

Survey Fablabs -IoT

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Introduction

According to WP2, the objective of this work package is to establish the basis for the development of new types of educational materials for IoT-oriented FabLabs. This objective requires work on the identification of needs of: - the potential user's groups: 1) University students (with a special focus on female students, who are critically underrepresented in Engineering and Technology fields in EU), 2) University professors, 3) companies, and 4) secondary school students in their final years before entering higher education.

For that purpose, we carried out, during the initial phase of the project, among other analyses of the state of the art on established IoT Fablabs, a survey of the different stakeholders (students, entrepreneurs, academics, industrial managers, and other players) thanks to the partners network of the universities and research centers involved in this project. This report reflects the results and analyses of the answers to the survey in all country partners: University of Ljubljana (Slovenia), BIBA- University of Bremen (Germany), T2i (Italy), CATIM (Portugal), CESGA and University of Vigo (Spain).

The main target groups for this survey were: University students, University professors, companies, and secondary school students in their final years before entering higher education. This task will allow the consortium to identify the needs for IoT- related technologies in the FabLabs context, as well as the best teaching approach and channels.

Survey results and analysis

The survey involved 187 participants, but only 92 completed the survey. The user's gender was 42.39% Female and 57.61% Male, and ages between 16 to 65 years old.

The survey was structured in three types of profiles: for Teachers/tutors, students, and technical staff.

The role in the institution

- Educator/Teacher 53.26%
- Student / Participant (to the FabLab's activities) 25.00%
- Technical staff 21.74%

Q. Where do they work/study?

Teachers/tutors	Students	Technical staff
<ul style="list-style-type: none"> Vocational Education center 10.20% High School/baccalaureate 24.49% University 51.02% Training academy/center 6.12% Professional 8.16% 	<ul style="list-style-type: none"> High School/baccalaureate 10.00% University 25.00% Fablab 30.00% Training academy/center 5.00% Professional 10.00% Other 20.00% 	<ul style="list-style-type: none"> Vocational Education center 0.00% High School/baccalaureate 10.00% University 25.00% Fablab (AO04) 30.00% Training academy/center 5.00% Professional 10.00% Other 20.00%

Q. Teaching/scholar level

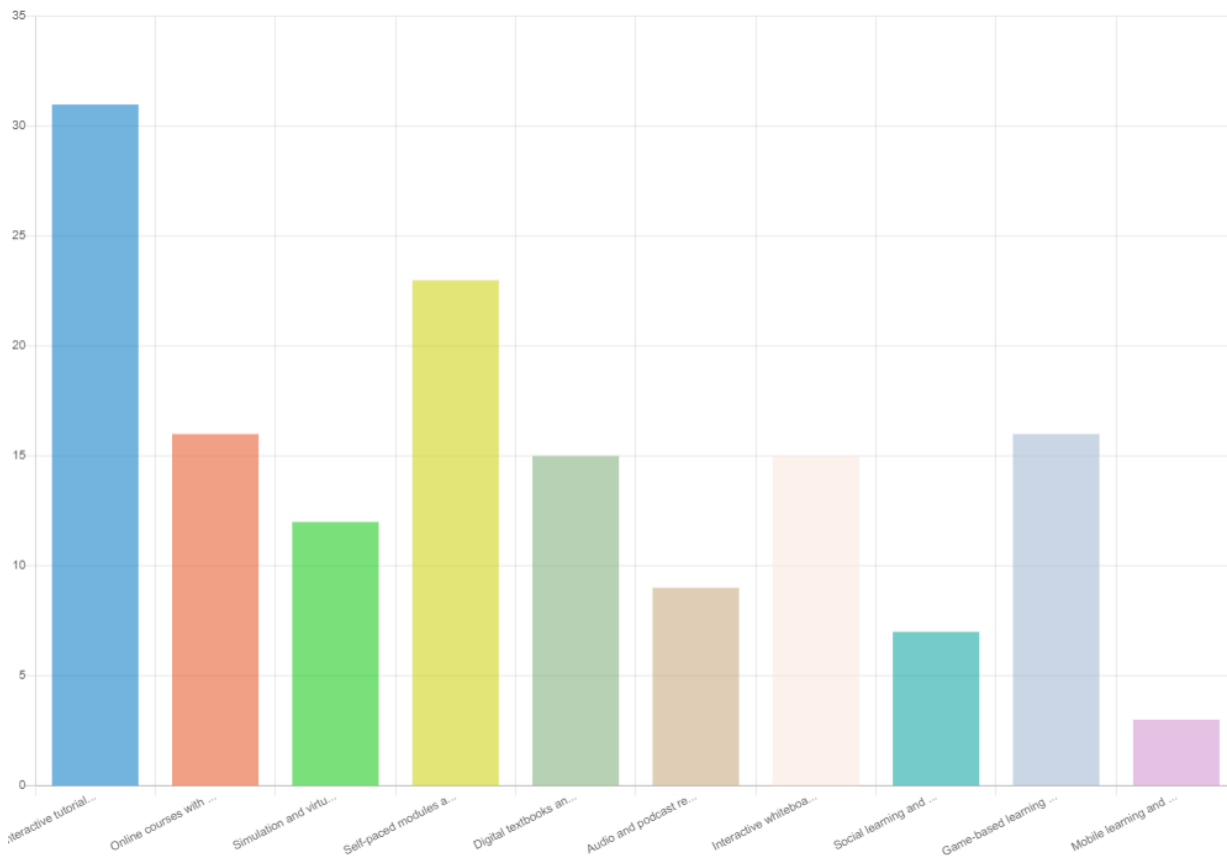
Teachers/tutors	Students	Technical staff
<ul style="list-style-type: none"> Apprenticeship 4.08% Bachelor's degree 26.53% Master's degree 32.65% Vocational Education 14.29% Lifelong Education 8.16% Other/Non formal education 14.29% 	<ul style="list-style-type: none"> Apprenticeship 8.70% Bachelor's degree 26.09% Master's degree 39.13% Vocational Education 13.04% Self-Learner 0.00% Other 13.04% (High School) 	<ul style="list-style-type: none"> Apprenticeship 0.00% Bachelor's degree 50.00% Master's degree 40.00% Vocational Education 0.00% Self-Learner 0.00% Other 10.00% (PhD)

Q. When it comes to using ICT, how do you rate your digital competence levels in Technical competencies (professional collaboration and communication, reflective practice, prof. development...)]

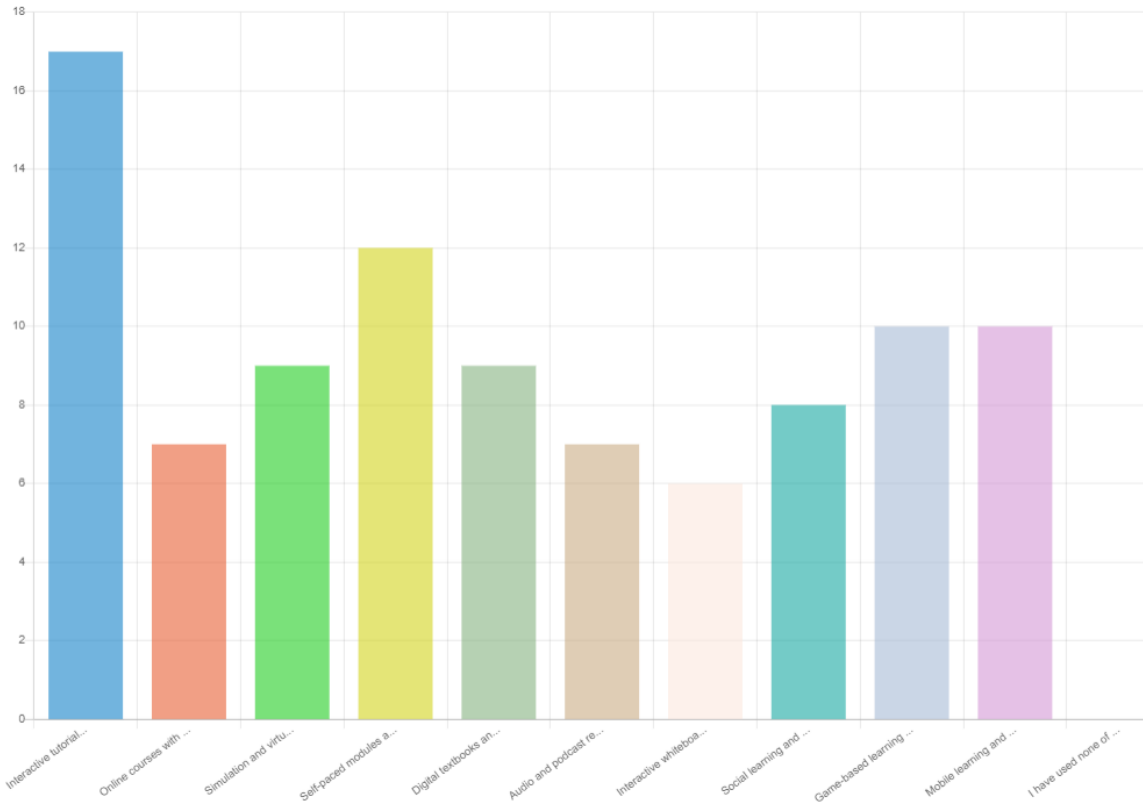
Teachers/tutors		Students		Technical staff	
• None	0.00%	• None	4.35%	• None	0.00%
• Basic	14.29%	• Basic	8.70%	• Basic	12.24%
• Intermediate	32.65%	• Intermediate	60.87%	• Intermediate	55.10%
• Advanced	53.06%	• Advanced	26.09%	• Advanced	32.65%

Q. If you have experience in using e-learning, which would be your favorite eLearning formats?

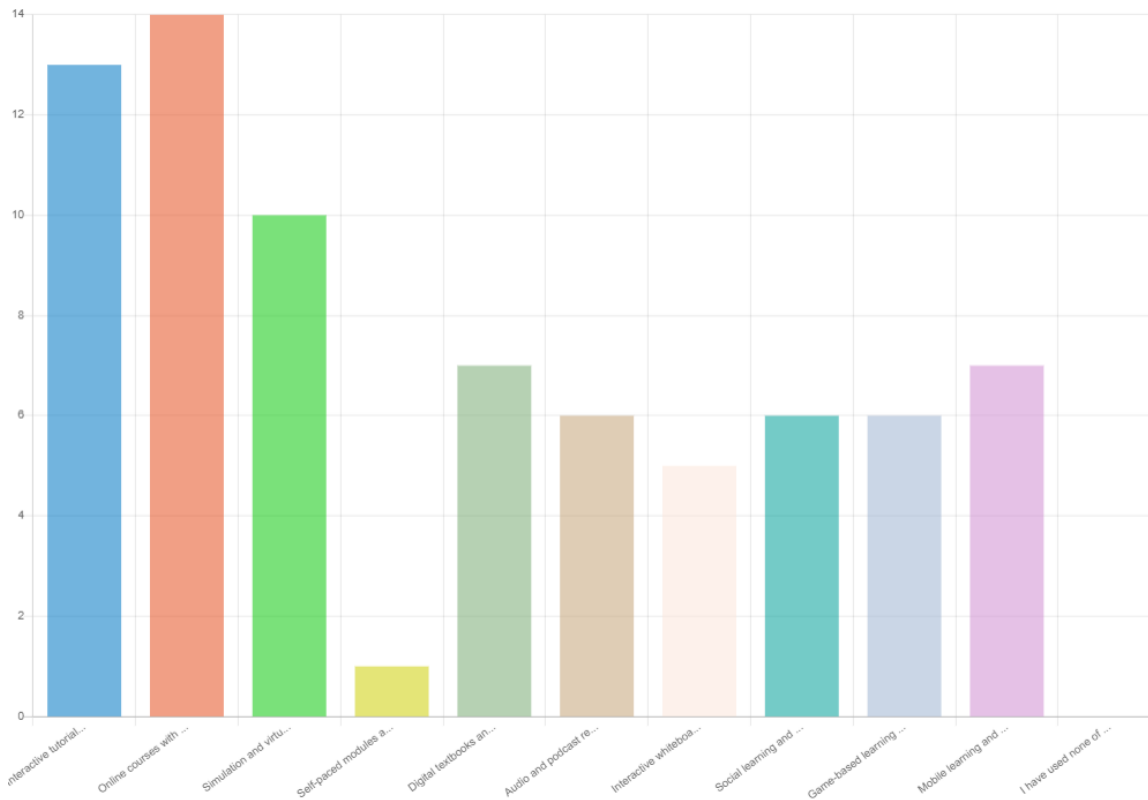
(Choose those you like as a teacher)



(Choose those you like as a student)



(Choose those you like as a Technical staff)

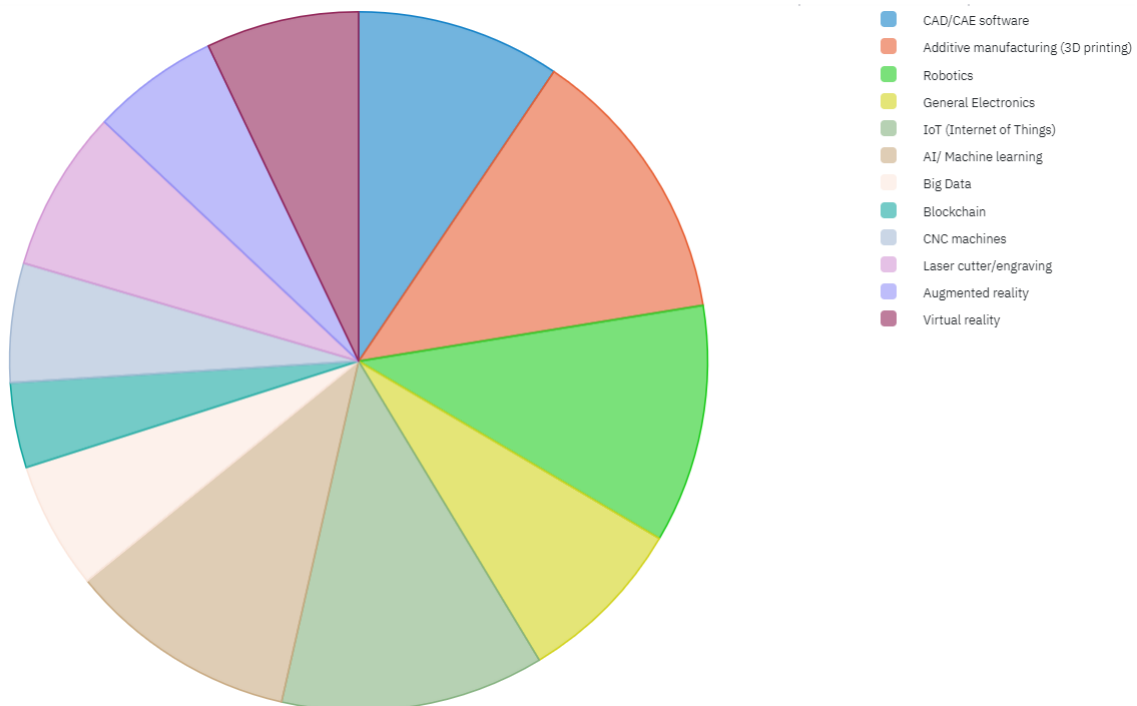


Q. Has a FabLab initiative/facility been integrated into your School /University /workplace /municipality?

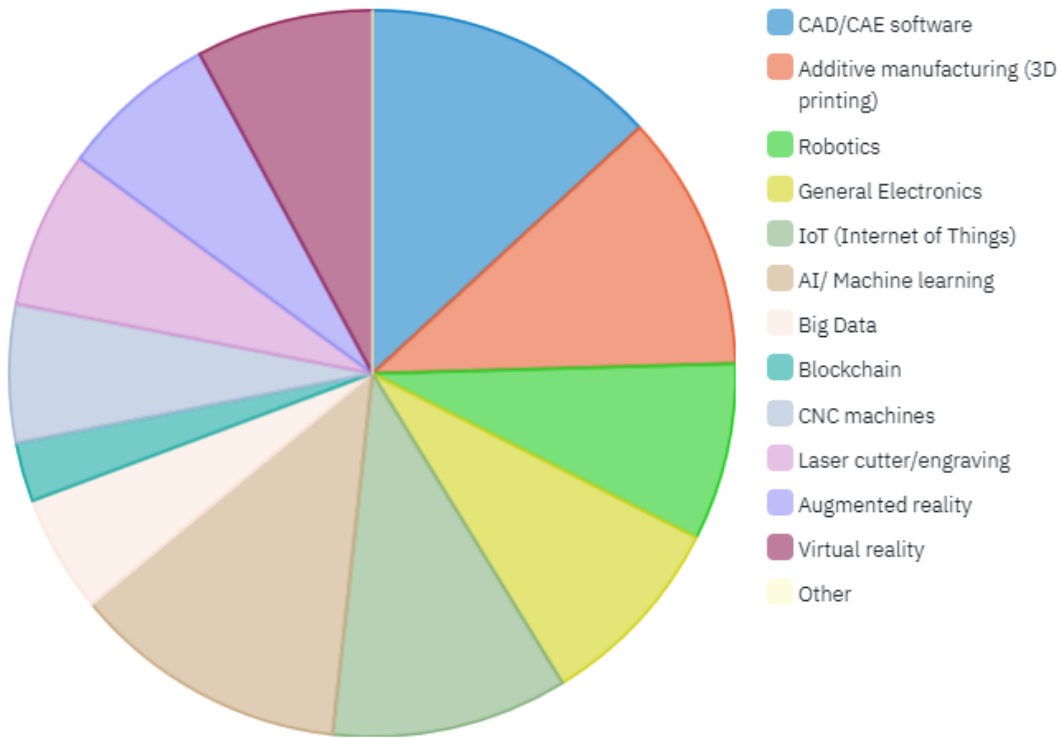
Teachers/tutors		Students		Technical staff	
				Does your FabLab have any agreement with a training school/University/center/company?	
• Yes	32.65%	• Yes	21.74%	• Yes	50.00%
• No	32.65%	• No	26.09%	• No	5.00%
• I don't Know	34.69%	• I don't Know	52.17%	• I don't Know	45.00%

Q. From these technologies/tools (list below) which are the most important for the near future and important to have access in a Fablab?

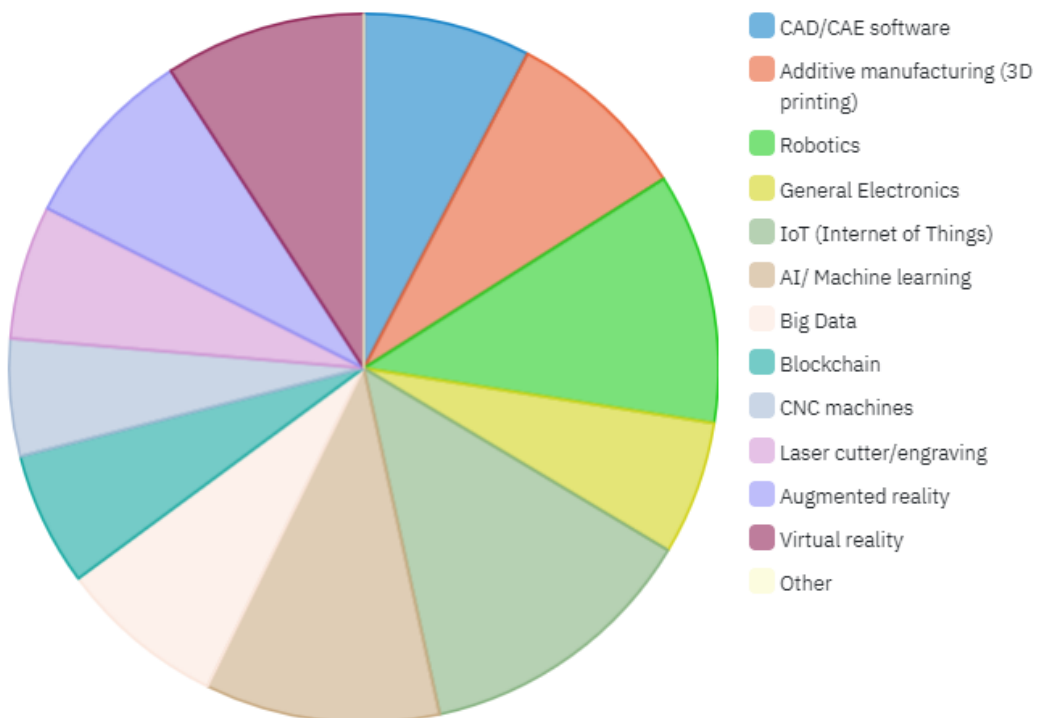
(Teachers)



(Students)



(Technical Staff)



Q. Which channels do you prefer to manage or to receive help on technologies:

Teachers/tutors	Students	Technical staff
<ul style="list-style-type: none"> Lectures (face to face) 51.02% eLearning 28.57% Blended learning (mixed models such as eLearning with workshops) 59.18% Other 2,04% 	<ul style="list-style-type: none"> Lectures (face to face) 73.91% eLearning 39.13% Blended learning (mixed models such as eLearning with workshops) 60.87% 	<ul style="list-style-type: none"> Lectures (face to face) 50.00% eLearning 40.00% Blended learning (mixed models such as eLearning with workshops) 80.00%

Q. Please rate your preference for the following methods to teach (1-less preferable / 5 – most preferable).

[Face-to-face lecture]

Teachers/tutors	Students	Technical staff
<ul style="list-style-type: none"> 1 - 6.12% 2 - 4.08% 3 - 18.37% 4 - 34.69% 5 - 36.73% 	<ul style="list-style-type: none"> 1 - 0.00% 2 - 4.35% 3 - 39.13% 4 - 26.09% 5 - 30.43% 	<ul style="list-style-type: none"> 1 - 5.00% 2 - 5.00% 3 - 20.00% 4 - 45.00% 5 - 25.00%

[Group learning]

Teachers/tutors	Students	Technical staff
<ul style="list-style-type: none"> 1 - 2.04% 2 - 8.16% 3 - 10.20% 4 - 32.65% 5 - 46.94% 	<ul style="list-style-type: none"> 1 - 4.35% 2 - 4.35% 3 - 13.04% 4 - 47.83% 5 - 30.43% 	<ul style="list-style-type: none"> 1 - 10.00% 2 - 5.00% 3 - 10.00% 4 - 55.00% 5 - 20.00%

[Workshop]

Teachers/tutors	Students	Technical staff
<ul style="list-style-type: none"> • 1 - 0.00% • 2 - 2.04% • 3 - 6.12% • 4 - 28.57% • 5 - 63.27% 	<ul style="list-style-type: none"> • 1 - 0.00% • 2 - 8.70% • 3 - 4.35% • 4 - 43.48 • 5 - 43.48% 	<ul style="list-style-type: none"> • 1 - 0.00% • 2 - 5.00% • 3 - 15.00% • 4 - 45.00% • 5 - 35.00%

[Project work]

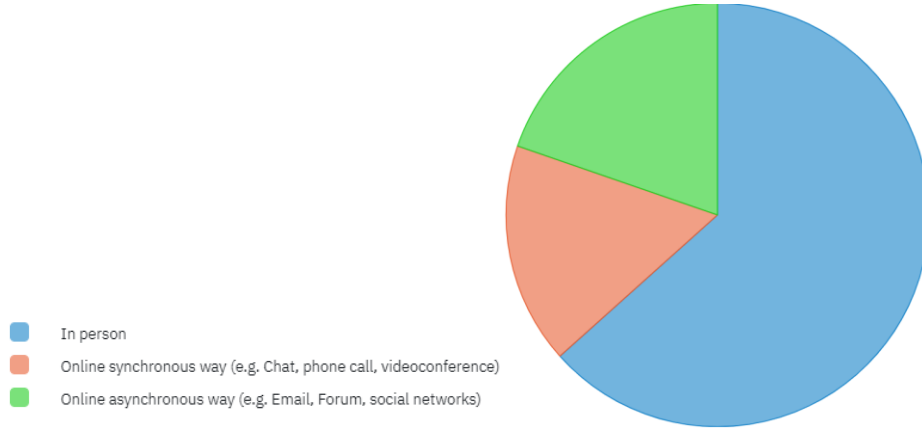
Teachers/tutors	Students	Technical staff
<ul style="list-style-type: none"> • 1 - 4.08% • 2 - 12.24% • 3 - 14.29% • 4 - 24.49% • 5 - 44.90% 	<ul style="list-style-type: none"> • 1 - 0.00% • 2 - 8.70% • 3 - 17.39% • 4 - 43.48% • 5 - 30.43% 	<ul style="list-style-type: none"> • 1 - 0.00% • 2 - 15.00% • 3 - 10.00% • 4 - 40.00% • 5 - 35.00%

[Remote laboratory]

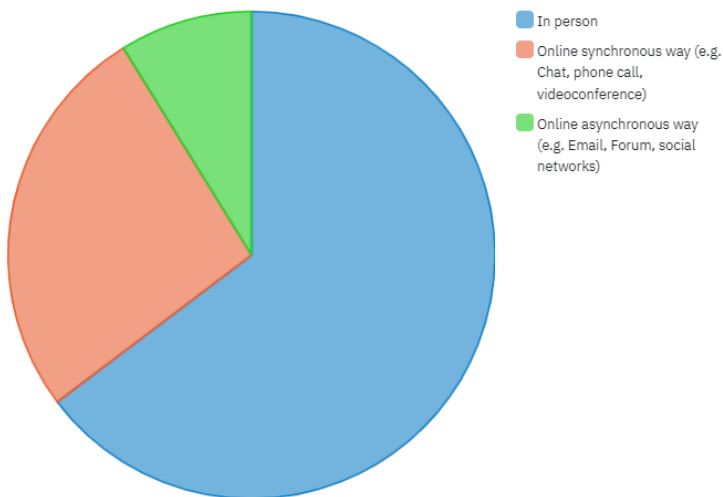
Teachers/tutors	Students	Technical staff
<ul style="list-style-type: none"> • 1 - 16.33% • 2 - 18.37% • 3 - 42.86% • 4 - 8.16% • 5 - 14.29% 	<ul style="list-style-type: none"> • 1 - 17.39% • 2 - 21.74% • 3 - 34.78% • 4 - 26.09% • 5 - 0.00% 	<ul style="list-style-type: none"> • 1 - 15.00% • 2 - 15.00% • 3 - 40.00% • 4 - 20.00% • 5 - 10.00%

Q. How would you like to interact with your students/participants?

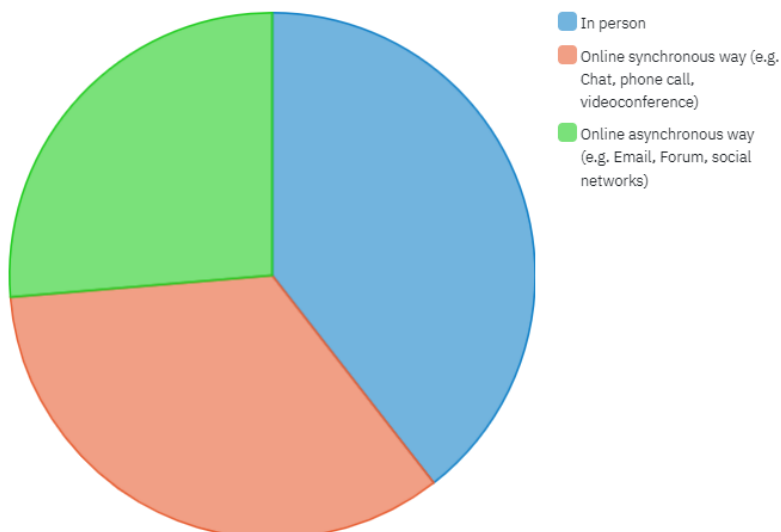
(Teachers)



(Students)



(Technical staff)

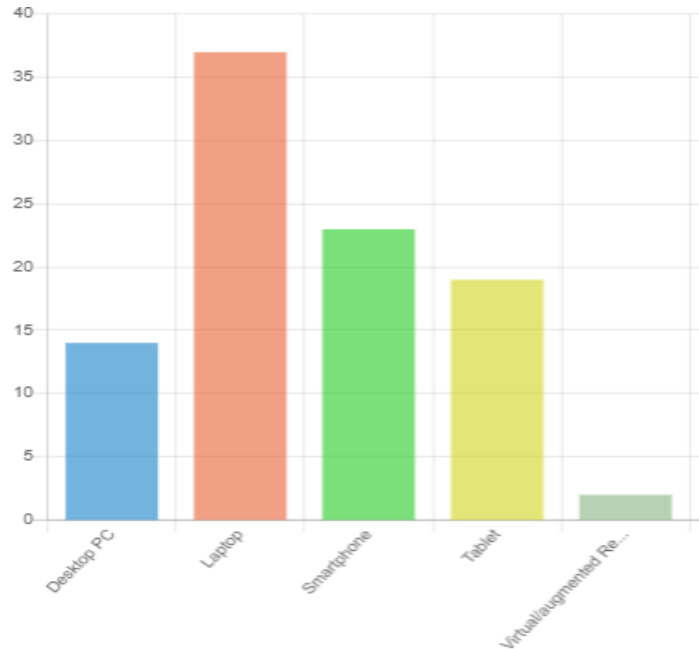


Q. Do you think that it is important to evaluate the pre-knowledge before training starts (assessment)?

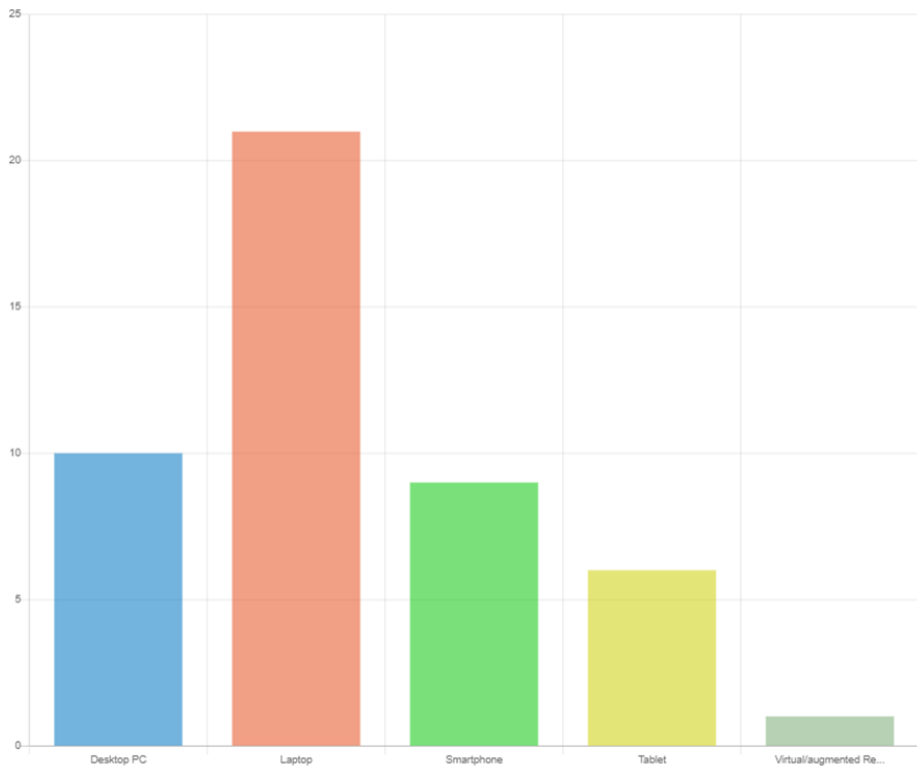
Teachers/tutors		Students		Technical staff	
• Yes	85.71%	• Yes	82.61%	• Yes	75.00%
• No	10.20%	• No	4.35%	• No -	5.00%
• I don't know	6.12%	• I don't know	13.04%	• I don't know	20.00%

Q. If you are on distance learning, which equipment you consider that your Student/learner will use :

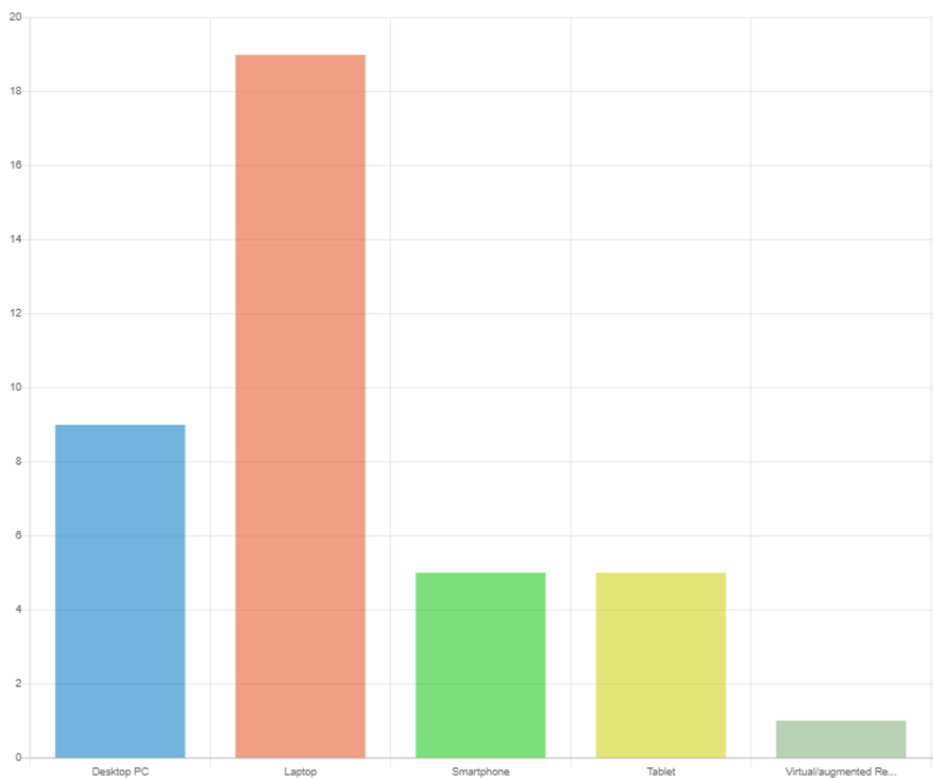
(Teachers/tutors)



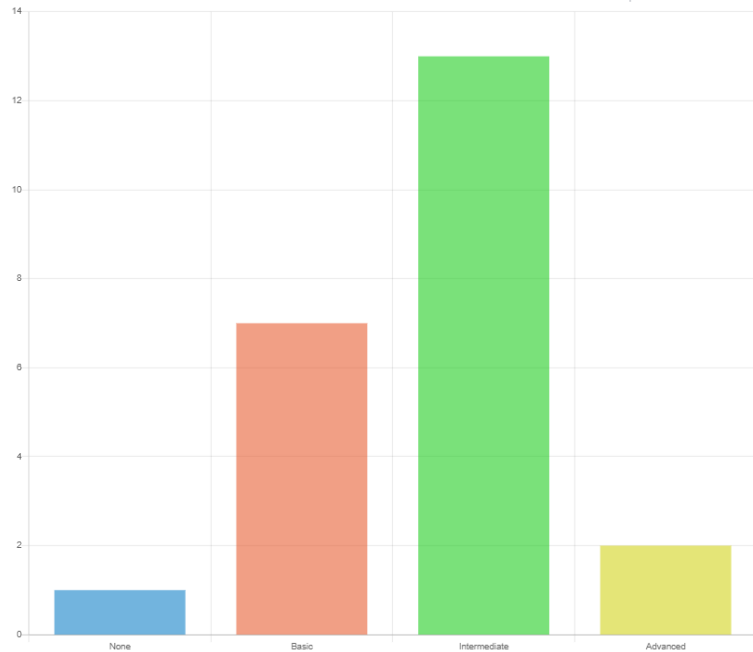
(Students)



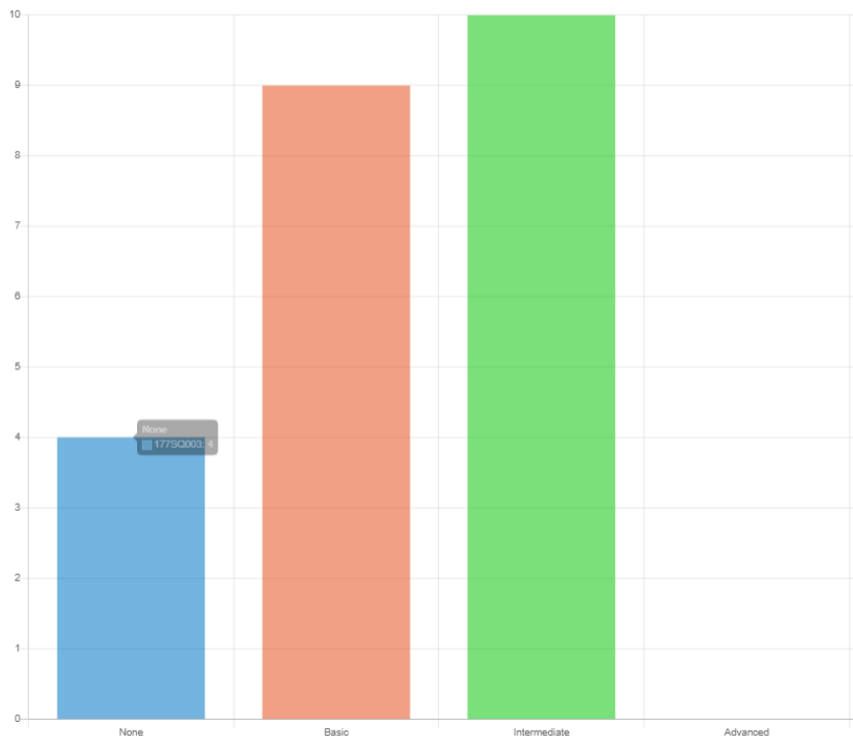
(Technical Staff)



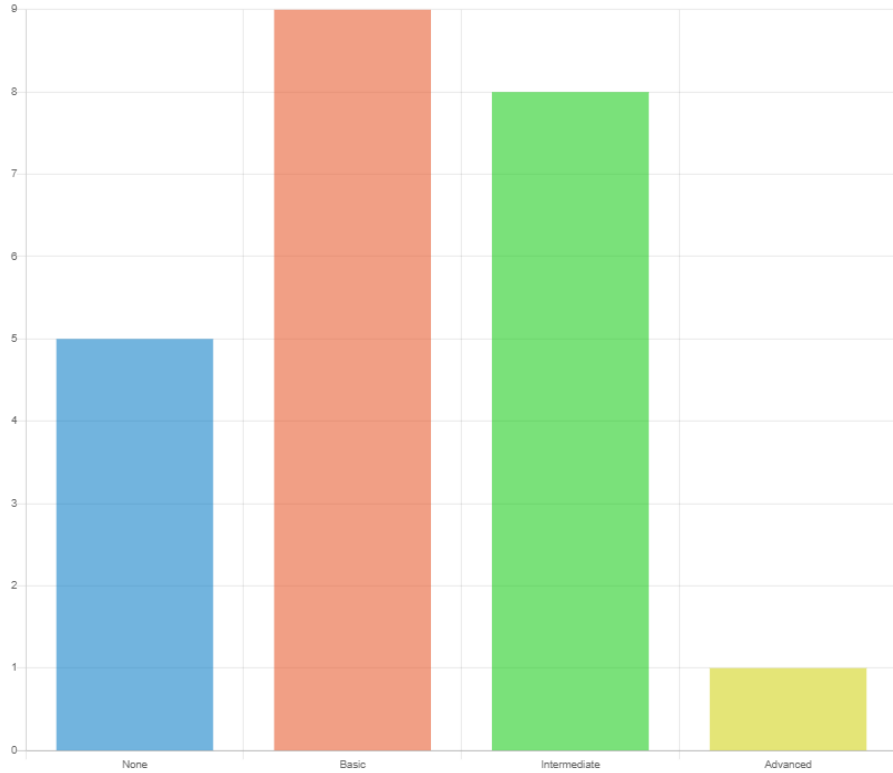
Q. When it comes to using ICT in your learning, how do you rate your digital competence levels in Communication and collaboration competencies (interaction, collaboration, data sharing...)



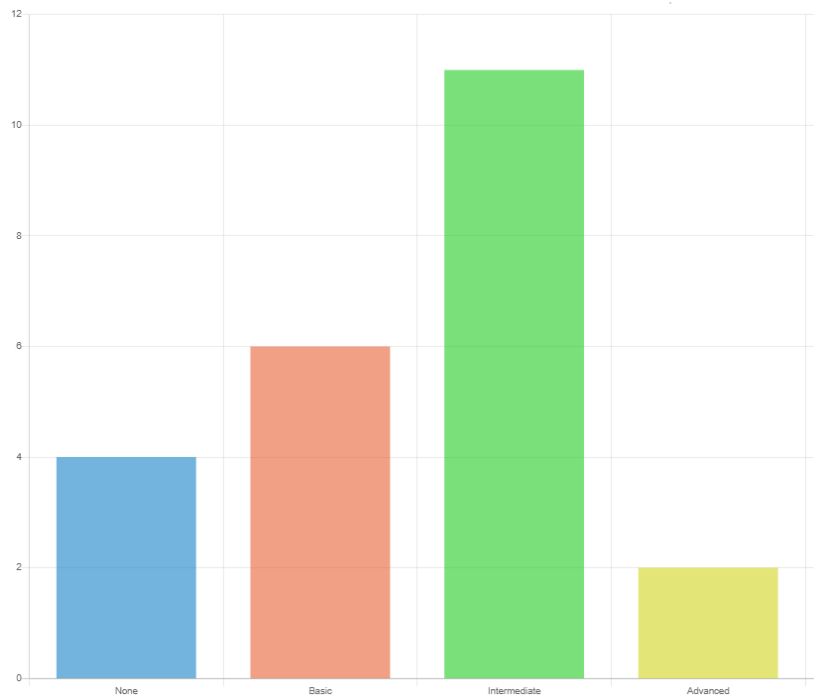
Q. When it comes to using ICT in your learning, how do you rate your digital competence levels in Digital Content creation (developing and integrating digital content, and programming)



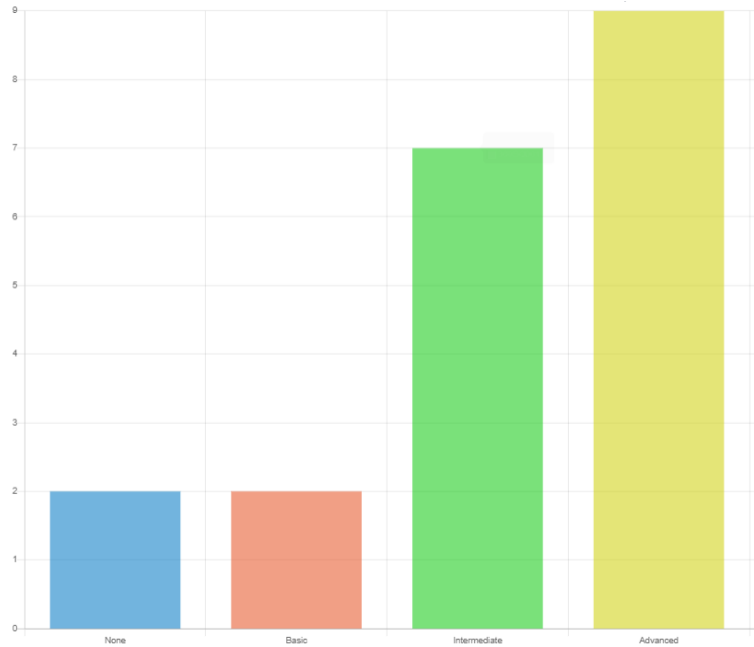
Q. When it comes to using ICT in your learning, how do you rate your digital competence levels in Security (protecting devices, data, health, environment...)



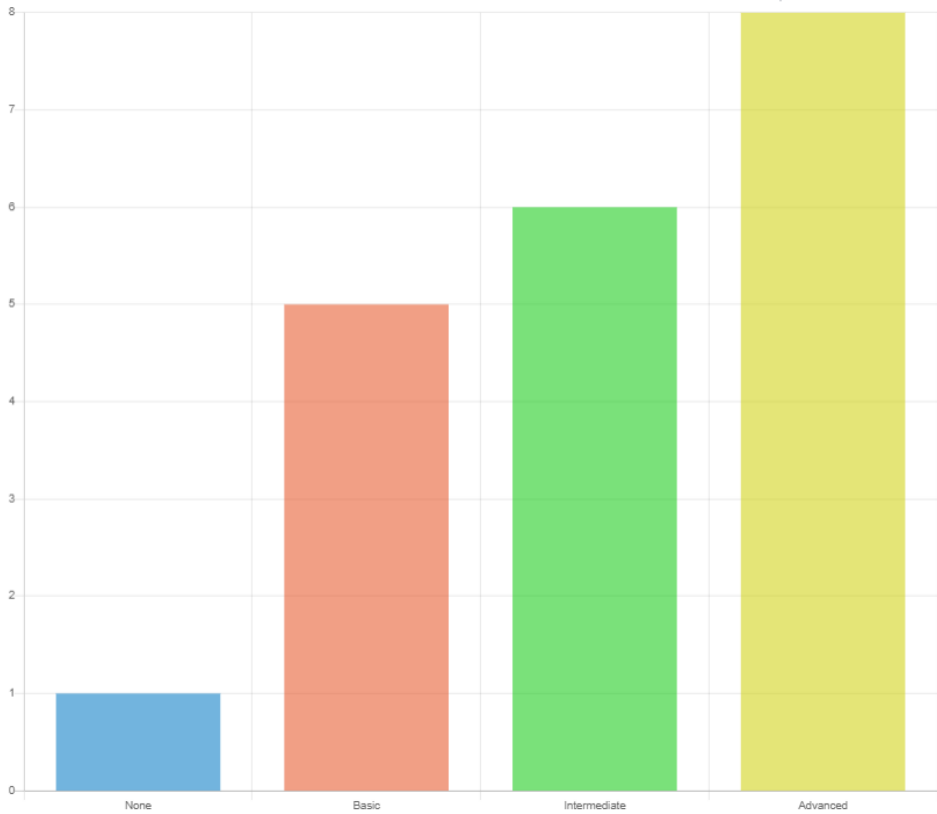
Q. When it comes to using ICT in your learning, how do you rate your digital competence levels in Problem-solving (identifying needs and technological responses, creatively using digital technologies, identifying digital competence gaps)



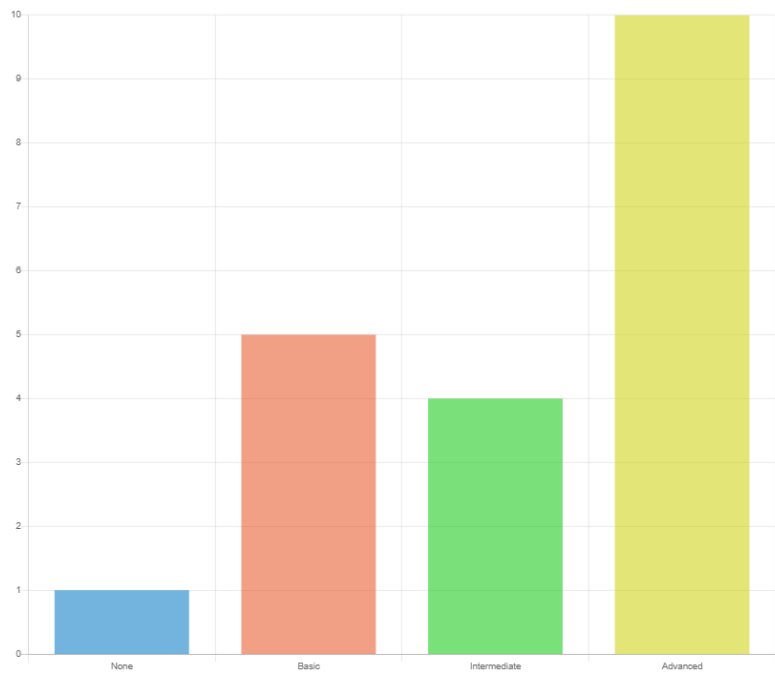
Q. When it comes to using ICT in your teaching or supporting, how do you rate your digital competence levels in: [Professional competencies (professional collaboration and communication, reflective practice, prof. development...)] (Technical Staff)



Q. When it comes to using ICT in your teaching or supporting, how do you rate your digital competence levels in: Pedagogical competences (managing and creating digital resources, managing teaching and learning, empowering, assessing learners...)



Q. When it comes to using ICT in your teaching or supporting, how do you rate your digital competence levels in: Learners' competencies (facilitating learners' digital competence)



Conclusions

FUNDAMENTAL COMPETENCES

Technical competences

In the questionnaire, participants were asked to rate their levels of technical digital skills, regarding the use of ICT in teaching, in terms of professional collaboration and communication, reflective practice, and professional development. The obtained information revealed that participants have a basic knowledge of these pedagogical skills.

Pedagogical competences

When it comes to the use of ICT in their teaching, the rate of digital competencies in pedagogical competencies related to the management and creation of digital resources, teaching management and student learning and assessment were questioned. Which information was obtained that participants require a basic knowledge of these pedagogical skills.

Learner's competences

When asked about the level of knowledge of digital competencies when it comes to using ICT in their teaching, related to the learners' digital competencies, the participants answered having a basic level of knowledge about these learners' competencies.

Participants who answered that they had experience in eLearning were asked what their favorite eLearning formats were, most of the participants chose interactive tutorials, instructional videos, and online courses with webinars as their preferred format.

INVOLVEMENT

The Project discussed in this report has provided valuable insights into teaching and learning IoT-related topics in the context of FabLab's (digital fabrication laboratories). The project has successfully gathered perspectives from various stakeholders, including educators' students, and FabLab staff, resulting in a better understanding of preferred eLearning formats and teaching strategies.

In conclusion, the project aims has successfully gathered valuable insights and perspectives from participants in Germany, Italy, Portugal, Slovenia, and Spain regarding the teaching and learning of IoT topics in a FabLab context. The project

intended to develop learning and teaching strategies, didactic methods, and learning materials to enhance the understanding of IoT-related technologies like Blockchain and AI/Big Data in FabLabs. The involvement of educators, students, and FabLab staff from different regions and educational backgrounds provides a diverse range of perspectives.

FUNDAMENTAL SKILLS

The findings from the questionnaires revealed several important points. In terms of fundamental competencies, participants generally exhibited advanced knowledge of technical digital skills, while their pedagogical competencies ranged from intermediate levels. Regarding learner competencies, participants reported having intermediate knowledge of digital competencies related to using ICT in teaching.

Participants with experience in eLearning favored interactive tutorials, instructional videos, and online courses with webinars as their preferred eLearning formats. They also emphasized the importance of evaluating pre-knowledge before training and expressed a preference for blended learning (mixed models such as eLearning with workshops) when managing or receiving help on technologies.

TOPICS FOR FABLABS

When envisioning the future of FabLabs, participants identified IoT, CAD/CAE software, and AI/Machine learning as the most important technologies. Other significant technologies included additive manufacturing (3D printing), CAD/CAE software, virtual reality, and general electronics. These choices align with current trends and highlight the importance of connectivity, automation, intelligence, rapid prototyping, data analysis, and immersive experiences.

To determine the importance of assessing pre-existing knowledge before training begins, participants were asked if they considered it important to evaluate pre-knowledge. The majority responded affirmatively, emphasizing the importance of evaluating pre-knowledge. When asked about their preferred channels for managing or seeking assistance with technologies, participants selected face-to-face lectures, eLearning, and blended learning (combining eLearning with workshops).

To determine the most commonly used equipment in distance learning, participants were asked which devices they would use for distance learning, and the majority indicated that they would use desktop PCs and laptops.

The participants were asked which methods they prefer to teach/support/learn, in a greater response was obtained by the work project and workshop methods, reflecting our previous perspectives for a Hands-on training approach.

They were also asked how they would like to interact with professors/students/participants/FabLab staff, in which most answered that they preferred to interact personally with professors/students/participants/FabLab staff.

Talking about technologies that are considered the most important addressed by the approach, mixing all answers from all participants, it seems all topics asked are important:

- ❖ CAD/CAE software
- ❖ Additive manufacturing
- ❖ Robotics
- ❖ General Electronics
- ❖ IoT (Internet of Things)
- ❖ AI/ Machine learning (SQ006)
- ❖ Big Data
- ❖ Blockchain
- ❖ CNC machines
- ❖ Laser cutter/engraving
- ❖ Augmented reality

In the conducted survey, participants were asked to identify the technologies and tools considered most important for the near future and that should be available in the FabLab. The specific question presented a list of technologies/tools and requested participants to indicate the most relevant ones. After analyzing the results, the technologies most chosen by participants were IoT (Internet of Things), robotics, general electronics, and artificial intelligence/machine learning. These technologies reflect current trends, where connectivity, automation, and intelligence play a fundamental role. Additionally, additive manufacturing (3D printing) and CAD/CAE (design and analysis software) also received attention among participants' choices. These technologies are related to the ability for rapid prototyping and product design, essential aspects of a FabLab. Another technology mentioned by participants was big data, indicating the importance of analyzing large volumes of data to gain insights and make informed decisions.

Overall, the project has provided valuable insights into the need's preferences, and expectations of stakeholders involved in FabLabs. The project's outcomes will

contribute to a better understanding of how to teach and learn IoT topics in FabLabs, improve the development strategy of new materials, and attract students and other stakeholders to explore and learn about emerging technologies. The results will inform the development of learning and teaching strategies, curriculum design, and training activities, ultimately enhancing the educational experience in FabLabs and promoting innovation in IoT-related fields.

PROMOTION

It seems that many survey participants don't know about the existence of a Fablabs facility, in their School/University/community, which reveals the lack of promotion or publicity about this important tool for learners, makers, and entrepreneurs.

Promoting the FabLabs involves raising awareness, generating interest, and fostering engagement among students, faculty, and staff. Some strategies, the project partnership could identify using the present project to promote the FabLabs within our community by using several strategies such as: maintain the project and fablab Websites and an active Social Media Presence, organizing Workshops and Training Sessions (pilot course will be a start point), conduct hands-on workshops and training sessions to introduce students and faculty to the FabLab's capabilities, offer training on specific tools and equipment, showcasing the potential for innovation and creativity, collaborate with Academic/school Departments, host Open Houses and Tours (Open days), participate in Orientation Events, promoting showcase Success Stories, engage with Student Organizations/associations, host Competitions and STEAM Challenges, using Campus Events and Fairs, seek Media Coverage, among others options that probably the project consortium will propose until the end of the project.

Annex 1 : Links to the Survey

- English (Base language):

<https://inqueritos.catim.pt/lime/index.php/175113?lang=en>

- German:

<https://inqueritos.catim.pt/lime/index.php/175113?lang=de>

- Italian:

<https://inqueritos.catim.pt/lime/index.php/175113?lang=it>

- Portuguese:

<https://inqueritos.catim.pt/lime/index.php/175113?lang=pt>

- Slovenian:

<https://inqueritos.catim.pt/lime/index.php/175113?lang=sl>

- Spanish:

<https://inqueritos.catim.pt/lime/index.php/175113?lang=es>