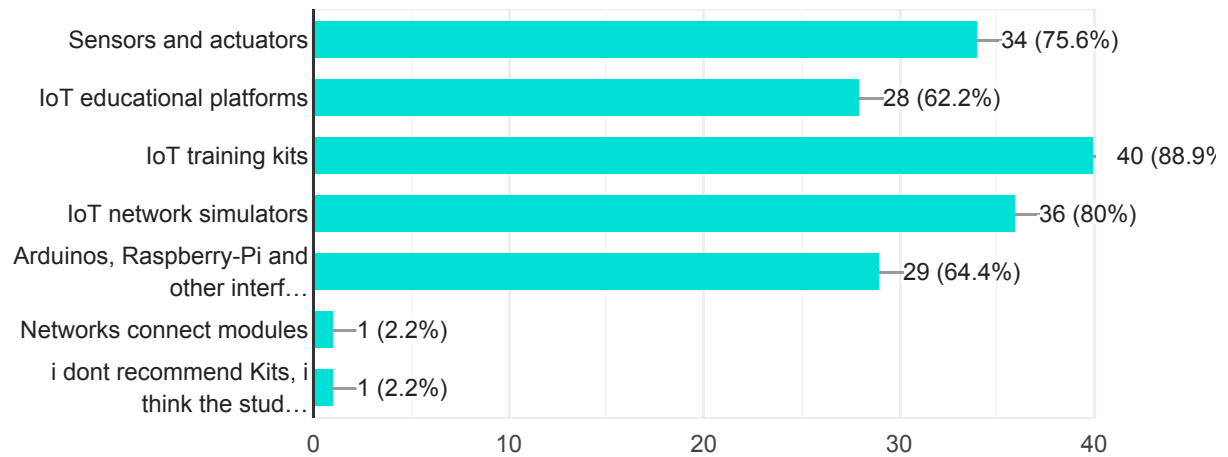Embedded Systems in general and not specific to the ras pi or arduino

To which extent do you think that students should be involved in IoT laboratory experiments?

45 responses

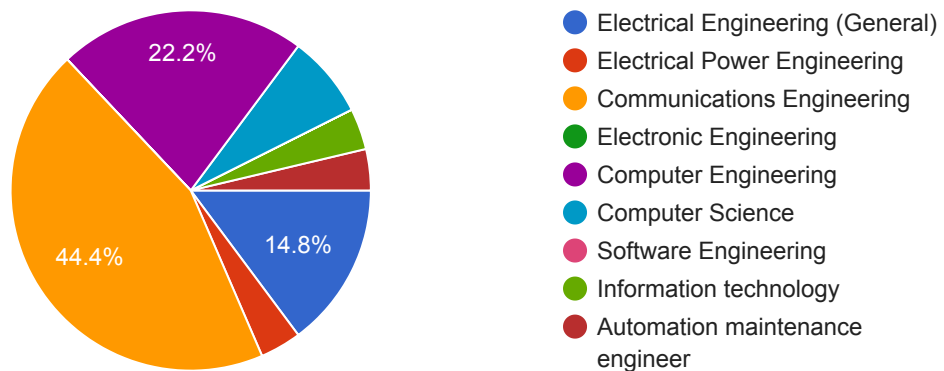## Which of the following equipment are required for an IoT laboratory ?

45 responses

Category	Count
Sensors and actuators	34 (75.6%)
IoT educational platforms	28 (62.2%)
IoT training kits	40 (88.9%)
IoT network simulators	36 (80%)
Arduinos, Raspberry-Pi and other interf…	29 (64.4%)
Networks connect modules	1 (2.2%)
i dont recommend Kits, i think the stud…	1 (2.2%)

For Industrial Sector

Considering your current job, what is your major field ?

27 responses

- Electrical Engineering (General)
- Electrical Power Engineering
- Communications Engineering
- Electronic Engineering
- Computer Engineering
- Computer Science
- Software Engineering
- Information technology
- Automation maintenance engineer

22.2%
44.4%
14.8%

How much is your current work related to IoT ?

27 responses
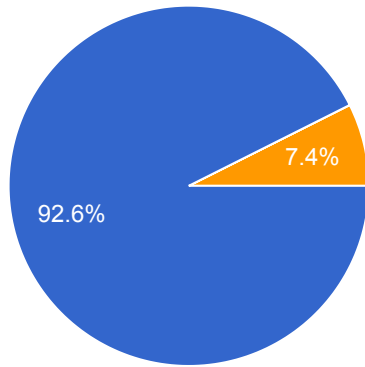
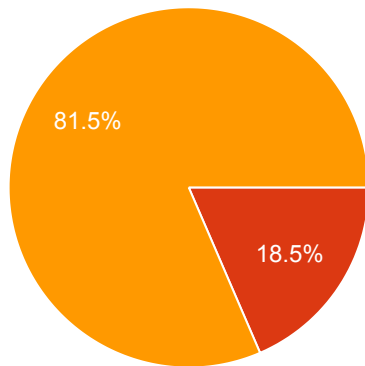## Do you believe that IoT should be taught in the undergraduate programs?

27 responses

● Yes
● No
● Yes but not necessary

92.6%

7.4%

Do you believe that IoT knowledge will open up more career opportunities for fresh graduate students?

27 responses

● No
● Maybe
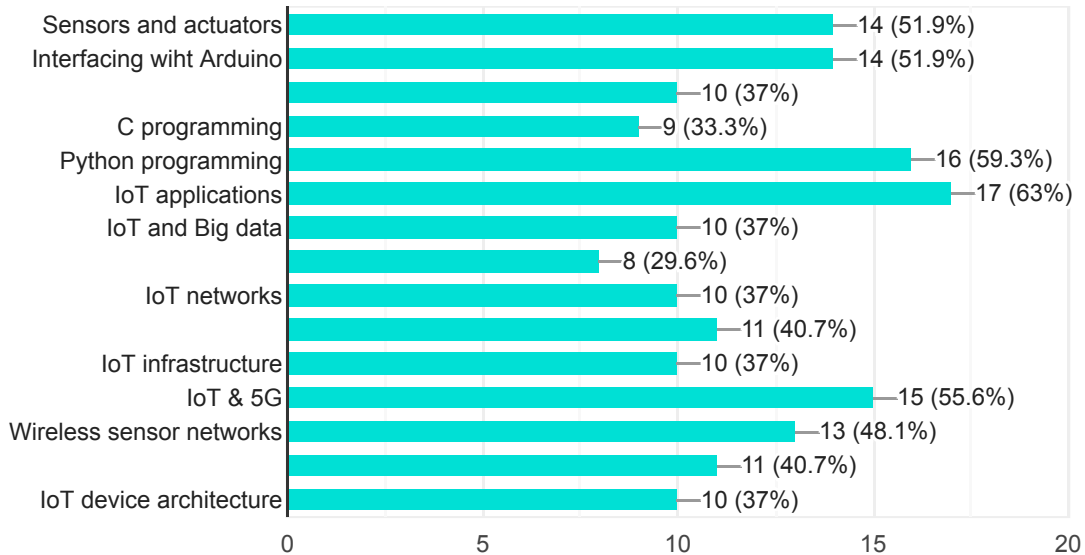● Yes (Surely)

81.5%

18.5%

To which extent do you think that IoT knowledge is required in the labor market ?

27 responses

Which of the following topics should be included in an IoT course for undergraduate students ? Please check all apply

27 responses

Horizontal bar chart:
- Sensors and actuators: 14 (51.9%)
- Interfacing wiht Arduino: 14 (51.9%)
- 10 (37%)
- C programming: 9 (33.3%)
- Python programming: 16 (59.3%)
- IoT applications: 17 (63%)
- IoT and Big data: 10 (37%)
- 8 (29.6%)
- IoT networks: 10 (37%)
- 11 (40.7%)
- IoT infrastructure: 10 (37%)
- IoT & 5G: 15 (55.6%)
- Wireless sensor networks: 13 (48.1%)
- 11 (40.7%)
- IoT device architecture: 10 (37%)

X-axis: 0, 5, 10, 15, 20

Please list other topics that should be included in the IoT course and not mentioned above
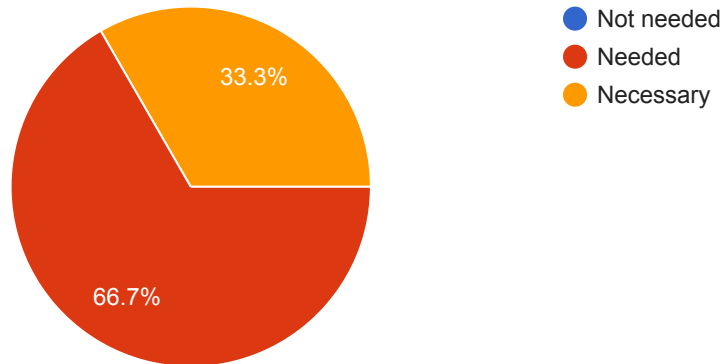
27 responses

AI

None

Cloud Computing, apk applications.

..

Nothing else for telecom Eng

Cloud offerings for IoT(for instance AWS)

Electric power system

Satellite communications

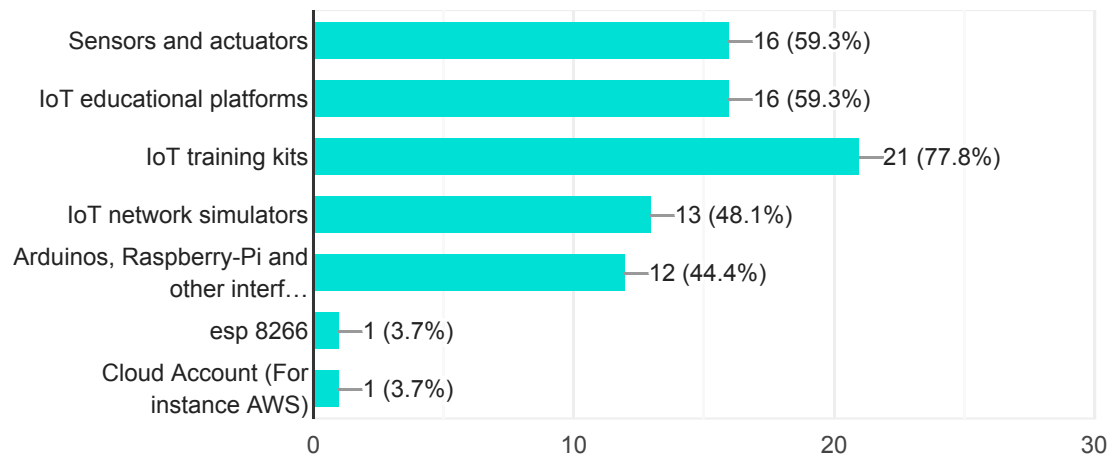Artificial intelligence, machine learning, and cyber security.

To which extent do you think that students should be involved in IoT laboratory experiments?

27 responses

Legend:
- Not needed
- Needed
- Necessary

33.3%
66.7%

Which of the following equipment are required for an IoT laboratory ?

27 responses

Equipment	Count
Sensors and actuators	16 (59.3%)
IoT educational platforms	16 (59.3%)
IoT training kits	21 (77.8%)
IoT network simulators	13 (48.1%)
Arduinos, Raspberry-Pi and other interf…	12 (44.4%)
esp 8266	1 (3.7%)
Cloud Account (For instance AWS)	1 (3.7%)