

University of Applied Sciences and Arts of Southern Switzerland
Department of Business Economy, Health and Social
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Uni-TI Project: a feasibility study

Citizens in a situation of handicap actors in the creation of their own assistive devices through 3D technology and with the help of occupational therapy and engineers students at SUPSI.

Thesis work (Bachelor Thesis)

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ABSTRACT

Theoretical framework: In 2016, at the electronic laboratory of the rehabilitation center in Kerpape (Brittany, France), the REHAB-LAB was born. It is a laboratory where occupational therapists, technical referents and patients collaborate in the process of creating the assistive devices (AD) intended for the patients' use, using 3D printing technology. Empirical evidence shows that the co-design of aids in collaboration with the patient, leads for the latter to increased levels of empowerment, engagement, sense of competence and adherence to the aid. Without the implementation of this process, the AD is often abandoned after a few months from the prescription due to the symbolic nature of the AD that highlights the disability or the inadequacy of the help received (the patient's perception of non-need and complexity of using AD).

Objective: The purpose of this thesis is to probe the opinion of the occupational therapists of the Ticino centers with respect to the possibility of implementing a laboratory similar to the REHAB-LAB, called Uni-TI, at the Department of Business Economy, Health and Social (DEASS) of SUPSI. The fact that the laboratory would be based in the University, in particular in the Department of Health, would also bring educational benefits. Indeed, it would help to increase the development of digital skills in the academic curriculum of future occupational therapists. It would also provide a service to the community, with the reach of all those who need an AD in the territory.

Methodology: The following thesis serves as a tool to help implement this synergy between the REHAB-LAB and SUPSI. It consists of an exploratory study that uses a semi-structured questionnaire addressed to the occupational therapists of the centers of the territory who have met the inclusion criteria. The questionnaire's aim is to investigate the referent occupational therapists' perception of the process of co-construction of ADs, their interest and level of knowledge with respect to the 3D printing technology and the willingness to participate in a pilot study for implementing Uni-TI. In this way, it will be possible to create a custom-made project in line with the specific needs and desires of the Ticino occupational therapists who will later benefit from this laboratory.

Results: By analyzing the data collected, a number of elements have emerged that can help to deepen the reasoning related to the development of the Uni-TI project and the needs of local professionals regarding the topic. Generally speaking, there was a strong interest in the subject and 4 out of 6 structures that participated in the survey declared themselves willing to participate in the pilot study. Compared to the possibility of implementing Uni-TI in Ticino, there have been some concerns about how health insurers could reimburse treatments and how they will work together with the various parts involved in the project. These elements are in line with the reflections that arise from the other REHAB-LABs in Europe.

Discussion and conclusions: Both the literature and the study results provide interesting arguments for the development and dissemination of 3D printing technology and the Uni-TI project in Ticino. Useful elements have emerged to deepen the reflection on how the project can be developed so that it can perfectly adapt to the needs of the territory, bringing benefits to all the parts that would be involved: the university, students, professionals, people in need of an AD and the whole community.

Key words: *assistive devices, 3D printing, occupational therapy, codesign, empowerment*

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1 INTRODUCTION

1.1 Motivation

I have always been fascinated by new technologies, and the implications they can have in the world of healthcare.

For this reason, I was very intrigued and interested in the structure where I performed my second curricular internship: the Kerpape Rehabilitation Center in Lorient, Brittany, France.

More than 400 patients reside in this facility where many diseases related to different fields are treated: neurology, traumatology, pediatric care, cardiac re-education, respiratory re-education, etc. It is a very large center where inter-professional take-on are carried out because the people who are admitted there usually have a very complex medical history. What surprised me is the fact that, in addition to the health professionals we encounter in the same context, the engineers, whose role, among others, is to find technological solutions to patients' problems are also part of the rehabilitation team.

There is also an innovative laboratory within the structure, the REHAB-LAB, which, since 2016, enables the occupational therapist, the engineer and the patient himself to work together for the modeling of the assistive devices¹ (AD) intended for the patient, using 3D printing technology. The future user is involved from the beginning, actively collaborating on the conception of the object and then in its realization, giving it the appearance that he considers most congenial to him (Centre Mutualiste de Rééducation et de Réadaptation Fonctionnelles de Kerpape [CMRRF Kerpape], s.d.). This has repercussions not only in terms of adherence to the use of the aid, but also emotionally with important consequences on the health and quality of life of the person² (Kraskowsky & Finlayson, 2001).

The potential of such a project is manifold, so, back in Ticino, I submitted to Prof. Moioli, head of the degree course in occupational therapy, the idea of connecting the Professional University School of Switzerland (SUPSI) with the electronic laboratory of Kerpape to create a possible collaboration. The project was entrusted to Prof Rossini who is in charge of implementing this synergy with REHAB-LAB at the university. In this context, my thesis serves as a tool to help the implementation of this synergy between the REHAB-LAB and SUPSI with the birth of a new laboratory called Uni-TI.

In summary, the idea would be to make the university hub (department of health), a meeting place between local professionals and students, as well as a place of training and research, where there is a direct relationship with the person, which would be the main protagonist of his process of creating an AD.

1.2 Goals of Bachelor thesis

The main points of this Bachelor work are as follows:

- It is important to probe the opinion of the heads of occupational therapy services in rehabilitation centers potentially interested in a project such as Uni-TI. Investigating everyone's personal opinion will allow us to draw elements useful for

¹ The term assistive device (AD) refers to any custom aid used to increase, maintain or improve the functional abilities of people with disabilities (Assistive technology act, 2004).

² From now on throughout the body of the text I will use the term "person" to define a person in a situation of handicap with special needs for whom an AD is needed.

consideration on the possibility of implementing this new laboratory in the Department of Business Economy, Health and Social (DEASS) of SUPSI.

- Depending on the availability from the institutions involved, we need to find a rehabilitation center in the Territory of Ticino willing to participate in the pilot study that is scheduled to start in September 2020, before the possible implementation of Uni-TI, scheduled for September 2021.
- To perform a critical analysis of the subject being studied by drawing a questionnaire and analyzing its results in the light of the existing literature.

1.3 Search question

I used the PIVOT method (population-question-variable at study-place-time) (Tétreault & Guillez, 2014) to properly formulate the research question:

PIVO(T): *"What is the perception of the potential (I) of involved Ticino rehabilitation experts (P) with respect to the implementation of an outpatient REHAB-LAB (V) at the DEASS of SUPSI (O)?"*

1.4 Identified context and particularity

The characteristics of the Ticino territory mean that the implementation of a REHAB-LAB within a single rehabilitative facility would preclude patients from other facilities or who are followed by occupational therapists (OTs) working in a private practice, to use it. Considering the small size of Ticino, its location within the university headquarters could prevent an iniquity in the distribution of resources in the territory. In addition, the involvement of SUPSI would bring many benefits for different actors: students of basic training of DEASS but also of departments such as Departments of Innovative Technologies (DTI) or Departments of Environment Construction and Design (DACD), local professionals, people and their caregivers.

This study aims to be useful in creating a project that is custom-made, and therefore it asks potential protagonists to listen to those who would benefit from it by adapting to their specific needs and desires.

1.5 Thesis structure

The first part of the thesis will frame the theoretical basis necessary to understand the subject in question. The Uni-TI project will then be illustrated. Next, there will be an in-depth study on the theme of ergotherapy and digitization, with the contribution of models that integrate the person, employment and technology. The theoretical framework ends with the presentation of a model to operate in the specific scope of the co-design of aids and on the conceptual inputs and critical issues of the Fab-labs (of which REHAB-LABs are part).

The methodology used, the creation of the survey questionnaire and the criteria for inclusion will be described.

The collected data will then be presented and analyzed. Finally, the results will be compared with the literature described above, with the aim of drawing conclusions and useful suggestions for future clinical practice.

2 THEORETICAL FRAMEWORKS

2.1 The REHAB-LAB

I find it necessary to start by introducing the concept of REHAB-LAB as it is in place at the Kerpape Center and to which I was able to participate as an intern.

The REHAB-LAB was born from the concept of Fab-Lab which was defined in the late 1990s as a place of free access for anyone, where all kinds of tools and computers are made available with the aim of designing and making objects of all kinds.

It is not necessary to have specific technical skills, as the spirit that animates the Fab-lab is sharing, both in terms of material and knowledge, and the goal is to "do it ourselves". The emergence of "accessible" technologies, such as 3D printing, has led to a strong spread of these laboratories where everyone is able to express their creativity (Allègre et al., 2017). In recent years, many schools of thought have emerged from similar values like Do-It-Yourself (DIY), Makers, Design For Everyone, etc. with the aim of increasing independence and improving the quality of life of those who benefit from it. According to them, due to demographic change, the number of frail people is rapidly growing and the key solution in managing this change will not be the provision of more paramedics and designers, but the fact that people manage to engage in a responsible and collaborative maintenance of their health (Couvreur & Goossens, 2011).

The REHAB-LAB therefore consists of bringing the concepts of the Fab-lab into a rehabilitation center, adapts to the AD the particularities of each user and starts from the need to produce ADs that can be useful for rehabilitation. The REHAB-LAB is based on the synergistic work of the engineer, the OT and the patient. The latter will take part in the creation of the aid, submitting his input on the specifics necessary for his aid and then, if he is willing to cooperate in the production process. He will be helped to model it with a special computer program (in the specific case of Kerpape: Fusion 360).



1 Model illustrating the process of collaboration between patient, OT and engineer in the creation of assistive devices through 3D printing (CMRRF Kerpape, s.d.) (reproduced with permission from CMRRF Kerpape)

The person with a disability has, according to his will and possibility, three levels of participation where, the most complex, includes the following steps:

- can simply make the request to create the AD with 3D printing,
- can take part in its conception,
- can personally model its object (CMRRF Kerpape, s.d.).

The special feature of 3D printing is to allow a high level of participation from the patient. For example, he can use the computer tool even if he has poor motor skills, provided that the workstation has been adapted in advance (head/eyes tracking, specific joysticks, etc.) (Allègre et al., 2017).

The patient is in a symmetrical relationship with the caregivers and is seen as the ultimate expert of himself. This fully reflects the principles of the patient-centered approach, so dear to occupational therapy (Rebeiro, 2001).

The engineer is responsible for transmitting knowledge about the 3D printing technology to both OTs and people, adapting according to the patient's skills, the workstation and pedagogical modes. The OT, on the other hand, accompanies the patient in the analysis of his needs and defines with him his employment priorities by adopting a compensatory and adaptive approach when necessary and, thanks to his expertise in the health field (physio-pathology, biomechanics, etc.), helps the engineer to understand the purpose of the aid. This must be congenial to the needs of the person, but it must also adapt to the living environment in which the person will be called to make use of this object in the performance of the occupation for which he needs it. One of the key models of ergotherapy is PEO: "Person – Environment – Occupation" (Law et al., 1996). The person (P) is understood in a holistic way, inserted in a context (E) within which he carries out activities (O) developing over time an employment performance. All these aspects must therefore be thoroughly analyzed in collaboration with the OT in order to understand all the characteristics that the object will have to possess.

The OT can use appointments at the REHAB-LAB as a therapeutic session also regarding aspects that are outside the printing of the object. Consider, for example, the massive use of cognitive energies that the patient must provide in order to calculate and digitally adapt the size of the object to be realized. It will also be possible to assess and exercise the patient's visual and spatial abilities, executive functions and learning abilities, in the context of an activity that is stimulating for him (Allègre et al., 2017).

Let us remember that the activity of modeling objects could become significant for the patient and we know how positive this can be for his health. It is also worth to note the participatory potential of the REHAB-LAB, and that a real digital community has been formed thanks to which it is possible to share not only the files of the objects created, but also advice and opinions with people from all over the world who benefit from 3D printing, as this is the case for example on the Thingiverse platform (Manero et al., 2019).

Experienced patients also have the opportunity to design, always with the appropriate technical support, aids for patients who cannot be involved in 3D modeling or teach this art to the most novice patients. This has an effect on one's self-esteem, sense of competence and *empowerment* (Lunsford et al., 2016 ; Ostuzzi et al., 2015).

Recall that 3D printing has many advantages over the classic production process used by OTs, among them:

- cost reduction (according to some studies 3D printed devices are about 56% cheaper than a similar laminate device) (Day & Riley, 2018),
- customization (you can give the design you prefer, choose the color, add an engraved or embossed writing to it, etc.),
- direct user engagement (even in case of poor mobility),
- reproducibility (once modeled the object is saved as a file and can be reprinted anywhere),
- creation time,
- aesthetics,
- weight (CMRRF Kerpape, s.d.),

- robustness (usually the object is conceived with the attention not to create fragility or breaking points reasoning with respect to the lines of strength that structure it) (Ganesan et al., 2016) ,
- adherence by the user (the fact of having created it increases its use) (Lunsford et al., 2016),
- the ability to share their projects with others (CMRRF Kerpape, s.d.).

To give an organizational structure to the laboratory, the founders of the REHAB-LAB bent down to reflect on the principles that inspired them to define their field of action regarding AD. They wondered what approach they wanted to take and, in addition to the patient-centered approach, already implied in the founding values of the REHAB-LAB, they decided to focus on employment. Here in Kerpape, the ADs made in collaboration with the users are intended to allow the performance of activities that are significant to the person. They also aim to increase the levels of engagement and participation (Allègre et al., 2017; Lunsford et al., 2016).

They also created a charter for the REHAB-LAB community members by explicitly defining the founding values of the lab that should be shared by members who are part of it. Among others, there is the rule not to create objects that are already on the market and also to ensure the gratuitousness of the service for the last users, i.e. people with disabilities (*REHAB-LAB – Site de la communauté REHAB-LAB*, s.d.) (see Appendix 9.1).

2.1.1 Uni-TI Project

The Uni-TI Project would see the implementation of a REHAB-LAB at a university campus in this case at SUPSI's DEASS.

This would comply with the main concepts of the REHAB-LAB:

- The co-design of aids that can promote employment, thanks to the collaboration of citizens with special needs, OTs and technical contacts
- Implementation of the laboratory in a healthcare framework (in this case, the DEASS)

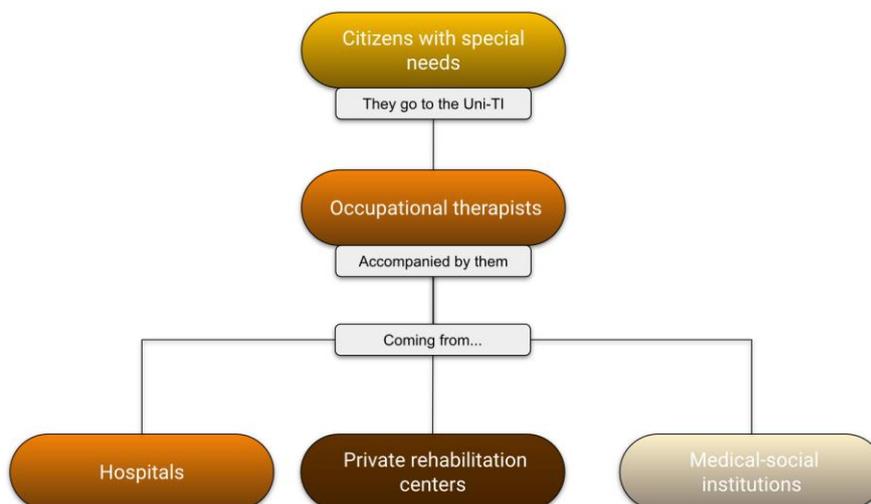


2 Diagram showing actors who will structure Uni-TI

The interdisciplinary collaboration envisaged by the first point would be maintained thanks to the joint and synergistic work of the occupational therapy students, who have the health

knowledge, with students from the DTI and DACD, who have the technical skills, and with disabled citizens who would come from outside, that is, from the rehabilitation centers of the territory, accompanied by the OTs with whom they are undertaking therapy or people who are followed by OTs in private (Figure 3).

It should be noted that in the future, in addition to this main organization, Uni-TI could also be available to former Uni-TI participants who wish to access it again, but who are no longer under the care of an OT.



3 Diagram showing the main organization of Uni-TI

This would reduce the risk of unequal access to the service in the territory, adapting the project to the Ticino context, small in size but rich in rehabilitation centers and permeated by a strong sense of belonging. It is for this reason that it was decided to probe the opinion of the experts of the territory regarding the project and, in light of their availability, to start a pilot study scheduled for September 2020.

The objectives of Uni-TI are therefore:

1. To build a bridge between citizens with special needs, OTs and technical contacts by sharing each other's skills and knowledge.
2. To reduce the risk of unequal access to services in the territory and to promote innovation.
3. To create connections and strengthen existing ones between citizens, rehabilitation centers in the area and SUPSI.
4. To strengthen the multi-professional approach by encouraging rehabilitation interventions based on a Community approach with the ultimate aim of increasing the empowerment of citizens with special needs.

It should also be noted that the creation of Uni-TI would see the school involved in an innovative and enriching European project for all parties. This would be a direct collaboration with the Kerpape team, which is already in relation with other European institutions (centers and universities). Prof Rossini and I were invited to participate in the REHAB-LAB 4U (Twinings - *Digital Health Europe*, s.d.) project and we were trained, together with other partners from Italy, Denmark and Belgium, directly in Kerpape to develop digital skills in the field of 3D printing technology and where they gave us the procedures to create and manage a REHAB-LAB (*REHAB-LAB 4U Project [2019-2020] – REHAB-LAB*, s.d., page 4).

On this occasion, which was truly enriching on the professional and personal level, we had the opportunity to see the laboratory in operation, to speak directly with the actors

involved (from people with disabilities, to health professionals and technical contacts) and to see the effectiveness of this practice, thanks in part to the valuable testimonies of the patients who have already participated in it.



4 REHAB-LAB 4U training images, January 2020, Lorient

Thanks to the fact that the Kerpape team won this Twinning with the REHAB-LAB 4U project, it received funds from the European Community not only to create partnerships with other countries, but also to enlarge the community (Ryø Mathiesen, s.d.). Among the various ongoing projects, there is one that focuses on the development of a platform that would include all of the REHAB-LAB members, with the possibility of exchanging useful information, updates, news and ideas (REHAB-LAB 4U Project [2019-2020] – REHAB-LAB, s.d., p. 4).

The idea of placing the laboratory at SUPSI's DEASS leads us to believe that this could provide innovative training opportunities both during and after obtaining a bachelor's degree. In addition, it would stimulate research, especially participatory, by carrying out new studies in relation to the enormous potential of this instrument. All over the world, in fact, the various ways of using the 3D printer in healthcare are being explored: from the creation of lightweight, cost-effective and perfectly tailored prosthesis and orthosis thanks to the associated use of the scanner (according to some research the 3D printed devices have brought comfort, fit, ventilation, weight and aesthetic characteristics higher than the standard devices) (Baronio et al., 2016; Fitzpatrick et al., 2016; Schwartz et al., 2019), to the involvement of caregivers modeling to increase their empowerment. There is also the possibility to collaborate with other institutions such as schools and psychiatric facilities whose actors could model aids for third parties, putting into play an educational approach in the first case and rehabilitating in the second case.

Even during this absolutely extraordinary period, which sees us involved in dealing with the global emergency caused by the Covid19, we have seen the enormous potential of this tool that has allowed many Fab-labs, including the REHAB-LAB, but also private *makers*, to participate, as active members of the community, to conceive and print materials that are useful to health professionals and citizens around the world (e.g., visors, etc.) (REHAB-LAB & COVID-19 – REHAB-LAB, s.d.). This event allows us to reflect how a tool such as 3D printing technology can contribute to the strengthening of personal resources and to the enhancement of the ability to act of the individual citizen who in this case has been able to contribute to social and personal well-being, emancipating himself from the usual production systems no longer able to fully respond to market demand (in this case related to the health devices of protection from the virus).

The roles we are called to fill as OTs are also, among others, those of managers and health advocacy (Scuola Universitaria Professionale della Svizzera Italiana – Dipartimento di Economia Aziendale Sanità e Sociale [SUPSI-DEASS], 2016) and these invite us to take a proactive and critical attitude about the environment around us with the aim of promoting health (Simonelli & Simonelli, 2011). It is thanks to the implementation of projects inspired by the principles of salutogenesis, that we OTs can play an important role at the social level contributing to the improvement of the quality of life of many members of the community within which we operate.

Uni-TI therefore has enormous potential in terms of direct and indirect positive implications for all the people who may be involved.

2.2 Issues encountered

We know that a research takes place once a problem has been detected (Mortari & Zannini, 2017). In depth, with regard to what is discussed above, I have highlighted two in particular: one that directly concerns clinical practice (the abandonment of AD) and one related to the training of OTs (the need to integrate more digital skills into the training plan).

2.2.1 Abandoning assistive devices

During the internships I have done to date, observing and comparing myself with the experts of rehabilitation, I found that the ADs that were suggested to buy in commerce, rather than manufactured directly by OTs, were often abandoned by the patient. Several articles address the issue of the abandonment of AD as it represents a great challenge for rehabilitation professionals, especially OTs, involved in the front line (Cruz et al., 2016; Petrie et al., 2018; Verza et al., 2006).

An inadequate prescription of AD takes away time that could be used differently, for example, to make adjustments that the customer might find more in line with his needs and environment (Kraskowsky & Finlayson, 2001). It must also be considered that there would also be a waste of private and public money (Donabedian, 1990).

The first reason for not using said aids is their inadequacy (Kraskowsky & Finlayson, 2001). The second reason is the refusal of aid caused by various reasons summarized in two main categories:

- one is given by the belief that the devices do not make a difference or are complicated to use
- the other is caused by the symbolic nature of the aid that visually associates the person with the status of a “sick person” (Kraskowsky & Finlayson, 2001).

In fact, the presence of aids in the user's environment strengthens and reveals their identity as a physical disabled person (Allègre et al., 2017). Researchers have developed the concept of the “disability adaptation process”, they compared it to the work of mourning processing, and which they divided into three phases: shock, disorganization and therefore reorganization (Khomiakoff et al., 2009). According to the authors, as healthcare professionals, it is important to know the phase in which the patient is in order to work on the acceptance of aids and thus to become, as Cyrulnik defines them, “resilience tutor” (Cyrulnik & Jorland, 2012). That is defined as “a biological, psycho-emotional, social and cultural process that allows a new development after psychological trauma” (Cyrulnik & Jorland, 2012, p.8). External resources such as family and caregivers, referred to as “resilience guardians”, can facilitate the process of adapting to

the new situation by stimulating the mobilization of the person's internal resources (good self-esteem, mental abilities and spiritual resources) (Delage et al., 2017).

In summary, these studies indicate the fundamental need for therapists to listen to customer needs, concerns and opinions regarding AD, prior to prescription (Kraskowsky & Finlayson, 2001).

I would also add that one of the proposed solutions is to make the person involved in the process of creating the aid. This will allow him to fully understand how it works and will also have an effect on adherence and acceptance, improving his quality of life and optimizing the therapeutic process (Hofmann et al., 2019). This activity could serve as an adjuvant for the resilience mentioned above.

This approach turns out to be perfectly in tune with the theoretical basis that governs ergotherapy: the patient is placed at the center, is understood as the greatest expert of himself and his pathology and this puts him in a horizontal relationship with the therapists (Rebeiro, 2001). He actively participates (engagement), his voice is heard, and this contributes greatly to the development of his autonomy, his grip on power over the acts of care and his own person (Kraskowsky & Finlayson, 2001). This can be understood as a gesture of health promotion, as well as preventive, as it empowers the patient with respect to the management of his own problem. In this regard, we must mention the role of well-explained health advocate in the OTPF -framework for the clinical practice of occupational therapy (American Occupational Therapy Association [AOTA], 2008), as it is right and healthy to make the patient active and autonomous in his choices, and I would add above all, in the process of care. This is in accordance with the new concept of health, understood as a subjective phenomenon possible to any condition provided that the appropriate resources have developed (and it is our duty as OTs to create the conditions for them to develop) (Simonelli & Simonelli, 2011). With regard to the active creation of AD, this could become, as mentioned, a significant new occupation for the patient and an opportunity for participation. In fact, the patients would not be alone, but accompanied by OTs and engineers and would go to a place used ad hoc. Working groups could be created, and from there, a real network to exchange tips and suggestions (as in the case of the Thingiverse platform) (Allègre et al., 2017). In this regard, Wilcock and Townsend (2008) wrote: "All people need to be able or be allowed to engage in the occupations they must do or choose to do, to grow through what they do and achieve independence or interdependence, participation, safety, health and well-being." After consulting the International Classification of Functioning, Disability and Health (ICF) (World Health Organization [WHO], s.d.), we see that the concepts of activity and social participation are central and how strong the link between personal health and the possibility of action is (also modulated by the environment). One of the key models of our profession is the aforementioned PEO (Law et al., 1996). One of the variables on which we can intervene as OTs is therefore that of the physical environment, creating places where many opportunities for participation and activity can be developed (role of manager and health advocate) (SUPSI- DEASS, 2016), as in the case of Uni-TI.

At present there are numerous movements that advance the principles discussed so far including increasing empowerment, decision-making and the freedom of choice of patients: DIY, Makers, Design for Every(one) and indeed the REHAB-LAB. With digital manufacturing, more and more people are creating ADs for themselves and others, stimulating research on the concept of DIY and Do-For-Others (DFO) applied to care (Hofmann et al., 2019). It is an expanding and innovative current that corresponds to the paradigm shift mentioned above: from an asymmetric care relationship, to a collaborative one, based on partnership and that responds to a specific need of patients, or to be actively involved (engagement) in the process of care.

2.2.2 The need to integrate more digital skills into the OT training plan

The other problem is that occupational therapy is called to deal with new technologies as these accompany us in all our daily activities (Sandnes et al., 2017). During the internships, I was able to see how often a technological aid can radically change the quality of life of people, especially in a fragile state. Consider, for example, mobility systems (e.g. electric wheelchairs), communication (e.g. voice synthesizers), to facilitate certain tasks (e.g. home automation to manage electrical appliances), training (e.g., rehabilitation apps, robotics, use of the virtual reality) the ability to carry out remote occupational therapeutic consultations (e.g. tele-rehabilitation) (Liu, 2018). OTs should therefore increase their incentives to develop technological skills with the students. In some countries, such as Sweden, the representative association of the profession includes in the description of the skills of OTs, among others, also the digital one, which is described as one of the key components of future working life. Specifically, you are asked to search for information, communicate and interact digitally in relation to the profession; use and develop digital systems, tools and services; adapting activities against the transformation that digitization brings to society; highlight the opportunities and risks that digitization entails for the activity and participation of people at the individual, group and community level; develop new tools and ways of working in digital healthcare; manage questions about technology solutions and provide the right support to develop and improve the digital working environment (Occupational Therapy in Sweden - *Sveriges Arbetsterapeuter*, s.d.).

The ideal place to create this laboratory of exchange between patients, OTs and engineers could therefore be the university. In this way, students would have a state-of-the-art technological tool, the 3D printer, to which they would be educated and through which to practice. They would also be in contact with patients in their place of training and could further improve their clinical practice throughout the study period, collaborating in an interdisciplinary way with students, engineers and/or designers, who in turn would acquire skills related to the healthcare sphere. There is a growing need for close collaboration between engineering experts (new technologies) and health experts as the experience shows an enormous potential that could be derived in terms of therapeutic performance and a possibility of developing the highest quality projects, thanks to the complementarity of skills (Sandnes et al., 2017). In my opinion, the figure most suited to fulfill this "bridge" role between the two worlds is that of the OT: known for being a creative professional, expert in adapting and creating AD, specialized in the relationship with the patient, in grasping his priority needs and giving answers. However, the fact that we have few technical-informatics skills could sometimes compromise the implementation of useful aids, and here is the answer we find in the interdisciplinary approach. That's why there should be more elements in your resume so that you can communicate effectively with experts in other fields as well. Wagner et al. (2018) demonstrate, through their experiment, the feasibility of implementation in the curriculum of OTs of theoretical elements related to 3D technology. They also point out that students would thus acquire a new commercially available work ability and would carry with them experience about creatively solving the problems they encountered during the classes (Wagner et al., 2018). This would also allow OTs not to be excluded from the process of creating ADs, prosthesis and orthotics if these technologies developed to the point where the work of OTs becomes obsolete. As this is a new tool for the creation of ADs, which the evidence has highlighted for quality results, it is good for OTs to inquire about this.

We know that healthcare professions require constant updating as techniques, methods, new discoveries influence clinical practice, it is our ethical duty to offer quality therapy, to aim at the maximum well-being of the patient responding to his needs. If the cure proves to be adequate, better results in time, money, energy and other resources for the benefit of all stakeholders will follow (Donabedian, 1990).

Furthermore, although scholars believe in the potential of 3D technology associated with rehabilitation, we note that it is rarely integrated into the training plan of healthcare professionals or even less implemented and made operational continuously within treatment centers. There is a gap between what the evidence shows and their application in clinical practice. With this project, instead, a preferable future is proposed in which clinicians and clients can co-design their ADs according to a DIY/DFO approach applied to occupational therapy and more generally to care (Hofmann et al., 2019).

Another aspect of great interest in the training of OTs in relation to Uni-TI is that it is a European project and this opens the door to intercultural exchanges, which can bring a lot to students. According to Sandnes et al., (2017) the society is becoming more and more diverse and the world is becoming more global. In addition to the particular field of study, students also need general knowledge and skills to operate within different professional and cultural fields. A key objective of the partnership with other institutions is to contribute to the exchange of knowledge, the development of joint curricular material through classes offered to students of both institutions operated through a combination of physical presence and distance education technologies (Sandnes et al., 2017). Creating digital learning contexts changes the way we learn: from online communities (e.g. e-learning) to personalized digital learning experiences, which facilitate the development of cross-cutting skills such as problem solving, the ability to collaborate and creativity, all presented in a playful and interactive form (Sandnes et al., 2017). The health emergency we are currently involved in has highlighted the importance of having this methodology of study and remote working and how extremely important it is to promote the knowledge necessary for their use.

The European Commission, like many other institutions, is developing policies and supporting research to make students fit for life and work in the 21st century (Erasmus project, Horizon Europe, Horizon Europe European Global Adjustment Fund, Marie Skodowska-Curie actions, etc...) (oestean, 2015). And it is precisely in the context of a Horizon Europe project that we had the opportunity to learn about and be educated at the REHAB-LAB methodology (Twinning's - Digital Health Europe, s.d.) .

2.3 Digitization and occupational therapy

Technological innovations are the protagonists of excellence in modern society. Researchers speak of them as the fourth industrial revolution (Liu, 2018). Digital transformation is structurally changing employment, but also the labor market and education sector, requiring a change in the skills needed to live an active and independent life in society (Larsson-Lund, 2018). The need to invest not only in technological material, but also in the acquisition of digital skills and knowledge, both as professionals in all sectors, including healthcare, and citizens, is growing exponentially. According to the European Commission, "digitization leads to the need for every citizen to have at least the basic digital skills to live, work, learn and participate in modern society" (oestean, 2015).

Some aspects of digitalization relate directly to employment, participation, health and well-being, or issues of fundamental interest to occupational therapy (Larsson-Lund, 2018). Today we see that employment patterns have changed, as has the quality of the

demands required to carry out many activities. For work, for example, physically demanding tasks have been reduced and cognitive demands have increased (Sellberg & Susi, 2014).

There are people who can adapt to these changes optimally, sensing a facilitation of tasks and experiencing an improvement in participation, health and well-being. Others, however, as is the case for some people with disabilities, have insufficient digital competence and appear to be at risk of social exclusion (Fallahpour et al., 2014). Digitalization could therefore bring great benefits, but on the other hand, it could reduce opportunities for vulnerable (if not properly accompanied) individuals to participate in society. These elements offer us important insights into the issues of employment equality, accessibility and usability for both the individual and the community (Larsson-Lund & Nyman, 2019).

It would be desirable, in the context of occupational therapy, to analyse this social transformation and its effects on the population, preserving critical thinking, using the benefits of digitization and thinking of solutions to counteract any risks that this could bring to health, through the proposal of quality interventions. According to Liu (2018), as OTs, we can be protagonists at this stage because, even during the fourth industrial revolution, the foundations of critical thinking, creativity, self-reliance and occupational empowerment are sought by robotics and artificial intelligence experts in order to ensure social equity and with the desire to represent human values in respect of the common good. We can therefore use our experience and our way of conceiving meaningful human occupations during the process of designing and implementing new technologies as long as we have learned the fundamentals and language of the digital world and thus be able to communicate effectively with the interdisciplinary team within which we are called to collaborate.

For OTs, this is a challenge to necessarily continue to update and upgrade our skills to keep up with the new social and professional needs (Larsson-Lund & Nyman, 2019). In the reflection on this issue, I wondered what available tools and models we have to help our clinical reasoning to integrate the technological aspect to the person and employment. These tools can guide the clinical practice in general and in the specific field of the co-design of AD in collaboration with the person.

2.3.1 Employment/technology/person models

In an attempt to answer this question, I came across the article of Stucki et al., (2007) which created a unified model for the conceptual description of the rehabilitation strategy, based on the ICF, approved by the World Health Organization (WHO) in 2001. This model shows how other disciplines, not in the health sector, can provide tools and techniques to it to achieve the goals of those who deal with people's health. Interventions carried out by disciplines outside the health sector are mainly part of the environmental component of the ICF and their common goal is to improve functioning and minimize people's disability experience. In the context of rehabilitation, engineering can be understood as a scientifically based process that aims for the development and dissemination of rehabilitation technology that consists of procedures and ADs to meet the needs of people with disabilities (Stucki et al., 2007).

Engineering is therefore entitled to intervene in the rehabilitative field with the aim of adapting the environment making it more accessible and usable by the public and creating aids useful to optimize people's skills in order to improve their occupational performance and enabling an increase in participation levels.

Continuing my research, I became aware of the PET (person, environment, tool) MODEL, also in line with the ICF (Jarl & Lundqvist, 2018). This model starts from the concept already addressed that technologies involve everybody in every area of life influencing almost everything we do in our daily lives. Today, to shop, use public transports, work, or stay in touch with friends, we are called to make use of what is called traditional technology, mainstream technology (MST), intended for everyone, such as computers, smartphones and Internet-based services, which are a guarantee of good inclusion, participation and quality of life (Larsson-Lund, 2018). We can therefore say that everyone in our daily life adopts technological AD. So, what is the difference between MST and AD, which are intended exclusively for people with disabilities? Throughout history, numerous AD has benefited people without disabilities and vice versa. It can easily be seen that this punctuation emphasizes the dichotomy person with disability/healthy person, influencing our thinking. According to the authors of the PET MODEL, to truly change the outlook, a theoretical support framework is needed that promotes a universalistic vision.

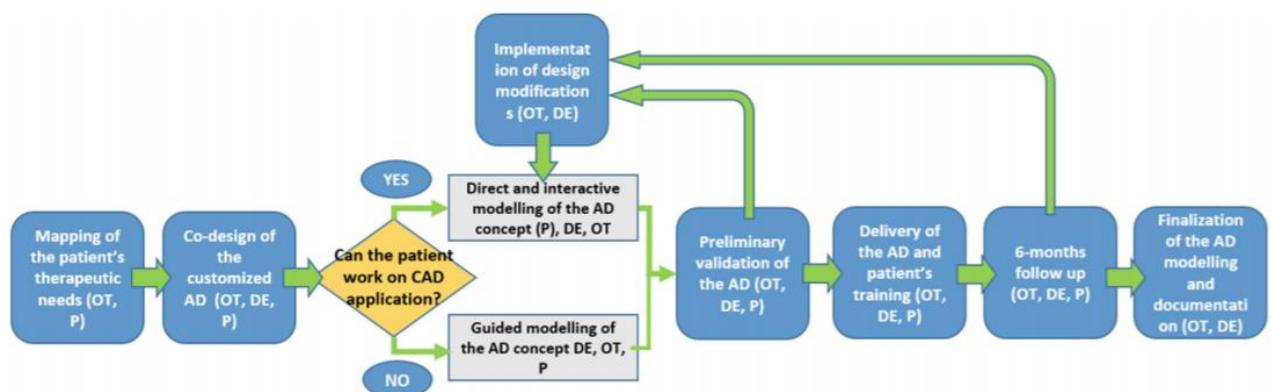
The PET MODEL wants to be applicable to all human beings, without applying distinctions, and uses the terminology of the ICF. The PET MODEL conceived mathematically the functioning (F) of an individual: it corresponds to a function of personal, environmental and tools factors, $F = f(P, E, T)$. Each set of factors (person, environment and tool) interacts with the others causing important effects on the quality of the activities and participation of the person, facilitating or making them more difficult (Jarl & Lundqvist, 2018).

This model, instead of considering the transition before/after the event that led the person to be disable, such as a transition from independence to dependence, describes it as a transition from one model of dependency to another, less desired (Gignac & Cott, 1998). The central point of the PET MODEL is that the difference between people with and without disabilities is a difference in ability degree rather than a difference in nature (Jarl & Lundqvist, 2018). Adopting this universalistic vision, we could see that there are a lot of similarities between patients and the healthcare professionals and this could change the therapist's vision of objectives, patient's needs and therapeutic interventions.

Moreover, according to the authors, adopting a universalistic view of the use of technology could be possible to reduce the misconception and stigma associated with the use of AD, with benefits for disability practice and research (Parette & Scherer, 2004). I find this model interesting in that it has made me think a lot about looking towards the other, how much this must be stripped from any preconception in order to remain faithful to the essential that is the person with its desires. I believe that recognizing ourselves dependent on aids to optimize our daily performance makes us feel closer to the next person. I therefore think that this is a highly inclusive concept and that it pushes us to establish an equal relationship with the person who will require our intervention. The starting point is always that of dialogue, which aims to see beyond appearances, to investigate desires, the volition of the person, as what happens at the REHAB-LAB. This model appears to be in line with the person-centered approach (Rebeiro, 2001) as they both ensure that we see people as unique individuals, regardless of whether or not they are in a situation of handicap. Working in this way ensures that people are truly listened to and kept at the heart of every decision-making process. The goal of rehabilitation workers should be to help people live fulfilling lives, support them so that they can achieve their goals and aspirations for the future.

2.3.2 Specific methods and tools for co-creation ADs

With the REHAB-LAB 4U, the opportunity was created to participate in a rich exchange between the various actors, about the many themes that are solicited by the co-construction of the ADs. We have wondered, among many other subjects, about what we attribute to certain concepts/words, how the health systems of the countries of origin of the various partners work, what could be a procedural model to propose as an example in presenting the practice, and whether there were assessments that could be carried out in order to make the activity measurable. The Italian team, from the University of Modena and Reggio Emilia (UNIMORE), have already begun to work on this, proposing a methodological approach to structuring the co-design process and more standardized assessment tests to be submitted to people with disabilities, including: Canadian Occupational Performance Measure (COPM) (Law et al., 1996) to assess the employment needs of the person, USERfit PA (Poulson 1996) to make an analysis of the features that must be used to produce, the Psychosocial Impact of Scale support devices (PIADS) (Demers, Monette, et al., 2002), to assess whether the patient has acquired a certain degree of familiarity and competence in the use of AD and the User Assessment of Quebec for the satisfaction of technical aids (QUEST) (Demers, Weiss-lambrou, et al., 2002), to assess satisfaction with both AD and service (Gherardini et al., 2020).



5 UNIMORE team proposed model for the AD co-creation process (Gherardini et al., 2020)

The application of the method for designing inclusive assistive devices described by UNIMORE is preceded by a mapping of patient's occupational needs. The main players in this phase are the OT and the patient who together define the history and explicit needs of the latter with the aim of verifying whether there is a need to create one or more AD and their relative priority. At this stage the patient is helped to express his desires, expectations and frustrations arising from the gesture that fails or has difficulty to perform thanks to tools such as that of storytelling (Gherardini et al., 2018) or more structured as COPM (Law et al., 1996) to assess the outcomes of patients in areas of self-care, productivity and leisure (Gherardini et al., 2020).

Once the need to create an AD is highlighted, the co-design process begins, organized in the following steps:

1. Identification of the characteristics of the AD: thanks to some tools such as USERfit (Poulson et al., 1996) the team identifies the qualities and technical requirements that the object must have to meet the needs of the person (Gherardini et al., 2020).
2. From the idea to the prototype: the OT, the engineer and the patient are involved in the co-creation of the AD. This is a very creative phase, in which the patient is stimulated to provide solutions in order to create the first prototype. The

development of the latter is divided into 3 phases: -a) development of the virtual model, -b) validation of the virtual model by the patient. This is the crucial stage in which the latest changes can be made at the patient's suggestion according to his functional needs, but also aesthetic preferences (the design, colors and peculiarities of the object that you want to make), -c) 3D printing of the AD (Gherardini et al., 2018).

3. Delivery of AD to the patient and evaluation: at this stage the OT, after delivering and instructing the patient to use the AD, evaluates the patient's expectations of how AD will impact his daily life, through the PIADS (Demers, Monette, et al., 2002).
4. Follow-up after 3 months: the OT investigates whether AD is still in use, if any problems have arisen, and re-administers the PIADS (Demers, Monette, et al., 2002) in order to probe the influence that AD has had on the daily life of the patient. He also proposed the QUEST (Demers, Weiss-lambrou, et al., 2002) in order to assess patient satisfaction with AD.
5. Follow-up after 6 months: the OT is checked again against whether the AD is still in use and to see if problems have arisen during use (Gherardini et al., 2020).

The method thus explicit makes it very clear that each patient is directly involved during the entire co-design process (Gherardini et al., 2018). According to this model, patient involvement can be based on direct interaction with digital technologies through the use, for example, of the Natural User Interface (NUI) which allows the user to, by directly tapping the PC screen (through hands or a stylus), modifying the parameters of the object, sharing digital content, etc. (Gherardini et al., 2020).

As you can see the procedure, it is very similar to the one used at the REHAB-LAB, although it differs in some respects. It is possible that in the near future the Kerpape and UNIMORE teams will work together to create a methodological approach further enriched with elements from both fronts. It seems necessary to provide systematic approaches and standardized tests to scientifically validate the effectiveness of this innovative methodology.

2.5 #handicapowerment

We have seen many theoretical additions to the theme of the co-creation of aids, numerous scholars, structures, professionals who are mobilizing in this direction. In addition to the Kerpape REHAB-LAB, there are other associations (which have adopted a different organizational structure), which have a Fab-Lab, including the Human-Lab, accessible to all those who want to create their own assists. Nicolas Huchet, one of the founding partners, was the first to create and use this service, as having undergone an amputation of the right upper limb, and not finding on the market a product that met his needs (because of poor efficiency or because it was too expensive) he sought for himself the answer to his needs. He declares: "... when I had my accident I became a person with disabilities, today I feel like an expert in bionic hands" (*MyHumanKit Nicolas Huchet TEDxParis*, s.d.). This statement would seem to support the above arguments about the sense of empowerment that comes from the responsibility taken and the proactive attitude towards one's own rehabilitation on the part of the patient himself. The Human-Lab is part of Thingiverse on-line open source TheHumanKit, which invites people with and without disabilities to go to the Fab-lab to learn how to make wheelchairs with PVC tubes, prosthetics and AD tailored, etc.

The founders argue that this way of thinking about care is leading to a real revolution in health as it aims at health for all according to the principle of fairness, accessibility and

social justice. According to them, it is also a renewal in the educational field that is changing the way people look at themselves and their disability, determining the solution to their difficulties on their own, as confirmed by a recent report by French students in advanced studies on public health (*«Fablabs et handicap», a rapport intéressant des élèves du Master interprofession in Santé publique de l'EHESP – RLabFFs, s.d.*). I would add, recalling the PET MODEL, that it is desirable to change the gaze of the caregivers and third parties towards people with disabilities coming out of dualism with/without handicap.

TheHumanKit team also coined the hashtag #handicapowerment naming this innovative concept that sees technology combined with mutual help, as the solution to overcome their limits, turning them into motivation (My Human Kit) *Nicolas Huchet TEDxParis, s.d.*

2.6 Fab-lab criticalities

We have analyzed the processes and benefits that can come from this new way of understanding care. In an article published in the independent digital journal Hospimedia, which specializes in current health and social medicine, doubts and questions also arise about some aspects related to Fab-Labs.

Legal and financial instability, as well as a lack of coordination between the Fab-labs themselves and with medical facilities and social services dedicated to disability, are the most perplexing aspects (Moret, 2019). According to the authors, it would be necessary to strengthen cooperation with health facilities as in fact happens for the REHAB-LAB. This also achieves an economic advantage by reducing the dependence on external actors for funding, another critical point highlighted by the study. Fab-labs mainly operating in non-profit services, have modest financial resources, filled with public contributions and partnerships, which, however, could lead to a reduction in their freedom of action. On the legal side, an important issue to be defined is the legal responsibility of the Fab-labs should an object built within it fails or breaks. This could be a disadvantage on the development of the REHAB-LAB community due to the fear of being legally attacked. While waiting for a position from the relevant institutions, it was placed in a grey area and none of the end-users ever reported a feeling of dissatisfaction about the service offered at the REHAB-LAB.

The Kerpape team, in an effort to structure the work of the Fab-labs and from here to respond to the latter problem, created a database that collects all modeled objects and projects developed in relation to disabilities so far (Moret, 2019).

The news, of course, poses new questions for which we are called to bend down to reflect, analyze and give answers. Today we are in the midst of change, every novelty takes time to adapt the new concept to the system of economic, legal and political rules that structure society. This is an ongoing process, which will soon provide the solutions required.

Today, the idea that policy's view towards the manufacture of 3D aids may change following the realization of the great contribution that Fab-lab and Makers around the world have made to the fight against Covid19 by producing health aids for thousands of people (*REHAB-LAB & COVID-19 – REHAB-LAB, S.D.*).

3 THE STUDY

3.1 Methodology and research design

The writing of the following Bachelor thesis required an initial part of bibliography research from:

- a. Scientific articles and publications
- b. Material provided during participation in Twinning REHAB-LAB 4U
- c. Relevant websites

The careful reading of all the documentation was found to be crucial to fully understand the subject in question and to be able to create the questionnaire for the data analysis. The criterion of inclusion considered for the study of the state of the art concerns the date of publication. It was chosen not to consider the articles before the year 1990 (to safeguard some bibliographic references now dated, but elaborated by prominent authors), giving preference to those published within the last five years.

The databases consulted were: PubMed, Google Scholar and Sage. The key words used were: assistive devices, 3D printing, empowerment, occupational therapy, codesign.

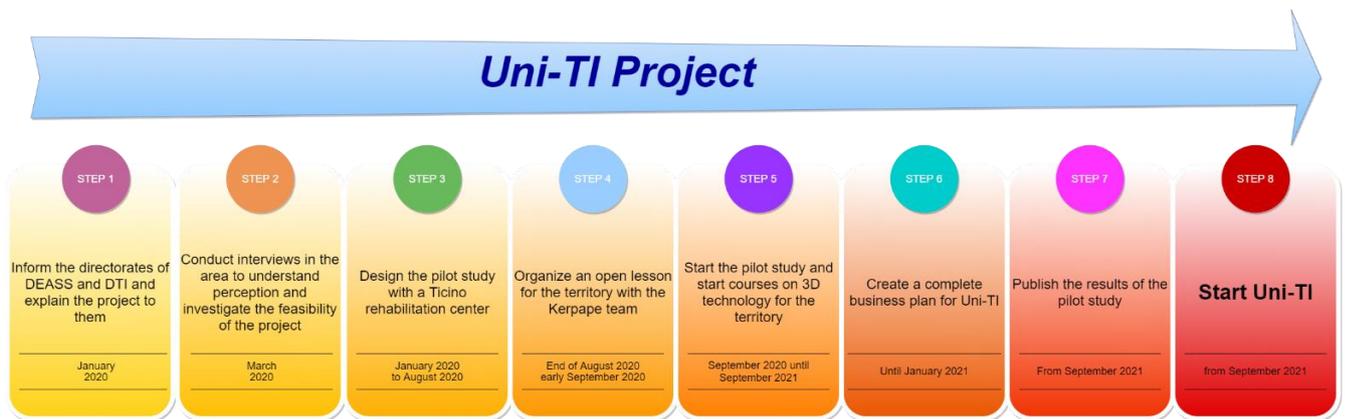
In the second part of the thesis work, being qualitative research, specifically an exploratory study, I submitted a semi-structured survey to the population that I identified in the research, to investigate their perception about the Uni-TI project and the possible availability to participate, as a structure, in the pilot study. I then processed the collected data and integrated the results into the evidence, reflected on how the latter could influence clinical practice and finally came to conclusions.

Since the research directly involves people, ethical standards have been respected and anonymity has been guaranteed.

3.1 Road Map

To structure the project, we have created a road map that illustrates the timeline stages that we have identified to be needed to implement Uni-TI. Here they are:

- 1) Inform the directorates of DEASS and DTI and explain the project to them (January 2020)
- 2) Conduct interviews in the area to understand perception and investigate the feasibility of the project (March 2020)
- 3) Design the pilot study with a Ticino rehabilitation center (January 2020 to August 2020)
- 4) Organize an open lesson for the territory with the Kerpape team (end of August 2020 early September 2020)
- 5) Start the pilot study and start classes on 3D technology for the territory (September 2020 until September 2021)
- 6) Create a complete business plan for Uni-TI (until January 2021)
- 7) Publish the results of the pilot study (from September 2021)
- 8) Start Uni-TI (from September 2021)



6 Uni-TI Project Road Map

This thesis focuses on points 2 and 3 of the following *Road map*, which is to submit a survey to the contacts of the rehabilitation centers of the territory, which are part of the inclusion criteria, to understand their perception and thus investigate the feasibility of the project, and subsequently, if someone decides to offer their availability, it would start with the designated structure a pilot study to verify the feasibility of Uni-TI.

With regard to point 2, I created, in collaboration with Prof Rossini, a semi-structured questionnaire to be submitted to those responsible for the ergotherapy service of the centers of the territory that were part of the inclusion criteria that we defined.

I have attached a video I have created (available to the following link <https://drive.google.com/drive/folders/1DqXkgkDgWZkbg6Baou-cJ-rqBGG5Z67N>), which describes what the REHAB-LAB and the Uni-TI project are. In this way, once the survey was received, the respondents could have all the elements necessary for its compilation.

3.2 Participants

The following inclusion criteria were used to select OTs working in the Ticino rehabilitation centers to which the questionnaire should be submitted:

1. the facility dealt with the areas of neurology and traumatology (adult and pediatric)
2. occupational therapy service included at least 2 OTs.

In total, between February and March 2020, 17 facilities in the Ticino area received the questionnaire by e-mail.

Initially, the inclusion criteria stipulated that the occupational therapy service included at least 3 OTs, in doing so the structures examined were 12. After 2 weeks, having received 3 responses (and out of these 2 declared themselves willing to participate in the pilot study), I decided to change the inclusion criteria in order to increase the number of structures involved in the study, which thus became 17. At the same time, I requested the participation in the questionnaire of the structures already involved. After another 2 weeks of waiting I received 6 total responses and of these, 4 facilities declared themselves willing to participate in the pilot study.

3.3 Tool

The tool used is a semi-structured questionnaire, developed for the survey, which investigates the perception of the population under consideration about the Uni-TI project, their willingness to participate in the pilot study, their possible previous experience with respect to 3D printing in the health field, the economic availability and willingness to take advantage in the future of such a service, their knowledge with respect to the REHAB LAB, their opinion with respect to interdisciplinary work and with respect to the relevance of the project related to the personal clinical practice, their idea about who and how many people could take advantage of Uni-TI, etc. (see Appendix 9.2). From these were highlighted 9 macro-arguments that will act as a hat for the analysis of the results: general perception, prior knowledge related to the REHAB-LAB and perception of the relevance between occupational therapy professional practice and 3D printing technology, perception of the implementation of Uni-TI, digital skills, perception of interdisciplinary work related to collaboration between patient, OT and engineer, perceived criticality, potential users of Uni-TI, potential economic investment and perceived potential of Uni-TI.

The questionnaire is composed of 24 questions including 13 open and 11 multiple choice. As anticipated, in order to allow respondents to easily answer the questions, it was necessary to create a video that presented the REHAB-LAB and illustrated the planned project for Ticino. Anonymity was guaranteed. For this reason, participants were asked to make contact by e-mail if they were interested in participating in the pilot study (as provided by step 3 of the road map).

3.4 Data Collection

The data collection took place between the 15th of February and the 13th of March 2020 (the deadline was clearly spelled out to the participants in the accompanying e-mail to the questionnaire). I got 6 responses out of a total of 17 participants i.e. about a third of respondents answered the questionnaire. The data collected were used to gather valuable information on the perception of some OTs operating in territory structures about the Uni-TI project and the technology of 3D printing more generally. The data analysis has provided some interesting elements that need to be integrated with the reflection on the implementation of Uni-TI reminding us that at the heart of this project are the needs of all the actors involved and the need to adapt the laboratory to the specific requirements of the Ticino territory.

3.5 Biases

During the data collection, I received an e-mail from one of the interviewees in which he told me that he had forwarded the questionnaire to a colleague, a Lombard OT passionate about 3D printing. I subsequently received another e-mail, this time from the Italian OT, in which he confirmed his strong interest in the subject and that he had answered the survey. This unforeseen event caused a change in the results because, the application for research and consequently the criteria for inclusion, planned to interview only the experts of the Ticino territory. As the results were anonymous, I could not identify which of the answers belonged to the Italian OT (except for a response in which he refers to the province of Varese). On the other hand, the fact that we are also interested in a project of this type abroad is to be interpreted in a positive way. The Ticino and Lombardy regions are bordering and historically linked and represent two realities very close to each other,

even if they belong to two different nations. In fact, there are many synergies already in place between the two territories. This event could provide new insights into the process of creating and implementing Uni-TI and any international collaborations that could always be created with the aim of expanding the REHAB-LAB community.

4 RESULTS

In general, the answers indicate that there is an important interest in the topic proposed in the questionnaire. The data also provide interesting insights to be reflected on and indicate the needs of health professionals working in the area with respect to the Uni-TI project.

Below are the answers provided by the 6 participants in the interview organized according to the 9 macro-themes mentioned above.

4.1 General perception

Overall, all respondents rated the Uni-TI project as innovative, some reasoned the answer by claiming that a similar laboratory is not yet present in Ticino.

Expert X³: "It is a project that certainly does not exist in the territory, which would allow to quickly and systematically solve small (or great) difficulties of people with disabilities".

One respondent claim to be part of a project equivalent to Uni-TI (but with the addition of an "orthopedic technician" to the team) and that he has used this technology in his clinical practice in the province of Varese, unlike others who have never used it in the professional context. The expert who claims to use 3D printing in his clinical practice claims to have used it to create small aids that he had not found on the market. These aids were designed in the form of drafts by the OT and then a designer reproduced them in digital format and were later printed.

Expert X: "I happened to use it for the creation of small aids (ring to use a tablet, an aid to hook a dishwasher and a particular handle to help a child to write) that I could not find on the market. I created a design of the aid I needed, the designer turned it into 3D and later it was printed."

We see that according to the model described, the involvement of the patient is lacking in both the co-design and co-creation process of the assistive devices not thus going to take advantage of the therapeutic potential given by making the patient the actor of his own care process, as what happens at the REHAB-LAB. Therefore, there seems to be a need to make OTs aware of this therapeutic possibility, which relies on more and more scientific evidence to support it.

4.2 Prior knowledge of REHAB-LAB and perception of relevance between occupational therapy professional practice and 3D printing technology

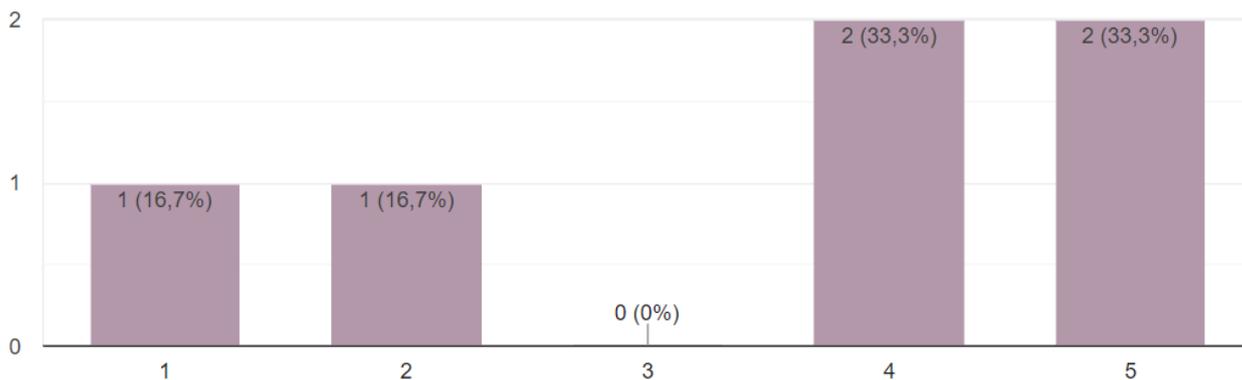
All respondents say that they are not aware of the REHAB-LAB and of these 4 out of 6 declare that they would consider this laboratory relevant for their work environment because they do not find the aids they are looking for on the market (Figure 8).

³ I will use the term "Expert X" to quote the answers given the anonymity guaranteed in the process.

Expert X: *"I often need to adapt small everyday objects and not to find the specific solution for each user."*

One respondent argues the importance of innovation in the occupational therapy field.

Expert X: *"I find innovation a necessary way to keep up with the times."*



7 Explanatory chart for answers to question 10: "How much do you rate the Rehab-lab relevant to your work context?"

Some of the respondents gave a low score to the question "How much do you rate the REHAB-LAB as relevant to your work environment?" because they claim that the REHAB-LAB is only suitable for people with severe disabilities.

Expert X: *"the REHAB-LAB makes sense to exist only in accordance with a chronic acquired or congenital disability context."*

Surely this data illustrates the need to better define the "typical" user of this laboratory and to further explain the dimension that sees the production of AD by third parties (e.g., collaboration with schools or institutes dedicated to mental health, etc.).

4.3 Perception of Uni-TI implementation

OTs who do not use 3D technology in their professional practice when asked if they wanted to implement it in Ticino have split into two groups.

The part that does not see the need is justified by the following two arguments:

- the case studies they work with don't match the typical patient they think can participate in the lab.

Expert X: *"I don't imagine it can help my professional practice because I work with people with orthopedic, lung or cancer issues."*

- because they claim that they do not have sufficient resources and skills to use for this initiative.

Expert X: *"No because so far the resources and skills have not been enough, but various projects around have already been launched."*

The other group, on the other hand, believes that it could be useful to them because it facilitates the creation of custom AD and specific complex orthoses.

Expert X: *"It would be useful to make certain orthoses of a certain complexity and/or for the creation of custom ADs."*

The need to clarify the "typical" user of Uni-TI is still highlighted.

4.4 Digital skills

Overall, 3D printing technology seems to be known in the territory: 5 out of 6 respondents say they know about it, but in general there seems to be a lack of skills related to 3D printing among the OTs interviewed. In fact, the majority has given a low score in the question relating to this theme. 4 out of 6 scored 1 on a scale of 1 to 5. This would seem to confirm the need to implement the teaching of these skills in the course of studies.

4.5 Perception of interdisciplinary work related to collaboration between patient, OT and the engineer

When asked about the perception of interdisciplinary work related to collaboration between patient, OT and the engineer, from a communication point of view, the majority of respondents stated that this is a relevant and enriching contribution for all the actors involved.

Expert X: *"It is interesting and absolutely essential for every solution proposed to the end user to take into account both the aspects/needs of the person (the role of the OT), and the narrower aspects of the technical aspects. In this collaboration can really emerge the role of the OT as a health/rehabilitation figure able to dialogue with different professionals."*

With regard to the perception of collaboration mentioned above from the point of view of learning/professional enrichment, 100% of respondents agree that it is a positive and enriching collaboration.

Expert X: *"Definitely enriching and able to improve the services a lot."*

4.6 Perceived criticality

When asked about the perception of collaboration between patient, OT and engineer from the point of view of the space-time organization, many raised concerns about logistics. It seems to be a crucial point that of physical distance so much that the respondents argue that an important reflection on this is necessary.

Expert X: *"It won't be easy. I can imagine that the various actors can also be geographically distant. This could create logistical problems..."*

There are also those who point out that nowadays, thanks to technology, it is not necessary to meet physically in order to collaborate (as, I would add, demonstrated the pandemic from Covid19).

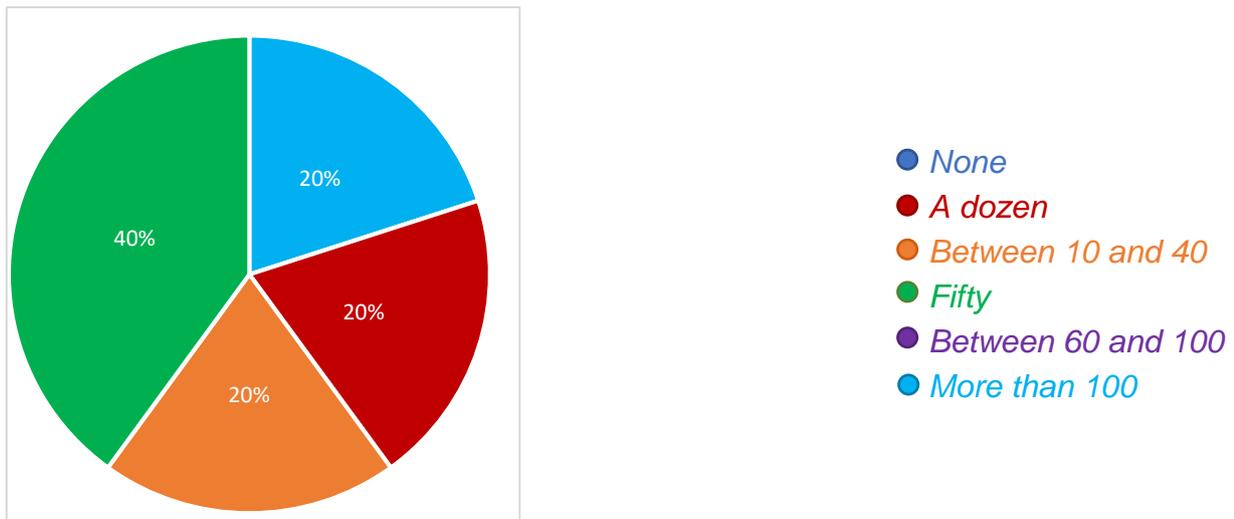
Expert X: *"In 2020 there is Internet, you don't need physical encounter."*

The administrative and financial aspect also has some concerns to be clarified, especially with regard to health insurers, another crucial point on which, the respondents say, it seems necessary to stop and reflect.

Expert X: *"To be clarified with insurance health companies."*

4.7 Potential users of Uni-TI

This graph shows the number of people who, according to Ticino experts, could take advantage of the service offered by Uni-TI per year. We see that the answers are heterogeneous and range from a dozen to more than 100 users per year.



8 Explanatory chart for answers to question 18: "How many people do you think could benefit from a service like Uni-TI per year?"

In an attempt to define The Users of Uni-TI, half of those surveyed said that patients with severe disabilities could use this service to compensate for poor functions.

Expert X: *"Especially people with serious disabilities, as you can find them in the specialized institute."*

An interviewee states that both people with disabilities and without, and argues that anyone who needs an AD that is not on the market would benefit from it.

Expert X: "Anyone who needs an auxiliary vehicle that is not on the market or anyone who does not get a sufficient employment performance with a prefabricated AD."

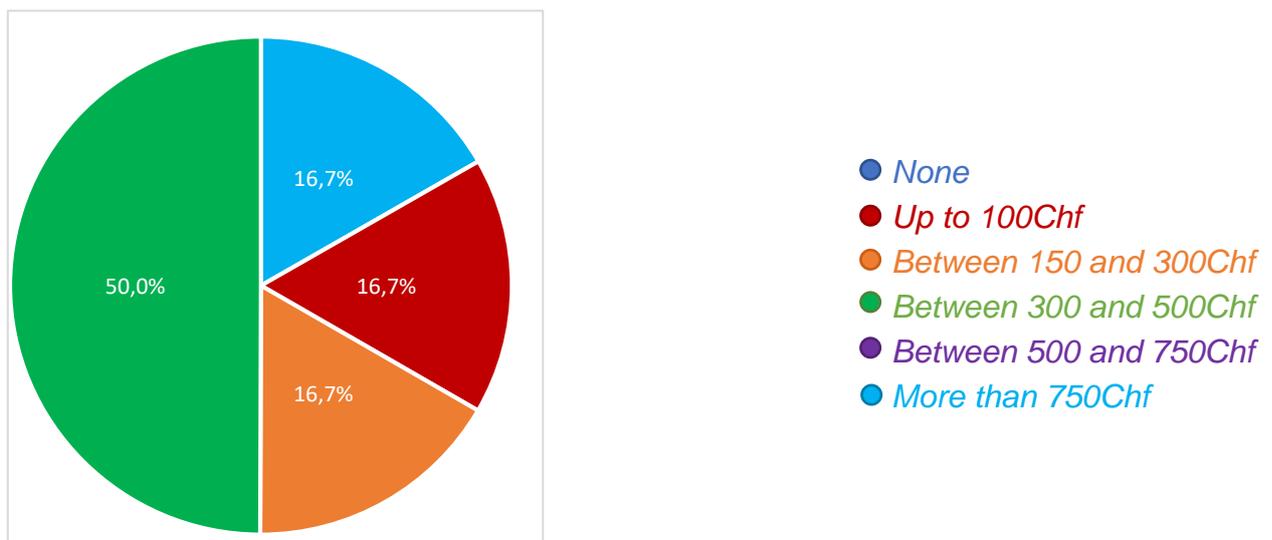
In addition, an OT observes that there are two different types of users: rehabilitation health professionals and people with disabilities.

Expert X: "The therapists would have a place to make the aids for their clients, people with disabilities would have a place where they could ask for advice on the creation of something they do not find on the market, for their particular need."

4.8 Potential economic investment

With regard to the economic investment by respondents in relation to Uni-TI, once again, the opinions are mixed. Some would be willing to invest to train as OTs (or train service OTs) up to 100chf per year, others between 300 and 500chf per year and still some would be willing to pay more than 500chf per year.

With regard to the investment by Ticino centers to be able to use the service offered by Uni-TI as a professional together with the person with a disability, the graph shows that the responses range from 0 to more than 750chf per year.



9 Explanatory chart referring to the answers to question 22: "How willing would you be to invest economically to use the Uni-TI service as a professional with the person with the person with a disability?"

There is therefore a good level of interest so much so that 6 out of 6 respondents stated they were willing to invest economically for their training (or to train the OTs of the service) and 5 are willing to contribute economically for the use, by the structure of belonging, of the service that Uni-TI wants to offer.

4.9 Uni-TI's Perceived Potential

In conclusion, the general opinion about the possibility of implementing Uni-TI on the territory is positive even if the majority of respondents consider it a daunting but possible task.

Expert X: *"It's going to be tough. But whoever lasts wins it!"*

There are those who argue that it is necessary to train Ticino OTs in 3D *printing* technology:

Expert X: *"To be able to implement the project in the territory of Ticino you should, in my opinion, first of all train the OTs present in the territory, to "give birth" to the question, also focusing on the fact that 3D printing is now a reality, and, in my opinion, OTs must know it, use it or at least know how to turn it on"*

Finally, 4 out of 6 facilities stated that they would be willing to participate in a pilot study of the Uni-TI project, which demonstrates the important general interest in the subject.

5 DISCUSSION

In the light of the above evidence, we are therefore proceeding to reflect on the subject. There is a lot of data that have provided interesting ideas for reflection by emphasizing the elements that most interest Ticino OTs.

Surely one of the most important key results, and which testifies to the strong interest of the territory towards the proposed theme, is that as many as 4 out of 6 structures have declared themselves willing to participate in the pilot study. This result will allow us to respect the steps and times that we have defined through the road map thus making a big step towards the realization of Uni-TI.

The coming of the pandemic from Covid19 did not prevent the progress of the project, rather there were additional opportunities for collaboration between the Kerpape team and DEASS. Lacking internships at the local clinics, the possibility of carrying out research internships has been opened up. Two occupational therapy students and a local OT already experienced in the use of the 3D printer, became aware of the project thanks to the questionnaire and were thus added to the Uni-TI project. They, together with the Kerpape team, are working on the realization of pedagogical material related to the theoretical aspects of occupational therapy (models, clinical case studies, etc.) to be presented to students in the coming years in relation to Uni-TI.

Also interesting are the contributions that 3D technology has made to the fight against Covid19 are interesting, providing an excellent argument in favor of the need to implement laboratories such as the REHAB-LAB in the territory at healthcare facilities (REHAB-LAB & COVID-19 – REHAB-LAB, s.d.).

Another key point is that the respondents' reference to the collaborative creation of aids through the use, of 3D technology is overall very positive. One of the reasons we find it several times mentioned in the answers is that on the market it is difficult to find the AD suitable for the real need of the person, and hence the need to find an effective way to create the perfectly tailored object, as was highlighted by Kraskowsky & Finlayson (2001). We have seen in the literature how high the rate of abandonment of AD is and how difficult the task of OTs is to find the right aid in order to counter this phenomenon (Cruz et al., 2016, Petrie et al., 2018, Verza et al., 2006). It is therefore a real, current and real need in the area to which we are called to respond. This laboratory could represent a valid answer to the problem given that one of the solutions proposed by the evidence is that of involving the patient himself in the process of defining and creating the aid (Hofmann et al., 2019).

As stated by the other respondents, it seems that there is still no *sui generis* laboratory in Ticino and it seems that, although some are less interested, most have shown a willingness to be involved into the subject. I think that, reading the results of the study, the market demand from local professionals, relating to the possibility of being trained and taking advantage of this technology, is clearly visible. As we have seen, all respondents have expressed their willingness to invest economically for their training (or to train service OTs).

The data regarding "Potential users of Uni-TI" and "Digital Skills" seem to highlight two needs, inherent in the territory, on which it will be important for Uni-TI to intervene:

- Better clarify what the "typical" user of the Uni-TI service can be

- The need to implement the teaching of these skills in the path of OTs' studies so that everyone can have the basis for being able to move closer to content related to the world of new technologies.

With regard to this last point, the evidence has shown us the feasibility and the benefits that can result for students in terms of better adaptation to the demands of the lab, our market and the development of thinking skills thanks to the exercise of skills such as problem solving, creativity, the ability to collaborate and dialogue with professionals from different worlds from the health sector, etc. (Wagner et al., 2018).

On the first point, however, the data show that according to some participants, the service provided by Uni-TI is intended only for people with serious disabilities. It is true that at the Kerpape center patients who participate in the REHAB-LAB have on average serious disabilities or have chronic neurodegenerative diseases, but I believe that it can be used by all those who need an aid they do not find on the market, regardless of the nature and presence of a pathology, as other respondents have argued. It is the very spirit that animates the Fab-labs to welcome all those who are interested, making available to each one materials and tools useful to the realization of DIY objects, according to a highly inclusive approach (Allègre et al., 2017). We must also not forget the therapeutic aspect "hidden" behind the co-creation of the aid that leads to an increase in levels of self-esteem and empowerment that results from taking responsibility towards one's own rehabilitation (Ostuzzi et al., 2015). Producing AD for third parties also has beneficial therapeutic effects, increasing motivation and the feeling of being a resource for the community. Collaborations may arise with institutions such as schools, mental health centers, etc. For example, 3D printing content could be included in the training plans of middle and high schools as part of an awareness of the issue of disability. The children could thus produce AD for the people of the rehabilitation centers, thus creating real contact between the various actors.

Although experts are more in favor of working together between professionals from different sectors, in agreement with Sandnes et al. (2017), thanks to the complementarity of their skills, would provide the highest quality therapeutic performance, the Ticino reality seems to express concerns related to the logistical and administrative-financial aspects, as can be seen from the data related to the "Perceived Criticality". We have found that one crucial point that is of concern to respondents is the aspect of reimbursement, by health insurers, for the services offered to customers through the Uni-TI service. This point is certainly to be reasoned in depth and will be clarified with the drafting of the Uni-TI *Business Plan*. The link with the university will allow the project to be economically achievable thanks to the fact that, being integrated into the training plan of occupational therapy students, they will be able to collaborate through internships or optional modules and then work in a free form for the project, self-maintaining thanks to internal resources, can be sustainable in the long term.

The issue of space-time organization also seems to be problematic in the eyes of the respondents. Many believe that the physical distance could compromise good communication between team members and be a logistical glitch. Surely, we will be called to think in depth about the organizational aspects to make the work and the moves as streamlined as possible for each member of the team. The Uni-TI laboratory, which will be based at SUPSI's DEASS, will become the common reference center and will be a new bridge that will unite SUPSI, with its teachers and students, to the centers of the territory and to the citizens. It will also strengthen existing interdepartmental synergies by becoming a reference on the topic for other Swiss health schools. Fortunately, technical contacts will be experts in digital communication and, if necessary, the way in which the

various actors communicate can be adapted, without the collaborative work being compromised in itself or in its quality. These skills are also part of set of skills that we are called to acquire as professionals operating in the 21st century industrial revolution (Liu, 2018).

In conclusion, the data tell us that the perception of respondents from the point of view of learning/professional enrichment, relating to the collaboration between a person with a disability, a technical contact and OT represents a positive and stimulating synergy for all. It therefore seems pertinent to promote this kind of collaboration, not only between professionals from different backgrounds, but also with each other and the people themselves. The latter are recognized as the leading experts on themselves and their pathology and, as the authors point out, express the right need to feel more active in the process of care that concerns them (Lunsford et al., 2016).

5.1 Research limitations and additional considerations

Here are some limitations I highlighted by reflecting on the entire search process.

During the processing of the data, I was able to see that to three questions, not all respondents answered, and one respondent explicitly stated that they did not understand the question. Surely this makes me reflect on the importance of asking questions in an even more accurate and understandable way and will serve as a warning to future research.

Another consideration is that the interview took place at a particular time for Switzerland and countries across Europe (and beyond). The Covid19 emergency may have affected, as an external variable, the levels of participation in the questionnaire. The last two weeks of data collection, which ended on 13 March 2020 (the total duration was about one month), are paired precisely with the beginning of the spread of the virus in Europe and therefore with the first stages of reorganization within the treatment centers. The energies of the professionals in that period, and later, were absorbed almost entirely by the pandemic negatively affecting the levels of participation in the study.

This global emergency also influenced the performance of the second training of the Twinning REHABLAB 4U scheduled between 16 and 20 March 2020, which was reorganized and carried out partly in e-learning form and partly postponed to a date to be defined. Some partners were not able to participate in all the planned video conferences as they were involved in intervening in the centers of competence by activating the measures to combat the virus. All the professionals involved also reported that they had to temporarily shelve the ongoing projects, related to the implementation of REHAB-LABs at their centers, because they were overwhelmed by the problems caused by the pandemic. With regard to Uni-TI, as mentioned, the need to create new internships for third year occupational therapy's students, has resulted in the involvement of two students who for 3 months will be able to devote themselves to the project. Their aim will be to further investigate the theoretical aspects of the collaborative construction of aids, together with an OT from the territory who has joined the project.

This pandemic also highlighted the need to invest in this laboratory that unites professionals from the world of technology and healthcare and invites them to collaborate for the common good. There are many testimonies from around the world documenting the key role that 3D technology played in the fight against the Covid19. Some Italian engineers have modeled in 3D and printed valves that have allowed the use of hundreds of respirators, which otherwise could not have been solved in a minimum time frame, through the classical production mode ("Coronavirus", 2020). Others have managed to

think of a system to turn diving masks into respirators (Come la stampa 3D sta aiutando a gestire l'emergenza ospedaliera", 2020), while others have designed and printed a respirator consisting entirely of 3D-printed components (Kety, 2020). All the Fab-Labs and *Makers* of the various regions and nations of the world have also organized themselves, using social *media*, to build a system of mutual relief and produce protective materials for health professionals, but also for individual citizens (e.g., visors, etc.) (Dauphin, 2020), (REHAB-LAB & COVID-19 – REHAB-LAB, s.d.). This has allowed people with these machines and skills to be socially active, thereby increasing their empowerment and levels of social *engagement*. These devices also allow citizens to emancipate themselves from classical production systems, thus having the opportunity to intervene if, as in the case of the pandemic, they can no longer meet market demand, thus gaining autonomy and freedom.

5.2 Implications for practice and hopes for the future

The implications for the practice are mainly for two aspects:

1. the one related to the training of OTs
2. clinical work.

As for the first one we can imagine that Uni-TI could be the first step in inserting digital skills into the curriculum of OTs trained in Ticino, bringing innovation and tools that students will be able to spend in a lab our market that requires to be more and more technological (Larsson-Lund & Nyman, 2019) as already happens in other European countries such as Sweden (Occupational Therapy in Sweden - Sveriges Arbetsterapeuter, s.d.). To engage students more in the REHAB-LAB, the Kerpape electronic laboratory team visits engineering faculties in various universities to present the project to students who are looking for an internship related to the new technologies applied to the world of healthcare. Uni-TI could model this initiative by implementing it on the Ticino soil. From this, new ideas could arise to promote the project, such as proposing periods of joint internships between occupational therapy and engineering students at the health facilities that will lend themselves, creating interesting and enriching collaborations both professionally and personally. It will not be necessary for the centers involved to have a REHAB-LAB, but it may be the students themselves who, by bringing a 3D printer and thanks to their expertise, will be able to bring the REHAB-LAB into the facilities themselves. There will be patients who need a personalized AD and the process of collaborative creation can begin. This intervention could be used as a test to evaluate the effectiveness of the laboratory and once proven; it will be possible to move to the actual stable implementation of the REHAB-LAB in the structure itself.

In summary, we have seen through the evidence and thanks to the processing of the data collected through the interview with the experts of the territory, how necessary it is to intensify the contribution of digital skills in the OT study plan in order to have the basis to communicate and collaborate effectively with experts in the technological world and vice versa to bring to the latter the skills related to the health world (Larsson-Lund, 2018).

With regard to the second point, we found, through the questionnaire, that the OTs of the territory are interested in the theme of 3D technology as we have detected their need to find the custom-made aids that are very unlikely to be on the market. In addition, they consider the Uni-TI project innovative and cutting edge from the point of view of the therapeutic offer that they could offer patients. There would therefore seem to be room and interest in the proposal of specific training classes for professionals and for the pilot study of Uni-TI, given the willingness of the centers to lend themselves.

An interesting initiative in place at the Kerpape center, which could be implemented in Ticino once the workshops are started (and at the REHAB-LABs that will be born thanks to the REHAB-LAB 4U, in Europe), to keep the team of OTs updated, and not only, consists in organizing short meetings called "picnics", every fortnight, held during the lunch break (hence the name), at the electronic laboratory. On these occasions, all the aids and 3D projects created since the last picnic are shown and we compare ourselves with doubts, perplexities, advice, etc. On an hour of meeting, for a few months now, Kerpape management has decided that half an hour can be included in the working hours. I think it is a good practice and paying a portion of this time could incentivize professionals to participate and increase their knowledge.

In conclusion, Uni-TI would represent the first REHAB-LAB from Ticino and Switzerland, to our knowledge, and it could stimulate the birth of other centers in the Swiss territory by becoming a reference point for innovation in healthcare and an example of international and inter-professional collaboration. The hope is that this laboratory will be implemented because the evidence shows that it would lead to an increase in the quality offered in the clinical practice of OTs and the lives of patients who will benefit from it, not only because they will have an object tailored to their personal needs and tastes, but also because they themselves will have created it by feeling part of the process of care (engagement) and increasing their sense of power over the acts of care (empowerment) that affect them directly (Lunsford et al., 2016).

6 CONCLUSIONS

The Uni-TI project seems to interest many OTs in the area because it responds to the needs of the actors involved: from the OT who wants to find the help perfectly suitable for the person, to the patient, who needs to be more involved in the process of care adapting everything to his personal tastes and needs.

In order for the project to be continuous over time, we need to think of a low-cost implementation mode and produce enough profits for the system to be able to feed itself. The fact that the laboratory is associated with the university would allow the resources of students and existing premises to be used.

The benefits potentially derived from Uni-TI would invest a lot of actors: from patients, to OTs, to technical contacts, to students of both these two addresses, to SUPSI in general and to the whole community, creating bridges between them.

The inter-professional collaboration already carried out during the training phase would bring a change in the mind form of the students who will bring with them, once they graduate, in the world of work giving rise to numerous projects. The above evidence has clearly shown us the quality benefits that would be achieved in terms of therapeutic performance with the ultimate goal of doing the best for the person. Certainly, further studies will be needed to investigate the subject even more in depth and to increase knowledge and evidence on this issue.

This exploratory study actively participates in the future implementation of Uni-Ti by collecting evidence related to the theme and adding some data related to the Ticino territory, thanks to the following thesis and the poster derived from it (see Appendix 9.3). I hope that this project can take place. As part of the REHAB-LAB community myself, I can say that I have met people who are willing to share, experiment, create and have been able to develop numerous skills including creativity and a collaborative spirit. I have seen the enthusiasm of patients in participating in the laboratory, but also of professionals, in a harmonious climate and where humanity reigns. I have also learned that everything has a solution and that, thanks to teamwork, community, putting together skills and ideas, you can go very far.

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9 ABBREVIATIONS INDEX

AD: assistive devices
COPM: Canadian Occupational Performance Measure
DACD: Departments of Environment Construction and Design
DEASS: Department of Business Economy, Health and Social
DFO: Do-For-Others
DIY: Do-It-Yourself
DTI: Departments of Innovative Technologies
ICF: Classification of Functioning, Disability and Health
MST: mainstream technology
NUI: Natural User Interface
OT: occupational therapist
PEO: Person – Environment – Occupation
PET MODEL: person, environment, tool model
PIADS: Psychosocial Impact of Scale support devices
PIVOT: population-question-variable at study-place-time
QUEST: User Assessment of Quebec for the satisfaction of technical aids
SUPSI: Professional University School of Switzerland
UNIMORE: University of Modena and Reggio Emilia
WHO: World Health Organization

10 APPENDIX

10.1 The REHAB-LAB community members chart



Charter of members of the REHAB-LAB Community

HOME

The REHAB-LAB is a **place of reception** dedicated to the manufacture of technical compensation devices (technical aids). It is intended for users of **medical or medical-social structures** (patients, residents...).

3D PRINTING

REHAB-LAB uses 3D printing technology to make technical aids. It promotes the use of tools accessible to as many people as possible (software, access interfaces, etc.)

Collaboration

At REHAB-LAB, three types of actors collaborate.

- **The users** of the structure as well as their surroundings
- **Occupational therapists and the multi-professional team**
- **Technical references**

PIECES MADE

The pieces made are **custom technical aids** (as well as orthotics). They must be adapted and customized for each person, and **not be the subject of mass production**.

EXCLUDED PARTS

REHAB-LAB **does not manufacture**: rehabilitation parts, reproductions of commercial objects, objects that have no purpose of compensation, objects at risk...

Sharing

REHAB-LAB **shares** its achievements and experience with the community REHAB LAB. It is committed to disseminating to the general public where possible.

Free

The REHAB-LAB must be **completely free for the people who benefit from it**, its operating costs must be borne by the reception structure.

REHAB-LAB Community Community Charter - Last updated October 18, 2018

(REHAB-LAB – Site de la communauté REHAB-LAB, s.d.) (reproduced with permission from CMRRF Kerpape)

Project or Uni-TI Questionnaire

After viewing the video mentioned in the e-mail (which you can find at this link: <https://drive.google.com/drive/folders/1DqXkgkDgWZkbq6Baou-cJ-rqBGG5Z67N> and downloadable at this link <https://we.tl/t-64sLA3c6Mp>) I kindly ask you to respond, by Friday 13 March 2020, to the following questionnaire with the aim of finding the data useful to my thesis.

The way you create the questionnaire guarantees anonymity.

If you answer yes to the last question, please contact me to learn more about it.

I thank you heartily for your cooperation, your help is invaluable to me!

:)

1. How much do you rate the innovative Uni-TI project?

Only one answer possible.

1 2 3 4 5

Not at all innovative Very innovative

2. Justifies the previous answer

3. Do you know the 3D printer?

Only one answer possible.

Yes

No

4. How much do you value your 3D printing expertise?

Only one answer possible.

1 2 3 4 5

Nothing Very High

5. Do you use 3D printing in your professional practice?

Only one answer possible.

Yes

No

6. If so, can you describe when, why, with/for whom and how do you use it?

7. If not, can you imagine that it would help your professional practice? Why is that?

8. Did you know about the Rehab-Lab already?

Only one answer possible.

Yes

No

9. If so, where, through whom and when did you learn about it?

10. How much do you rate the Rehab-lab relevant to your work context?

Only one answer possible.

1 2 3 4 5

Not relevant not at all Very, relevant

11. Justifies the previous answer

-
-
12. Uni-TI involves a co-construction that involves in addition to the person in a handicap, an occupational therapist and a technical contact: have you already experienced a similar collaboration?

Only one answer possible.

Yes

No

13. If so, why? When? With whom?

14. Regardless of whether you have had direct experience of it, what is your perception of this interdisciplinary work from a communication point of view?

15. From the point of view of the space-time organization?

16. From an administrative-financial point of view?

17. From a learning/professional enrichment point of view?

18. How many people do you think could use a service like Uni-TI per year?

Only one answer possible.

- None
- About 10
- 10 - 40
- About 50
- 60 - 100
- +100

19. What people do you think could use a service like Uni-TI per year?

20. Why?

21. How much would you be willing to invest economically in Uni-TI to train as an occupational therapist (or train service OTs)?

Only one answer possible.

- Nothing
- up to 100 chf per year
- between 150 and 300 chf per year
- between 300 and 500
- more than 500 chf per year

22. How much would you be willing to invest economically to use the Uni-TI service as a professional with the person with a disability?

Only one answer possible.

- Nothing
- up to 100 chf between 150 and 300 chf
- between 300 and 500 chf
- between 500 and 750 chf
- more than 750 chf

23. What is your perception about the possibility of implementing Uni-TI on Ticino territory?

24. If there was a pilot study of the Uni-TI project, would you be willing to participate as a rehabilitation facility?

Only one answer possible.

- Yes
- No

SUPSI

Citizens in a situation of handicapped actors in the creation of their own auxiliary means through 3D technology

Stefania Cornaglia

*Keywords: occupational therapy, assistive devices, 3D printing, codesign, empowerment***Introduction**

Occupational therapists (OTs) promote the maximum autonomy of people in carrying out activities that are significant to them by also suggesting, if necessary, the use of auxiliary means (AD) (4). However, we often have to deal with the problem of patients abandoning them (4), (6). According to Kraskowsky & Finlayson, the rate of use of AD's is highest at the moment after the prescription and then drops to 54% after 3 months and 57% after 9 months (4). The most common causes are:

- the perception of non-need and complexity of using AD (4)
- the inadequacy of aid (4)
- the rejection of the AT caused by its symbolic nature that strengthens and reveals the identity of the physical disabled (1), (4), (8).

Some studies propose a solution to adopt a professional-patient partnership approach by making it a part in the process of designing and creating the aid (2). In this way, the AD will exactly match the needs of the user who, will fully understand how to use it (1). The fact that it has been created will also increase its adherence and acceptance, improving its quality of life (5).

Description of the specific context – innovation factors

In 2016, in Brittany, at the functional rehabilitation center in Kerpape, the REHAB-LAB was born: a laboratory in which engineer, OT and patient work in synergy for the co-creation of AD's intended for the latter, using 3D technology (1). 3D technology allows you to model the AD via a computer program and then make it real thanks to the 3D printer (1), (2), (6). The patient can participate in the laboratory on several levels, until he can model his AD independently, adapting the workstation according to his skills (1). It is a highly inclusive tool that stimulates social participation because a large community has been created around it (1), (6).

A project is currently underway in Ticino to implement Uni-TI: a laboratory inspired by REHAB-LAB, in the health department of SUPSI. This will see students of occupational therapy and innovative technologies collaborate in the development of 3D solutions with patients from the rehabilitation centers of the territory. To investigate the perception of Ticino OTs about Uni-TI and their willingness to participate in a pilot project for its implementation, in my thesis I collect data to adapt the laboratory to the specific needs of the territory. Preliminary results show a high level of interest from professionals and highlight some elements to be investigated, such as the economic aspect (reimbursement of benefits by health insurers) and laboratory logistics.

Relationship with employment science

With the creation of numerous fab-labs (of which REHAB-LAB is a part), i.e. places where technologies for the construction of any tool are put at the service of all (1), more and more people are creating ADs for themselves and others, stimulating research on the concept of Do-it-yourself (DIY) and Do-For-Others (DFO) applied to care (2). It has been shown that the patient's engagement in the care process, results in an increase in levels of self-esteem, sense of competence and occupational empowerment (5), (7) and is one of the rights of the patient who, as OTs, are called to enforce (advocacy role).

The fact that the ADs built at the REHAB-LAB correspond exactly to the needs and tastes of the patient (3D modeling allows you to choose the design, color, insert on the object engraved or embossed, etc.) (1), having himself participated in their realization, allows to preserve its employment equality as the AD will have more chances to be used in the long term, guaranteeing its employment performance (PO) (5).

In addition, this mode of production of AT is perfectly in line with the patient-centered approach (ACP approach), which is as dear to ergotherapy as to occupational science (SO) (9).

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Stefania Cornaglia, *Cdl in Ergoterapia, Employment science and future areas of ergotherapy*, stefania.cornaglia@student.supsi.ch, 10.05.2020

Theoretical framework- scientific basis

In PET (person, environment, tool) MODEL, the operation (F) of an individual is mathematically conceived as a function of personal, environmental and instrument factors: F = f (P, E, T) (3). Each set of factors interacts with others and can facilitate or hinder the activities and participation of the individual. This model invites us to take a universalist vision that wants to go beyond splitting person with disability/healthy person (3). The authors include in the element 'tool' both mainstream technology (MST), intended for all (e.g. smartphones), and AD. The difference between people with and without disabilities therefore lies in the degree of dependence on instruments, rather than in nature (3). A universalist view of the use of technology brings numerous benefits to disability practice and research by reducing the otherness and stigma associated with the use of AD (8). It is a highly inclusive concept that pushes us to recognize ourselves in the patients we care for and to establish with them an equal relationship based on dialogue and listening to their own individual needs and desires, as is the case at REHAB-LAB (1).

Discussion

The model proposed by the Kerpape team offers us a possibility that, in addition to solving the problem of abandoning AD, it has important therapeutic benefits related to the psychological and emotional aspect of the person who, in this way, is taken care of in a holistic way (1), (9). The limitations proposed by this methodology could be the fact that they have the skills and materials related to 3D technology. The context could also influence the laboratory's performance. For example, unlike REHAB-LAB, Uni-TI would be located at the university. On the one hand, there would be important benefits for pupils and their training, going to stimulate inter-professional collaborations from the university context (10). On the other hand, as suggested by the experts of the territory, it will be appropriate to rethink the organizational structure of Uni-TI to bring patients from the centers to the university, solving the consequent logistical and financial problems. This is an interesting challenge that, once the first hurdles have been overcome, it will bring many benefits to all stakeholders involved. Alternatives to the REHAB-LAB methodology, but based on the same principles, are to engage as therapists to understand the subjective experience of their clients and their unique perspectives in order to provide the most appropriate response to their need, applying the ACP approach (4), (9). As PET MODEL suggests, it can certainly help us with this (3). It would be desirable, even if it was not possible to manufacture an AT in DIY mode, to have the person participate throughout the process of choosing the AD (4). This will prevent inadequate interventions which could lead to job deprivation caused by the inability to carry out the significant occupations that are fundamental to everyone's health (4), (9).

Conclusions and implications for practice (next steps and/or initiatives)

The problem of abandoning ADs poses a major challenge for occupational therapy (4). Among the various solutions that implemented at the REHAB-LAB and that you want to implement in Ticino is advantageous and responds to the needs of all the actors involved: from the OT who wants to find the perfectly adequate aid to the needs, to the person in a situation of handicap, who needs to be more involved in the care process and to have an AD that corresponds to his tastes and needs, to the community that would use an inclusive and state-of-the-art service that citizens can use (1). For these reasons Uni-TI, as well as the REHAB-LAB, arouse the interest of a large number of people. Surely it will be necessary to increase the knowledge and evidence on this and overcome the challenges derived from the concrete creation of laboratories.

For occupational therapy, the hope is that attitudes can increasingly be adopted in clinical practice to strengthen the partnership with the person by stimulating his empowerment, given by the taking of power over acts of care (1), (5). This is the only way to respond perfectly to his needs in general, not only in relation to the administration of ADs, improving his autonomy in PO and quality of life (1), (5), (7).

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