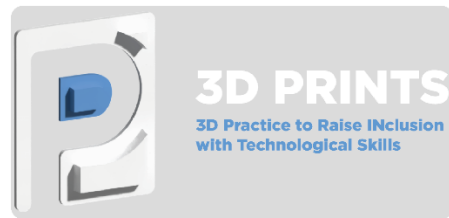




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TRAINING LABORATORY

3D Practice to Raise INclusion with Technological Skills

2023-1-IT01-KA210-VET-000153881

Erasmus+ project

Consortium between PREVIFORM Lda, INVIVO, MOVIMENTO DEHONIANO and MIRADA LOCAL.



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DESCRIPTION OF THE PROJECT

The 3D PRINTS project aims to transform the care paradigm for individuals with disabilities by introducing 3D printing technology as a catalyst for social inclusion. In alignment with the principle that inclusion is a right, the project emphasizes the direct participation of excluded individuals. The overarching goal is to shift from a traditional welfare-centric approach to one focused on autonomy, dignity, and authentic social inclusion. To achieve this, 3D PRINTS proposes a multidisciplinary training initiative merging the realms of social-health and 3D printing (Priority II). By leveraging innovative practices of the digital age, the project seeks to demonstrate how 3D printing technologies can enhance rehabilitation, autonomy, education, employment, and social integration for people with various disabilities, irrespective of age or pathology. Addressing the imperative for innovation in Vocational Education and Training (VET) (Priority III), 3D PRINTS aims to develop a training model that not only imparts skills in 3D prototyping but also enhances basic interpersonal skills among professionals. The targeted outcomes include the creation of learning units with assessable outcomes, facilitating the evaluation of professional profiles before and after training.

The concrete objectives of 3D PRINTS encompass:

1. Developing skills in 3D prototyping.
2. Bridging the gap between the social-health and 3D printing domains.
3. Enhancing relational and empathic skills among professionals.

Anticipated tangible results include an online repository with methodological guidelines, training materials, and 3D prototypes, along with a blended training course available as an Open Educational Resource (OER). The project also envisions initiating networking activities between social-health agencies, associations of disabled individuals, and stakeholders interested in sustaining the initiative beyond the project's duration.

Target groups for 3D PRINTS include health professionals, social and health workers, educators, and social workers. Trainers, tutors, and, notably, people with disabilities directly involved in 3D prototyping workshops form integral parts of the project's focus. The initiative strives to sensitize all stakeholders, both public and private, to the importance of respecting the uniqueness of every individual.

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Motivated by the growing population with disabilities and the imperative for a paradigm shift, 3D PRINTS aligns with EU laws and the UNCRPD. The project addresses training gaps, uneven services, and the need for a holistic approach in disability care. By fostering collaboration among transnational partners, 3D PRINTS aims to create a sustainable, inclusive, and participatory model for improving access and quality of health, social, and educational services. The collaboration brings together organizations from Italy, Spain, and Portugal, ensuring a diverse and comprehensive approach to the challenges at hand.

PRESENTATION OF THE PARTNERS

To attain the project's objectives, a collaborative partnership has been forged, encompassing entities that contribute diverse experiences, profiles, and skills essential for generating relevant and high-quality outcomes. This transnational collaboration is strategically structured, with each institution playing a crucial role in enhancing knowledge, implementing methodologies, and utilizing training tools and emerging technologies. The primary focus is on professionals in health, social services, youth work, education, and social work, forming the target group of the project.

The consortium consists of the following key partners:

- **European Dehonian Movement (MDE):** This organization is dedicated to advancing the professional development of individuals with disabilities or those in vulnerable conditions. MDE's focus extends to their inclusion and reintegration into the labor market through education, vocational training, and various social, cultural, and religious activities. Particular attention is given to enhancing accessibility and enjoyment of goods and services for people with disabilities and disadvantaged groups.
- **INVIVO:** As a social promotion association, INVIVO aims to disseminate the culture of innovation and design digital craftsmanship. Its mission is to broaden horizons, increase knowledge, and enhance skills in areas such as innovation, communication, advanced manufacturing, design, and Industry 4.0. INVIVO operates across diverse sectors, including design, education, social and technological innovation, digital craftsmanship, and communication.
- **PREVIFORM:** Functioning as a certified training organization, PREVIFORM offers a range of ICT courses and specialized training programs, including those related to the utilization of 3D printing. In addition to its focus on technology training, PREVIFORM creates educational tools that leverage new production, communication, and information technologies. The organization also provides digital wellness courses tailored for adult education.

- **MIRADA LOCAL**: Specializing in institutional, social, and public policy communication, MIRADA LOCAL is actively engaged in citizen participation and awareness initiatives. With a track record of organizing various training and awareness-raising activities on social issues, the organization creates spaces for citizen participation, fostering a two-way relationship between citizens and governments. MIRADA LOCAL is an integral part of the inter-institutional and university LIPA NET, specializing in pro-applied sociality, and possesses extensive experience in generating dialogue and support within networks with stakeholders.

This transnational collaboration serves not only to consolidate networks but also to facilitate the exchange of ideas, practices, and methods. The synergy of these partners is instrumental in producing final results that align with the project's objectives, necessitating effective dissemination strategies commensurate with the scope and scale of the initiative.

INTRODUCTION

In the pursuit of fostering inclusion through the acquisition of technological skills, the project "3D Practice to Raise INclusion with Technological Skills" embarks on a comprehensive exploration documented within this framework. Designated as project number 2023-1-IT01-KA210-VET-000153881, this endeavor mandates a meticulous and structured approach to written work, aligning with specific guidelines and standards. The ensuing document adheres to a well-defined format encompassing essential elements such as the cover, index, introduction, body of work, conclusion, bibliography, and annexes.

In the dynamic landscape of contemporary healthcare, the fusion of innovative technology and advanced medical care plays a crucial role in promoting effective and personalized solutions. This pioneering project delves into the depths of revolutionary 3D printing technology and its application in the healthcare sector. Alongside our esteemed partners, we embark on a journey to explore the technical intricacies, challenges faced, and triumphs achieved in incorporating 3D printing across various facets of healthcare. Commencing with a comprehensive overview of 3D printing, this manual will provide detailed guidance on the technical principles, technologies, and essential materials involved in each stage of this groundbreaking process. Emphasis will be placed on specific applications in healthcare, where 3D printing excels in creating customized prosthetics, intricate medical models, tailor-made implants, and more. However, we won't overlook the inherent challenges of adopting 3D printing in the healthcare sector, from regulatory issues to quality control and scalability. This project seeks not only to present the challenges but also to offer valuable strategies and insights to overcome them. Furthermore, we will highlight success stories that illustrate how 3D printing is already positively transforming healthcare delivery worldwide. By exploring these exemplary cases, we aim to inspire and motivate those seeking to integrate this innovative technology into their own healthcare environments. It's not just about technology, we recognize the importance of interpersonal and technical skills in the healthcare sector. Therefore, this project will also examine the relevance of empathetic skills, as well as hard and soft skills, and provide practical strategies for effectively incorporating them into daily practice. Together, let's explore the limitless possibilities that 3D printing offers in transforming the healthcare landscape, shaping a future where customization,

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innovation, and compassion come together to enhance the quality of life for patients worldwide.

CHAPTER 1

3D Practice to Raise INclusion with Technological Skills

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WHAT IS 3D PRINTING

3D printing in an industry named Additive Manufacturing is a computer-controlled process that creates three-dimensional objects by depositing materials, usually in layers.

AM technologies can be broadly divided into three types:

- The first of which is sintering whereby the material is heated without being liquified to create complex high-resolution objects. Direct metal laser sintering uses metal powder whereas selective laser sintering uses a laser on thermoplastic powders so that the particles stick together.
- The second AM technology fully melts the materials, this includes direct laser metal sintering which uses a laser to melt layers of metal powder, and electron beam melting, which uses electron beams to melt the powders.
- The third broad type of technology is stereolithography, which uses a process called photopolymerization, whereby an ultraviolet laser is fired into a vat of photopolymer resin to create torque-resistant ceramic parts able to endure extreme temperatures.

3D printing allows for the creation of bespoke parts with complex geometries and little wastage. Ideal for rapid prototyping, the digital process means that design alterations can be done quickly and efficiently during the manufacturing process. Unlike with more traditional subtractive manufacturing techniques, the lack of material wastage provides cost reduction for high-value parts, while 3d printing has also been shown to reduce lead times. In addition, parts that previously required assembly from multiple pieces can be fabricated as a single object which can provide improved strength and durability. AM can also be used to fabricate unique objects or replacement pieces where the original parts are no longer produced. Additive manufacturing or 3D printing is a prototyping and production technology that allows an idea to be quickly transformed into a product via a digital file. 3D printing is used in almost all sectors from design to jewelry, automotive to medicine... An example of the potential of 3D printing was what happened during the Covid-19 emergency. During this emergency, hospitals had a shortage of "venturi" valves for artificial respirators and CPAP valves to convert snorkel masks into CPAP respirators, and thanks to the Makers' network and 3D printing, it was possible to

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produce more valves than the emergency demand in a couple of days, which would not have been enough time to produce the mold for industrial production.

THE USE OF 3D PRINTERS IN THE HEALTHCARE SECTOR

3D printing in healthcare is often used to create intricate scaffolds that mimic the structure of human tissues or organs. These scaffolds provide a framework for cells to grow and adhere to, facilitating tissue regeneration. While 3D printing may not always be faster than traditional manufacturing techniques for every type of product, it can streamline the manufacturing of certain medical devices and components. Products based on patient-specific anatomy are on the rise, available both through large-scale manufacturers and point-of-care 3D printing facilities in healthcare settings. Patient-specific customization reduces the need for large-scale mass production and centralized manufacturing. It enables decentralized production in which parts can be printed where and when they are needed, potentially saving time and resources.

3d printing is helping the health sector in which way:

1. **Personalized Prosthetics:** 3D printing allows for the creation of customized prosthetics that perfectly match an individual's unique anatomy. Personalized prosthetics aim to provide better comfort and functionality.
2. **Surgical Planning and Practice:** Surgeons can use 3D printed models to practice complex procedures before performing them on a patient. This reduces the risk of errors during surgery and improves outcomes.
3. **Medical Devices:** Medical devices, such as surgical tools and implants, can be produced with 3D printing machines. This allows for greater precision and customization, leading to better outcomes for patients.
4. **Organ and Tissue Printing:** Researchers are working on 3D printing organs, like livers and kidneys, and tissues, potentially creating a new approach to treating diseases and injuries.
5. **Pharmaceutical Printing:** 3D printing can also be used to create customized medication dosages and formulations. It improves patient adherence and reduces side effects. For example, the FDA approved an epilepsy drug (Spritam) which is produced through 3D printers. The drug is printed layer by layer using the powdered drug. This makes the drug easier to dissolve than average pills.
6. **Medical Education:** 3D printing allows for the creation of anatomical models that can be used in medical education to enhance understanding and learning.

The use of 3d printing in healthcare has many advantages including:

1. **Adaptable Design:** 3D printing enables adaptable and patient-specific design. Medical devices, implants, and prosthetics can be customized to match the precise anatomies and needs of individual patients.
2. **On-Demand Printing:** Healthcare providers can employ 3D printing for the on-demand manufacturing of medical components and devices. This reduces the need for large inventories and ensures that products are readily available when required.
3. **Fast Prototyping:** 3D printing facilitates rapid prototyping of new medical devices and innovations. This accelerates the development process, allowing for quick testing and refinement of ideas before they reach the clinical stage.
4. **Rapid Production and Design:** Traditional manufacturing processes can be time-consuming, whereas 3D printing allows for swift production and design iterations. This is crucial in emergencies and when addressing urgent medical needs.
5. **Decreased Waste:** 3D printing generates minimal waste compared to subtractive manufacturing methods. This eco-friendly aspect contributes to reducing the environmental footprint of healthcare production.
6. **Cost:** 3D printing can be cost-effective, especially when producing complex, customized medical devices. It reduces the cost of labor, materials, and tooling, making healthcare more accessible.
7. **Parts That Are Sturdy and Light:** 3D printing allows for the creation of parts that are both sturdy and lightweight, a crucial advantage in applications such as orthopedics and aerospace medicine. This results in improved patient comfort and mobility.
8. **Environmentally Responsible:** 3D printing's efficiency in material use and reduced waste aligns with environmental sustainability goals. Its minimal environmental impact makes it a responsible choice for healthcare manufacturing.
9. **Easy Access:** As 3D printers become more affordable and accessible, healthcare facilities can integrate this technology into their operations. It guarantees that even smaller clinics and hospitals can benefit from its advantages.
10. **Healthcare Innovation:** 3D printing encourages innovation in the healthcare sector. It fosters the development of novel medical solutions, from customized

surgical tools to cutting-edge prosthetics, advancing patient care and treatment outcomes.

11. **Improved Visualization:** Create detailed models of complex anatomical structures that may be difficult to visualize using traditional 2D images. This can aid in the diagnosis of illnesses and the planning of surgical interventions.
12. **Reduced Surgical Time:** Providing surgeons with a 3D-printed model of a patient's anatomy prior to surgery allows them to better plan and rehearse the procedure. This can lead to shorter surgical times, which reduces the risk of complications and improves patient outcomes.
13. **Increased Efficiency:** Streamlines the production of medical devices, prosthetics, and implants. This reduces the time and cost associated with traditional manufacturing methods, while also improving the quality and precision of the final product. However, individualized products may take more time than 'one-size-fits-all' items, like surgical equipment, for example; however, 3D printing is still way faster and more cost and production efficient than conventional methods.
14. **Innovation:** Allows for rapid prototyping and testing of new medical devices and treatments, which can accelerate the development of innovative solutions for patients.

THE TECHNICAL PRINCIPLES, TECHNOLOGIES AND MATERIALS USED IN 3D PRINTING AND ALL STAGES OF THE 3D PRINTING PROCESS

Amongst the three types of categorization, seven kinds of processes in 3d printing are quickly presented:

1. Binder Jetting

This technique uses a 3d printing style head moving on x, y and z axes to deposit alternating layers of powdered material and a liquid binder as an adhesive.

2. Directed Energy Deposition

Direct energy deposition additive manufacturing can be used with a wide variety of materials including ceramics, metals and polymers. A laser, electric arc or an electron beam gun mounted on an arm moves horizontally melting wire, filament feedstock or powder to build up material as a bed moves vertically.

3. Material Extrusion (FFF/FDM)

This common AM process uses spooled polymers which are either extruded or drawn through a heated nozzle which is mounted on a movable arm. This builds melted material layer by layer as the nozzle moves horizontally and the bed moves vertically. The layers adhere through temperature control or chemical bonding agents.

4. Powder Bed Fusion

Powder bed fusion encompasses a variety of AM techniques including direct metal laser melting (DMLM), direct metal laser sintering (DMLS), electron beam melting (EBM), selective laser sintering (SLS) and selective heat sintering (SHS). Electron beams, lasers or thermal print heads are used to melt or partially melt fine layers of material after which excess powder is blasted away.

5. Sheet Lamination

Sheet lamination can be split into two technologies: laminated object manufacturing (LOM) and ultrasonic additive manufacturing (UAM). Laminated object manufacturing is suited to creating items with visual or aesthetic appeal and uses alternate layers of paper and adhesive. UAM uses ultrasonic welding to join thin metal sheets; a low energy, low temperature process, UAM can be used with various metals such as aluminium, stainless steel and titanium.

6. Vat Polymerisation (SLA)

This process uses a vat of liquid resin photopolymer to create an object layer by layer. Mirrors are used to direct ultraviolet light which cures the successive layers of resin through photopolymerisation.

7. Wire Arc Additive Manufacturing (DED-arc)

Wire arc additive manufacturing uses arc welding power sources and manipulators to build 3D shapes through arc deposition. This process commonly uses wire as a material source and follows a predetermined path to create the desired shape. This method of additive manufacture is usually performed using robotic welding equipment. The detailed technology that will be used in a workshop is FDM, a technology that uses a filament of plastic material that passes through a heater and extruder deposited on the build plate and layer upon layer produces the desired object in the digital file. The most commonly used materials in 3D FDM printing are PLA, ABS, PET, LAYWOOD, CRYSTAL FLEX, PLA LAYBRICK, PVA, and HIPS. Each material differs in composition and extrusion temperature PLA, the most widely used material for 3D printing, is the polymer of lactic acid. The main properties are rheological, mechanical, and biodegradability:

1. **Rheological:** The elasticity of the melt is lower than that of olefins.
2. **Mechanical:** varies from that of an amorphous polymer to that of a semi-crystalline polymer; properties intermediate to those of PET and polystyrene. Glass transition temperature is higher than room temperature, and transparent materials are obtained.
3. **Biodegradability:** as produced, it is not biodegradable; it becomes biodegradable after hydrolysis at temperatures above 60 °C and humidity above 20%. Commonly used plastics have an average life of 100 to even 1000 years. PLA, on the other hand, has a much shorter biodegradation time: depending on the environment in which it is dropped, it has an average life of 1 to 4 years.

Pro:

- It can be recycled and/or composted;
- Even dispersed in the sea, once dissolved or reduced to microplastics, it is not toxic to fish or humans if ingested;
- It eliminates dependence on oil;
- Even burnt, it does not release heavy metals or toxic gases.

Cons:

- Cannot be used to make “backyard” compost as it needs industrial conditions to be broken down (high temperature);

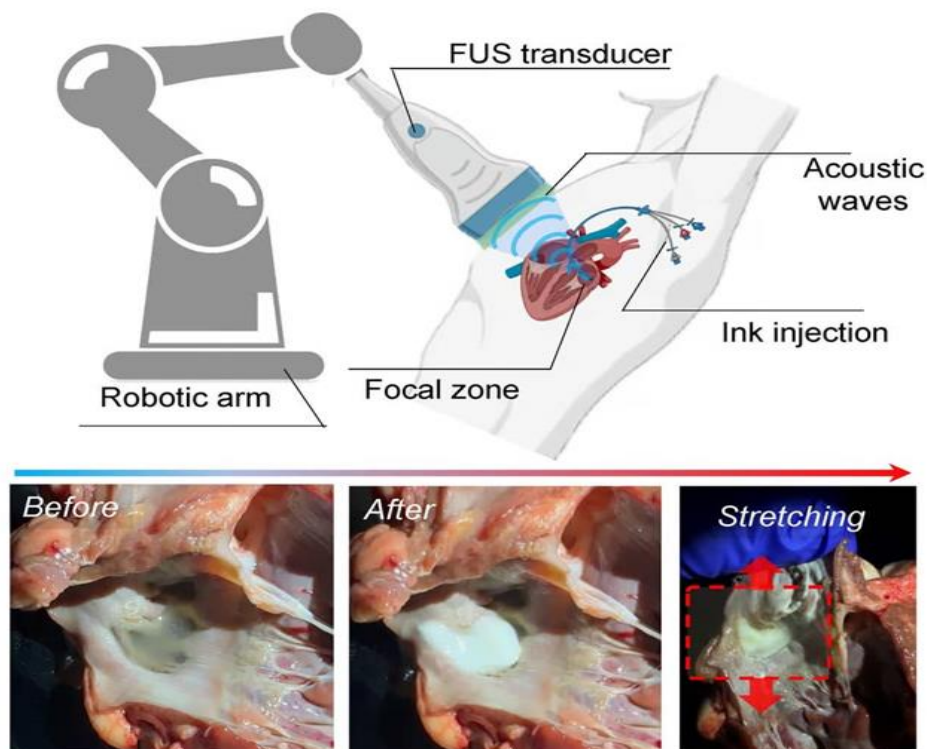
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- In a normal landfill, i.e. not exposed to sunlight, the time for decomposition is comparable to that of normal plastic;
- It only takes a relatively small amount of PLA to contaminate a separate plastic collection as it cannot be recycled together with normal plastic, preventing recycling and stopping profits for plastic recycling companies];
- The cultivated area used to produce the raw material is taken away from the production of food for humans.

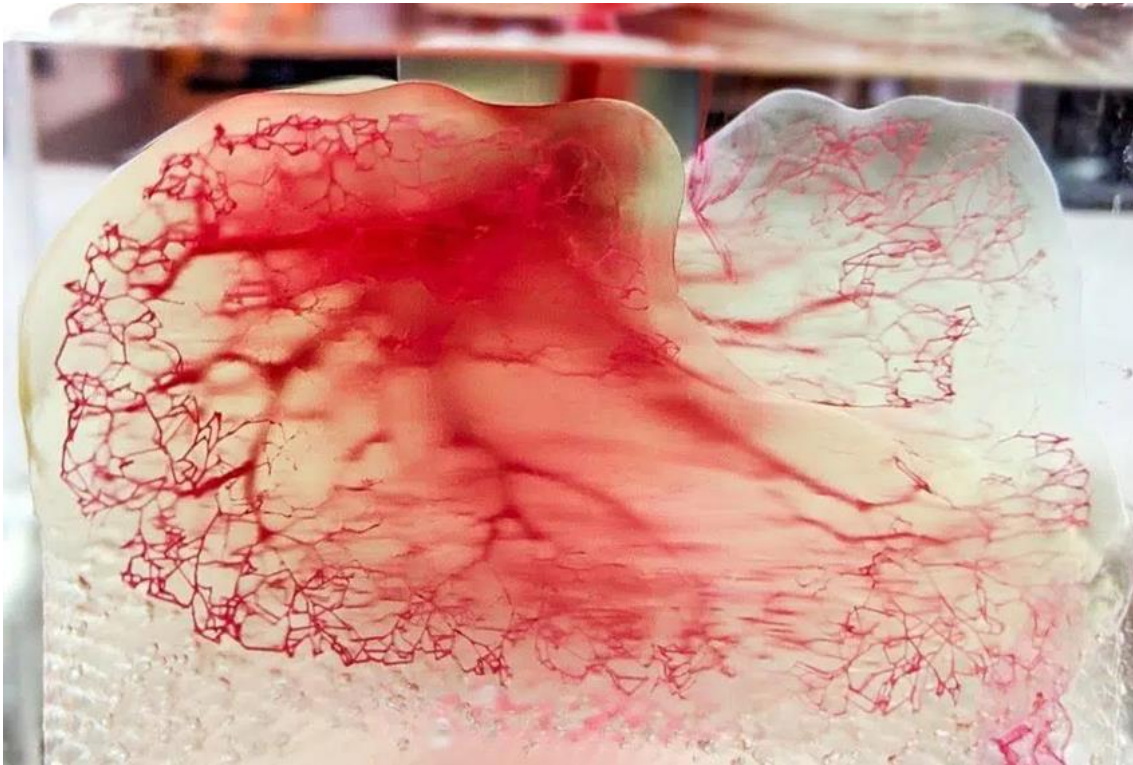
The main components of which a 3D printer is composed and which are essential for its operation are Stepper motors that precisely manage the movement of the extruder in space. The extruder assembly consists of a motor that pushes the filament into the heater which, after passing from solid to molten state, is extruded through the brass nozzle onto the printing plate. A printing plate can be made of aluminum, glass, composite, smooth, or micro-perforated. The most commonly used ones are also heated so that the extruded material adheres better and prevents detachment from the plate during printing, which would result in printing failure. Helical screws, together with stepper motors are used to move the printing plate. Microcontroller, an electronic board on which the firmware is loaded that, connected to the electronic components, manages the mechanical handling, the extrusion temperatures, and the entire printing process. To produce/prototype an object with the 3d printer we need a digital file, the digital file we need contains the geometry of the object to be printed, these object geometries can be found on online platforms where there are files of objects ready to be printed or we can draw with software designed for 3d drawing also called CAD or NURBS.

CHALLENGES OF 3D PRINTING FOR THE HEALTHCARE SECTOR

3D printing is widely regarded as the future of medicine due to its transformative potential in healthcare. Firstly, it enables the creation of personalized medical devices and prosthetics tailored to individual anatomy. This improves patient outcomes and comfort. Secondly, 3D printing excels in replicating intricate anatomical structures. It facilitates surgical planning, education, and medical procedure refinement. Thirdly, rapid prototyping also accelerates the development of medical technologies, reducing time-to-market for innovations. The on-demand production capabilities of 3D printing in hospitals streamline patient care and cost-efficiency by eliminating large inventories and lengthy lead times. Though initial investment may be high, long-term savings result from reduced need for revision surgeries with customized implants. Finally, 3D printing aids remote healthcare, producing medical devices in underserved areas and expanding access to services. Continual innovation in medicine, from drug delivery systems to wearable devices, is also fostered by 3D printing technology.



Duke University, Harvard Medical School,
 Implants printed directly inside the human body.
 3D printing based on ultrasound
 Biocompatible sonic "ink" (sono-ink)



3D Systems e United Therapeutics
Print to Perfusion

High resolution scaffolds that can be perfused with living cells to create tissues.

3D printer products have gained popularity for use in surgical procedures in a number of medical specialties. They enable the creation of patient-specific anatomical models, surgical guides, and implants, enhancing surgical precision and planning. Surgeons also benefit from customized tools, improving efficiency. Furthermore, 3D-printed models serve as valuable educational aids, enhancing surgical training. In specific fields, such as otolaryngology, temporal bone models aid in ear surgery practice. 3D printing is pivotal in oral and maxillofacial surgery for dental implants and prosthetics tailored to patients' anatomies. Additionally, it contributes to prosthetic limb development and surgical training.

3D printing has become increasingly common in the medical field. It is being widely adopted for various applications, including anatomical modeling, surgical planning, the creation of custom implants and prosthetics, and even drug delivery systems. Many hospitals and medical institutions have integrated 3D printing into their practices to improve patient care, surgical outcomes, and medical device development. While its adoption may vary by region and institution, the overall trend is toward

increased use of 3D printing in medicine due to its numerous advantages and potential for innovation.

HOW CAN 3D PRINTING BE USEFUL IN HEALTHCARE?

Medicine and healthcare greatly benefit from 3D printing technology. The medical industry has been one of the early adopters of 3D printing technology, and the benefits are numerous. The ability to create customized and patient-specific medical devices, prosthetics, implants, and models with 3D printing technology has revolutionized the way healthcare providers approach patient care. This technology has enabled faster production, reduced costs, and improved patient outcomes.

3D printing technology has allowed for greater accuracy in surgical planning and improved medical education. 3D-printed models of patient anatomy can be used to plan surgical procedures, and medical students and residents can learn about anatomy, surgical procedures, and medical devices through the use of 3D-printed models. 3D printing technology has also facilitated the development of new and innovative medical devices and products, and it has allowed for greater accessibility to medical devices and prosthetics, especially in remote or low-income areas. It also allows customization and adaptability, reduced production times, easy access to, for example, dentures and personalized devices and brings innovations in surgery and personalized preoperative planning.

SUCCESS STORIES

Among the successful 3d printing projects applied to the health sector find bioprinting technology (Cellink a 3d printing technology developed to print organic materia) and orthoses that are able to stabilize, relieve, immobilize, guide, or correct an injured body part. Because each patient's morphology is different, the use of 3D printing is ideal for designing these unique devices tailored to each individual. Therefore, on this occasion, we wanted to collect some of the most remarkable orthotic designs made to date.

Cellink

CELLINK is leading 3d bioprinting company that is committed to providing the most advanced 3D bioprinting products, services and technologies needed to understand and master biology. Their develop technologies that democratize 3D bioprinting – providing the leading researchers in the world the tools they need to create the future of health. Whether it is developing and utilizing alternatives to animal models, accelerating drug discovery, rethinking regenerative medicine or developing tissue engineered organs to treat diseases previously considered untreatable



Bioprinting

3D bioprinting is an additive manufacturing process similar to 3D printing – it uses a digital file as a blueprint to print an object layer by layer. But unlike 3D printing, bioprinters print with cells and biomaterials, creating organ-like structures that let living cells multiply. Although bioprinting is a relatively new technology, it has huge potential to benefit industries like regenerative and personalized medicine, drug discovery and cosmetics. 3D bioprinting works in many ways as it changes depending on the application that you're planning on using it for, and the technology you're using. There are three basic stages of 3D bioprinting that most workflows follow: First, select and prepare a bioink and create a model fit for your application. Second, put the bioink into its correct place for the bioprinter, select the printing parameters, print the construct. Third, treat the 3D construct according to your application.

Orthoses

With 3D printing technology, aids can first be digitally designed and then printed out layer by layer. In orthopedic technology, we mainly use 3D printing to produce particularly light, flexible and at the same time highly functional aids (or parts of them). This is the case, for example, with some finger and hand orthoses, or with certain orthoses and prostheses that are specially made for children. If, on the other hand, larger aids are involved, production using 3D printing - compared to manual production from conventional materials - is not expedient. A major advantage of 3D printing technology is the possibility of personalised design. Colours and patterns can be put together completely individually for 3D printed orthoses and prostheses.

Pohlig

Pohlig developed SimBrace technology, a 3D scanning process designed for patients that adjusts the shape and position of the brace based on the patient's morphology.



3D-Druck Orthesen

ASSESSMENT EXERCISES

Questionnaire

1) Select the option that seems most correct to you.

1.1) 3d printing is a technology:

- a) Subtractive
- b) Additive

1.2) What is the printing technology using filament material

- a) SLA
- b) MJF
- c) BINDER JET
- d) CJP
- e) FDM
- f) DLMS

1.3) Which of these types of software are used in the 3d printing process?

- a) Office
- b) slicing
- c) Data mining

1.4) What is the right format of 3d model for 3d printing

- a) STL
- b) AI
- c) CDR

1.5) Which of these slicing parameters impact the printing time?

- a) Layer Height
- b) Infill
- c) Noozle diameter
- d) All the above

2) Carry out the following simulation:

The simulation of the 3D printing process, using a 3D model downloaded from an open-source online library, allows the trainer to see whether the professional who has

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attended the course has acquired new skills in 3D printing and a sufficient level of autonomy in managing and controlling the 3D printing process. To configure the printing parameters, prepare the G-Code file and start the printer. Carry out the following steps:

- download a digital file from the object library on the site Thingiverse - Digital Designs for Physical Objects.
- upload it to the slicing software and set the printing parameters to print as required by the trainer.
- upload the file to the 3d printer, check the printer components, and start printing.

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CELLINK

POHLIG

CHAPTER 2

3D Practice to Raise INclusion with Technological Skills

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THE IMPORTANCE OF EMPATHIC SKILLS IN THE HEALTHCARE SECTOR

PROSOCIAL COMMUNICATION MODEL AND PROSOCIALITY

Healthcare is hugely dependent on the empathic attitudes and behaviours of patients, medical and nursing staff. Diseases such as dementia, mental illness or cardio vascular diseases and cancer can best be treated when the health care staff is capable of understanding – and sometimes even feeling- the needs of the patients. This is a way of generating trust in the relationship between them. The same applies to any form of disability which requires a constant relation between professionals and patients. So the first question asked here is about the quality of the relationship between these two stakeholders. The following model may give a good explanation: When relating to other people we tend to choose different relational styles. Most common is “cooperation”, where we give something in exchange for a compensation, service or favour. Sometimes we are not even interested in giving something and instead we try to obtain as much benefit for us in a relation, although this would make us a “taker”. This would not be very ethical, unless we are in our early childhood and depend entirely on our mother and parents. Then there is a third relational style, which consists of giving without expecting anything in return, and the following chapter deals with this, “prosocial”, way of benefitting others (A.Grant, 2013). As we will see, giving is not possible without being empathic, and also, it is a relational style that brings high quality to interpersonal relations in health care: “Prosocial” is a concept that has arisen, basically, as an antonym of the “antisocial” concept, which studies and demonstrates the factors and benefits of empathy in human relations, as well as the constructive role of help giving and help seeking, solidarity, giving and sharing, have for all the persons, groups or societies which are involved either as authors or receivers. Most of the authors use it as an adjective (something prosocial); Robert Roche began to use the noun Prosociality to refer to this one not only to qualify actions, but also to name a model of thinking (Roche 1998). Roche founded the line of work that has been developed since 1984 in the Laboratorio de Investigación Prosocial Aplicada, (LIPA) of the Universitat Autònoma de Barcelona (UAB) centres not so much on the motivations which lie behind the prosocial behaviour, but rather on its optimisation: how to facilitate the occurrence of prosocial behaviours in the contexts in which we move, how they are propitiated, how we can increase them in quality and

frequency. In this chapter, we would like to focus on this way of conceiving, prosocial behaviours for the project 3Dprints.

WHAT IS HARD SKILLS

Hard skills, or technical skills, are essential for effective performance in many jobs. They represent specific competencies related to concrete and measurable tasks. Their importance varies according to the nature of the work, but generally includes things like technical knowledge in software, mathematical skills, programming ability, language proficiency, among others. While hard skills are important, it is essential to recognize that soft skills, such as communication skills, teamwork, and conflict resolution, also play a crucial role in professional success. Ideally, a professional should have a healthy balance between hard skills and soft skills to excel in their career. In this chapter, we will present some of the important hard skills for a worker in the healthcare sector regarding 3D printers. We will also present some characteristics that, in parallel with soft skills, become crucial.

Professional skills are all those professional skills required to carry out a specific job. They include both technical skills (hard skills) which can be demonstrated through a certificate, and transversal and personal skills (soft skills), which are not always demonstrable, but are important for the success of the job. Hard skills can also be indicated with the expression "technical skills". These are skills that can be learned, demonstrated, and evaluated, and which are fundamental to being able to carry out a particular job. In short, they are all the lessons we learn during our studies, and which we perfect with experience when we start working. Among these, we can include linguistic skills, the use of graphics programs, programming skills, knowledge of software and programming languages, and graphic skills (a set of technical skills aimed at the efficient use of digital tools). Digital skills, for example, generally refer to your experience in its various facets and different application areas that use computers and/or the Internet as primary tools. Based on the job profile, candidates are expected to be able to handle certain software securely from the first working day. Most of the time, employers require basic experience with Microsoft Office programs such as Word and Excel. Depending on the industry, employers require confident use of more specialized tools such as graphic editing programs (Photoshop, In Design), Content Management systems (WordPress, Typo3), and SEO tools (XOVI, SISTRIX). Some jobs require fundamentals of coaching, which is personal, goal-oriented teaching of other people. Coaching also requires a strong foundation of soft skills, such as a general understanding of human nature, organizational

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talent, problem-solving, and empathy. Communication with customers is an important task in many professions. Consequently, practical experience in this area is essential and should be considered a useful hard skill to learn. This includes many soft skills: depending on the industry, target, product, and customer base, the more empathetic, analytical, organized, and communicative you are, the better your consultancy will be. Some industries require as much flexibility as possible, while others rely on strict discipline. Other examples of hard skills are knowledge of a certain programming language or knowing how to play the guitar...and much more. We can therefore define them as a toolbox of tangible skills, which, unlike soft skills, can be quantified and measured with a test, a grade, or a certificate. All the knowledge needed to carry out a job, and can be integrated with refresher and improvement courses. They are different for each sector in which you move: those who deal with programming will have stronger hard IT skills, while those who deal with accounting will have solid knowledge in the economic field.

In the eyes of companies, hard skills represent the answer to a series of needs necessary for the work they offer and are therefore essential. It is no coincidence that each job advertisement essentially reports which specialist skills are explicitly required, under the headings "Required requirements" or "Profile sought". From your point of view, they are therefore very important because they enrich your CV and make you interesting from a work point of view. Continuing to train expands your skills and is often a key to success. For each job position, specific hard skills are required to be included in the CV. Among these, we can include digital skills, language skills, the use of specific machinery, marketing knowledge, analytical skills, writing and communication skills, and video editing and production skills. Hard skills are "technical" knowledge and skills.

PARTICIPATED PROSOCIAL VISUALIZATION

We would like to introduce the methodology of Participated Prosocial Visualization (PPV) as one example of hard skills in the context of prosocial behaviours. PPV works on the basis of open questions which are used to lead and empower a group to find out ways to plan, analyse and diagnose as well as solve problems, etc., with the help of a facilitator who is in charge of the method and the steps taken, without interfering in the contents. For more details, please read the guide in the second half of this chapter, "METHODOLOGIES TO INCREASE THE HARD AND SOFT SKILLS EXAMINED".

THE IMPORTANCE OF HARD SKILLS

The importance of methodologies to enhance both technical and interpersonal skills cannot be underestimated. These methodologies provide structured approaches and frameworks for individuals to systematically develop and improve their competencies. To increase both hard and soft skills for the use of a 3D printer, different methodologies can be adopted:

1. Technical knowledge of the operation of 3D printers: The worker should have technical knowledge of the operation of a 3D printer, including the printing process and the use of appropriate materials. This refers to understanding the technical specifications and basic principles involved in the operation of a 3D printer. This knowledge includes familiarity with the various components, such as the extrusion system, the build platform, the control software, and the materials used. It also means understanding the different 3D printing technologies available, such as fusion deposition material (FDM), selective laser sintering (SLS), or stereolithography (SLA), as well as their applications and limitations. In general, technical knowledge about how 3D printers work involves mastering the skills needed to use, maintain, and troubleshoot a 3D printer.

To gain technical knowledge about how 3D printers work, you need to gain skills in several areas, which include:

A. Three-Dimensional Design Principles: It is important to understand the fundamental principles of computer-aided design (CAD) modeling;

B. Materials and types of 3D printers: There are different types of 3D printers, each with its preferred materials, printing methods, and limitations. It is important to know the characteristics of commonly used materials, such as plastic, metal, or resin, and how they influence the printing process;

C. Slicing Software: 3D models must be "sliced" into thin slices to be printed on a 3D printer. There are several slicing software available that allow you to prepare models for printing by dividing them into layers. Knowledge of the use of this software is essential to obtain quality printing results;

D. Printing parameters: Each material and type of printer requires specific printing parameters, such as printing temperature, extrusion speed, layer

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height, and others. It is important to understand how to adjust and optimize these parameters to achieve high-quality printing;

E. Maintenance and Calibration: 3D printers require regular maintenance and calibration to function properly. It's critical to know basic maintenance procedures, such as cleaning print surfaces and checking belt or screw tension levels, to prevent printing problems;

F. Troubleshooting: During the printing process, various problems may occur, such as insufficient adhesion to the print bed, and stringing or overlapping of materials. A technical understanding of 3D printers helps you identify and resolve such issues.

To acquire these skills, it is possible to participate in specific training courses on the operation of 3D printers, consult technical documentation, educational materials, or dedicated online resources, and above all experiment and practice with a real 3D printer.

2. Understanding print materials: The worker should know about available print materials and their characteristics, such as flexibility, durability and safety for specific environments. Understanding printing materials for a 3D printer refers to the knowledge and understanding of the properties, characteristics and limitations of materials that can be used for 3D printing. This includes knowledge of the various types of materials, such as plastic, metal, resins, ceramics, etc., as well as their technical specifications and their performance during the 3D printing process. Knowledge of printing materials is essential to obtain high-quality printing results and to be able to select the material best suited to the needs of the project. Understanding print materials in 3D printing is a concept that refers to the knowledge and ability to correctly use the different materials used in 3D printing technology. 3D printing uses a wide range of materials, including plastics, metals, ceramics, resins and polymers. Each material has specific characteristics such as strength, flexibility, hardness and durability, which affect the performance and properties of the finished product. Understanding 3D printing materials involves knowing the properties of each material, as well as their print settings, such as temperature, print speed, and print bed adhesion.

3. Problem-solving skills: 3D printing can pose technical challenges, such as adhesion problems, design errors or material blockages. In this case, combining hard and soft skills becomes a key point for dealing with 3D printing problems, as they need to be

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able to identify and solve any problems or challenges that may arise during the printing process. These problems can include printing defects, such as thin or missing lines, pattern distortion, poor adhesion or machine calibration errors. The ability to solve such problems requires in-depth knowledge of 3D printing technology, the ability to identify the causes of the problems and knowledge of the appropriate solutions to correct them.

4. Managing 3D printers: 3D printer management refers to the set of activities and processes necessary to efficiently manage 3D printers in a work environment. This includes planning and organizing print jobs, maintaining and repairing printers, managing materials and resources, managing design files, and preparing models for printing. The main goal of 3D printer management is to ensure efficient and quality production of 3D printed models.

5. Understanding the technology: Having technical knowledge allows you to understand how 3D printers work, including the basic principles of additive manufacturing. This understanding is essential for using your printer correctly and obtaining high-quality results.

6. Using software: 3D printers require the use of specific software to create print files.

7. Printing Parameters: Different materials and object types require specific printing parameters to achieve optimal results.

8. Troubleshooting: Problems such as jams or poor performance may occur during the 3D printing process.

In general, hard skills in using 3D printers are important to ensure correct and safe use of the technology and to obtain high-quality molds.

Hard skills for using 3D printers are important for both people with disabilities and workers in the health sector because they offer different opportunities and benefits for both:

1. For people with disabilities:

- **Autonomy:** Learning to use a 3D printer allows people with disabilities to create personalized objects and prosthetics, reducing dependence on others for the purchase or production of assistive devices.

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- **Creativity and customization:** 3D printing allows people with disabilities to create objects tailored to their specific needs. This may include customized prostheses, ergonomic solutions or adaptations to address specific motor or functional difficulties.

- **Employment:** Acquiring skills in 3D printing can open up new professional opportunities for people with disabilities, allowing them to work in the prosthetics sector or in the production of assistive devices. This can improve job prospects and economic independence.

2. For social workers:

- **Customization of solutions:** Healthcare workers with 3D printing skills can offer customized and individualized solutions for the disabled people they serve.

- **Cost reduction:** Producing assistive devices via 3D printing can be cheaper than purchasing commercial solutions.

- **Innovation:** The adoption of technologies such as 3D printing can mean working in a pioneering and innovative way in the field of assistance to people with disabilities.

In summary, hard skills for using 3D printers are important as they offer new opportunities for autonomy, customization, employment and innovation in the field of assistance to disabled people.

WHAT IS SOFT SKILLS

If hard skills are "technical" knowledge and skills, soft skills instead concern one's social and interpersonal skills. They are also called "soft skills" and are personal. Soft skills concern one's sphere and are not always easy to demonstrate. Some examples of soft skills are analytical thinking, active learning; autonomy in carrying out the required tasks; problem solving; analytical ability, creativity, originality and initiative, leadership, programming skills, flexibility, tolerance to stress, and the creation of innovative solutions. High skills (literally "high skills") are all those skills that allow you to improve the working conditions of colleagues and the company in general. Even in this case, each job has its most requested high skills. Some examples of high skills are project management skills, knowledge of artificial intelligence, analytical reasoning skills, human resources skills, audio and video production, translation, and writing.

PROSOCIALITY

THE PROSOCIAL MATTER AND THE THEORETICAL APPROACHES

As a framework for the application of prosocial behaviors in the project 3Dprints, we suggest the model developed by Robert Roche of LIPA (Laboratorio de Investigación Prosocial Aplicada, Laboratory of Applied Prosocial Research) of the Universitat Autònoma de Barcelona, Spain. There, prosocial behavior is understood as “those behaviors, that, without expecting any extrinsic or material rewards, favor other persons or groups according to their criteria or in accordance to objectively positive social goals, increasing the probability of generating a good-quality and joint positive reciprocity in the interpersonal or social relationships, safeguarding identity, creativity and autonomous initiative of the individuals or groups involved” (Roche, 1995, p.16). This definition, which has been widely developed in previous publications (Roche, 1991, Roche, 1997b; Roche, 1999; Roche, 2004a; Roche, 1998), proposes the receiver as the last criterion. This is a highly significant aspect since it supposes a fundamental appreciation within the current approaches that study and apply prosociality, often focused on the issuer of the action and not on the receiver of the action. To summarize, a prosocial action is an action that benefits someone in the way he or she would like to be benefited. This contrasts against a conception of "helping" actions, which within the model of prosociality does not include the circumstances, needs, identity, and culture of the receiver. Incorporating

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the reality of the other person in the definition of prosociality itself avoids the risk of accepting as prosocial actions, those that instead of providing a benefit to the other person, damage the other. For example: doing a favor with a good intention, for which the receiver did not thank, because it just didn't help him/her; generating dependent relationships; or, with no intention, making feel the other person undervalued.

WHEN IS IT POSSIBLE TO QUALIFY AN ACTION AS PROSOCIAL?

An element to be emphasized in this definition is that even the prosocial actions carried out with the agreement of the receiver must answer to certain quality standards if they are to safeguard the identity, autonomy, creativity, and initiative of the individuals or groups involved. These conditions or requisites place a critical question, for example, on an action desired by a receiver and perceived by him or her as beneficial. However, if there were objective indicators that prove that the abovementioned action is, in fact damaging, it would not be prosocial (e.g. sharing cigarettes with adolescents or marihuana). There is a wide scale of actions in human interaction that would be considered to be prosocial behaviors and, therefore, not only those of help or those of donation. The author prepared a proposal of diverse categories of prosocial actions (Roche, 1995) amongst which there is naturally physical help, physical service, verbal help, and verbal consolation, but also the actions of giving and sharing, the assertion and positive valuation of others, attentive listening, empathy, solidarity, and positive presence and unit - each one with a precise operative definition.

THE IMPORTANCE OF THE SOFT SKILLS

IMPORTANCE AND BENEFITS OF PROSOCIALITY

Prosocial behaviors can improve social relations. Furthermore, psychology is currently discovering how a person who acts in a prosocial way obtains psychological benefits. It allows real empathic communication and it is a moderator of ambition and power. Prosocial action constitutes a perceptively clear, incisive stimulus aimed efficiently at the target and at the receiver to whom it channels attention and consideration. Conditions of high conscience and sensibility about the action and its roots, increasing their value and becoming real models. Therefore, it greatly increases the statistical possibilities so that the receiver becomes the initiator or author, in turn, of other similar actions. It is important to consider that the type of reciprocity to be promoted should not respond to expectations that could determine the behavior of the receiver, either to implicit contracts of immediate alternation or in continuity or in an alternation postponed in time. It is precisely here that the truly prosocial action lies: it has to be carried out in a way in which the first target is good for others, not the author, although they could be foreseen, be deduced, or have subsequent positive consequences for the author. If this is the case, the reciprocity that could take place would come to close a very positive circle of interrelation, always voluntary, but highly effective in the survival of the systems or human groups.

Operator of social transformation: The prosocial action provokes concentric positivity circles in the environment. It is always difficult to realize the real effects that a prosocial action can generate in receivers, who eventually become authors towards other people and situations. Therefore, the prosocial action sometimes becomes reciprocal. At other times it turns to other people, but it probably never remains inactive. Even for scientific methods, it would be difficult to verify the positive multiplier effects of the prosocial action due to the progressive distancing and complexity of the various receivers, with an incidence often superior to the simple formula of transmission of one-to-one. In any case, it is a positive and progressive incidence in the wider social spectrum which can increase its power of transformation depending on the agent's-initiator's power involved in the sequence.

Prosociality: a sure way to build trusting relationships with patients and people living with some degree of disability

Although the study of prosocial behavior began in the realm of psychology to address all behavior performed for the benefit of others, the concept has generated interest in medical circles for its potential to improve both the quality of medical attention and the health of the doctors themselves. Healthcare professions, like other social service professions, commonly are linked to the concept of altruism. Altruism is regarded in medical training to be a core ethical duty. The concept is predicated on the notion that doctors and socio-sanitary home care professionals engage in professional activity that exacts considerable costs on them since they must abandon their own needs to devote their full energy and attention to the patients. While the altruism concept may be heroic, doctors and socio-sanitary home care professionals are not always able to apply it once they face the reality of their work. Moreover, altruism is not an observable behavior, meaning it is difficult to demand it or expect it from physicians once they begin practicing. Bishop, J. and Rees, C. (2007) proposed replacing, in medical training programs, the concept of altruism with that of prosocial behavior, which is more balanced, applicable, observable, and measurable. The concept of prosocial behaviour also permits balancing the interests of doctors, their self-care, and the interests of patients.

Prosocial behavior may be defined in the following manner: “those behaviors that, without seeking extrinsic or material compensation, favor other people or groups according to the criteria set by those, or favor objectively positive social aims, increasing the probability of generating a positive reciprocity marked by quality and solidarity in the ensuing interpersonal or social relationships, while safeguarding the identity, creativity, and initiative of the individuals or groups involved” (Roche, 1995, p.16). From this definition, we can extract that a prosocial action is one that effectively benefits patients in the manner that they desire, provided that the action strengthens the identity, creativity, autonomy, and initiative of both the patient and the doctor. An action would not be considered prosocial if, for example, despite the good intentions of the giver, the receiver viewed the action as a disservice, the action generated a dependent relationship in the long term, or the receiver interpreted it as a sign of underestimation. For Roche, a wide range of behaviors in human interaction may be considered prosocial behaviors, beyond simply those involving physical help. The author proposed diverse categories of actions

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qualifying as prosocial (Roche, 1995) among which are, of course, physical help, physical service, verbal help, and verbal consolation, but also the acts of giving and sharing, reassurance, and positive evaluation of the receiver, deep listening, empathy, solidarity and positive presence, and unity. Each category was operationally defined (Roche, 2009).

The definitions of the 10 categories may be seen in the bibliography, and also are available in Spanish on the website www.prosocialidad.org. Prosocialisation of health encounters using Prosocial Communication

In the context of an educational meeting, whether it is between a teacher and a student, or a doctor and a patient, communicating prosocially fosters a relationship based on reciprocal appreciation and the welfare of everyone involved. Communication in the health encounter should be guided by the act of socializing, or “the act of carrying out, in practice, one or more prosocial acts aimed at helping other people, attending to their needs and interests, promoting authentic interaction and social communication, and protecting the identity and dignity of the people or groups involved” (Juarez, 2008a, p.15) In our judgment, the factors of the Prosocial Communication model constitute important elements for analyzing medical relationships that involve oral or written interaction; dialogue, when providing prescriptions; and that involve two people with equal dignity in a context of unequal power, information, knowledge, experience, and expertise. Therefore, applying the PC model in this context requires practicing reciprocal esteem centered on actions that benefit well-being, identity, independence, and creativity, with a transforming dialogue appropriate to everyone involved. We consider it important to flesh out the idea of horizontality and symmetry in a prosocial doctor-patient encounter. Reflecting on the idea of horizontality in the encounter, Roche (Juárez, 2008b) suggested that when there is unequal power, the person having more power should initiate the prosocial aspect of the relationship, while if power is balanced, everybody involved should initiate these behaviors. In relationships of asymmetrical power, the person with greater power has greater responsibility, and therefore must “be the first to act prosocially, yield power and resources, and share...” (Juárez, 2008b). The cited author proposed that the person having more power should increase prosociality in personal, human, and humanistic realms. This person should build on the already existing positive elements, scarce as they may be, and value them, identify their source, and express the elements in a way that allows them to grow through quality communication, achieving a positive and

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prosocial exchange. Applying this concept to the doctor-patient educational relationship: the physician, who holds the power, can modify the power or reduce it, promoting its attenuation and therefore promoting horizontality in the relationship, without threatening or obstructing the authority the physician of course has, given his or her experience. To conclude, we would like to present an initial contribution from a research project. Juarez (2009) has created a list of observable, measurable, and quantifiable communicative actions which, according to a sample of Argentinian medical patients, are indicators of prosocial as opposed to unsatisfactory communication in doctors. It has interesting parallels with the corresponding indicators in educational settings.

Some indicators of prosocial relationship with patients

Homecare professional who give clear feedback	Feedback given by the socio sanitary home care professional (an explanation of a disease, the name of a disease afflicting the patient, a diagnosis, or a treatment) that qualifies as comprehensible, clarifying, well structured, is expressed in simple language from the perspective of the patient, is adequate and correct given the needs of the patient, and contributes to resolving or resolves completely the problem that brought the patient to the doctor.
Socio sanitary home care professional who give prosocial feedback	Feedback given by the socio sanitary home care professional that displays an empathic manner on the part of the physician, reflected in a remark or behaviour that, from the perspective of the patients, indicates an understanding of their views, or indicates that the physician has put him/herself in their position and understands their emotions. One way for physicians to show prosocial empathy is by picking up the words of the patient, using and paraphrasing them. (See this behaviour in patients, also)

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Patients who ask

An indicator of a prosocial manner of communication may be that patients feel comfortable and have enough confidence to express their doubts. Patients who don't ask questions might send conflicting signals: perhaps they understand everything, or perhaps they understand nothing and are too ashamed or afraid to ask the socio sanitary home care professional for clarification.

Patients who paraphrase

The patient has learned something new and is able to repeat it thoroughly in his/her own words. If patients can paraphrase or quote detailed explanations or recommendations that the socio sanitary home care professional has just provided, or can talk about behaviours learned from the socio sanitary home care professional, it suggests the socio sanitary home care professional-patient encounter was satisfactory and that the socio sanitary home care professional succeeded in communicating his/her message appropriately.

Grateful patients

Indicators of prosocial communication by the socio sanitary home care professional may be expressions of gratitude by patients toward the socio sanitary home care professional or toward others; selecting that particular socio sanitary home care professional to handle a health problem; or recommending the physician to other people.

EMPATHY AND PROSOCIAL COMMUNICATION

The indicators of a prosocial style of communication in the doctor-patient relationship may be applied to the professional relationships of any health mediator working with people, whether the health mediator is a doctor, nurse, social worker, pharmacist, physical therapist, etc. To build relationships of trust, professionals who work in the dynamic of a “helping relationship” with their clients need to have a great capacity for empathy, which goes hand in hand with prosocial behavior (Stiff, J., Price Dillard, J., Somera, L., Kim, H., & Sleight, 1988) But, what competencies must health professionals possess to perform well, to strengthen their careers, and to develop over time? This question was a source of motivation for Spencer & Spencer (1993) when he saw that the knowledge with which professionals are educated does not always correspond to the tools that are necessary or useful for resolving real-life work-related conflicts. He created a method that has been applied since 1991 in 24 countries, in more than 100 studies (interviews of samples of professionals in all circles) to identify the competencies that are necessary for performing a job successfully and satisfactorily, and he detailed the method in a text called “competencies for of our people are For help and service professionals including nurses and doctors, the competencies of empathy, or the ability to establish credibility, achieve trust, and be judged positively by patients, are considered crucial. In the case of empathy (the ability to understand the patient’s point of view), a scale was developed from -1 (minimum) to 5 (maximum) to indicate the level of empathy that a doctor or nurse expresses toward the patient. According to this study, the effectiveness of the service and the overall impact of the doctor are limited by the depth and accuracy of the doctor’s interpersonal understanding. In this section we will not discuss Spencer’s study in further detail, although it is useful, as a complement to the indicators proposed by Juarez, to present the table developed by Spencer & Spencer showing the possible degrees of understanding a patient. The list was based on interviews conducted with a sample of doctors and social service and health mediators. The highest level of understanding was 5, and the lowest level of understanding, and hence the least desirable in terms of the success of the service, was -1. Interpersonal Understanding Scale (Spencer & Spencer, 1993, p.39)

-1	Lack of Understanding. Misunderstands or is surprised by others' feelings or actions; or sees others primarily in term of racial, cultural, or gender stereotypes.
0	Not Applicable. Or shows no explicit awareness of others, but no evidence of serious misunderstanding. This level is often found in combination with direct persuasion.
1	Understands Either Emotion or Content. Understands either present emotions or explicit content, but not both together.
2	Understands Both Emotion and Content. Understands both present emotions and explicit content.
3	Understands meanings. Understands current unspoken thoughts, concerns, or feelings; or gets others willingly to take actions desired by the speaker.
4	Understands underlying Issues. Understands underlying problems: the reason for someone's ongoing or long-term feelings, behaviours, or concerns; or presents a balanced view of someone's specific strengths and weaknesses.
5	Understands Complex Underlying Issues. Understands complex causes of others' long-term underlying attitudes, behaviour patterns, or problems.

HOW TO APPLY SOFT SKILLS TO THE HELATHCARE SECTOR

To find out how to apply soft skills in the health sector, we present the Pro-Social Communication model, which consists of a practical self-assessment test. To understand the test better, in what follows, we present the 17 factors of the Prosocial Communication model, explained individually. It is important to remember that this self-diagnostic test should be taken anonymously.

Factor 1. Am I available? My availability as a receiver refers to having a positive attitude when people speak to me, or direct themselves to me in some way. Sometimes this calls for effort on my part to stop what I was doing and adapt to the person speaking to me.

To determine whether I am an available receiver, I can ask: Do I briefly interrupt my activities to positively attend to the person speaking to me? Am I available? Do I demonstrate my availability to my patients, both verbally and nonverbally?

Factor 2. Am I an opportune communicator? Many misunderstandings can be avoided simply by finding the right moment to speak with the other person. Perhaps when people are at home, after a stressful day of work, reproaching somebody because he or she made a mess, has a higher probability of triggering an argument than it does at some other more relaxed moment. In work teams, misunderstandings, arguments, or tensions between colleagues are common during periods of high work. Conflicts with the families of patients are more likely when people are tired, overworked, or stressed.

Before talking to people, do I check whether they have time? Do I ask myself whether their current mood (or mine) is suitable for the seriousness of the topic? Do I choose the appropriate time and place to initiate a conversation? Before giving a diagnosis, indicating a treatment, or providing information, do I make sure that emotional, spatial, and temporal circumstances are right for both the patient and myself?

Factor 3. “Emptying” myself to be completely receptive For others to find us 100% receptive when they speak to us, we must actively “empty” ourselves. This can be a challenging task, but it is not impossible. Emptying oneself is not the same as eliminating

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or permanently forgetting your problems or opinions; rather, it is a short-lived exercise in putting aside your interpretations, prejudices, and problems so that they don't interfere with your ability to understand what another person is trying to say.

Do the people speaking with me with feel that their statements deserve my full attention? Do they feel that I am fully interested in what they are saying? Am I able to empty myself of all my concerns to attend completely to my conversation with the patient?

Factor 4. Do I live the present moment to the fullest? Every person should know how to live fully and intensely in the present moment. According to Roche, people anchored in the past or focused on the future do not live, but rather “are lived”. For instance, in a relationship, the principle entails considering the importance of “us”: you and me, in the here and now, every instant. What we did in the past, what we will do in the future, or what we will cease to do cannot and should not interfere with the present interaction. This is a healthy attitude that helps lay the groundwork upon which we can build an authentic relationship with any person, never mind romantic partners or our children. For instance, in the health field, it is essential to be able to see patients while living in the present moment, putting aside the mental burden (sometimes a heavy burden) of all the things that need to be done later, or the large number of patients still waiting to be seen.

Do I have prejudices toward the other person because of a past experience? When we discuss a complicated topic, do I refer to events “of yesterday” or “of tomorrow” to discuss “now”? Do I concentrate 100% on the present moment with every patient, without distracting myself with past or future concerns?

Factor 5. Do I perceive myself to be an empathic person? Much has been said and written about empathy, but probably the best judge of whether I am empathic or not is the person I am speaking to. Empathy involves a special ability to see things from the perspectives of other people, and even to experience their emotions. Many people consider themselves to be tremendously empathic, but if they asked their romantic partner, children, or friends if they are empathic, the answers might be surprising. Empathy can be learned, if we develop the habit of giving feedback to others (“are you okay?” “You don't look well”), for instance, by practicing the greeting, a very important

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moment for the relationship, or our non-verbal communication (Roche, 2006). We referred to empathy emanating from “me”, which would be considered empathy only if “you” somehow noticed that I am expressing it. Here, we add two new concepts to that of empathy: reciprocity and unity, which entail generating a positive response in the other person as a result of feeling understood, welcomed and accepted unconditionally. These three words—empathy, reciprocity, and unity— constitute a unified concept, defining what a relationship is like when it is satisfactory in a prosocial sense. The “me” empathises because I feel responsible for building a relationship with another person, not only to understand the person but also to welcome, value, listen, and if necessary, even empower the person (build the person’s confidence in him or herself, his or her ideas and interests) whoever the person might be. We must invest more time not only toward understanding what people say and think but toward becoming interested in their interests (even if they are, or we perceive them to be, different from ours), and making the effort of trying to understand their perspective. Instead of taking advantage of their weaknesses, I become interested, I ask questions, giving others the opportunity to organize their own thoughts, to describe what really bothers them, or to describe their genuine interests; so that they can restructure their ideas until they are clear even to them (if they were not already). It is said, that if we take interest in the situation and the thinking of someone, our own emotions tend to become favourable to this person (Stone, et al 1999).

Am I indifferent to whether my listeners are upset or not when I speak to them? Do I convey interest with my facial expression when somebody speaks to me? Do I tend to give verbal and non-verbal signals such that the other feels that I understand fully? Do I commonly ask for feedback from others to gauge how they perceive my empathy? Do I take it upon myself to know and understand the views of others? Do I assume the responsibility of empowering (providing emotional security, facilitating the organization of thoughts, asking questions to allow people to find their true interests) the person I am interacting with when the person expresses confusion or uncertainties that make it difficult for us to reach an agreement? Am I able to put myself in the shoes of my patients? Do I go to the effort of knowing and understanding their point of view? Do I give feedback paraphrasing what they have told me?

Factor 6. Do I strive to confirm the dignity of my listeners? When we converse with somebody, speaking and listening are important behaviours, but equally important

is making people feel and see that we take them seriously. Others should feel that I have confirmed their value as people, I know them, I appreciate their presence, and they are worth my interest, respect, and attention. Confirmation can occur through words, but mostly it happens through facial expressions, posture, gestures, or other signals.

When people inform me of positive news, do I smile as a way of welcoming this information? Do I make eye contact with them? Do I regularly ask questions to encourage them to speak, and to make them feel that I care about their words? Do I show my partner, friends, colleagues, and students, in any way, that I value their presence? Do I affirm my patients' value as people, calling them by name, asking personal questions, and welcoming their emotions whether positive or negative? Do I avoid undervaluing, passing off as obvious, or reducing the importance of what the patient tells or attempts to tell me?

Factor 7. Do I positively rate the people I am speaking to? It has been shown that the best way to promote a new ability in another person is to believe and trust in his or her potential. This is true even for adults. By the same token, it is advisable for couples, work teams, or people we interact with on a daily basis—relationships with a higher probability of wear—to practice seeing the other person “with new eyes” every day. In other words, we should stop complaining or lamenting: why don't you act anymore like you did when we first met; why don't act how I want you to; if I were you I would do things differently; instead, we must acknowledge the achievements and efforts of others, however small, although they may be “camouflaged” by negative features. Of course, we must keep an appropriate balance: the point is not to shower others with praise every five minutes. This could be counterproductive, as easy praise might be interpreted as ironic and an attempt at self-assurance.

Do I identify and acknowledge the efforts and skills of other people? When I positively rate what another person tells me, does he or she notice? Do I positively rate the work of my colleagues even when other people are present? Do I express my admiration for clever colleagues even if they are not my friends? With my patients, at some moment during our encounter, do I positively rate any of their behaviours or words? Do I congratulate them on their effort or progress?

Factor 8: Do I listen with care? Knowing how to listen is undoubtedly the most difficult aspect of communication. Listening involves great effort, as it requires understanding a message while avoiding distractions. And, the listener cannot control the course of the conversation, rather it is the speaker who manages talking time and pauses so that the other can speak. Of course, we all like speaking to somebody who knows how to listen: somebody who waits for-me to finish my idea before talking, and who doesn't interrupt me midsentence. To develop this habit, people must begin by devoting themselves completely to listening to the speaker, remaining fully receptive until the speaker has finished.

When I listen to someone, do I make eye contact and directly face him or her? Or instead, do I go about my other business while the person speaks? Do I reaffirm what the person has said, verbally or with gestures? Do I strive, verbally and nonverbally, to make my patient know that I am listening attentively?

Factor 9. Quality emission. We must be careful not only with what words we say, but how we say them. One inappropriate message can trigger a large problem. Quality emission entails, among other things, using a tone of voice and intensity appropriate for the listener. If the other feels that I am shouting, even though I believe I am speaking softly, this is likely to impact our conversation. For this, it is important to watch my assertiveness (do I say things at just the right moment?); my talking speed (when I am speaking fast, do I make sure the listener can follow along?), and of course, the same features that constitute quality listening; physical displays like eye contact, facing the speaker, making comments appropriate for the topic of conversation, etc.

Do I communicate information to my patient in the manner that is friendliest and clearest given his or her personality characteristics, culture, and age?

Factor 10. Accepting the negative. Accepting the negative means not only being open to criticism, but also acknowledging everything that bothers me and interferes with my communication with the other person. Accepting the negative means accepting everything bothers me and acknowledging it; not hiding it, avoiding it to give it some kind of personal or internal meaning. According to Roche, "negative" is the absence of positive. As such, if we clearly observe a lack of positive in some aspect of the

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communication, this is our opportunity to improve it. Lack of understanding, for example, suggests the need to understand. Putting this skill into practice requires considerable effort and will, and applying of all the aforementioned abilities.

Am I able to accept features I consider negative in the other so that they don't interfere with our communication? Do I accept anything negative the other person sees in me without it interfering in our communication? Am I able to overcome my negative mood stemming from my own problems so that it does not interfere in my communication with others? Do I accept anything negative the patient might see in me as well as anything negative I might see in the patient?

Factor 11. Positive conflict resolution Resolving conflicts positively entails, first and foremost, eliminating violence from conflict resolution, and accepting conflict as something normal that happens when diverse people share a common space. Conflict is not violence. Acknowledging conflicts also means managing each conflict according to its nature: the optimal way to resolve a difference of opinion concerning a factual problem (something that happened), where perhaps a few verbal statements would suffice, is different from how we would resolve differences of personal interests, especially when these differences appear to be incompatible (or truly are). Accordingly, a different solution would be required for value differences, for which a lifetime of debating may not be enough to convince the other person to change his or her view. And, for differences that involve a fundamental problem in the relationship between two people, no matter what words are said, the conflict will not be resolved until harmony in the relationship is achieved first.

When I have a conflict with a patient, family member, colleague, or boss; before discussing points of view or solutions, do I try first to identify the type of conflict, so that I can search for the most appropriate strategy to maintain communication? Do I put aside my own stereotypes and express to my adversary that I respect his or her dignity? Am I able to solicit the involvement of a third party, accepted by the adversary and me (a mediator, referee, judge), if I perceive that I, or the person I am in conflict with, is not prepared to establish a GO TO INDEX dialogue that is respectful and free of verbal or nonverbal discrediting? Do I try to resolve conflicts in a manner that is constructive and enriching for the patient and my relationship with him or her?

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Factor 12. Shared decision-making Not all decisions necessarily involve conflict. Perhaps people more or less agree on a matter, but they find it difficult to make a decision. In shared decision-making, context does not occur passively or spontaneously, but rather it is designed and constructed, and we aim to create an appropriate and favourable space for the problem we want to solve. Interacting in a prosocial manner fosters making decisions as a group, valuing every idea, recognizing minority views, and including the whole group in the process. The challenge is to bring horizontality and participation into action, by actively using, as a group, all the factors of the model.

Before discussing a complex topic with a patient, family member, work team, or colleague, do I strive to set clear and agreed-upon rules of interaction: who will speak first, is it acceptable or not to interrupt, who gets the last word? Do I try to organize the communication exchange beforehand: establish which topics will be discussed and which will be left out? Do I place a priority on using, as soon as possible, methods that are inclusive, efficient, and appropriate for the context and the nature of the problem, in a manner that promotes shared decisionmaking? Do I share the decision-making process with the patient as much as possible, such that the patient feel included?

Factor 13. Information that is sufficient, pertinent, relevant, representative, frequent, and not excessive A well-spoken word is worth more than a speech. This is true of all types of communication. With people with whom we share a common space, at work or in the family, we see this principle on a daily basis: saying things without going overboard; talking, but neither overly more nor overly less than what the other person expected. It is a difficult skill, but it can be learned.

Do I select the quantity and type of information that is most appropriate for each patient given his or her personal characteristics and present circumstances?

Factor 14. Openness to positive and negative emotions, and revealing them assertively This is one of the most important aspects of quality communication, since more so than rational contents, emotional and sentimental factors are what make the communication more “personal”, “private”, and “exclusive”. “Opening up” to a fellow person in a manner that is contextually appropriate allows him or her to know what I think, feel, or want. Of course, we should be selective in communicating positive and

negative emotions in order for doing so to be truly beneficial (we should avoid displaying an indiscriminate, never-ending catharsis).

Do people know what I expect from them? Do I frequently communicate my positive emotions? Do I reveal my complaints carefully and at the right moment? Am I able to avoid spontaneous reproaches? Do I express my emotions (worries, doubts, joys) or expectations to my patients regarding the situation at hand?

Factor 15. Controlling communication We must control communication, rather than the communication controlling us. We should maintain a set of rules appropriate for the needs and identity of all parties involved, so that the desired goals can be achieved each time important matters are discussed. Communication rules are especially useful for handling complicated topics on which people might disagree. On a different note, we each have our own way of viewing and understanding the world. The same word can mean different things to different people. Comparing meanings is a useful practice, especially for commonly misunderstood words.

Thus, we should be able to: Ask when we don't understand; ask if we have understood correctly; give advance warning of bad news so that the receiver can prepare adequately; or when faced with a contentious issue, asking ourselves, What did I understand? What did you mean? Does this word mean the same to both of us? Do I strive to make sure that my communication with a patient is completely efficient and satisfying? Do I ask my patients if they have understood my questions, or my indications? Do I make sure that my patients have understood a technical word I used?

Factor 16. Making clear, in a prosocial manner, the structural rules of the system, and the basic rules of conversation Rules are “like cycles of interaction that repeat themselves” (Roche, 2006, p.149). Many times we don't notice rules exist until somebody breaks them. For instance, at home, if a visitor comes to eat and sits in the chair where the mother usually sits, nobody says anything, but the youngest child gets angry and asks the visitor to sit somewhere else, for the family rule is that that is mom's chair. Roche identified categories of rules of interaction: normative (rules that control aspects of individual behaviour, e.g., smoking is not permitted inside the hospital) and interaction (rules that control the communication or behaviour of two or more people during an

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interaction, e.g., in the waiting room of the head doctor, do not shout, speak softly). Within these rule categories, the author distinguished between those that are explicit (those we are conscious of and speak about openly), those that are made explicit (they were implicit until somebody in the interaction identified them and everybody accepted them), and those that are implicit (rules for which there is confusion regarding the norm, or rules that have not been agreed upon, but rather they stem from habits, from chance, or from the expectations of one or more people in the system). Going one step further, each of these rules may be neutral (rules that do not harm the social dynamic), or negative (they negatively impact some members of the group by preventing their actions). Expressing or speaking about our rules is a way to identify us as a system or a group. We should be able to control our own functioning and have the flexibility to change the rule structure whenever necessary. However, sometimes the accepted rules of an interaction aren't explicit, but rather are assumed. Making these rules explicit can be a complicated but very important step. The challenge that the PC model takes on is not the novelty of making rules explicit, but rather doing so in a prosocial manner. An example of an interaction rule that is implicit and negative would be "do not ask questions to X home care professional because home care professional X does not like to be interrupted". Undoubtedly, this rule impacts the trusting relationship with the patients, the atmosphere in the health clinic, and even the successful implementation of a treatment, since a patient who does not feel at liberty to express doubts might not carry out a treatment properly. We can say that this rule threatens the system and perhaps Home care professional X is unaware of it, or perhaps is aware but prefers not to talk about it. It would be unwise to accuse the Home-care professional or bring up the issue in a room full of patients. Making the rule explicit can be a harmful exercise if it is not done properly, in the right place, or at the right time. Making rules explicit means taking charge of a common learning process. For instance, what should a hospital unit do with a boss who never delegates, doesn't trust, and is never happy with what his team does? And especially, what should be done when the boss is convinced that he or she is horizontal, democratic, and inclusive? For such a boss, the implicit interaction rule is: people are free to talk, but I decide. The work team may assume this to be the rule without saying anything: in this unit of this hospital, the boss decides, and that's how the system works...nobody complains, nobody takes initiative, people wait for the opinion of the boss, even if they are accused of not participating. It is an implicit rule that everybody accepts, apparently without problem. The problem for the system begins when one or more team members arrive who are not

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aware of the rule or do not accept it: they want to debate, opine, and make decisions. The unspoken rule creates conflict. Explaining the rule bluntly maybe even more harmful than maintaining the status quo. However, making the rules explicit in a prosocial manner could prevent problems. For instance, if in the appropriate environment, a person who the boss accepts and holds in high regard, asks the boss: How do you prefer to work? What is the most efficient method for you? Do prefer to always make the decisions yourself or do you like to decide with others? Because, I have the impression that the last word is always yours. Do you do this because you work faster this way? And the boss, in a peaceful environment, will think about it, reflect, and say...really, do I do that?? Or might say, it's true, I don't trust anybody but myself...from now on the rule will be official, and I will make it clear to the group: "Folks, I know I can appear authoritarian, and maybe I am, but look, I have a limit, nothing can occur in this unit unless I authorize it. I'm sorry if you don't like it, but unfortunately that's the way it is, so I hope we can get along and this doesn't cause any conflict." And the rest will say, boy, I don't like this, but rules are rules; others will say, okay, this is the rule, I will respect it but as soon as I get the chance, I am switching to a more democratic unit. This does not eliminate the authoritarian environment, but it helps keep the relationships healthy.

Do I try to explain openly and personally, without undervaluing or over protecting the patient, what the rules are that we must follow throughout treatment?

Factor 17. Cultivating a specific empathic aim A communicative process, focused on the relationship and on others, cannot focus only on the past and present communicative exchange, but must also take charge of its future effects. In other words, once the communication exchange is finished, after a few days, weeks, or months with the person, ideally the communication stimulates empathy and maintains it, cultivating an empathic goal that permits continuing quality communication and making the others feel like "legitimate others" (Maturana, 1995), making them see that we remember them, that we have not forgotten their issue, that we are working on their case, that we have taken them seriously, that we are interested in what we spoke about the previous visit. This should happen through some type of intentional communicative exchange or even a behavioural exchange (an action or a gesture) specifically designed to convey validation, acknowledgment, and esteem. For instance, a simple phone call to ask if the problem was

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solved could suffice. Or an email, or an interested question about the issue that the other person indicated was important.

Do I take the time to provide, at a minimum, specific feedback, over time, to my friends, family members, colleagues, students, parents, that shows my interest in the issues that affect them personally? When somebody has asked something of me, do I make an effort to, at a minimum, give a quality response regarding the possibility, or lack thereof, of meeting the person's wishes? Do I strive to stimulate the continuation of the empathy created with the other and strengthen the trusting relationship we have created, through some kind of prosocial actions once the communicative exchange has finalized? Do I try to make the patients feel that I remember them and am concerned with them? Do I show interest in what we talked about last time we met?

Identifying our strong and weak points. Everybody has strong points and weak points. Nobody communicates “well” or “poorly”, but rather everybody has aspects he or she can strengthen, empower, or develop further, perhaps because of a lack of practice or not being aware of the aspect. The most important step in the identification process is being motivated to change, and having the ability to self-evaluate and persevere (because no change is automatic). Furthermore, if this identification process is done together with another person with whom we share high regard and trust, the results can be promising: the results of the self diagnostic test can be compared and commented on by both people, as we suggest in the following exercise (H). The following exercise enriches one's relationship with others, provides useful and perhaps new information concerning how others see us, and helps us to understand how we view ourselves in terms of how we interact with others. After the following exercise, we can also train PC with roleplaying exercises or group exercises, remembering that each exercise should have a corresponding meta-communicative analysis.

H. Practical self-diagnostic test. *How do I rate the communicative style I use with my patients? The prosocial communication model adapted to the role of the socio sanitary home care professional. For the self-diagnosis we must work with Table 1.*

For a refined analysis, it is useful to carry out this test with specific types of patients in mind. First, we can ask, how do I rate my communication with this particular patient?

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Later, we can ask more general questions: How do I rate my communication with my patients in general? With foreign patients who don't speak my language? With elderly patients? I examine every item in this fashion and give myself a score from 1-5. Granted, this self-diagnostic test does not reflect facts, but rather my own subjective perceptions at a particular moment in my relationship with the patient. The same test performed at a later time could show a different result. The contribution of this test is to help me to visualize something as abstract as the strong and weak points of my communicative style.

This self-diagnostic test is the basis for designing a possible subsequent optimization program.

Model-Phase	Factor, Attitudes and Behaviors	5 Always	4 Almost always	3 Some -times	2 Almos t never	1 Neve r
Previous	1.Openness and readiness as receiver Do I make myself available, and do I show this to my patients, both verbally and nonverbally?					
	2.Opportunity as initiator Before giving a diagnosis, suggesting a treatment, or providing information, do I make sure that the emotional, spatial, and temporal circumstances for the patient and myself are appropriate?					
Process	3.To empty oneself: Am I able to empty myself of my other thoughts and worries to give the patient 100% of my attention?					

	<p>4.Live the present moment thoroughly</p> <p>When attending a patient, do I concentrate fully to the present momento without distracting myself with thoughts of past or future events?</p>					
	<p>5.Empathy, reciprocity and unity</p> <p>Am I able to put myself in my patients’ shoes? Do I make an effort to understand their point of view? Do I give feedback paraphrasing what they have told me?</p>					
	<p>6.Confirmation of the other person’s dignity</p> <p>Do I affirm my patients’ value as person and human being, calling them by name, asking personal questions, and welcoming their emotions whether positive or negative? Do I avoid undervaluing what my patients say or attempt to say, passing it off as obvious, or reducing its importance?</p>					
	<p>7.Positive evaluation of the behaviours of the other</p>					

	<p>Do I positively evaluate any aspect, comment, or behaviour of my patients or congratulate their progress or efforts, at least at some moment during our interaction?</p>					
	<p>8.Quality listening Do I make an effort both verbally and non verbally, to make my patient feel that I am listening attentively?</p>					
	<p>9.Quality emission Do I communicate information to my patients in a friendly way and in a clear manner which is appropriate for their personality characteristics, culture, and age, disability, gender identity, etc.?</p>					
	<p>10.Acceptance of what is perceived as negative Do I accept anything negative that the patients may see in me, as well as anything negative I might see in them?</p>					
	<p>11.Conflict resolution Do I try to resolve conflicts in a manner that is constructive and enriching both for the</p>					

	<p>patients and for your relationship with them?</p>					
	<p>12.Shared decision taking For decisions that affect the patients, do I include them in the decision-making process as much as possible, making them feel like they play a part?</p>					
Contents	<p>13.Appropriate, relevant, not excessive, representative and frequent information Do I choose the most appropriate amount and type of information for patients, or my expectations regarding the issues we face?</p>					
Meta-communication	<p>14.Openness to reveal emotions Do I express my emotions (worries, doubts, joy) to patients, or my expectations regarding the issues we face?</p> <p>15.Checking and controlling the communicative process Do I concern myself with checking that my communication with the patients is completely efficient and appropriate? Do I ask them if they have</p>					

	<p>understood my questions and suggestions? Do I make sure that they have understood a technical word I just used?</p>					
	<p>16.Making explicit the structural rules of the system in a prosocial way</p> <p>Do I try to explain openly and intimately the rules and protocol that must be followed throughout treatment, without undervaluing or overprotecting the patient?</p>					
<p>After the communicative act</p>	<p>17.Cultivate and carry out an empathic and concrete goal</p> <p>Do I take it upon myself to make patients feel a that I remember them and that I am concerned with them? Do I show interest in what was discussed the previous time we met?</p>					

METHODOLOGIES TO INCREASE THE HARD AND SOFT SKILLS EXAMINED

To increase the hard and soft skills for the use of the 3D printer, different methodologies can be adopted:

1. **Technical training:** it is essential to acquire specific skills in the use of the 3D printer through technical training courses. These courses can be offered by vocational education institutions, training centers, or by experts in the field. Technical training can provide a solid foundation of knowledge about the 3D printer, from operation to maintenance, including preparing print files.

2. **Hands-on experimentation:** Practice is key to learning and perfecting skills related to using the 3D printer. It's a good idea to spend some time doing hands-on experimentation, making several prints, and testing different materials and settings. This allows you to refine your technical skills, learn how to resolve any problems, and gain confidence in using the machine.

3. **Collaboration and knowledge sharing:** You can improve soft skills, such as teamwork and communication, through collaboration with other 3D printer users. Participating in online communities, forums or interest groups allows you to share knowledge, experiences, and problems encountered, encouraging individual growth and the sharing of skills.

4. **Personal Projects:** Engaging in personal projects using your 3D printer can help develop both hard and soft skills. You can create objects, prototypes, or models to practice and put the knowledge you have acquired into practice. This allows you to face challenges, improve technical skills, and stimulate creativity.

5. **Self-study:** to constantly improve the hard skills related to the use of the 3D printer, it is essential to stay updated on new technologies, materials, and printing methodologies. Self-study through reading books, accessing online resources (tutorials, videos, blogs), and participating in webinars or conferences allows you to maintain a high level of skills and knowledge in the field of 3D printing.

In summary, to increase skills regarding the use of the 3D printer it is necessary to combine technical training, constant practice, sharing knowledge with other users, and the creation of personal projects.

GUIDE TO CARRY OUT A PARTICIPATED PROSOCIAL VISUALIZATION

Additionally, Participatory Pro-Social Visualization presents a methodology that can be applied to help enhance competencies through various exercises.

(group of 10-12 participants, duration between 1 and 1.5 hours)

1. What is Participatory Prosocial Visualization (or: 'Inclusion is participation)?

VPP is a group work methodology, designed for planning, decision-making, or diagnosing problems, tasks, opinions and experiences. VPP works through questions, visualization of answers and the facilitation of the process by a neutral person in relation to the group.

The objective is to visualize the answers to a question with cards that are hung on a surface visible to the entire group. This gives the possibility of ordering the cards according to similar or identical ideas by rows, clouds or columns. In this way, similar responses are grouped and important topics for the group are highlighted. By producing several groupings of cards, a differentiation between the responses is obtained.





2. VPP as a tool to detect training needs:

The VPP is ideal to detect the needs and expectations of a group regarding a certain situation, goal or task, since there are a number of rules that are applied: First, every group member has the same possibility to express him or herself by writing his or her idea, need or expectation on a card, which will be visualized on the panel. Therefore, the process is anonymous and also inclusive, as no card can be removed or crossed out etc.

The facilitator supervises this process and makes sure that there is no card displaying any judging or insulting content regarding any person.

In order to detect the needs of a group of training participants, there can be raised different questions. The results will be slightly different but will produce answers that describe the needs from different angles.

-Example Question: What are your needs that I should respond to as a trainer??"

Result: A list of needs, that can be taken into account when designing a training.

-Example question: “What are the difficulties that I perceive when carrying out training in 3-D printing with people who live with a disability?”

Result: A list of difficulties that can be solved.

-Example question: “If you think about the motivation with which people living with disabilities come to training: How can I as a trainer get everyone involved?”

Result: A list of proposals on how to involve the group in training.

3. The steps to be taken in the Participatory Prosocial Visualization (group of 10-12 participants, duration between 1 and 1.5 hours):

Time	Contents	Material
	<p>Preparation:</p> <p>What question do I want to ask? Is the group in a position/does it have the knowledge to answer it?</p> <p>How many participants are we (or: I invite)? Who are they?</p> <p>How long do I want to take for this process? More directive or more permissive facilitation style?</p> <p>How many ideas (cards) can I visualize in this time frame?</p> <p>What is my role as a facilitator?</p>	<p>Panel, panel covering paper, glue dots, cards, pens</p>
<p>5-10min</p>	<p>Introduction from the facilitator regarding the following aspects:</p> <p>What are we going to do and why?</p> <p>How are we going to proceed?</p> <p>What is the objective of the session and the duration?</p> <p>The facilitator:</p> <p>Explain the question and make sure: have the participants understood the question?</p> <p>Explain your role as a facilitator. You are responsible for the process, you will not intervene in the contents, ideas, answers written on the cards</p> <p>Explain how anonymity works (write in capital letters, for example. Also: do not identify the author of a card, but interpret it as a group)</p>	

5-10min	<p>“Brainstorming”:</p> <p>Distribute one card per participant (example)</p> <p>Each participant writes an answer to the posed question (an idea) on a card, the one that seems most important to her/him. Important: use letters that are readable from a distance</p>
15 or more minutes	<p>The facilitator collects the cards from the participants</p> <p>Reads a card aloud and places it on the panel.</p> <p>Then he or she reads the next card aloud and ask the group: “Is this card related to the previous one or do you think it is a new idea?”</p> <ul style="list-style-type: none"> - If the idea on the card represents the same context as the first, place it next to it, that is, in a row with the first. - If the card does not represent the same context as the first, place it under the first card thus opening a new row <p>So, in the same way continue with the other cards: 1) read it out aloud 2) ask if it belongs to one of the rows that already exist on the panel, or if it is a new idea, so a new row opens.</p> <ul style="list-style-type: none"> -Proceed like this until all the cards are placed on the panel. -If the group does not agree where to place a card, the card can be written a second time and placed in two different rows.
5min	<p>When the visualization is finished, the facilitator asks the participants to propose a title for each row. The facilitator (or a participant) writes this title on a card and places it at the beginning of the respective row.</p> <p>In the end the facilitator has achieved the following objectives:</p> <ul style="list-style-type: none"> --to promote the participation of everyone, whether shy or extroverted - to allow creativity (no censorship, apart from insults, personal attacks, etc.) -a visual structure has been organized for the ideas/cards -participants have summarized long explanations in a single short sentence (an idea on a card)

	- the facilitator has helped to summarize rows of several ideas in a single title, which gives a better overview
5min	<p>Vote:</p> <p>The facilitator distributes one glue dot (self-adhesive sticker) to each participant in the group, if there are less than 7 rows on the panel, and two gomets if there are more than 7 rows.</p> <p>-then, a new question is written and displayed: “Which line of ideas/topics do you find most relevant/...do you want to work on?”</p> <p>The participants vote</p>
	<p>The voting results allow:</p> <p>-to prioritize certain topics over others</p> <p>-divide the group into small groups. Each small group can work on a topic/outcome.</p>
30-45min	-after 30-45 min the small groups present their results to the entire group (plenary)
	End of the session

ASSESSMENT EXERCISES

1. Prosocial behaviors

- a) are linked to empathy
- b) they depend exclusively on the behaviors of others
- c) they are a political statement
- d) a completely new invention

2. The definition of prosocial behaviors is based on:

- a) the corresponding national legislation
- b) the cognitive capacity of the author of the aid
- c) the benefit of the other person according to his needs
- d) the emotional state of the recipient

3. What are the important criteria for prosocial actions to be effective?

Prosocial behaviors

- a) trust and the probability of reciprocity increase and the recipient gains autonomy
- b) they make the recipient of help more dependent on the author
- c) increase mutual sympathy
- d) provoke emotions of inferiority in the recipient

4. When I actively listen to the other person

- a) I ask from time to time if I have understood correctly what you want to express
- b) I already think about what I want to answer
- c) I deal with other thoughts at the same time

d) I interrupt when the other person talks for too long

ASSESSMENT FORMS TO EVALUATE

Reader Satisfaction Evaluation Questionnaire:

<https://forms.gle/GRevrr35T7Y1nk3c8>

Instructions:

Please provide your opinions and feedback on the manual through this questionnaire. Your participation is valuable and will help us improve future editions. Answer honestly, and if possible, provide detailed comments for better understanding.

ABOUT THE CONTENT:

- a. On a scale of 1 to 5, how satisfied are you with the clarity of the presented content? (1 - Very Dissatisfied, 5 - Very Satisfied)
- b. Did the content of the manual meet your expectations? (Yes/No)

ORGANIZATION AND STRUCTURE:

- a. How do you rate the organization and structure of the manual? (Excellent, Good, Fair, Poor)
- b. Did you find easy access to the desired sections and chapters? (Yes/No)

WRITING STYLE:

- a. Was the writing style clear and understandable? (Yes/No)
- b. Were there any technical jargon or difficult-to-understand vocabulary? (Yes/No)

USEFULNESS OF CONTENT:

- a. To what extent was the content of the manual useful to you? (Very Useful, Useful, Neutral, Not Very Useful, Not at All Useful)
- b. Do you believe the provided information will be applicable in practice? (Yes/No)

VISUAL PRESENTATION:

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a. How do you rate the visual presentation of the manual? (Excellent, Good, Fair, Poor)

b. Did the graphics, images, and illustrations contribute to understanding the content? (Yes/No)

READABILITY:

a. Was the manual easy to read and understand? (Yes/No)

b. Were the font and text size adequate? (Yes/No)

EXERCISES AND PRACTICAL ACTIVITIES:

a. Were the exercises and practical activities helpful in reinforcing learning? (Yes/No)

b. Were they challenging but achievable? (Yes/No)

FORMAT AND DISTRIBUTION:

a. What was the distribution format of the manual you used? (Printed Version, Online PDF, Other - Specify)

b. How do you rate the accessibility of the chosen format? (Good, Fair, Poor)

RECOMMENDATIONS:

a. Would you recommend this manual to colleagues or friends? (Yes/No)

b. If you have suggestions for improvements, please share them:

DEMOGRAPHIC INFORMATION (OPTIONAL):

If you wish, share information about your profile (e.g., field of work, level of experience, etc.).

We sincerely appreciate your time devoted to this questionnaire. Your responses are crucial for enhancing the quality of our manual.

CONCLUSION

In conclusion, the project "3D Practice to Raise INclusion with Technological Skills" unfolds as a comprehensive exploration into the transformative potential of 3D printing technology within the realm of healthcare. As we navigate the dynamic landscape of contemporary healthcare, the fusion of innovative technology and advanced medical care emerges as a pivotal force in providing effective and personalized solutions. This pioneering initiative, marked by project number 2023-1-IT01-KA210-VET-000153881, not only meticulously follows a structured approach but also addresses the critical elements of written work, from introduction to conclusion. Delving into the depths of 3D printing technology, the project sheds light on its application in creating customized prosthetics, intricate medical models, tailor-made implants, and more. As we traverse the technical intricacies, challenges, and triumphs associated with incorporating 3D printing across various facets of healthcare, a nuanced understanding of its potential unfolds. Moreover, the project recognizes the significance of not only technical skills but also interpersonal and empathetic skills in the healthcare sector. In addition to providing detailed guidance on the technical principles, technologies, and essential materials involved in 3D printing, practical strategies for effectively incorporating empathetic skills, as well as hard and soft skills, into daily practice are emphasized. The document concludes by showcasing success stories that exemplify how 3D printing is already positively transforming healthcare delivery on a global scale. Through these examples, the project aims to inspire and motivate individuals and organizations seeking to integrate this innovative technology into their healthcare environments. Together, let us envision a future where the limitless possibilities of 3D printing converge with customization, innovation, and compassion to enhance the quality of life for patients worldwide. Taken into account that 3-D designing and printing can offer new ways of empowering people who live with disabilities, the prosocial relational and communication model is a methodology to operationalize this goal in concrete terms. As an integral part of Prosociality, the Prosocial Participative Visualization tool helps to involve educators, health personnel and people with disabilities to embark on this important goal: participation is inclusion!

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