young social makers

Skills & Competence Framework

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1. Introduction

Young Social Makers is an Erasmus+ project with partners from across Europe coming together to bridge the gap between VET teaching, makers culture and our social responsibility towards fellow citizens with special needs

Young social makers (YSM) lays the foundations for a learning programme in the field of education for students in VET, and give them the knowledge, skills and competences to ideate, design and prototype social objects which cover the needs of people with special needs, using digitally enhanced manufacturing tools and machinery, such as 3D printing, laser cutting, rapid prototyping and design thinking. At the same time they will acquire, through working together on the social objects, co-creation, co-design and co-operation skills (horizontal skills in high demand by the labour market).

The teachers and educational staff are core in the students skills acquisition and therefore, a specific component of the YSM learning programme and approach is dedicated to providing them with the knowledge, skills and competences, technical and non-technical necessary to educate and train their students and support and guide them not only in the acquisition of the skills but also the actual assignment of generating a prototype.

The objective of the present document is to define skills framework and curriculum for the whole YSM learning programme, i.e. both for the teachers as well as the students. It has used as starting point the preparatory research at the submission and starting phases of the project[1].

2. Methodology

The approach to define the skills and competences has been developed in several phases[2]:

1. Preparatory desk research: analysis by the partners of existing experiences and initiatives in the field of Makers philosophy, fablab technology, tools and machinery (including design tools), digitally enhanced manufacturing, user centred design and user engagement (of people with special needs in particular), in their countries and on EU level.
2. Fine-tuning: This analysis was further fine-tuned and combined with the expertise and expert knowledge of the partners leading up to a shortlist of skills and competences considered the most relevant and appropriate for the O2 YSM Teacher Training Programme and the O3 YSM Student Learning Programme and Materials. Partners

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also identified a series of tools considered most appropriate for the target group based upon the analysis and their own experience with these tools.

3. Teacher and expert feedback: the identified skills and competence were presented to the teachers and experts in a survey form inquiring into their current knowledge and skills with regards to people with special needs, as well maker cultural and fablab technologies and skills.

4. Conclusions: based upon the results from the survey the final list of skills and competences has been defined and the final set of tools to be included in the training programmes identified.

The present document highlights the results from the survey in section 3 and the final skills and competence framework in section 4.

3. Teacher & expert feedback

The questionnaire presented to VET teachers and experts in the field of VET consisted of 3 sections:

– Section 1: General information about the respondent,
– Section 2: Awareness about people with special needs and their challenges,
– Section 3: Knowledge with regards to maker culture techniques & fablab technologies,
– Section 4: Knowledge with regards to fablab software and tools.

A total of 55 respondents participated including teachers, school directors and support staff have participated in this survey, which aims to offer a clear vision of the strengths and needs of the educational staff who will carry out the following phases (O2 and O3) of the Young Social Makers project.

3.1   Characteristics of the respondents.

The average age of the participants in the questionnaire was 41 years. Of these, 15% were under 30, 36% were in the 30-40 age range, 34% were between the ages of 40-50, and 15% of the participating teachers were over 50. Based on these results, it's observed that teaching staff for the YSM project is a young but experienced group.

Age of participants

15%   15%

35%   36%

■<30 ■30-40 ■40-50 ■>50
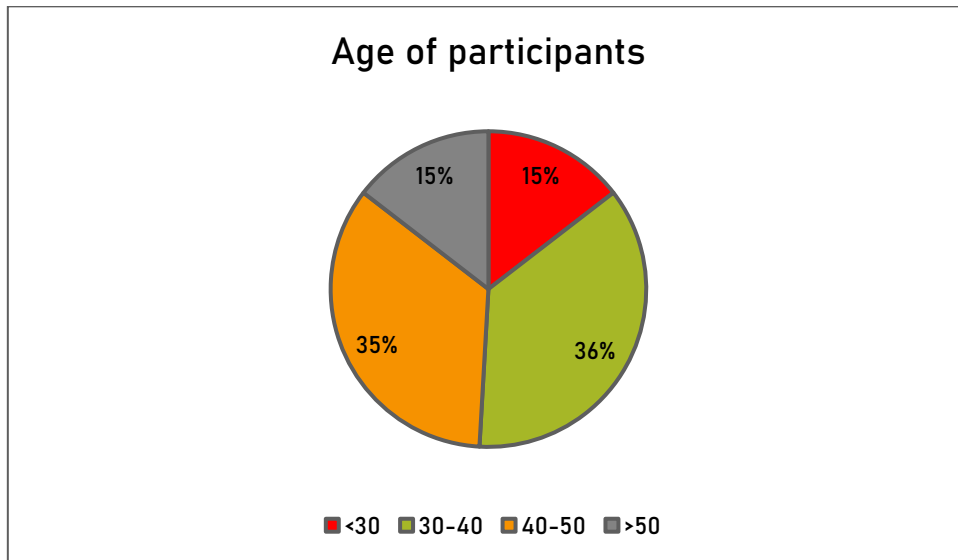
Most of the respondents were teachers (73% of the respondents), who are the on of the main target groups of the survey and the fundamental pillar for the development of the following phases of the project. This opinion is further enriched with the participation of directors and educational support staff (18%), and even with social organizations in the area of influence of the partners (9%).

Occupations

5

10

40

■ Teachers ■ Educational Staff ■ Others
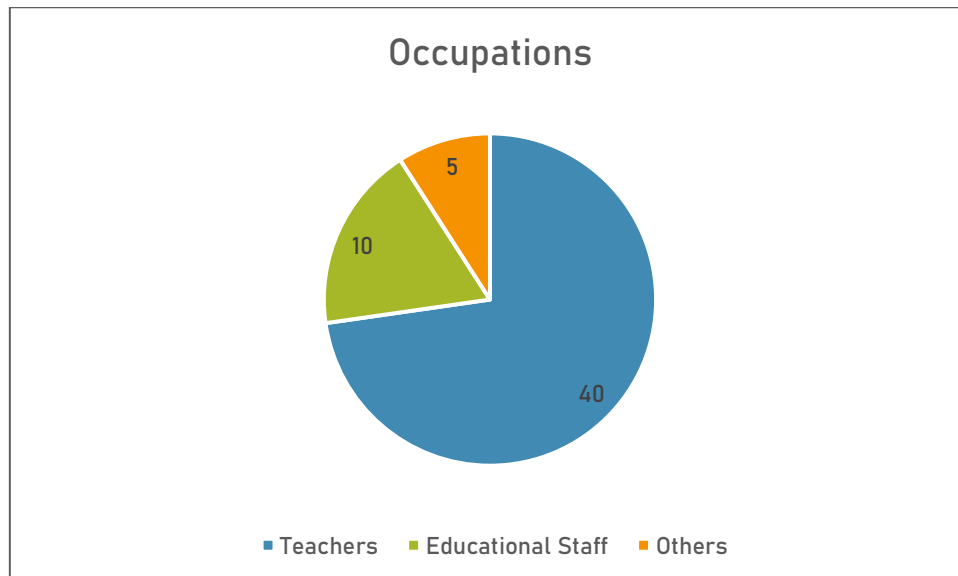
All partners contributed with survey participants, the educational partners assuming 62% of respondents stemming from their own entities. The remaining 38% correspond to centers and entities in their areas of influence, which shows an important work of dissemination of the project.
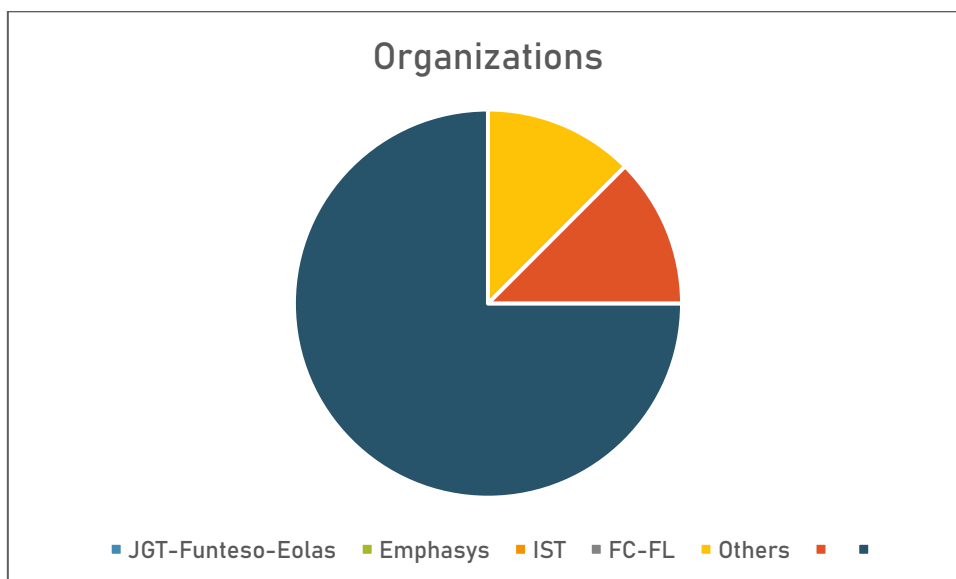
3.2   Awareness of the problems of people with special needs

People with special needs is a term that covers not only people with disabilities but also any group of citizens whose personal or professional activity implies specific needs. Such as for example elderly people, persons with mental health issues, and so on. This section aims to analyse the knowledge and awareness of respondents towards these groups of people.

With regards to the collaboration with organizations that help people with special needs 60% of respondents directly participate with associations that help people with special needs.
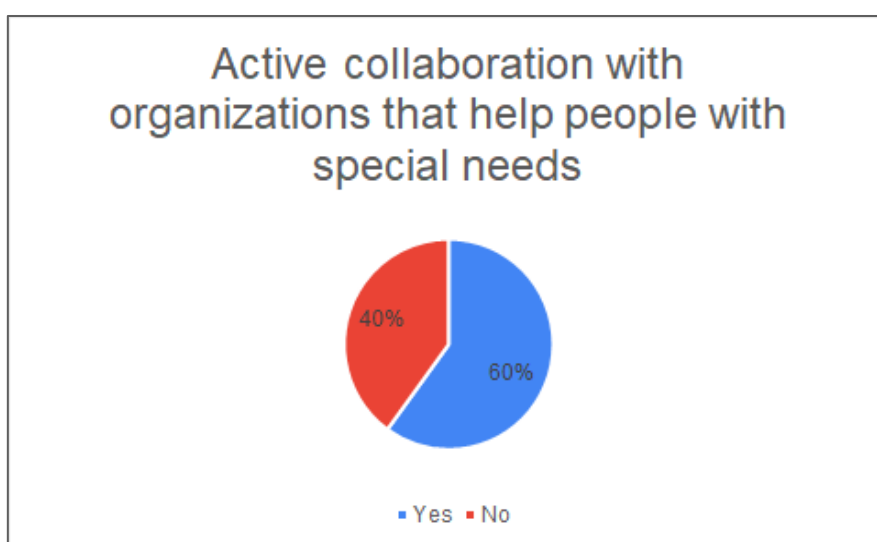
When asked about a direct relationship with persons with special needs 60% of respondents actively participate with associations that help people with special needs.
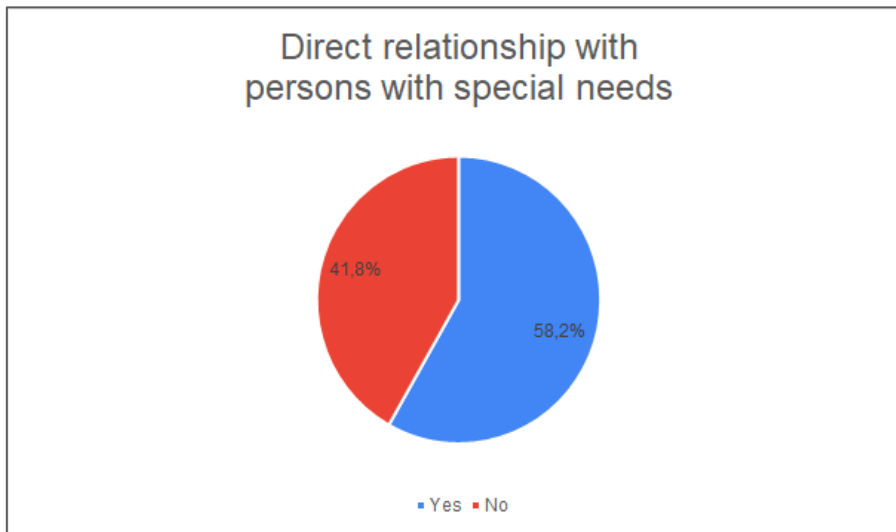
When asked for the most effective way to help people with special needs, 42 of 55 respondents are aligned with the YSM strategy. In 40% of cases, they also consider it useful to volunteer or do financial work.
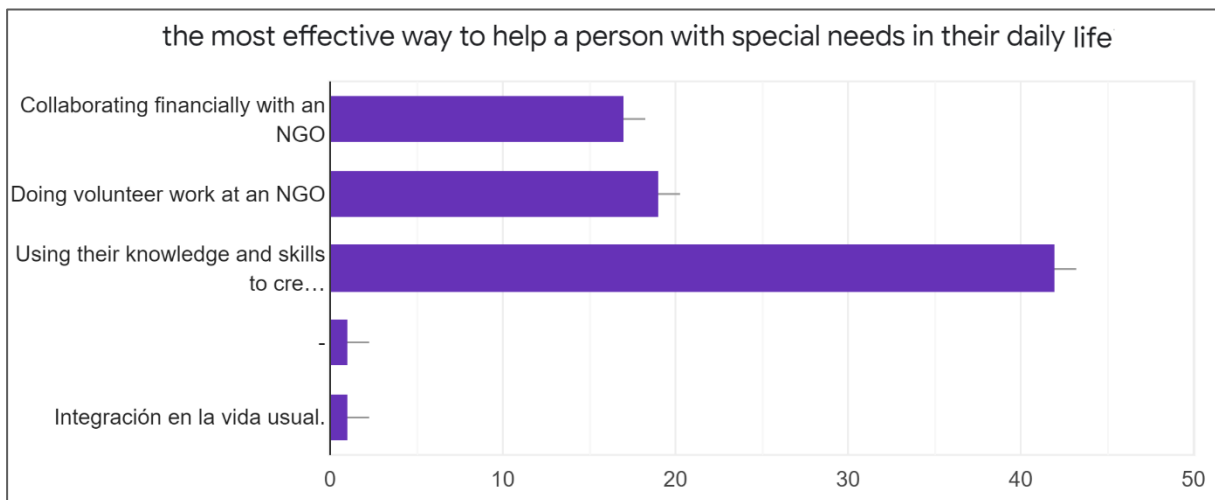
When respondents must put themselves in the position of being a person with special needs, it is consistent with the previous results, with the YSM culture being the favourite option again.

If you were a person with special needs, what is the most effective way to help you?

Collaborating financially with an NGO	13
Doing volunteer work at an NGO	19
Using their knowledge and skills to cre…	45
Querría ser como el resto.	1
Helping me to be more autonomous	1
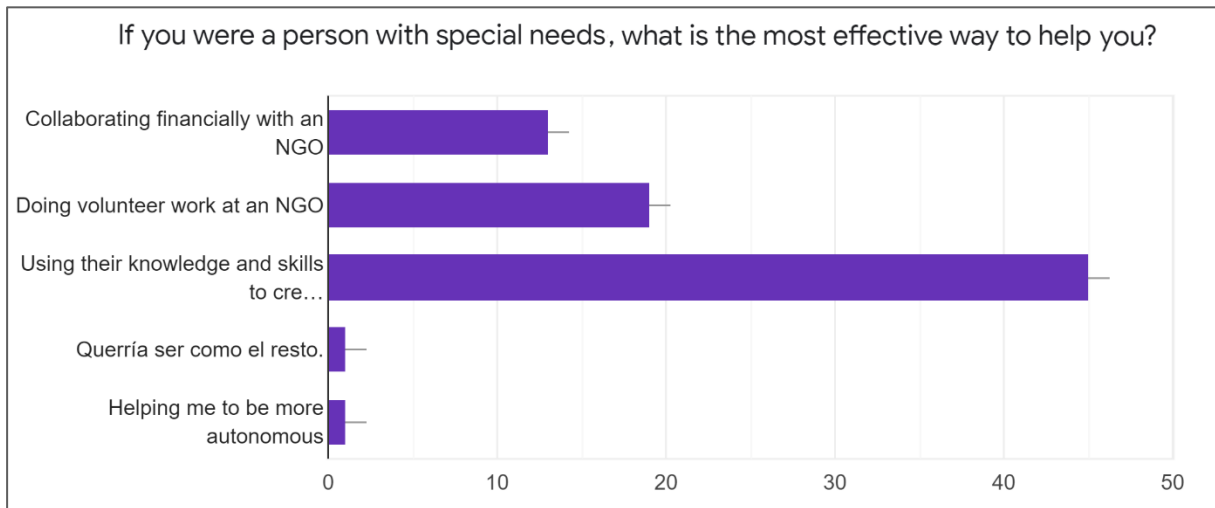
We also asked respondents about their interest to further collaborate, and as expected, most of the survey participants are excited to participate and collaborate on the project.
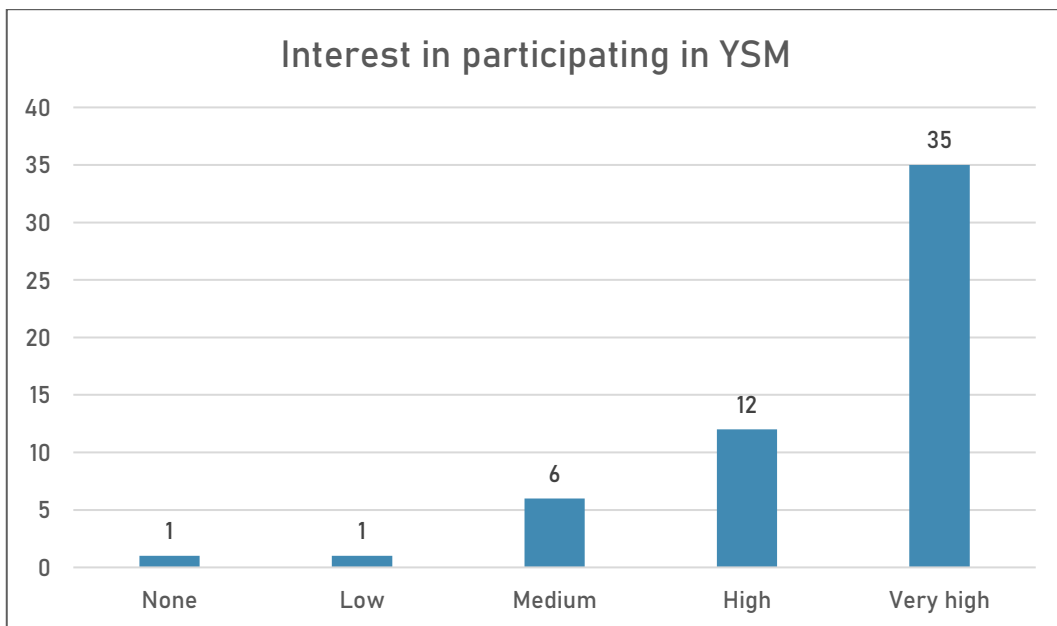
Interest in participating in YSM

None	Low	Medium	High	Very high
1	1	6	12	35

3.3   Maker culture techniques & fablab technologies

In the preparatory research the YSM project identified different skills such as collaborative design, teamwork, 3D modelling, awareness of the difficulties of people with special needs, etc. This section aims to establish the degree of mastery of these skills by respondents. The objective of the next set of questions was to identify the existing level of knowledge of the respondents, their interest in receiving training and the perceived level of knowledge of their students, with regards to the predefined set of techniques from the preparatory research.
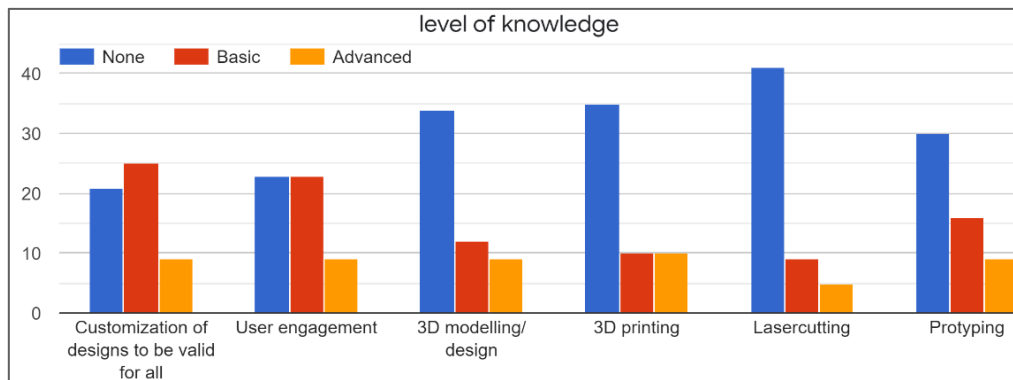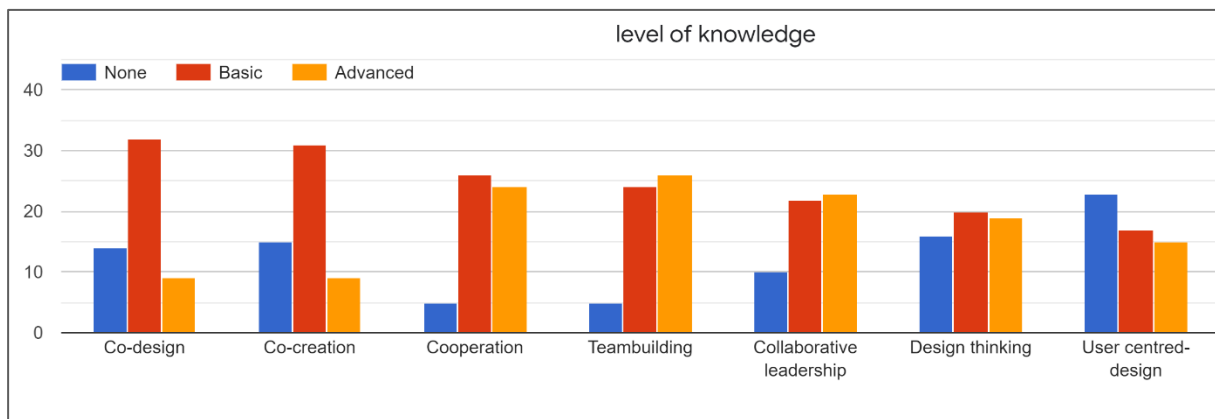
When analysing the level of knowledge of the teachers with regards to maker culture related techniques, the respondents indicate to mostly dominate "soft" skills and have more difficulties with fablab technology skills.

When asked whether they considered it useful to receive specific training on the maker cultural related techniques and/or fablab technologies, most of the respondents value positively receiving training in all skills. Even though they did indicate to have knowledge (basic or even advanced) on "soft" skills, even on these topics there is an interest to receive further training. This shows clearly the timeliness and appropriateness of a learning programme as proposed by YSM.

do you consider useful to receive training on the following skills?

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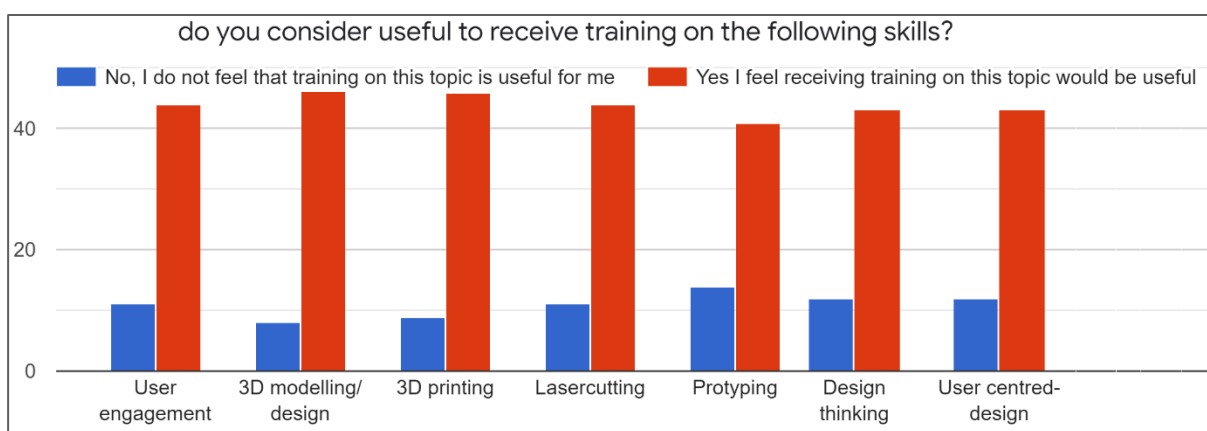
As the approach of YSM foresees a cascaded approach in which the teachers are trained in a first tier, and they in the second tier train their students, it is also important to gain insight into the levels of knowledge of their students as perceived by the teachers. When asked for the level of knowledge of their students, most of the respondents recognize their students' gaps in many of the skills identified in the preparatory research.
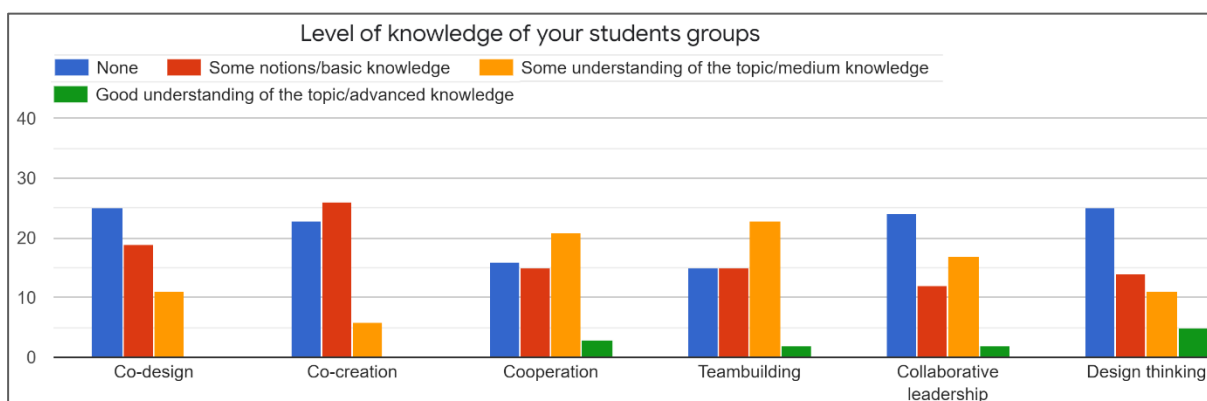
Level of knowledge of your students groups

Level of knowledge of your students groups
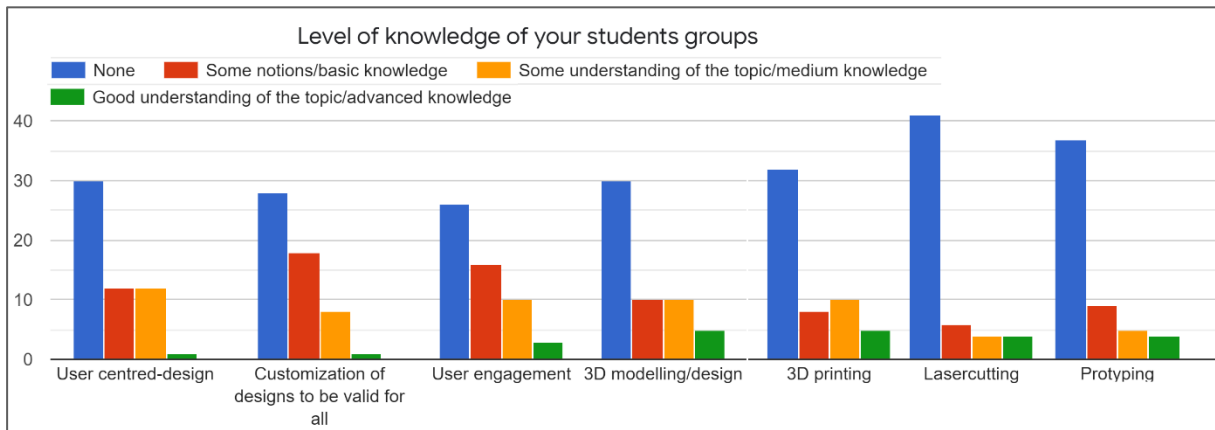
3.4   Software and tools

For the collaborative creation of social objects, "Makers" use various software and tools. In this section we try to analyse the previous level of training of the target groups. In the preparatory phase YSM partners already identified a set of tools relevant for the project and among which experience and knowledge is available among the partner organisations, thus enhancing the capacity to transfer the skills related to these tools.

When looking at the frequency of the use of tools by the surveyed teachers, OnShape, Blender, Scrum, Makercase, Sketchpad are rarely used. On the opposite side, Autocad, Tinkercad, SketchUp, Cura, Adobe Illustrator, Canva and Arduino are more common for many questioned teachers.
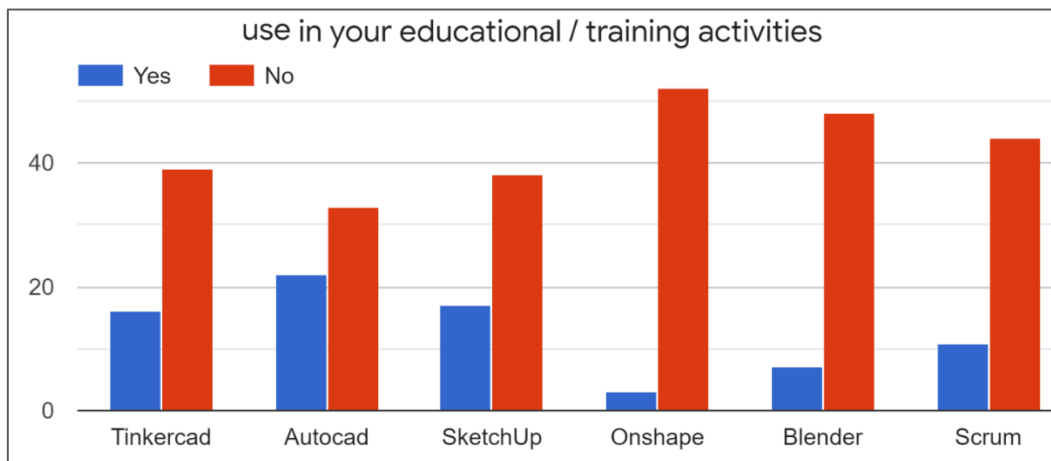
use in your educational / training activities

use in your educational / training activities
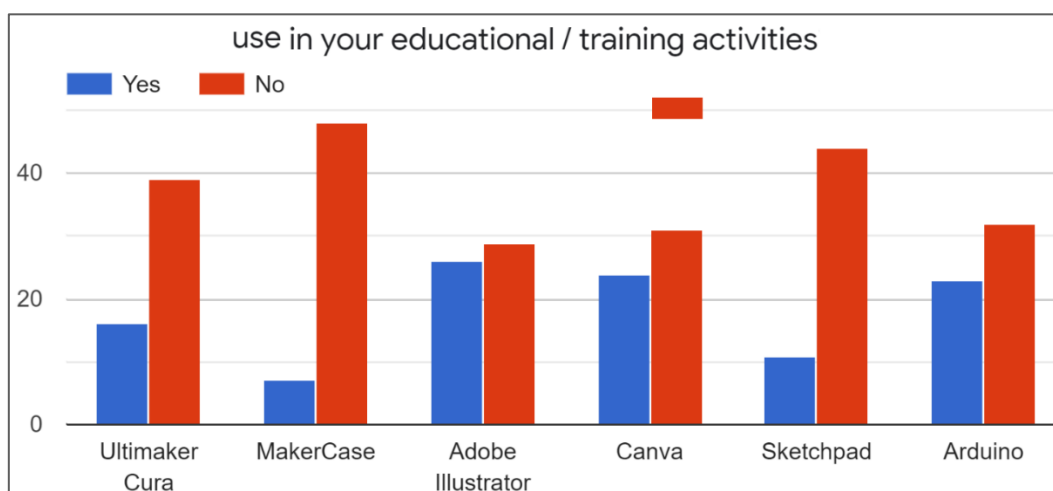
4. Conclusions

With a participation of more than 50 education professionals from 4 different countries the results are considered representative of the YSM direct target group. Especially in view of the fact that the large majority are teachers (73% of the respondents). The remaining 27% represent management personnel and those responsible for civil entities.

There is a high level of interest not only from teachers from the participating educational partners, but also from teachers and educational staff from other VET institutions and centres: 38% of the respondents belong to entities in the partners' environment, but not directly from them. This shows that the interests and needs as identified in YSM are common across all centres and not only the participating ones.

There is quite a high level of awareness and sensitivy towards people with special needs, with 60% of respondents actively collaborating with entities that help people with special needs, and more than 75% of the respondents agree that the way to act in the project is the most appropriate way to help people with special needs. This lays a perfect foundation for the validation activities in which teachers and students will work together to find solutions for the challenges faced by people with special needs. This is confirmed by the fact that 96% of the respondents show a high or very high interest in participating in the YSM project.

Although all areas of knowledge with regards to maker culture related techniques are dominated at least by between 10 and 25% of the participants (a percentage that increases if the results are extrapolated to "teachers only"), there is clear need for more training on these topics. The recommendation is to design training content that allows teachers to decide whether or not to access the specific content based on their perceived level of knowledge. The design premise for the content for the maker related techniques should be that there is some level of knowledge among teachers, and focus on the adaptation of the topic to the particular situation and objectives of YSM, more than on the general aspects of the topic itself.

With regards to the fablab technologies, the large majority of the respondents indicate to have no knowledge, as such it is recommended to focus on giving them the skills needed to train their students (and mobilise those within the centres with advanced knowledge to support those with no or basic knowledge). The design premise for the content with regards to fablab technologies should be that the target group as no (or very little knowledge).

With regards to the fablab software and tools, TinkerCad, Autocad, SketchUp, Ultimaker Cura, Adobe Ilustrator, Canva and Arduino are the software tools most used by teachers in their design projects in the classroom. Training on these topics should emphasize more the relevance for the YSM project and the development of the objects, than a basic introduction to the tools (which would be more necessary for the other tools identified).

This approach would align with the fact that more than 70% of the respondents show their predisposition to train in the skills that are worked on in the project, independent of their prior level of knowledge.

Between 90 and 95% of teachers assume that their groups of students have deficiencies in the main skills used in the project, and that effective formative action is necessary with students to train them in these skills. This confirms that the envisaged cascade approach in which YSM first trains the teachers, who then train the students it the most appropriate one.

5. YSM skills & competences

Based upon the conclusions, the skills and competences which are to be addressed in both the O2 YSM Teacher Training Programme and the O3 Student Learning Programme and Materials can be divided in three sets of skills and competences

5.1   Understanding your target group

This set of skills and competences is related to the awareness and understanding of the issues and challenges with regards to people with special needs and how to integrate them into the ideation, design and elaboration process for the social object.

- People with special needs and their challenges. Introduction to the "world" of people with special needs and the different challenges and barriers they face, includes a classification of the different types of special needs.

- Customization of designs to be valid for all. Explains the background about how designs aimed for people with special needs can become mainstreaming for all, it is mainly examples of these type of designs.

- User centred-design. How to develop a design process that puts the user at the center of the design. Introduction to the concept.

- User engagement: How, in the process of designing your social object, artefact or prototype you can involve end-users, and why this is important in the design of a successful product. It includes tips and tricks to bear in mind when engaging users with special needs.

The first skill can be introduced through example or stories, the user challenges to be designed will form an excellent basis for this.

The rest of the skills can be introduced through "skill cards", which are in essence factsheets which first introduce the concept, then explain how it can be applied for the Young Social Makers training, and finally a set of tips and tricks (one set for teachers and one set for students).

5.2   Skills and competences for Maker related techniques

- Co-creation: how to ideate the social object, artefact or prototype using a co-creation approach, it introduces the concept and explain the methodology.

- Co-design: how to design the social object, artefact or prototype using a co-creation approach, it introduces the concept and explain the methodology.

- Cooperation: how to ensure a team cooperates in an effective, coherent and transparent way. Tips and tricks for effective cooperation.

- Teambuilding: how to create a sense of ownership of the team and its results by all, ensuring respect and a feeling of belonging among all its participants.

- Collaborative leadership: what is collaborative leadership and how can it help in effective cooperation and collaboration across teams.

- Design thinking: introduction to the topic and how it can be applied to the design of the the social object, artefact or prototype.

These skills can be introduced through "skill cards", which are in essence factsheets which first introduce the concept, then explain how it can be applied for the Young Social Makers training, and finally a set of tips and tricks (one set for teachers and one set for students).

5.3   Skills and competences for fablab technologies, software and tools

Skill: 3D modelling/design

Related Tools:

TinkerCad - tinkeercad.com (Owner - Autodesk) - Tinkercad is a free, online 3D modeling program that runs in a web browser. It is easy to use and compatible with 3d printing. It is a proper tool which gives

you solid 3d files needed for 3d printing. It contains many features for STEAM teachers. Tinkercad consists of multiple modules such as electronics (Arduino), coding, classroom, Minecraft, Lego bricks etc. (proposed by Emphaysis)

AutoCAD (Owner – Autodesk) - AutoCAD is probably the most popular computer-aided design and drafting software application. It is used for a number of applications like creating blueprints for buildings, bridges and computer chips. When the files are extracted they can also be used for machines such as CNC machines (laser cuttings), for 2D designs. (For educational puporses, it is available for free for 3 years - https://www.autodesk.com/education/free-software/autocad). (proposed by Emphaysis)

SketchUp is a 3D modelling software. It's quite easy to use. More intuitive than other Cad programs because it is focused on 3D modelling. It has free and pro version, and it's possible to get an special license for education purposes at very low cost. (proposed by JGT). Sketchup is not advisable when designing for 3D-printing, it gives a lot of issues. https://www.sketchup.com/

Onshape.com is cloud based professional CAD software. The great benefit is that the students/teachers don't have to install anything and the system requirements are limited. As long as your designs are public no license fee is required. It is also possible to sign up as a student (for free).

Blender is a complete 3D modeling and designing. Although it is also aimed to 3D animations, Blender has become one of the most popular tools for those who want to design objects to be printed in 3D printers. Blender was a commercial product but it was abandoned by their investors. The community got the code and now it is a complete open source coded set of tools. https://www.blender.org

Scrum is an agile process framework for managing complex knowledge work, with an initial emphasis on software development, although it has been used in other fields and is slowly starting to be explored for other complex work, research and advanced technologies. It is designed for teams of ten or fewer members, who break their work into goals that can be completed within timeboxed iterations, called sprints, no longer than one month and most commonly two weeks, then track progress and re-plan in 15-minute time-boxed daily meetings, called daily scrums. There is a wide variety of tools that can be used.

Skill: 3D printing: "How to" on 3D printing

- Designing for 3D-printing (how to design in a way it is most easy, quickest and cost beneficial to 3D-print

- Slicing your models, what settings to use (Cura, Simplify3d (paid), slic3r)

- Preparing and calibrating the 3D-Printer

- Debugging 3D-print failures (good guide available on simplify3d)

Ultimaker Cura is one of the most popular free software used for printing 3D objects. It can be integrated on several CAD software to translate a 3D design into an instruction file for a 3D printer or

a laser cutter, allowing the user to prepare the printer (slicing the models, layers., ect.) to get the best results. https://ultimaker.com/software/ultimaker-cura

Skill: Laser cutting

Related tools:

Inkscape (free vectorbased software) nkscape is a Free and open source vector graphics editor for GNU/Linux, Windows and MacOS X. It offers a rich set of features and is widely used for both artistic and technical illustrations such as cartoons, clip art, logos, typography, diagramming and flowcharting. https://inkscape.org/

MakerCase is a web-based application for designing boxes or project cases for laser cutters and CNC routers. MakerCase runs in a web browser and automatically generates a blueprint for cutting based on user specifications. The user enters the desired box dimensions and material thickness, and MakerCase automatically generates a three-dimensional model of the box that can be freely rotated. It is good for getting a feel on how to make something 3D with a lasercutter. https://en.makercase.com/#/

Adobe Illustrator is a premium application used for creating vector graphics for print or the web. Developed alongside with Adobe Photoshop as a companion product, Illustrator is the standard for making logos, graphics, comics, fonts, and much more. It comes with a cost, but there is a special price for teachers. https://www.adobe.com/products/illustrator.html?promoid=PGRQQLFS&mv=other#

Skill: prototyping

Technique 1: Mood Boards: A mood board is a type of visual presentation or a collage consisting of images, text, and samples of objects in a composition. It can be based upon a set topic or can be any material chosen at random. A mood board can be used to convey a general idea or feeling about a particular topic. They may be physical or digital, and can be effective presentation tools

Related tool - A related tool is CANVA provides templates to customise your own. It comes with a media library for images, illustrations and more design elements. https://www.canva.com/create/mood-boards/

Technique 2: Sketching: Sketches will help you invent and explore concepts by being able to record ideas quickly. Sketches will make it easier for you to discuss, critique, and share your ideas with others. That's why sketches are a great tool to help you and your team to choose which ideas are worth pursuing.

Related tool - Sketchpad: Free *online* drawing application for all ages. Create digital artwork to share *online* and export to popular image formats JPEG, PNG, SVG, and PDF. https://sketch.io/sketchpad/

Technique 3: Paper prototyping. Paper prototypes are used: To communicate ideas: between designers, developers, users and other stakeholders in the first stages of the user-centered design

process. As a usability testing technique: to observe the human interaction with user interfaces even before these interfaces are designed and developed.

<u>Others</u>

Arduino Create is an integrated online platform that enables Makers and Professional Developers to write code, access content, configure boards, and share projects. Go from an idea to finished IoT project quicker than ever before. With Arduino Create you can use an online IDE, connect multiple devices with the Arduino IoT Cloud, browse a collection of projects on Arduino Project Hub, and connect remotely to your boards with Arduino Device Manager. As well you can share your creations, along with step-by-step guides, schematics, references, and receive feedback from others. https://www.arduino.cc/en/Main/Create

The skills mentioned can be introduced through "skill cards", which are in essence factsheets which first introduce the concept, then explain how it can be applied for the Young Social Makers training, and finally a set of tips and tricks (one set for teachers and one set for students).

The tools are best introduced using factsheets in which the tool is explained, why it is useful for YSM and identification of a set of characteristics (free vs paid; language options, etc.).