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IO1: Innovative VET Curriculum on Health4.0 and its Underlying Digital Technologies

Lead by KAINOTOMIA & SIA EE

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Preamble

This report presents the outcome of work performed by the Erasmus+ Digi4H consortium to establish a relevant VET Curriculum on the topic of Health4.0, which concerns the *4th Industrial Revolution* taking place within the European health sector. To establish this specific Curriculum, the Digi4H partners used both their organisations knowledge as well as expertise and feedback obtained from consultations that took place in the relevant partner countries. This report thus consists of two parts, *Part 'A'*, with outcomes arising from the national focus groups and *Part 'B'* which presents the structure and details of the Health 4.0 curriculum established. Due to the continuous digital revolution taking place in the Health Sector one should take note that the established curriculum and presented in this report is one that would need to be eventually revised and updated in five to six years' time. The curriculum has been explicitly designed taking into consideration the needs of our target audience. The latter period of when this curriculum was developed happened to coincide with the COVID-19 pandemic. This period has highlighted more than ever before, the need of health care workers and related stakeholders to be assisted in becoming competent in a range of digital technologies. We hope this DIGI4H Curriculum will contribute a step in that direction.

The Digi4H Consortium

April 2020

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PART A: FOCUS GROUP CONSULTATIONS REPORT

1.0 INTRODUCTION

The main aim of this Project called digi4HEALTH (*A Digital VET Toolkit for Promoting the 4th Industrial Revolution in the European Health Sector*) is to develop a novel digital toolkit by which European VET Trainers and health sector mentors can reach out and assist healthcare professionals and stakeholders to catch up with digital technologies of the 4th Industrial Revolution. The main three target groups of the digi4HEALTH project are:

- TG1: The primary Target group consists of EU VET trainers and healthcare mentors
- TG2: The secondary target group consists of Healthcare personnel
- TG3: The third group consists of VET learners

The first intellectual output (IO1) of the digi4HEALTH project is an innovative Curriculum generated by all digi4HEALTH partners under the guidance of the curriculum design experts within the consortium. The curriculum is intended to cover a spectrum of Health 4.0 topics to allow a range of healthcare personnel such as general practitioners, podiatrists, physiotherapists, occupational therapists, radiographers and nurses to understand better what HEALTH4.0 is all about and how its underlying technologies can be exploited in their daily work when dealing with patients.

1.1 Data collection Method

In order to define the training needs of the aforementioned target groups and the contents and training methods of the digi4HEALTH Curriculum, each partner formed and conducted focus group discussions and individual interviews with healthcare personnel, and VET trainers. The focus group's purpose was for each partner organisation to consult members of their respective formed focus group for proposing content for a relevant curriculum on a range of Health4.0 digital technologies and issues.

The questions for the focus group discussions / individual interviews were divided into **three categories** to facilitate the dynamics of the focus groups:

- Those focused on the description of the ***digital technologies*** used and required in their working context;
- Those centered on the ***capacities*** identified or needed for learning/teaching;
- Those oriented to identify ***good practices*** in their field.

In total **60 representatives** of the three target groups, among them a variety of healthcare professionals (general practitioners, radiologists, dentists, nurses, occupational therapists, physiotherapists, odontologists, cardiologists etc.) and VET trainers/ learners, were interviewed in the **5 partner countries** (Malta, Greece, Lithuania, Romania, Spain) from the **6 partner organisations** (MECB Ltd., Kainotomia, Kaunas, UPB Camis, INHWE, KVELOCE). Additionally, an EU wide focus group was conducted by our partner INHWE, with professionals from non-partner countries and this resulted in getting even more broadened and diverse feedback regarding the development of our curriculum

2.0 NATIONAL FOCUS GROUP OUTCOMES

2.1. Malta

A Focus Group of 7 participants was organised at the premises of the MECB office in Mosta, Malta on 22nd January of 2020. MECB also conducted three individual interviews (as target group stakeholders) were busy in the other date) on the 9th and the 23rd of January 2020 making the total number of participants interviewed to 10 persons. This group consisted of :

- Two medical doctors, one being a general practitioner; one lectures at the University of Malta Faculty of Medicine and the other at Barts Medical School;
- A VET nursing trainer (teaching at the Institute for Applied Sciences of the Malta College of Arts, Science & Technology) and another practicing nurse;
- An occupational therapist, a speech language pathologist, a radiographer, and a nurse (the latter four being trainers at the University Faculty of Health Science)
- a Podiatrist, and
- a Midwife.

As for the demographic data, these were: 3 trainers (T), 3 learners (L) and 4 both trainers and learners (T and L); there was an equal representation of both genders.

During the focus group discussion and the interviews, at least 50% or more of the participants stated that they had no prior knowledge of CAD/CAM, 3D scanning, IOT and blockchain. On the other hand, all of them had heard about artificial intelligence. 90% of the participants knew about drones, whereas 80% knew about 3D printing, robotics and cloud-based technologies. All heard about AI. The least knowledge amongst the participants was in the fields of IOT and cloud-based technologies. Participants knew mostly about case studies in the field of robotics this being 80% amongst the technologies. Artificial intelligence, 3D printing and cloud-based technology case studies followed at 70%. 60% had read about a case study/studies involving the use of drones. 3D scanning, CAD/CAM were the least known in terms of health-related case studies.

During the discussion it was evident within the group that all agreed on the need to exploit digital technologies as an educational tool. They also indicated that technology can also make interventions more efficient and in certain cases less invasive to patients. Nonetheless, they stressed the importance that the *human* element, *emotional* aspect and *personal* contact with a patient go a long way in the treatment process and recovery. Specifically, worth noting is that technologies can carry the risk of de-humanizing healthcare delivery, leading medical professionals to for instance rely heavily on AI and data driven decisions that might not always be in the patient's best interests. Digital technologies were also seen as one way to facilitate a learner's journey in terms of time, and understanding. However, there was mutual agreement that such training resources could be expensive and the learners must be digitally literate and

receptive. It was also noted that some of the content and parts of the curriculum to be developed should be made available to patients and/or their carers (e.g. **fact sheets** to explain to patients the difference between a vein/artery or how to self-inject). Therefore, when developing resources such as **e-learning content**, the needs of patients and their carers should be factored in.

With respect to the preferred training methodology, although *face to face* learning was considered the most popular, limitations on these busy health professionals and in particular time constraints meant this can be a major restriction. They thus agreed that ideally, the curriculum must be available in a **digital forma**t which is accessible to all, and, from **anywhere** and **anytime**.

Conclusions for Malta

a. Face to face tuition is the preferred option for curriculum delivery on Health 4.0 but closely followed by **e-learning** courses;
b. **Case studies** are a favorite way of learning, and, most wish to be exposed to different case studies for the various technology types to get more familiar;
c. Multiple ways of studying, or, a **mix of educational resources** for training and learning are the preferred option to learn versus just one type of resource/studying option;
d. All the participants had heard about the different digital technologies, but to varying extents;
e. All the participants had seen some health related case studies, but to different extent.
f. In terms of training needs, the following were outlined:

- In the case of occupational therapy, CADCAM/3D printing/3D Scanning is most useful;
- In the case of radiography and doctors involved in genetics, AI is most useful;
- In the case of nursing, medicine (GP) and podiatry, robotics and cloud-based systems are most useful;
- In the case of nursing, VR and AR are most useful;
- The least referred to technology as per FG data were Blockchain and IoT.

Detailed results and statistics for Malta are available in Annex II of this report.

2.2. Greece

For the purposes of identifying the training needs of healthcare professionals and VET trainers, Kainotomia organized two focus groups, and 4 individual interviews with the total numbers of participants to be 12 persons. The 1st Focus Group of 3 participants took place in the premises of the Parafestas Diagnostic Healthcare Center on the 16th of January 2020 in Larissa Greece, and a 2nd Focus Group with the presence of 5 participants took place at the Animus Rehabilitation Center on the 29th of January, 2020.

The demographic data and the professions of the participants were the following:

- 2 trainers (T): M (age 50), F (age 55) - associate professors (Rheumatologist and Physiotherapist)
- 10 learners (L): 5 F (ages 20,30,35,40, 58), 5 M (ages 25, 30, 32, 35, 56): 2 general practitioners, 1 dentist, 1 occupational health physician, 2 radiologists, 4 physiotherapists.

The discussion began with the staff of Kainotomia, explaining the purposes of the meeting and the aim of digi4HEALTH project and its designed outcomes. The discussion continued with questions on the specific technologies (see Appendix 1) and participants stated their familiarization with the digital technologies, specific case studies and use of technologies and their eagerness to learn more about some of the digital technologies. They continued, by giving specific examples on the use of these technologies. They mentioned that Robotics can help in the field of surgery in that certain points are harmful to the scalpel or dangerous to the patient's life. Also, Robotics can help occupational therapists and physiotherapists during the occupational therapy procedure. The robot can repeat multiple times the movement assisting the patient to move without the muscle fatigue of therapists, that would cause possible mistakes to the occupational therapy procedure. The use of robotics in this case, reduces the errors and mistakes margins by a lot. In addition, the Virtual Reality technology is useful in the surgical training of young surgeons as it can stimulate a real-life surgery. VR is also useful, in rehabilitation of patients with neuromuscular disorders and or balance issues and it improves patients' kinesthesia and proprioception (e.g. Nirvana VR system and Balance System SD). 3-D scanning helps with diagnosis, since it simplifies the image. The use of CAD/CAM technology in dentistry has helped to facilitate clinical cases in terms of time efficiency and aesthetics. They continued with the limitations of these technologies and most of them stressed the dangers of overdependency on the digital technologies, its high cost and the rupture in personal contact with the patients.

In general, the conclusion made by the focus group and the individual interviews, was that the Greek healthcare professionals are familiarized with some digital technologies that are more useful for their medical specialty. At least 60% of them have heard of CAD/CAM, Cloud-based technologies, Robotics, 3D printing and scanning and Robotics, on the other hand over 80% of

them haven't heard of Blockchain, Internet of Things and Augmented Reality. At least 60% of them have heard about case studies on the CAD/CAM, Virtual Reality and Artificial Intelligence, and Robotics.

Conclusions for Greece

The positive outcome is that the interviewed Greek healthcare staff and VET trainers are eager to learn about more digital technologies. However they indicated this would be very difficult to realize on a face to face basis due to their limited time and availability. They also indicated their need to get updated about new advancements in their field. At the same time, they all believe that continuous vocational education is the key to increase their knowledge about the new digital technologies. The Greek focus groups' participants tend to be more eager to know more about the following digital technologies (ranked from more useful and willingness to know more for their specialty to less useful):

- CAD/ CAM 100%
- 3D printing 100%
- 3D scanning 100%
- Robotics 100%
- Virtual Reality 80%
- Artificial Intelligence 80%
- Augmented Reality 80%
- Internet of Things 65%
- Drones 60%
- Blockchain 52%
- Cloud based technologies 50%

The most preferred training method for these participants was through **online courses** with the use of **case studies** and **infographics** due to their limited time to attend to face to face tuition and seminars.

2.3. Lithuania

A focus group of 7 participants took place on the 31st January, 2020 at Kaunas Science and Technology Park, in Kaunas, Lithuania. The demographic data of the focus group were the following:

- 2 trainers (T): M (age 34), F(age 49) - one Master of Educational science, another one – Master of Rehabilitation, qualification in physiotherapy, studying doctoral studies
- 5 learners (L): 5 F (age 36, 35,49, 18, 18), nurses

After being introduced to the project's aim and objectives, and the purpose of the focus group, participants expressed their awareness in Digital technologies and they expressed their wish to gain knowledge through case studies for all the technologies featured: this ranged from 14% (Artificial Intelligence) to 57% (CAD/CAM). Some technologies participants found of less interest, and their awareness of knowledge passing through case studies of these technologies was low – 86% (Artificial Intelligence). However, the answer «NO" has not been recorded.

Participants willingness to learn digital technologies featured from 14% (Artificial Intelligence) to 57% (CAD/CAM). Participants reported that certain digital technologies (such as 3D scanning, augmented reality and block chain), are not necessary or needed in their work, so they did not express their desire to study them either.

During the discussion, participants were asked about their knowledge and their perceived advantages of digital technologies in healthcare. They have mentioned the advantages that could improve the competitiveness of health specialists in the work field, improve the quality of their work; reduce the time for accomplishing the medical intervention; facilitate medical training and education; be suitable for training a generation of medical specialists as well as could be better adapted to patient specific needs.

Participants agreed on the fact that using technologies in the medical sector throughout work could be better and results could come faster and be more visible. It was noted that among participants certain digital technologies (e.g. Artificial Intelligence) were found as not/or not enough knowledgeable. As a reason, participants have mentioned mostly their limitation in time as well as being too busy. As a reason why they don't use these technologies in practice, participants mentioned the confirmed curriculum for VET teachers in the health sector that they were following to.

As disadvantages of using technologies in healthcare, the suitability of these technologies more for education and training than for practice was cited. In terms of digital technologies and their use in healthcare, participants mentioned the importance of working in interdisciplinary teams

and a possible disadvantage related to language barriers between doctors and engineers or different knowledge and understanding, definitions as well as time schedules Apart from the clear understanding of how the new technologies, innovative processes could be helpful, useful and more efficient, participants recognized that the person (human) in the health sector is still undoubtedly in the first position i.e. at the forefront. Participants agreed that significant reliance on the use of technologies in health sector might be risky for the patient. Besides the mentioned digital technologies, a new technology was a favourite amongst the participants – *Telemedicine*. It is a well-known technology in use and recognized as important, quick in time and reliable.

Participants found it difficult to outline specific skills that would be beneficial to teach to others regarding digital technologies. Participants agreed on the very strong importance of digital technologies in the health educational process, on the necessity to use them in the healthcare sector which is directly proportional to the quality of the education process, which needs to be always familiar with the newest technologies in the health market. The importance of the Digi4Health project and the results that will be achieved was stressed out by all participants.

Conclusions for Lithuania

According to the Lithuanian focus group their willingness to learn the following Digital Technologies (ranked from top down) are listed below:

- Virtual Reality 100%
- Cloud – based technologies 100%
- CAD/CAM 100%
- 3D printing 100%
- Robotics 100%
- Internet of Things (IOT) 100%
- Artificial Intelligence 100%
- Drones 100%
- Augmented Reality 86%
- 3D Scanning 29%
- Block Chain 29%

Regarding the preferred training methods, the most preferred training method was through **Power Point Presentations** with 61% of participants' approval followed by:

- E-Learning Courses 19% approval;
- Face-to-Face Course 16 % approval;
- Single Page Fact Sheets 1,3% approval;
- Case-Studies 1,3 % approval.

2.4. Romania

UPB Camis organized two focus group with total number of 9 participants one on 12th of December 2019 (focus group 1, FG1) and on the 10th of January 2020 (focus group 2, FG2) at the premises of Colentina Clinical Hospital of Bucharest (FG1) and University Politehnica of Bucharest (FG2). The demographic data of the two focus groups were the following:

- 2 trainers (T): F (age 59), M (age 52) - associate professors. Both of them are also orthopaedic surgeons
- 6 learners (L): 2 F (ages 25, 30), 4 M (ages 27, 30, 27, 29): 2 nurses, 1 dentist, 1 cardiologist, 2 orthopaedics residents

After the presentation of the project, its objectives and the aim of the focus group, participants were asked about the advantages of using technology in healthcare and their usefulness. The participants mentioned that technologies are good for: improving working results for patients; raising working efficiency; reducing the time for accomplishing the medical act; facilitating medical training and education; responding to the training needs of the new generation of medical specialists. Difficulty to distinguish between myths and reality regarding the medical applications of these new technologies was also noted during focus group discussion. Therefore, education is mandatory.

The reported disadvantages, barriers and limitations were: risk of focusing on the use of technology rather than on the patient; the need of multidisciplinary teams which are harder to organize; more and more technical complexities (difficult to have updated information on the new developments); high costs of implementing the new technologies in daily routines. Time of developing applications that are based on these technologies makes them suitable more for education, training, visualization and surgical rehearsal and less for emergency situations. As the use of these technologies implies working in interdisciplinary teams, disadvantages related to language barriers (between doctors and engineers, for instance) or different working paradigms, time schedules, specific constraints, etc. were mentioned by some participants. Participants considered that a heavy reliance on the use of these technologies might be risky for the patient, especially in surgical applications. Also, some participants mentioned that the focus should be maintained on patients and not on technology, i.e. to use these technologies when being sure that they improve medical outcomes. Regulations are needed in the medical field for these new technologies. New competences to acquire referred to correctly understanding: the basic concepts related to these technologies, ability to understand the information presented by other specialists that are using these technologies worldwide based on case-studies and examples, ability to interact with these new technologies, awareness on aspects related to software, hardware for these technologies and their practical use.

Training and being informed of these technologies' use in medical applications, based on reliable sources, are needed for keeping up to the rapid developments of all the fields involved

(medicine, engineering, IT, robotics, sensors, wearables, etc.). Vocational education and training is the key in this sense. Also, early transferring of information from the first years of medical studies is also a necessity. The same goes for engineers and future engineers which should be aware of their responsibilities in this field. In other words, training, education and collaboration are mandatory for being able to understand and use the new technologies. Medical modelling knowledge based on specific software was mentioned as needed for using the new technologies related to 3D scanning, 3D printing, AR and VR.

Conclusions for Romania

Based on focus group discussions, 3DP, VR, AR, 3D scanning and robotics are of interest for Romanian participants. They are more aware about Robotics (87%), Artificial Intelligence, Cloud Based Technologies, Augmented Reality and Virtual Reality (83%); the least known technologies were Block Chain (55%), Drones (61%) and Internet of Things (63%) – the participants haven't heard much about these technologies and their application on the medical field. Case studies and examples are noted as important to disseminate during this project as many online sources of information are unreliable. Many practical examples and case-studies are desired to supplement the theoretical information. The most preferred subjects for inclusion in the curriculum, according to the Romanian participants' needs were the following:

- CAD/CAM 100%
- 3D Printing 100%
- 3D Scanning 100%
- Augmented Reality 89%
- Virtual Reality 89%
- Robotics 66%
- Internet of Things (IOT) 44%
- Cloud-based Technologies 33%
- Block chain 22%
- Artificial Intelligence 22%
- Drones 11%

Concerning Learning Methods considered effective with these stakeholders these were:

1. E-learning course based on PowerPoint presentations
2. Case studies
3. Fact sheets
4. Face-to-face courses

2.4. Spain

In the case of Spain, as there are two partners from the same country (KVELOCE, INHWE) more focus groups were organized. INHWE also organized an international focus group on an EU level in addition to the local focus group that was demanded by the description of the project.

INHWE Focus Groups

The two focus groups were organized on the 17th of January 2020 (EU) via Skype and on the 24th January 2020 (Local) on Sant Cugat del Valles. The total number of participants were 12 people (6 from the local FG and 6 from the EU)

The demographic data of the EU FG were the following:

- Educator and paramedic from UK
- Educator and nurse from Ireland
- Educator and pharmacist from UK
- Pharmacists from Switzerland
- Doctor from Germany
- Physician Assistant from Germany

The demographic data from the local FG were the following:

- Educator and nurse
- Educator and occupational therapist
- Educator and specialist nurse
- Nurse
- Occupational therapist
- Student Nurse

Participants were asked to state their perceived advantages of technology in healthcare. There was a vague agreement between both groups that technology is a benefit to healthcare and a generally positive thing that will improve healthcare delivery and services. However, there was very little substantive evidence provided for this viewpoint. The majority of the discussion focused very much on how technology could benefit healthcare educators and enable them to ensure that they produced high quality, excellent healthcare professionals in the future and use CPD to 'upskill' current, working professionals. Much of the discussion in this section of the focus group often turned to the disadvantages with many examples outlined by focus group members. Four clear areas arose from the discussion, namely, there were questions asked about the adaptability and cost of technology in healthcare systems; a lack of evidenced based research or patient benefits with some technology; a fear that technology will replace healthcare professionals; and its applicability for use in educational settings.

Participants found it difficult to outline specific skills that would be beneficial to teach in a digital skills and technology curriculum however they did identify key areas that project partners should consider when designing the training materials. It was considered extremely important to highlight and link to other **core competencies and transversal skills** that are taught to healthcare professionals, such as communication, ethics and empathy. Both groups showed that there is a strong appetite for the aims and outputs being developed by the Digi4Health project. They reported these could be seen locally, in Catalunya, and in countries who are not participating in the project itself, similar thoughts prevail on the advantages, disadvantage and possible actions that must be taken to improve digital skills and knowledge. Interestingly, there seems to be little difference between higher performing healthcare systems and lower performing ones. Equally, there seems to be little difference in economically different states and systems. This would suggest that project can be successful across Europe and beyond.

Conclusions for INHWE

Participants were very interested in learning about all technologies listed with a minimum approval rating of 86%. Five technologies received 100% interest from participants while 3D Scanning and IOT received either positive feedback or 'not sure' with no participants stating they would categorically not want to receive training or case studies about these subjects.

1. CAD/CAM	100%
2. 3D Printing	100%
3. Augmented Reality	100%
4. Virtual Reality	100%
5. Block chain	100%
6. 3D Scanning	86%
7. Internet of Things (IOT)	86%
8. Artificial Intelligence	86%
9. Cloud-based Technologies	86%
10. Robotics	86%
11. Drones	86%

Preferred Learning Methods

A. Face-to-Face Course	53/77 – 68% approval
B. E-Learning Course	33/77 – 43% approval
C. Single Page Fact Sheets	13/77 – 17% approval
D. Case-Studies	24/77 – 31% approval
E. Power-Point Presentations	25/77 – 32% approval
F. Other	1/77 – 1% approval

KVELOCE Focus Group

Kveloce, organized one focus group on the 6th February 2020 at Institut Educació Secundària Pou Clar in Ontinyent, Valencia and two individual interviews were held at SENIOR EUROPA SOCIEDAD LIMITADA office in Valencia, Spain. The total number of participants was 10 persons:

- 2 Individual interviews (2 learners, L).
- 1 focus group (8 participants: 2 trainers, T, and 6 learners, L).

Demographic data ws the following:

- 8 learners (L). Female:1 odontologist, 1 optometrist (ages; 40,44); 6 VET students (ages;18,19,19,20,20,19).
- 2 trainers (T). Female: VET Educators (ages; 27,39).

When participants were asked about the preferred learning methodology, most of them chose **face to face** tuition followed by **e-learning courses**. The main reason was, that participants prefer to learn about something new in a direct way, but they also appreciated that e-learning course helped them optimize use of their time because of their busy schedules. In some cases, a **mix of educational resources** for training was chosen (face to face courses with additional PowerPoint presentation provided online). Trainers and learners stressed the great difficulty of being constantly up to date with new technologies due to the continuous changes and the lack of time of the professionals involved. Added to this, they understand that there are barriers such as technological skills, the lack of time and the high cost acquisition of the technology in healthcare systems. In general, the participants agreed on the advantages brought to patient care by the use of new technologies in the health sector such as: speed in response times, accuracy in diagnostics; and for the students, digital technologies provides a good tool help them learn.

Conclusions for KVELOCE

The participants were very interested in learning about most of the technologies highlighted. Participants knew more about Artificial Intelligence, Cloud-based Technologies, Robotics and 3D Printing, while Blockchain and Internet of Things had the lowest score on knowledgeability. Participants were very interested in learning most about 3D Printing, Robotics, Drones, AR, VR with a score of 100% while the relatively least chosen technologies were CAD/CAM, block chain, cloud-based technologies but also with high interest scores.

- 3D Printing 100%
- Robotics 100%
- Drones 100%
- Augmented Reality 100%
- Virtual Reality 100%

- 3D Scanning 80%
- Block chain 60%
- CAD/CAM 60%
- Internet of Things (IOT) 70%
- Artificial Intelligence 60%
- Cloud-based Technologies 60%

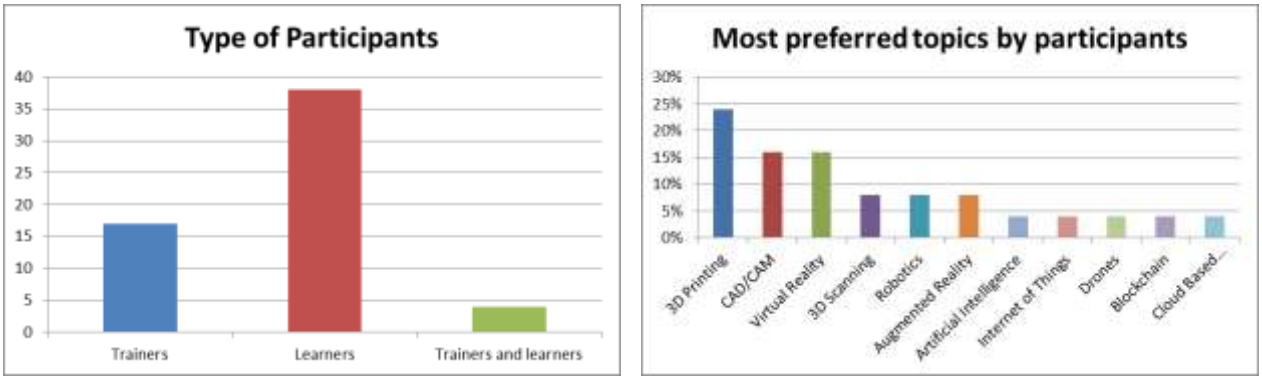
Most favourite Learning Methods (as selected by the participants):

1. Face-to-face courses
2. Case studies
3. E-learning course
4. PowerPoint presentations

For all the mentioned reasons, the participants in the FG and the individuals interviewed understood the importance of the Digi4Health project and they stated that they were looking forward to the results of the study and the project's training resources.

3.0 OVERALL FOCUS GROUP CONSULTATION RESULTS

From the data collected from the different focus groups, the following key indicators were obtained. Figure 1(a) outlines the type of stakeholders involved in the focus groups. It included a mix of either learners or trainers and also a mix of individuals that considered themselves as trainers but on some topics also as learners.



(a) (b)

Figure (1)

On the other hand, Figure 1(b) discloses that although all digital technologies were collectively of interest to the sample of individuals consulted, it was clear that some topics were of more interest than others. For instance, IOT, drones, blockchain and clouse-based technologies were of least interest to the individuals involved in these consultations.

Equipped with this established data as well as with the data concerning the use of training methods detailed in the different focus group consultations, we can now pass on to present a list of proposed topics for the DIGI4H Curriculum.

3.1 Proposed Curriculum Topics

Based on the outcomes of the focus group discussions, and the individual interviews there is the need for a curriculum model, which can be used by a range of healthcare personnel such as general practitioners, podiatrists, physiotherapists, occupational therapists and nurses. This is expected to cover a spectrum of Health 4.0 topics to allow them to understand better the technologies of HEALTH 4.0 and how they can be exploited in their daily work when dealing with patients. According to the focus groups' results (Figure 1b), the topics which received most attention and which thus are currently of more interest were 3D Printing (24% of participants), CAD/CAM (16% of participants) and Virtual Reality (16% of participants). On the other hand, the topics of *least* interest were Artificial Intelligence, Internet of Things, Drones, Blockchain and Cloud Based Technologies. Nonetheless, given developments going on in the healthcare sector, these areas are likely to make their presence more felt in the coming years and thus the Digi4Health partners are recommending that the curriculum precisely has a specific topic called *" Emerging Digital Technologies for Healthcare"*. This will encompass a number of topics which includes Artificial Intelligence, Internet of Things and Drone Technology.

Participants also expressed the need for an ***introductory module*** that will introduce them to *Industry 4.0 in Healthcare*. Interestingly, it was observed that some focus group participants brought up the need to have educational material for patients (and/or their carers); for the latter, this will allow them to learn more about the various technologies. It is therefore assumed that more knowledge will give space for more cooperation and understanding of what they will undergo in terms of treatment and/or interventions when this is explained to them by their respective healthcare professional. In summary, from the data established from the focus groups carried out by the different project partners, the **Digi4Health curriculum** will cover the following topics:

0.0 Background to Health 4.0
1.0 CADCAM Technology
2.0 3D Printing for Healthcare Applications
3.0 Robotics in Healthcare
4.0 3-D Scanning for Healthcare
5.0 Virtual & Augmented Reality in Healthcare
6.0 Emerging Digital Technologies for Healthcare

The curriculum will explicitly target VET learners and healthcare workers. All the topics will contain introductory and generic information, but also more specific details about the application of each technology in a sample of healthcare sectors.

3.2 Curriculum Delivery Methods

The focus groups' research in the partner countries, resulted in the need for the creation of a **mixed educational** curriculum delivery approach that supports face to face tuition (lectures), case studies, e-learning courses and PowerPoint presentations. Participants were more inclined to choose these resources as the most desired training and educational methods to learn (from a learners' perspective and teach (from a trainers' perspective) about the digital technologies of HEALTH 4.0. Nonetheless, taking into consideration the time constraints and busy schedules highlighted by the healthcare professionals, the options of online training resources including e-learning content and case studies in PDF formats are considered by the DIGI4H partners as most most appropriate to reach out to as many individuals in this sector across different EU Member States. Such online training resources should help these healthcare professionals to keep up dated knowledge of emerging new digital technologies in a timely and efficient manner.

Whilst the effectiveness of traditional *face-to-face learning* cannot be disputed, nonetheless, online learning comes provide a leaping advantage in terms of schedule freedom. **Educational technology** has certainly opened up a whole new type of learning. Keeping up with a strict face-to-face delivery approach might inconvenience many learners, preventing them from achieving academic improvements. Online training courses allow learners to enjoy a self-paced training schedule. They can study according to their own time, being easier to incorporate learning in their busy life, regardless of specifics or situations[1]. Full-time employees or individuals who simply do not have the necessary time to attend physical classes will not be left behind. Learning and completing courses after work, in the evening, during the weekends or when they have spare time is possible through this digital educational mode. The possibilities are multiple and anyone with an internet connection can easily access them. In this manner, the commitment of the project consortium stands out to enable effective knowledge transfer in the field of Health 4.0 by using blended teaching resources for its learners.

[1] This situation could have not been more evident than the period when this report was being generated during the COVID-19 Pandemic when educational institutions across the world were closed down

PART B: THE HEALTH 4.0 CURRICULUM

4.1 DIGI4HEALTH CURRICULUM CONCEPT

Based on the previous arguments made in ***Part A*** of this report, the digi4HEALTH partners conceptualized the following curriculum on Health4.0 to help European VET Trainers and health sector mentors transfer knowledge to learners and healthcare employees.

Curriculum Module	Module Objective	Intended Target Audience
0.0 Background to Health 4.0	The scope of this module is to introduce both VET and learners to the concept of Health 4.0. and the main areas / competences that accompany it for the professional development of the learners and the care of patients	Learners at EQF Level 5 or healthcare employees
1.0 CADCAM Technology	The scope of this module is to provide the basic information on CAD CAM technology and its applications in different healthcare sectors (e.g. dentistry, radiology, prosthetics and orthotics) and practical information such as case study descriptions and the CAD/CAM systems and their components.	Learners at EQF Level 5 or healthcare employees
2.0 3-D Printing for Healthcare Applications	The scope of this module is to provide the basic information on 3D printing and its applications in different healthcare sectors (medical education, orthopedics, dentistry, podiatry, prosthetics, general surgery, oncology, cardiology, etc.). and offer practical information as case studiy descriptions and hands-on activities	Learners at EQF Level 5 or healthcare employees
3.0 Robotics in Healthcare	The scope of this module is to provide the basic information on the use of robotics in different healthcare sectors (e.g. general surgery, microsurgery, oncology, cardiology, orthopaedics, physiotherapy, robotic service, etc. and offer examples on how robotics is used in different medical sectors for a variety of purpose and needs, demonstrates the potential of robotics in medicine and changes that have been achieved	Learners at EQF Level 5 or healthcare employees

Curriculum Module	Module Objective	Intended Target Audience
4.0 3-Scanning Technology for Healthcare applications	The scope of this module is to provide the basic information on 3D scanning in particular relation to its use for 3D printing with a focus on healthcare applications. The learner will become knowledgeable on the different techniques available and be informed on the whole reverse engineering process from converting a solid object into a mesh into a 3D Solid Mode	Learners at EQF Level 5 or healthcare employees
5.0 Virtual & Augmented Reality in Healthcare Sector	The scope of this module is to present the basic information on the use of Virtual Reality (VR) and Augmented Reality (AR) technologies in healthcare. It also provides examples on how VAR is currently used in different medical specialties. Hands-on activities supplement the theoretical background allowing VET audience to develop own applications.	Learners at EQF Level 5 or healthcare employees
6.0 Emerging Digital Technologies for Healthcare	The scope of this module is to provide the basic information on Artificial Intelligence (AI), Internet of Things (IOT) and Drones and its applications in different healthcare sectors and offer practical information as case study descriptions based on different projects.	Learners at EQF Level 5 or healthcare employees

4.2 APPROACH TO USING DIGI4H HEALTH 4.0 CURRICULUM

Digital solutions for healthcare can increase the well-being of millions of citizens and radically change the way healthcare is delivered to patients. Such emerging technologies, including 4G/5G mobile, AI, big data, drones, 3D printing and Virtual Reality are some means by which healthcare professionals will be increasingly supported in their work. As a result of these technologies, we are starting to see the impact of the 4th industrial revolution on healthcare. This digital revolution in healthcare is labeled as Health 4.0 by the Digi4Health consortium. As outlined above, this curriculum is intended to help both trainers and leaners understand the digital technologies that form core components of Health 4.0. However, it is also important to use these training resources to complement key competencies for the health workforce. Below you will find a number of points to consider when using this curriculum and some further relevant information which may be useful in translating this programme to your institutional needs.

When using the established Digi4Health Curriculum, one should remember to consider the following:

Core competencies – Digital skills are often needed to ensure that healthcare professionals' core competencies are enabled to the best of their abilities. Core competencies are a number of basic skills taught to all disciplines of the health workforce that make up a strategy for successful care coordination. The Institute of Medicine includes 5 areas which, together, make up core competencies: 1) patient-centered care, 2) teamwork and collaboration, 3) evidence-based practice, 4) quality improvement, and 5) informatics. The Digi4Health consortium suggests using this curriculum to ensure that core competencies are enhanced.

Collaborative practice – The WHO promotes collaborative practice and interprofessional education. It encourages all countries to prepare a collaborative practice-ready workforce which is a specific way of describing health workers who have received effective training in interprofessional education. Interprofessional education occurs when students from two or more professions learn together to enable effective collaboration, thus improving health outcomes. Once students understand how to work interprofessionally, they are ready to enter the workplace as a member of the collaborative practice team. This is a key step in moving health systems from fragmentation to a position of strength. This curriculum can help to encourage collaborative practice when used in an interprofessional setting.

Communication – Effective communication between health professionals and patients is crucial to the overall functioning of healthcare systems. It has a positive impact on readmission rates, understanding treatment options, adherence to treatment, following the medication schedule with consistency, cost related impacts and overall positive health outcomes for patients. However, it has been found that health communication can attract little attention, especially during medical and nursing training, while the proficiency of communication skills in health professionals can deteriorate after training. Additionally, digital skills are often a barrier to communication, with healthcare professionals focusing on technology over the patient. Communication skills should be taught alongside digital skills in a broader concept of Health 4.0.

Intercultural understanding – There are many areas of healthcare that are increasingly supported by demographic development in the field of intercultural competence. Nurses, doctors, dentists, and other healthcare professionals are all faced with major challenges of bringing intercultural competence into their professional environment. The goal of intercultural competence in healthcare is to reduce health disparities and to provide optimal care to patients regardless of their race, ethnic background, native languages spoken, and religious or cultural beliefs. Cultural competence training is important in healthcare fields where human interaction is

common, including medicine, nursing, allied health, mental health, social work, pharmacy, oral health, and public health fields, especially since the refugee crisis in Europe.

Ethical and humanistic understanding – Healthcare has undergone dramatic changes in recent years with advancement in Health 4.0 and the strive to attain high quality patient care in a climate of increasing healthcare costs. Numerous countries have had some negative reports on their health system such as Mid Staffordshire report (United Kingdom) and Leas Cross (Ireland). There is evidence to suggest that these changes have led to the dehumanization of the patient. Unfortunately, some organizational measures implemented to improve standards of care and improve patient safety have had the opposite effect resulting in unfulfilled expectations and complaints from patients. The need to rehumanize healthcare is echoed in many countries and the attempt to deliver person-centered care is paramount. Digital technologies can improve patient care if they are used to enhance the understanding of the health workforce with regards to ethics and humanism.

4.3 DETAILED CURRICULUM STRUCTURE

4.3.1. Background to Health 4.0

Title of Module	**0.0 Background to Health 4.0**
Duration of module	10 h, 40 slides
Level	EQF level 5
Keywords	Health 4.0, core competencies, IPE, soft skills
Proposed training method	Either online or Face-to-Face using training material, Case-Studies and Fact sheets
Assessment / evaluation method	Face-to-Face (via a practical exercise/demo) or through online self-assessment quiz
Module description	Digital solutions for healthcare can increase the well-being of millions of citizens and radically change the way healthcare is delivered to patients. Such emerging technologies, including 4G/5G mobile, AI, big data, drones, 3D printing and virtual reality are some means by which healthcare professionals will be increasingly supported in their work. As a result of these technologies, we are starting to see the impact of the 4th industrial revolution on healthcare. This digital revolution in healthcare is labeled as Health 4.0 by the Digi4Health consortium. This module will help trainers and leaners understand Health 4.0. while also give an understanding of how to use these training resources to complement key competencies for the health workforce. Below you will find a number of topics which will be included in this module.
General Background/Topics	This module will give a general overview of Health 4.0 and cover the following topics: - Introduction to Core competencies: (1) patient-centered care, (2) teamwork and collaboration, (3) evidence-based practice, (4) quality improvement, and (5) informatics - Collaborative practice in education and practice as an innovative strategy in healthcare force - The importance of effective Communication between health professionals and patients - Intercultural understanding: bringing intercultural competence into their professional environment - Ethical and humanistic understanding in healthcare
Competences	0.1. Background knowledge of Health 4.0 0.2. Background knowledge of digital skills in healthcare 0.3. Health 4.0 and its relationship with core competencies 0.4. Health 4.0 and its relationship with collaborative practice 0.5. Health 4.0 and its relationship with communication 0.6. Health 4.0 and its relationship with intercultural understanding 0.7. Health 4.0 and its relationship with ethics and humanism
VET audience	VET Learners 0.1 - 0.7 VET Educators 0.1 -0.7

4.3.2. CADCAM Technology in Healthcare

Title of Module	**1.0 CADCAM Technology in Healthcare**
Duration of module	10 h, 40 slides
Level	EQF level 5
Keywords	CAD CAM Technology, Dentistry, Prosthetics, Software, Hardware
Proposed training method	Either Online or Face-to-Face using training material, Case-Studies and Fact sheets
Assessment / evaluation method	Face-to-Face (via a practical exercise/demo) or through online self-assessment quiz
Module description	The course provides the basic information on CAD CAM technology and its applications in a range of healthcare sectors (e.g. dentistry, radiology and prosthetics and orthotics). It will also provide practical information such as case studies descriptions and information on typical CAD/CAM systems and components.
General Background/Topics	- Introduction to CAD/ CAM Technology: concepts, advantages, special considerations for medicine, when to choose CAD/CAM, expected costs. Examples of software and hardware of CAD/CAM Technology, four best practices for software testing - Typical CAD/ CAM Technology applications: CAD/CAM surgical guide, Customizing Implants With 3D Image Processing, Restorative Material Options for CAD/CAM Restorations - Case Studies of CAD /CAM Technology in Dentistry, Radiology, Prosthetics and Orthotics etc. - CAD/CAM technology and how it is included in the dental education
3 Proposed Health Sector Application Areas	- Sector 1: CAD/CAM Technology in Dentistry - Sector 2: CAD/CAM Technology in Radiology - Sector 3: CAD/CAM Technology in Prosthetics and Orthotics
Competences	1.1. Understand the potentials of CAD/CAM Technology for medical applications, its advantages and disadvantages regarding both the practitioner and the patient 1.2. Know the basics of CAD/ CAM Technology hardware, software and materials 1.3. Understand the medical procedures which depend on CAD/CAM technology 1.4. Know different categories of CAD/ CAM Technology applications in healthcare 1.5. Identify the different operating components of computer-aided design and computer-aided manufacturing (CAD/CAM) systems 1.6. Know different health sector education curricula and how they use CAD/CAM technology
VET audience	VET trainers: 1.1 - 1.6 VET learners: 1.1 - 1.5

4.3.3. 3-D Printing for Healthcare Applications

Title of Module	**2.0 3-D Printing for Healthcare Applications**
Duration of module	10h, 50 slides
Level	EQF 5
Keywords	3D printing, medical applications, visualization, devices, surgical aids
Proposed training method	Either Online or Face-to-Face using training material, Case-Studies and Fact sheets
Assessment / evaluation method	Face-to-Face (via a practical exercise/demo) or through online self-assessment quiz
Module description	The course provides the basic information on 3D printing and its applications in different healthcare sectors (medical education, orthopedics, dentistry, podiatry, prosthetics, general surgery, oncology, cardiology, etc.). It also offers practical information as case studies descriptions and hands-on activities for enhancing the value of the training material.
General Background/Topics	- Introduction to 3D Printing technology: concept, advantages in medicine, materials, 3D printers, data flow, software – basic level - Typical 3D Printing applications: devices for preoperative planning (medical replicas), devices to aid surgery (personalized surgical guides), therapeutic devices (implants, prosthetics) - Case studies in orthopedics, medical education, cardiology, podiatry, prosthetic, etc. - Hands-on activity: building a 3D replica of …. starting from computer tomography data
3 Proposed Health Sector Application Areas	- Sector 1: 3D printing in Orthopedics, - Sector 2: 3D printing in Prosthetics, - Sector 3: 3D printing in Medical education
Competences	2.1. Understand 3D Printing concept suitability for medical applications 2.2. Know the basics of 3D Printing hardware, software and materials 2.3. Understand how 3D Printing technology can be used for personalized medicine 2.4. Know different categories of 3D Printing applications in healthcare 2.5. Understand the working flow for generating a medical model using 3D Printing 2.6. Know different software for medical modeling as input in 3D Printing
VET audience	VET trainers: 2.1-2.6 VET learners: 2.1-2.4

4.3.4. Robotics in Healthcare

Title of Module	**3.0 Robotics in Healthcare**
Duration of module	10h, 40 slides
Level	EQF 5
Keywords	Robotics, minimally invasive surgery, Senchance robotic system, oncology, radiation therapy, robotic service, non-invasive robots
Proposed training method	Either Online or Face-to-Face using training material, Case-Studies and Fact sheets
Assessment / evaluation method	VET Trainers: Face-to-Face (via a practical exercise/demo) Or VET Learners: Online Self-Assessment Quiz
Module description	The course provides the basic information on the use of robotics and its applications in different healthcare sectors (general surgery, microsurgery, oncology, cardiology, orthopedics, physiotherapy, robotic service, etc.). It also provides examples on how robotics is currently used in different medical specialties for variety of purpose and needs, demonstrates the potential of robotics in medicine and changes that have been achieved, offers practical information as case studies descriptions for enhancing the value of the training material.
General Background/Topics	- Introduction to Robotics in Healthcare: concept, main advantages and disadvantages in medicine, robotics suitability for medical applications - Difference between traditional medicine methods and robotics in healthcare - Typical Robotics applications. - Case studies in surgery, oncology, robotic service to assist individuals with limited or no mobility (for disable people, for patients after traumas, surgeries), etc.
3 Proposed Health Sector Application Areas	- Sector 1 : Robotics in Surgery - Sector 2 : Robotics in Oncology - Sector 3 : Robotic Service
Competences	3.1. Understand Robotics concept suitability for medical applications 3.2. Know the basics of Robotics in different healthcare sectors 3.3. Understand how Robotics can be used for personalized medicine 3.4. Know different examples of Robotic applications in healthcare 3.5. Understand how to develop a basic Robotics application 3.6. Understand interdisciplinary learning environment based on the use of robots and electronic components
VET audience	VET trainers: 3.1-3.6 VET learners: 3.1-3.5

4.3.5. 3-D Scanning in Healthcare

Title of Module	**4.0 3-D Scanning in Healthcare**
Duration of module	10h, 40 slides
Level	EQF 5
Keywords	Reverse Engineering, 3D scanning, Scanners, Data Conversion
Proposed training method	Either Online or Face-to-Face using training material, Case-Studies and Fact sheets
Assessment / evaluation method	VET Trainers: Face-to-Face (via a practical exercise/demo) Or VET Learners: Online Self-Assessment Quiz
Module description	The course provides the basic information on 3D scanning in particular relation to its use for 3D printing with a focus on healthcare applications. The learner will become knowledgeable on the different techniques available and be informed on the whole reverse engineering process from converting a solid object into a mesh into a 3D Solid Model.
General Background/Topics	- Difference between Traditional Modelling and Computer Aided Reverse Engineering - 3D Scanning – Techniques, Modes (planar, rotary etc, Scanner Types (hand held, fixed etc) - Object Specifications for 3D Scanning (e.g. black vs white, matte vs shiny) - 3D Scanning software and Apps - Pre-Scanning Settings (resolution…) - Post Processing Data Files & Conversion from mesh to solid CAD Model - Applications of 3D scanning for 3D Printing in Healthcare - 3D Scanning vs Modelling from MRI/CT Scans
3 Proposed Health Sector Application Areas	- Sector 1: 3D Scanning in Dentistry - Sector 2: 3D Scanning for Prostethics/Bionics in Physiotheraphy/ Occupational Therapy/Podiatry - Sector 3: Reverse Engineering for Plastic Surgery
Competences	4.1. Understand 3D Scanning concept 4.2. Get to know the basics of different 3D scanning techniques, types, materials, related software and apps etc.. 4.3 Understand the process of 3D scanning from object to mesh to solid 3D model 4.4. Understand how 3D scanning can be used in healthcare applications 4.5 Run through a demo- example from start to finish
VET audience	VET Trainer: 4.1- 4.5 VET Learner: 4.1- 4.4

4.3.6. Virtual and Augmented Reality in Healthcare Sector

Title of Module	**5.0 Virtual and Augmented Reality in healthcare industry**
Duration of module	10h, 40 slides
Level	EQF 5
Keywords	Virtual Reality, Augmented Reality, medical education, anatomical visualization
Proposed training method	Either Online or Face-to-Face using training material, Case-Studies and Fact sheets
Assessment / evaluation method	VET Trainers: Face-to-Face (via a practical exercise/demo) Or VET Learners: Online Self-Assessment Quiz
Module description	The course presents the basic information on the use of Virtual Reality (VR) and Augmented Reality (AR) technologies in healthcare. It also provides examples on how VAR is currently used in different medical specialties. Hands-on activities supplement the theoretical background allowing VET audience to develop own applications.
General Background /Topics	- Introduction to VAR technology: concepts, suitability for medicine, hardware and software - Typical applications of VR and AR in healthcare: education, communication, surgery preplanning - Hands-on activity: developing a VR application for orthopedics education, developing an AR application for anatomical visualization
3 Proposed Health Sector Application Areas	- Case study in Orthopedics, - Case study in Cardiology, - Case study in Medical education
Competences	5.1. Understand VR concept in the context of medical domain 5.2. Understand AR concept in the context of medical domain 5.3. Understand the basics of VR and AR technologies 5.4. Know different examples of VR and AR applications in healthcare 5.5. Understand the working flow for generating personalized input data for VR and AR 5.6. Understand how to develop a basic VR application 5.7. Understand how to develop a basic AR application
VET audience	VET trainers: 5.1-5.7 VET learners : 5.1-5.4

4.3.7. Emerging Digital Technologies for Healthcare

Title of Module	**6.0 Emerging Digital Technologies for Healthcare**
Duration of module	10h, 40 slides
Level	EQF 5
Keywords	AI, IOT, Drones
Proposed training method	Either Online or Face-to-Face using training material, Case-Studies and Fact sheets
Assessment / evaluation method	VET Trainers: Face-to-Face (via a practical exercise/demo) Or VET Learners: Online Self-Assessment Quiz
Module description	The module will provide the basic information on the emerging digital technologies of Artificial Intelligence (AI), Internet of Things (IOT) and Drones and how these are being increasingly applied in a range of healthcare sectors. It will provide where relevant, practical information such as case study descriptions based on different techhnologies.
General Background /Topics	- Introduction to AI, IOT, Drone technologies for healthcare: concepts, suitability for medicine, hardware and software - Typical applications of AI, IOT and Drones in healthcare: education, prevention, diagnostic, disease treatment, images. - Case studies in (sepsis patients, breast cancer and fetal image)
3 Proposed Health Sector Application Areas	- Sector 1: Emerging Digital Technologies for Intensive medicine - Sector 2: Emerging Digital Technologies for Oncology - Sector 3: Emerging Digital Technologies for Gynecology
Competences	6.1. Understand AI concept in the context of medical domain 6.2. Understand IOT concept in the context of medical domain 6.3. Understand Drones concept in the context of medical domain 6.4. Understand the basics of AI, IOT and Drones technologies 6.5. Typical AI, IOT, Drones applications in healthcare: 6.6. Aware of different cases where AI, IOT and Drones are applied in the health sector.
VET audience	VET trainers: 6.1– 6.6 VET learners: 6.1 – 6.4

5.0 OVERALL REPORT CONCLUSIONS

This Digi4Health curriculum proposed in this report outlines a number of topics that VET trainers and learners, healthcare providers and patients may follow, to catch up with the Health 4.0. developments. The choice of topics included is as previously described based on focus group consultations that took place in the partner countries.

The curriculum starts with an introductory module (0.0 Background to Health 4.0) while on the other hand modules 1.0 – 4.0 are primarily intended for introducing both VET trainers and learners the six main topics:

0.0 Background to Health 4.0
1.0 CADCAM Technology
2.0 3D Printing for Healthcare Applications
3.0 Robotics in Healthcare
4.0 3-D Scanning for Healthcare
5.0 Virtual & Augmented Reality in Healthcare
6.0 Emerging Digital Technologies for Healthcare

Each module is divided into subtopics that will be presented as detailed information in the courseware to be developed. Each module will have relevant content as well as relevant links to external content (e.g.YouTube videos and case studies) which will be added to supplement the power point slides. The final aim is to create a variety of blended learning materials to educate and teach VET learners and VET trainers, healthcare personnel, patients and their caregivers. This will be achieved by exploiting technology to reach them and have them coming back for more to stay abreast of new developments.

Although this output is finalized, it may eventually need to be fine-tuned to match the content as actually developed in later modules and outputs of the project's deliverables, or, to meet imminent needs in Health 4.0 due to significant emerging advancements.

Partnership

Iklin, Malta

Bucharest, Romania

Barcelona, Spain

Kaunas, Lithuania

Larisa, Greece

Valencia, Spain

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Appendix 1: Focus Group Questions

Questions

Industry 4.0 Digital Technologies used and required in their working context (within health sector)

1. **Are you a trainer/learner? Please circle**
   L – Health Sector Professionals are considered as Learners
   T – VET Educators are considered as Trainers

2.

Type of Digital Technology	Knowledgeability (Choose 1 – Very Knowledgeable; or 3 – Knowledgeable; or 5 – Not knowledgeable)	Are you aware of case-studies of such technologies in the health sector? (Choose Y – Yes or N – No NS – Not sure)	Would you be willing to learn and see case-studies? (Choose Y – Yes or N – No NS – Not sure)	Which resource(s) would you prefer to facilitate your learning[L] or training[T]? (Choose A – face-to-face course; or B – e-learning course; or C) Single page fact sheets; or D) Case-studies; or E) Power-point presentations; or F) Other	Other Comments
CAD/CAM (Computer Aided Design & Computer Aided Manufacturing – integrated software systems allowing a 3D Drawing to be converted numerically to be able to be manufactured using integrated systems)					
3D Printing (Process of building 3D prototypes from a CAD model using additive manufacturing where the part is built layer on					

top of the other)					
3D Scanning (scanning a physical product to convert it into a digital design so as to be able to reverse engineer the product)					
Augmented Reality (interactive experience of a real-world environment where the objects are enhanced by computer-generated perceptual information e.g. using a smartphone)					
Virtual Reality s(is a simulated experience that can be completely different from the real world e.g. using a headset)					
Internet of Things (IOT) **(**system of interrelated computing devices that allows to transfer data over a network without requiring human-to-human or human-to-computer interaction)					
Block chain (where records e.g. patient data is linked using cryptography for safety)					
Artificial Intelligence (computer programming language allowing systems to be intelligent to be able to take decisions and learn without					

requiring human intervention)					
Cloud-based Technologies (hosting a software platform from a remote location that can be freely accessed and used anywhere via Internet/satellite access)					
Robotics **(robots** and computer systems for control, sensory feedback, and information processing to replicate human actions)					
Drones (unmanned aerial vehicle having a ground-based control)					
Others – specify					

3. **Which are the advantages, benefits these digital technologies could offer to trainers/learners? Please elaborate the response on these elements and provide examples**

4. **Which are the disadvantages, barriers or limitations these technologies could offer to trainers/learners? Please elaborate the response on these elements and provide examples**

5. **Which specific capacities related with digital technologies should be introduced in the curriculum and encouraged to train for learners? Why?**

6. **How can learners be prepared for the rapid and continuous evolution of the new digital technologies in the field of health?**

It will be important to thank all participants and, as already referred in the previous sections conclude with a brief summary of the conclusions and elements elaborated during the focus groups.

Appendix 2: National Focus Group Malta

A. Date/place/time that the focus group took place and number of participants

Country:	Malta
Date:	22.01.2020 (focus group. 7 participants), 9.01.2020 (interview) 23.01.2020 (2 interviews)
Place:	MECB office in Mosta, Malta; the other 3 participants were met individually and interviewed.
Number of participants:	10.
Demographic data:	3 trainers (T), 3 learners (L) and 4 both trainers and learners (T and L) as per Figure 1A. 50% of the participants were male, and the other 50% were female as per Figure 1B.

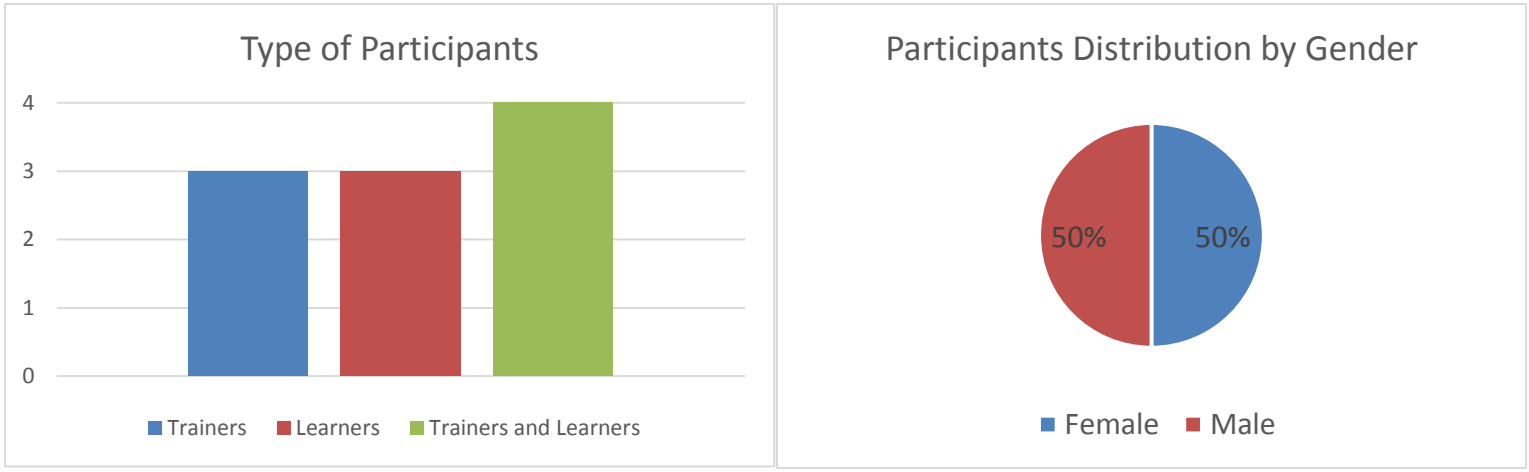


Figure 2a: (left) Participant Type and 2b (right) by Gender

B. Short description of recruitment process

Briefly describe how the participants were selected. Were there any challenges in organizing the focus group?

Primarily our efforts were focused on involving as many different healthcare professionals as possible. Recruitment through the Faculty of Health Sciences in Malta, personal networks and personal contacts enabled us to get in touch with a total of 10. All participants were asked to register directly online. Seven were able to attend to a focus group meeting, hence 70% of those recruited. The remaining three, were individually interviewed as their busy schedules and work commitments constrained their participation to the focus group on the selected date.

The professions were as follows: two medical doctors, one being a general practitioner (one of whom lectures at the Faculty of Medicine in Malta and the other at Barts Medical School), , a VET nursing trainer (teaching at the Institute for Applied Sciences of the Malta College of Arts, Science & Technology) , an occupational therapist, a speech language pathologist, a radiographer, and a nurse (the latter four being trainers at the Faculty of Health Science) a podiatrist, a midwife and another nurse.

C. Questions asked during discussions

Pre-defined questions:

1. **Are you a trainer/learner? Please circle**
   L – Health Sector Professionals are considered as Learners
   T – VET Educators are considered as Trainers
   3 participants were trainers, 3 participants were learners, while 4 participants were both trainers and learners.

2. The table below was filled in by gathering all answers of the participants.

Type of Digital Technology	Knowledgeability (Choose 1 – Very Knowledgeable; or 3 – Knowledgeable; or 4 – minimal knowledge; or 5 – Not knowledgeable)	Are you aware of case-studies of such technologies in the health sector? (Choose Y – Yes or N – No)	Would you be willing to learn and see case-studies? (Choose Y – Yes or N – No NS – Not sure)	Which resource(s) would you prefer to facilitate your learning^{L} or training^{T}? (Choose A – face-to-face course; or B – e-learning course; or C) Single page fact sheets; or D) Case-studies; or E) Power-point presentations; or F) Other	Other Comments
CAD/CAM	3 – 1L 4 – 2T, 2 (L and T) 5 – 2L + 1T + 2 (L and T)	Y – 2T, 2L N – 4(L and T) + 1T +1L	Y – 9 NS – 1	Of the 10 participants, just one chose only 1 resource this being B. The other 9 participants chose a combination of resources for training or learning. 6 – A 6 – B 3 – C 4 – D E – 1 F – 1 (hands on) Most desired resources are face to face courses and e-learning courses.	Using such a technology to develop a wrist band for children with cerebral palsy
3D Printing	3 – 2T + 3L + 1 (L and T) 4 1T + 1(L and T) 5 – 2(L and T)	Yes – 7 No – 3	Y – 8 NS – 2	Of the 10 participants, 3 chose D, A or B alone. The other 7 participants chose a combination of resources for training or learning. 6 – A 4 – B 3 – C 3 – D 2 – E Most desired resource are face to face courses and e-learning courses.	One participant using such a technology to develop a wrist band for children with cerebral palsy Another participant thinks that this technology is good in polypharmacy pills to manufacture plastic pills of the same shape and colour as patient's pills

3D Scanning	3 – 1T + 3L 4 – 1(L and T) 5 – 2T + 3(L and T)	Yes – 1 No – 9	Y – 6 NS – 3 N – 1	Of the 10 participants, 7 chose, A, B, C or D alone. Another 2 participants chose a combination of resources for training or learning. 1 participant gave no reply (therefore only 9 participants responded to this question). 3 - A 4 – B 2 – C 2 – D 1 – E Most desired resource is e-learning; second popular is face to face learning	
Augmented Reality	1 – 1L 3 – 1T, 2 L and T 4 – 2 L and T, 1 T 5 – 2L and 1 T	Yes – 4 No – 6	Y – 8 NS – 2	Of the 10 participants 2 chose A or D alone. The others all chose a combination of technologies. 5 – A 4 – B 2 – C 4 – D 4 – E 1 – F (hands on) Most desired resource is face to face learning; second commonest - e-learning, case studies and power point presentations.	One participant using such a technology to develop a wrist band for children with cerebral palsy Another participant stated that this technology can be used for the following in medicine: i) ear syringing ii) nebulized treatment iii) giving vaccines/injections iv) suturing v) catherization vi) gastronasal tube vii) blood letting to preview such experiences
Virtual Reality	1 – L 3 – 1T + 2 L and T 4 – 1T + 2 L and T 5 – 3T	Yes – 3 No - 7	Yes – 9 NS – 1	Of the 10 participants 3 chose just A or B or D. The others all chose a combination of technologies. 5 – A 6 – B 3 – C 5 – D 4 – E 1 – F (not specified) Most desired resource is e-learning; second commonest – face to face and case studies.	One participant stated that this technology can be used for the following in medicine: i) ear syringing ii) nebulized treatment iii) giving vaccines/INJECTIONS iv) suturing v) catherization vi) gastronasal tube vii) blood letting to preview such experiences

Internet of Things (IOT)	1 – L 3 – 1 L and T 4 – 1T + 1 L and T 5 – 2T + 2 L + 2 L and T	Yes – 1 No – 9	Y – 7 N – 1 NS – 2	One participant didn't respond therefore only 9 response were recorded. Two participants chose only B or only C. The others chose a combination of resources. 4 – A 4 – B 4 – C 4 – D 3 – E E-learning and face to face courses, fact sheets and case studies were equally popular.	
Block chain	3 – 1L + 2 L and T 4 – 1 L and T 5 – 3T + 2 L + 1 L and T	Yes – 1 No – 9	Y – 8 N – 1 NS – 1	One participant didn't respond therefore only 9 response were recorded. Four participants only chose one resource being B or C or D. The others chose a combination of resources. 4 – A 6 – B 4 – C 2 – D 1 – E 1 – F (not specified) E-learning was the most popular. Second popular choices were face to face courses and fact sheets.	One participant thinks that this is useful for electronic patient medical records Another participant would be particularly interested in the risks involved
Artificial Intelligence	3 – 2T + 3L + 2 L and T 4 – 1 T +2 L and T	Yes – 7 No – 3	Y – 8 N – 1 NS - 1	Two participants only chose one resource being A or B. The others chose a combination of resources. 7 – A 6 – B 3 – C 5 – D 1 – E	One participant using AI during her work on a project with a computer scientist developing a handwriting app for biofeedback Another participant suggests AI for: i) clinical system support systems ii) the annotation of generic datasets and interpretation ii) Implantable medical devices e.g. an artificial pancreas

Cloud-based Technologies	1 – 1L 3 – 3T + 1L + 3(L and T) 5 – 1L + 1(L and T)	Yes - 7 No – 3	Y – 8 NS – 2	Two participants only chose one resource being A or B. The others chose a combination of resources. 5 – A 6 – B 3 – C 2 – D 2 – E 1 – F (not specified) Most preferred is e-learning; second choice is face to face tuition.	One participant thinks that this is useful for electronic patients medical records A Participant commented that imagery e.g patient/carer taking a photo of a rash to be used when doctors are called in for house visits and communicated via cloud means (e.g. via whatsapp) cuts down on waiting time, and, can manage diagnosis for the patient and students in a shorter time
Robotics	1 – L and T 3 – 1T + 2 L and T + 2L 4 – 1T 5 – 1T + 1 L	Yes - 8 No – 2	Y – 9 NS – 1	Three participants only chose one resource being A or B or D. One participant gave no response, therefore only 9 replied. The others chose a combination of resources. 8 – A 4 – B 3 – C 3 – D 2 – E 1 – F (not specified) Most preferred face to face tuition followed by is e-learning as second choice.	One Participant explained that Simulators would be useful for physical disability. Another Participant commented that they would be useful for: Surgical simulators Another Participant mentioned that Simulators are useful for teaching students and patients Another Participant showed interest in its applications for e-patients
Drones	1 – 2 L 3 – 1T + 3 L and T + 1L 4 – 1L + 1 L and T 5 – 1T	Yes - 6 No – 4	Y – 4 N – 3 NS - 3	Three participants only chose one resource being A or E. Two participant gave no response, therefore only 8 replied. The others chose a combination of resources. 4 – A 3 – B 3 – C 3 – D 2 – E	Blood courier services between health centres and hospitals to prevent haemolysis
Others – specify					

7. Which are the advantages, benefits these digital technologies could offer to trainers/learners? Please elaborate the response on these elements and provide examples

- Digital technologies are ok to assist professionals/trainers but not to fully replace them i.e. Human based digitisation or non-fully automated digitisation is ok
- They could be used in schools where trainers/occupational therapists (OT) teach teachers. It is also good as an introductory course for undergraduate students (suggested as 4ECTSs). Specifically for the profession of occupational therapy, it would be good for 3rd years to be exposed to digital technologies as part of the Module on 'Skills and Media' or for 4th years as part of the Practical Skills Lab.
- For learners, such a way of studying is cost-effective and rapid. They can by-pass steep learning curves e.g. in diagnostics.
- For learners, increased efficiency, easier explanation (hence more tangible) and better understanding.
- Benefits of digital technologies are mostly educational for both students and patients.
- Digital technologies give more flexibility and hence increase student interest.

8. Which are the disadvantages, barriers or limitations these technologies could offer to trainers/learners? Please elaborate the response on these elements and provide examples

- There might be the risk of de-skilling if trainers & learners rely too much on technology/robots/AI; such technologies could take over too much for the future generation. In actual fact, there is no replacement for face-to-face interaction and the role of the professional/clinician is still very important for the emotional aspect of the patient
- High costs to purchase/implement technologies; expenses got divert resources away from basic needs leading to inequality in healthcare which is unethical.
- The curriculum is already very overloaded.
- Time consuming
- Complex for trainers who are not used to using new technologies
- These technologies carry the risk of de-humanising healthcare delivery, and leading medical professionals to rely heavily on AI and data driven decisions that might not always be in the patient's best interests.
- Issue of responsibility – who will be held responsible? In cases where errors in diagnosis or prescription or clinical decision making if these decisions are based on AI?

9. **Which specific capacities related with digital technologies should be introduced in the curriculum and encouraged to train for learners? Why?**
    - The OT department has a Lab were splints are designed and manually produced for hand therapy so CADCAM/3D printing/3D Scanning could be useful. Similarly, seats are designed and manually produced for conditions such as scoliosis. Producing modular splints/seats that could be modified as the patient grows/disability deteriorates would be useful.
    - Artificial Intelligence would be useful for Radiographers and Geneticists who require data analysis;
    - Robotics would be useful in nursing, for GPs and podiatrists to explain more easily to both learners, patients and their carers;
    - Cloud based systems – would be useful for GPs and podiatrists to manage patient records;
    - Virtual and augmented reality – could be useful for pain management particularly in paediatric care so mainly useful for nursing.

10. **How can learners be prepared for the rapid and continuous evolution of the new digital technologies in the field of health?**
    - By being exposed to such technologies. This is applicable not only to learners but also to practitioners. In the OT field knowledge is limited re: digital technologies although the opportunities are endless given that it relates to design of medical devices/apps to support patients.
    - Through Continuous Professional Development (CPD) courses and/or lectures.

Other questions that you asked during discussions:
Please fill in other questions you ask, if any, during discussions.

D. Answers to the questions

Give summarized responses.

- *Where necessary quote responses that show a different minority opinion or highlight an interesting idea.*
- *Quote the most repeated but also meaningful responses and write a short summary of the discussion made for each of the questions mentioned at point 3*

- Digital technologies are useful to support trainers and practitioners but they shouldn't be used to replace humans and their skills;

- For young learners (e.g. undergraduate students) e-learning tools would be best given their ease of understanding technology whereas for older learners and practitioners face-to-face short CPD courses would be a better option for learning. In the case of professionals that are very busy, online content would be a better option;

- Images and videos would be very useful for e-learning content. A picture is worth a thousand words.

i) Question on knowledge related to a particular Technology:

Our data showed that the level of knowledge amongst the professionals in respect of the technologies they were asked about varied and ranged from no knowledge (5) to 4 (minimal knowledge) to 3 (knowledgeable) and 1 (very knowledgeable). The graph below (Figure 2) shows this information: clearly at least 50% or more have no knowledge of CAD/CAM, 3D scanning, IOT and blockchain. On the other hand, all have heard about artificial intelligence. 90% of the participants know about drones, whereas 80% know about 3D printing, robotics and cloud-based technologies.

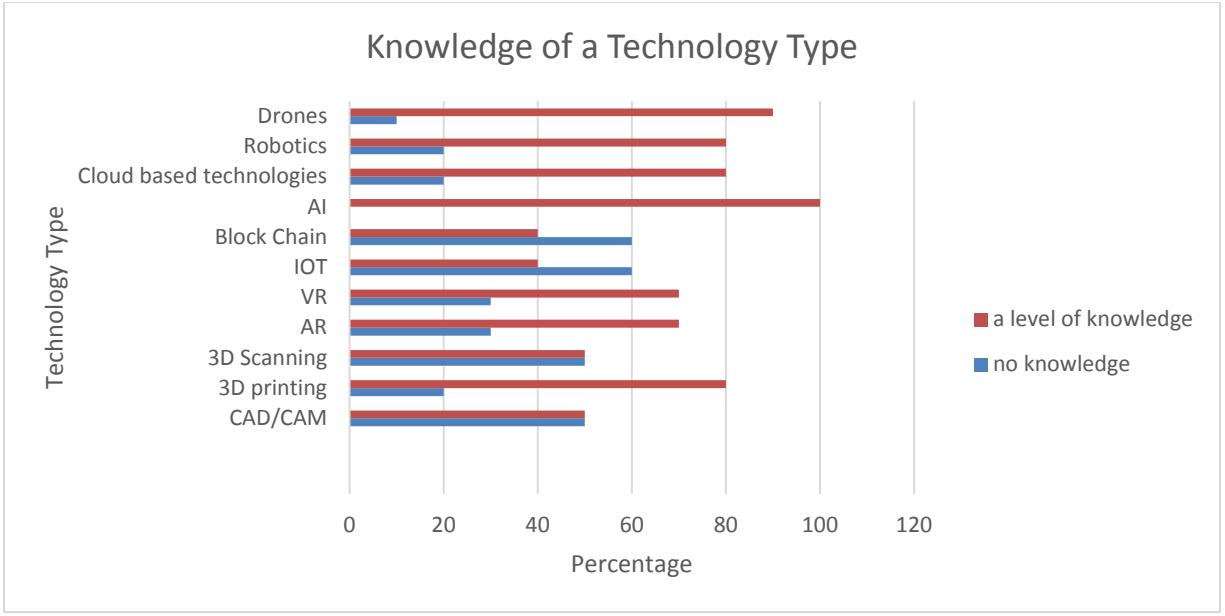


Figure 3: Participant Knowledge of Digital Technologies

Note: Legend reading 'a level of knowledge' means that the respondents had little knowledge of the technology, were knowledgeable or were very knowledgeable.

ii) Question on case study awareness related to technology applications

What was further interesting is the awareness and familiarity which the participants have with technology related case studies as shown in Figure 3. The field of robotics stood out with 80% of them having come across such case studies. Artificial intelligence, 3D printing and cloud based technology case studies followed at 70%. 60% have read about a case study/studies involving the use of drones. The other technologies stood at 40% or less.

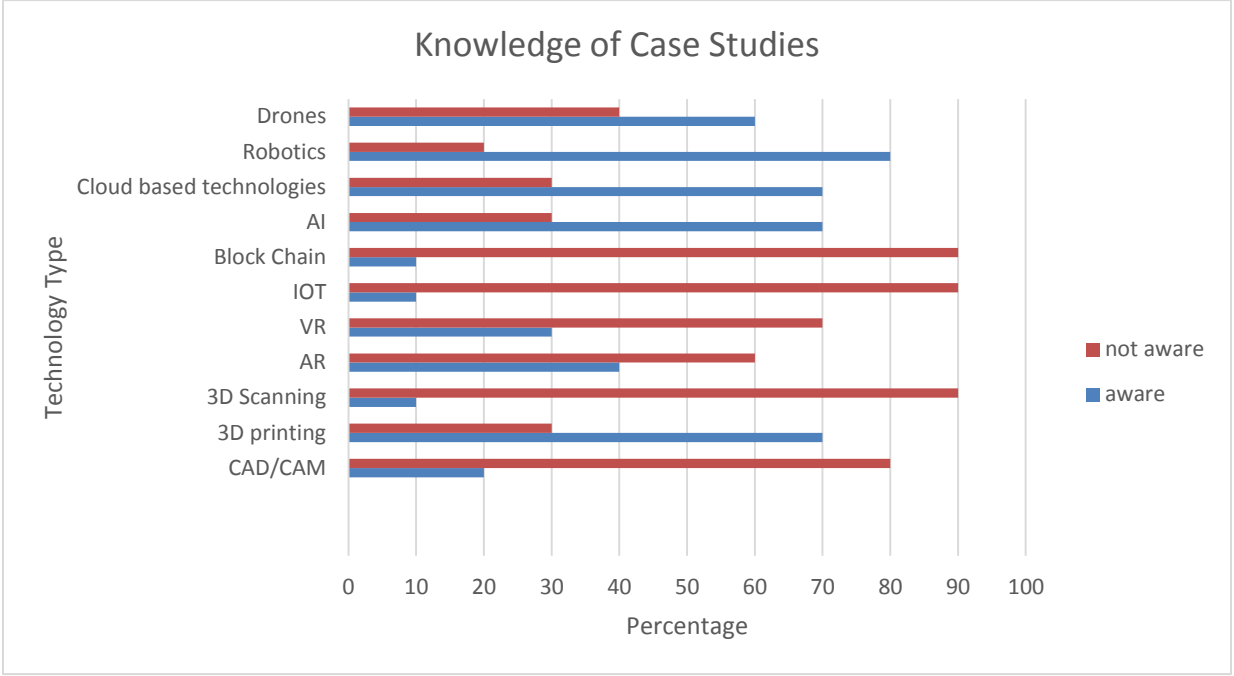


Figure 4: Participant Awareness of Case-Studies in the Health Sector for different Digital Technologies

iii) Question on willingness to learn and/or case studies about the use or application of certain technologies

Figure 4 hereunder illustrates the willingness amongst these healthcare professionals to learn and see case studies of technologies which have healthcare applications. Gaining knowledge through case studies, for all the technologies, featured between 40% (drones) to 90% (virtual reality); case studies are a good means of passing information to learners and trainers. Nonetheless, some degree of uncertainty was evidenced for each of the technologies as seen hereunder, whereas with 3D scanning, IOT, Block Chain, AI and drones, a NO was recorded for at least 1 participant (10%).

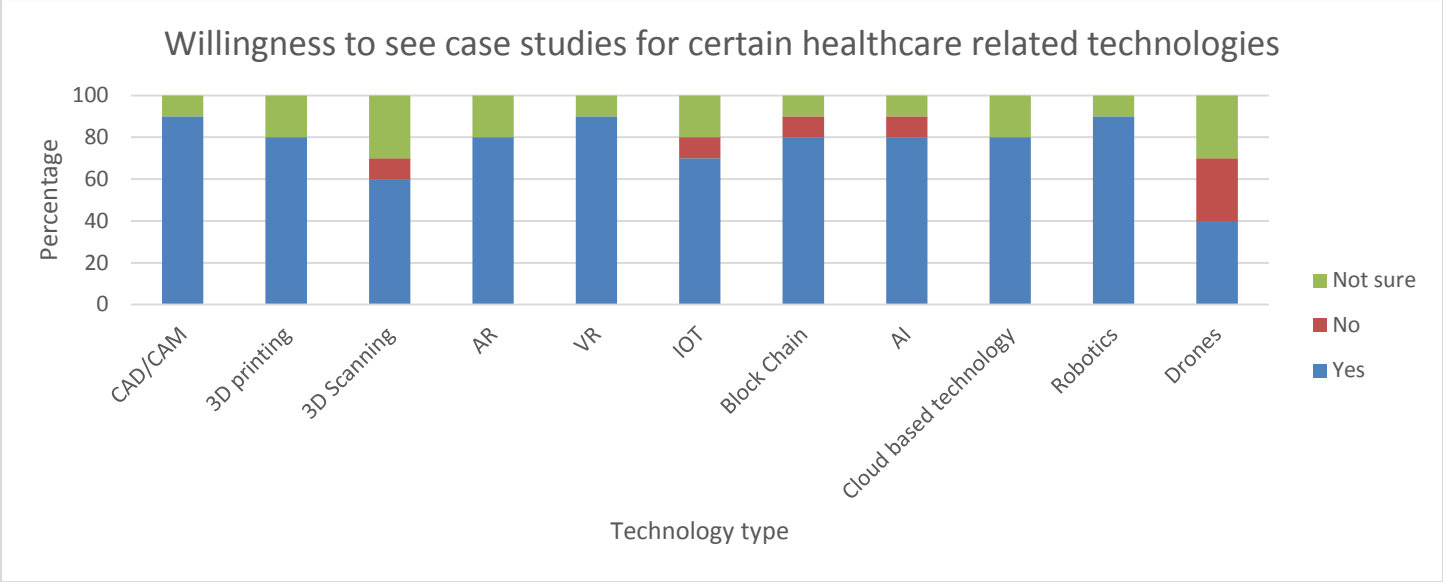


Figure 5: Participants Willingness to Learn Digital Technologies

iv) Question on the kind of resources they prefer to facilitate their learning and/or training

In most responses, the trainers, learners or both prefer multiple means of resources or options to further their studies or career paths for the different technologies – this is explained in Figure 5. The data shown in Figure 6 goes on to show that the most preferred path for further learning is face to face tuition, closely followed by e-learning and then case studies. For the latter, this consolidates the responses obtained in question iii) above where the willingness to learn more and view case studies was explained.

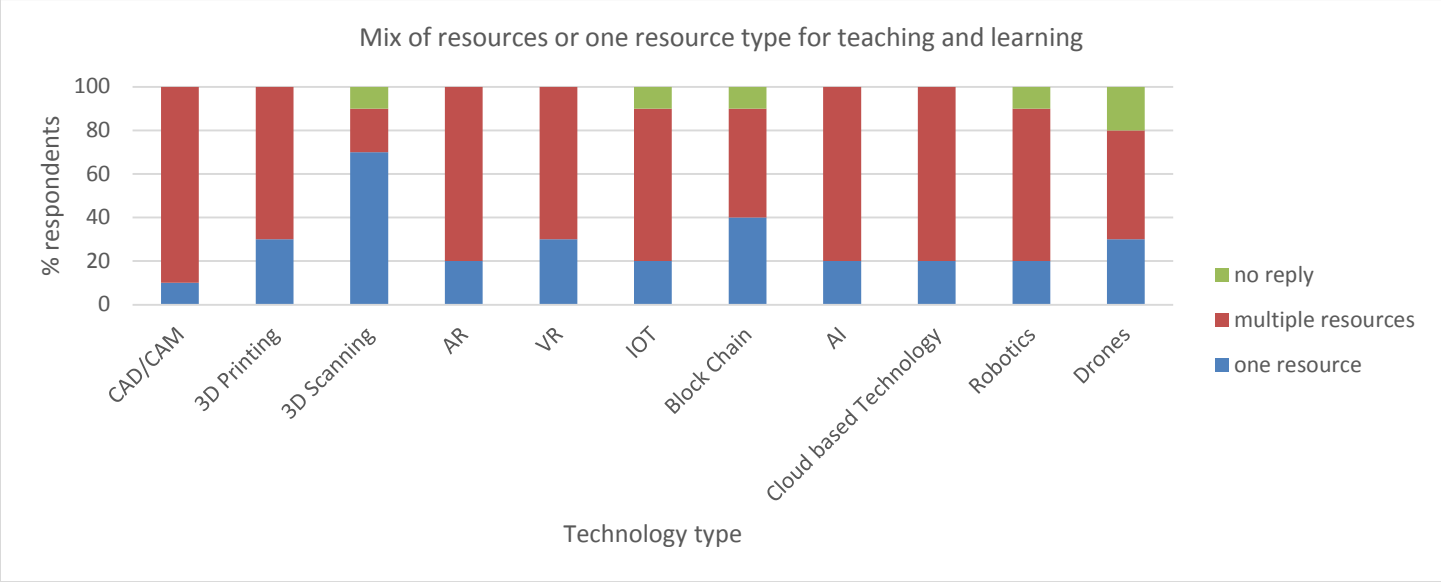


Figure 6: Resources for learning and training – a sole resource or a choice of multiple resources

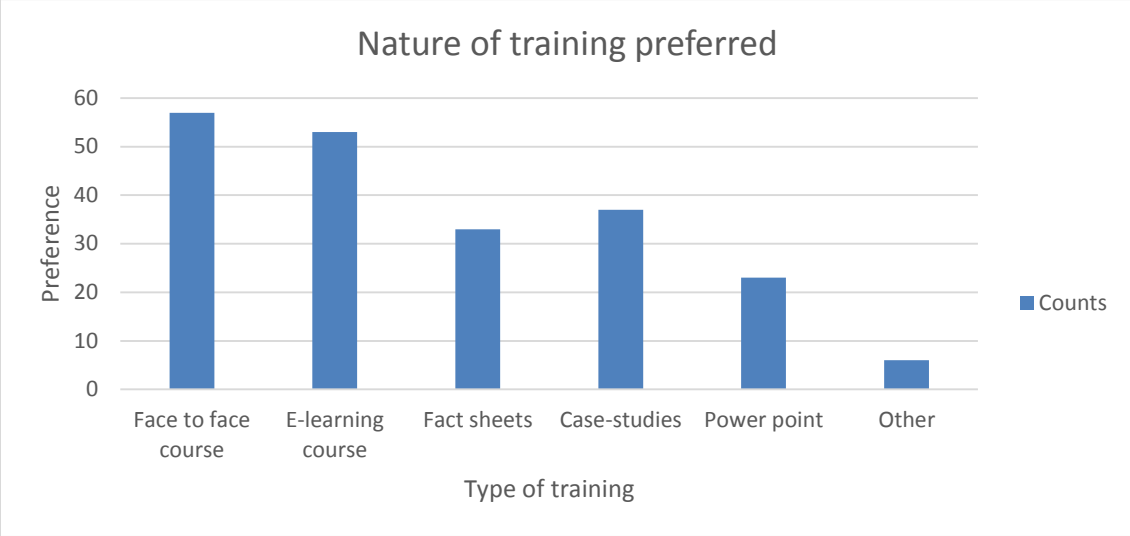


Figure 7: Type of Training Delivery Preferred

v) Conclusions for Malta

a. Face to face is the preferred option for curriculum delivery on Health 4.0 closely followed by e-learning courses.
b. Case studies are a favourite way of learning, and, most wish to be exposed to different case studies for the various technology types to get more familiarized.
c. Multiple ways of studying, or, a mix of educational resources for training and learning are the preferred option to learn versus just one type of resource/studying option.
d. All the participants have heard or know of the different health related technologies, but, to varying extents
e. All the participants have seen or know of various health related case studies, but to different extents.

E. General remarks

Please report on something else, if any, discussed outside the recommended subjects, that is relevant for the project.

- Apart from learners, some of the content of the curriculum could be used for patients and/or their carers (e.g. fact sheets to explain to patients the difference between a vein/artery or how to self-inject).

F. Photos taken during the Malta Focus Group Session

Appendix 3 National Focus Group Report: Greece

A. Date/place/time that the focus group took place and number of participants

Country:	Greece
Date:	16.1.2020 (focus group 1, FG1), 28.01.2020 (focus group 2, FG2), 29.01.2020 (interviews with doctors)
Place:	Parafestas Diagnostic Healthcare Center, Animus Rehabilitation Center, 4 interviews with doctors
Number of participants:	12
Demographic data:	2 trainers (T): M (age 50), F (age 55) - associate professors (Rheumatologist and Physiotherapist) 10 learners (L): 5 F (ages 20,30,35,40, 58), 5 M (ages 25, 30, 32, 35, 56): 2 general practitioners, 1 dentist, 1 occupational health physician, 2 radiologists, 4 physiotherapists.

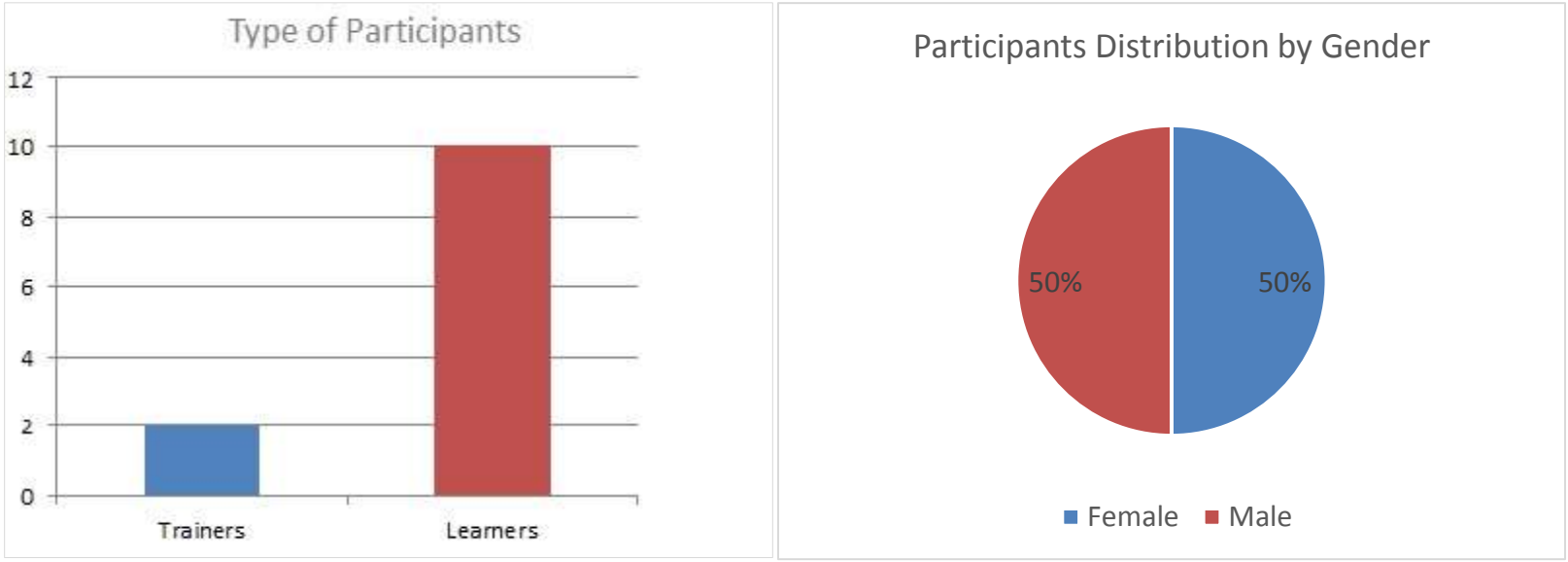


Figure 8a: (left) Participant Type and 8b (right) by Gender

B. Short description of recruitment process

Briefly describe how the participants were selected. Were there any challenges in organizing the focus group?

As mentioned in the project proposal, first we have contacted our associated partners (Animus Rehabilitation Center) and then we have invited doctors from various diagnostic healthcare centers, and the General University Hospital of Larissa and from several private clinics. Participants were selected based on their motivation and willingness to participate in the survey, based on their age and profile (to have more or less an equal gender representation) and according to their specialty.

C. Questions asked during discussions

Pre-defined questions:

1. Are you a trainer/learner? Please circle

L – Health Sector Professionals are considered as Learners

T – VET Educators are considered as Trainers

2 participants were trainers, while 6 participants were learners.

2. The table below was filled in by gathering all answers of the participants.

Type of Digital Technology	Knowledgeability (Choose 1 – Very Knowledgeable; or 3 – Knowledgeable; or 5 – Not knowledgeable)	Are you aware of case-studies of such technologies in the health sector? (Choose Y – Yes or N – No)	Would you be willing to learn and see case-studies? (Choose Y – Yes or N – No NS – Not sure)	Which resource(s) would you prefer to facilitate your learningL or trainingT? (Choose A – face-to-face course; or B – e-learning course; or C) Single page fact sheets; or D) Case-studies; or E) Power-point presentations; or F) Other	Other Comments
CAD/CAM	1 – 2T, 2L 3 – 6L 5 – 2L	Yes - 5 No - 7	Y – 5 N – 7	B based on E and D C	E-learning courses and factsheets are preferred as they do not have time limits and better fit to the busy schedule of the medical healthcare workforce. Everybody was familiar with this technology, except the two general physicians who mentioned that they have heard of this type of technology but it doesn't apply in their specialty. The dentist mentioned that the CAD/ CAM is being already used in dentistry and prosthodontics. By using CAD/CAM (computer-aided design and computer-aided manufacturing) dentists improve the design and time efficiency of the creation of dental restorations, especially dental prostheses. The radiologists mentioned that Computer-aided detection (CAD) software can improve radiologist efficiency when interpreting chest CTs (coronary angiograms), reducing reading times but there is possible error margin.

3D Printing	1 – 2T + 3L 3- 5 L 5 – 2L	Yes – 10 No – 2	Y – 10 No – 2	B based on E and D C	E-learning courses and factsheets are preferred as they do not have time limits and better fit to the busy schedule of the medical healthcare workforce. Practical courses are also considered a plus for this digital technology. Mentioned examples referred to the use of 3DP in dentistry.
3D Scanning	1- 1T + 3L 3 – 1T + 6L 5 – 1L	Yes – 9 No – 3	Y – 5 N - 7	B based on E and D C	E-learning courses and factsheets are preferred as they do not have time limits and better fit to the busy schedule of the medical healthcare workforce. Specific examples given was in physiotherapy using the 3D scanner for digital footprint and for making orthopedic shoe soles.
Augmented Reality	5-2T + 10L	No – 2T + 10L	Y-5 N-7	B based on E and D C	The doctors where not very familiarized with this type of digital technology
Virtual Reality	1 – 2T + 8L 5 – 2L	Yes – 2T + 8L No- 2L	Y-7 N-5	B based on E and D C	Mentioned examples referred to the use of VR in surgical students training (especially general anatomy and surgery). newspapers and journals. Except from the physiotherapists which use this technology with NIRVANA which is an innovative virtual reality system, which is globally considered as one of the top systems regarding patient rehabilitation with neuromuscular disorders.
Internet of Things (IOT)	5 – 2T, 10L	No – 2T, 10L	Y – 2 N- 10	C and D	Doctors where not very familiarized in this technology. The two professors knew the technology from online medical journals

Block chain	1- 2L 5 – 2T +8L	Yes – 2L No – 2T+ 8L	Y – 7 N- 5	B based on E and D C	The two general practitioners were familiarized with this technology and discussed about the difficulties implement it in Greece and that at the beginning it will increase the bureaucracy.
Artificial Intelligence	1 – 3L 1T 3- 1T 5 – 7L	Yes – 1T + 2L No – 1T + 8L	Y – 2 N – 3 NS – 7	B based on E and D C	Mentioned examples referred to the use of AI in rheumatology. Real time data analytics and artificial intelligence are helping the clinicians, healthcare systems and policy makers optimize the resources and improve patient outcomes
Cloud-based Technologies	1- 2T, 10 L	Yes- 2T, 10L	Y- 2 N- 10	C and D	Mentioned examples referred to the use of cloud-based technologies in the management of medical records and other patient related documents.
Robotics	1-2T, 5L 3- 5L	Yes-2T, 3L, No -7L	Y-12	B based on E and D C	Participants mentioned the use of robotics in surgery and in assisting patients with chronic diseases such as rheumatoid arthritis. The physiotherapists from Animus mentioned the - EKSO GT EXOSKELETON – BIONICS (a unique exoskeleton -robot assisted – walking system - LOKOMAT (a robot-assisted walking device fully adjustable to patient's anatomy; - Biodex System pro 4 is the most technologically advanced and reliable robot device using isokinetic dynamometry for evaluation and recovery of neuromuscular and musculoskeletal system of the patient.

Drones	1- 1T, 2L 3- 1T, 2L 5- 6L	Yes- 2T, 10L	Y- 2 N- 10	B based on E and D	Case studies referred to the use of drones in providing healthcare material (such as shots, or medication) to remote areas. Also, the physiotherapists mentioned that drones could be used in the reintegration of the patient - wheelchair user after its rehabilitation to be used as a mapping tool for possible barriers in the street.
Others – specify					

11. Which are the advantages, benefits these digital technologies could offer to trainers/learners? Please elaborate the response on these elements and provide examples

The advantages and benefits of the aforementioned digital technologies are summarized as follows:

- Increase the improvement of the services provided towards patients
- Improve time efficiency in diagnostics and in storing and accessing medical history of patient
- Increase diagnostic accuracy
- Monitoring patients without the physician's physical presence
- Can have the ability to respond to emergencies in remote areas (drones)

Doctors mentioned that Robotics can help in the field of surgery in that certain points are harmful to the scalpel or dangerous to the patient's life. Also, Robotics can help occupational therapists and physiotherapists during the occupational therapy procedure. The robot can repeat multiple times the movement assisting the patient to move without the muscle fatigue of therapists, that would cause possible mistakes to the occupational therapy procedure. The use of robotics in this case, reduces the errors and mistakes margins by a lot. In addition, the Virtual Reality technology is useful in the surgical training of young surgeons as it can stimulate a real-life surgery. VR is also useful, in rehabilitation of patients with neuromuscular disorders and or balance issues and it improves patients' kinesthesia and proprioception (e.g. Nirvana VR system and Balance System SD). 3-D scanning helps with diagnosis, since it simplifies the image. The use of CAD/CAM technology in dentistry has helped to facilitate clinical cases in terms of time efficiency and aesthetics, as the dentist can complete clinical cases on the same day that, under other conditions, without the use of digital technology takes up to three times the time to

complete the same task. In Rheumatology, assisted care with the help of robots rendering care in the hospitals or an intelligent robot guiding a patient by voice and visual sense at home are already at the threshold of entering the mainstream of patient care. Moreover, in the same field, wearable devices equipped with powerful sensors are useful in keeping a watch on patient symptoms all the time and providing useful insights on disease progression, clinical response or complications. In chronic care such as rheumatology the implications, possibilities and benefits are multiple. Real time data analytics and artificial intelligence are helping the clinicians, healthcare systems and policy makers optimize the resources and improve patient outcomes.

12. Which are the disadvantages, barriers or limitations these technologies could offer to trainers/learners? Please elaborate the response on these elements and provide examples

The replies on the limitations and disadvantages are summarized as follows:

- High cost for both patients and for the learner (medical healthcare) to learn and obtain the new technology
- Issues around privacy regarding cloud – based technologies and although generally this technology is secure there is always a potentially for this information to be hacked. Additionally, this information could in the future be used by third party companies who have a vested interested in understanding big data drug consumption or tracking individuals.
- Though technology can be a useful tool as long as it doesn't divorce health care providers from face to face interactions from patients (for example home visits from nurses in the community) and how this social interaction alone can have a positive effect on patients
- Overdependence / overreliance on technology. Health care providers need to be not so reliant on the technology that they can no longer do their job if it is not present. As well as the cultural tendency to believe the technology is always giving us valid data and that there are no errors can lead to wrong or dubious diagnostic results / universal diagnoses, rupture in personal contact with the patient and lack of showing empathy towards the patients.
- Lack of time or motivation for established medical healthcare to get to know the new technologies

The group gave specific examples regarding some of the disadvantages for example, regarding the high cost (the Siemens 3D scanner for instance that costs more than 120.000 euro) was considered an important limitation of wider spreading of these technologies in the current activities of Greek health specialists. Regarding the use of Robotics in physiotherapy, physiotherapists mentioned that the machine might not be flexible enough or might not cover a specific need of a patient. Another point was that even the new technologies have limitations for example the 3D printer in dentistry can only be used on

a few fixed hoops and not for printing a whole artificial denture. After that, some of the group participants mentioned that the use of these technologies needs also the right support by existing systems that have to do with the healthcare system.
For example, in Greece the block chain technology with the encryption of patients' data is not very useful, as there is no coding/classification of the diseases.

13. **Which specific capacities related with digital technologies should be introduced in the curriculum and encouraged to train for learners? Why?**
Based on focus group discussions, medical healthcare of the Greek interviewees are more eager about the CAD/CAM, robotics, blockchain, AI, 3D scanning and printing, digital technologies. The use of the above technologies, should be included in the curriculum because they are the future in the health field as they will solve incidents with minimal intervention, painless and with minimal time. Moreover, the excellent use of computer systems and knowledge in special diagnostic programs are also capacities that are related with the use of digital technologies and should be introduced in the curriculum.

14. **How can learners be prepared for the rapid and continuous evolution of the new digital technologies in the field of health?**
    - Continuous up-to-date education and lifelong learning, coordination of services for the proper dissemination of information
    - Job shadowing and work based learning abroad
    - Seminars and study of these technologies in both theory and practice

Other questions that you asked during discussions:
Please fill in other questions you ask, if any, during discussions.

N/A

D. Answers to the questions

Give summarized responses.

- *Where necessary quote responses that show a different minority opinion or highlight an interesting idea.*
- *Quote the most repeated but also meaningful responses and write a short summary of the discussion made for each of the questions mentioned at point 3 (please see a summary in the E. General Remarks)*

The interesting idea that came up the 2nd focus group with the physiotherapists from the Animus Rehabilitation is that a new management/ notification system that will use Internet of Things and Artificial Intelligence that would notify both the patients and physicians/ physiotherapists and occupational therapists for any change in the daily meetings or sessions with the patients. This would significantly reduce the error margins by the human factor, the internal bureaucracy (reduce multiple departments' communication for the change of patients' sessions and therapies) and would generally improve the patient's – doctors – medical healthcare staff relationships.

E. General remarks

In general, the conclusion made by the focus group and the individual interviews, was that the Greek healthcare professionals are familiarized with some digital technologies that are more useful for their medical specialty. The positive outcome is that they are also eager to learn about more technologies but they find it very difficult to be realized due to their limited time and availability, as they also need to get updated about the new advancements in their field. On the other hand, they all believe that continuous vocational education is the key to increase their knowledge about the new digital technologies. The Greek focus group participants tend to be more eager to know more about the following digital technologies:

- CAD/ CAD (especially the radiologists)
- 3D printing/scanning
- Robotics (especially the Rheumatologists and Physiotherapists)
- Virtual Reality and AI (especially the Physiotherapists)
- Blockchain (especially the General Physicians)

F. Photos of the Focus Group Sessions

Appendix 4 National Focus Group Report: Lithuania

A. Date/place/time that the focus group took place and number of participants

Country:	Lithuania
Date:	31.01.2020
Place:	Kaunas Science and Technology Park, Kaunas
Number of participants:	7
Demographic data:	2 trainers (T): M (age 34), F(age 49) - one Master of Educational science, another one – Master of Rehabilitation, qualification in physiotherapy, studying doctoral studies 3 learners (L): 5 F (age 36, 35, 49, 18, 18), nurses

Figure 9a: (left) Participant Type and 9b (right) by Gender

B. Short description of recruitment process

Briefly describe how the participants were selected. Were there any challenges in organizing the focus group?

As Kaunas Science and Technology Park has long and wide collaboration with many innovative companies, starts-ups, as well as teaching institutions, we have contacted one of our VET partners - Kaunas vocational education & training center. During the meeting we have presented the aim of the project and organized a discussion about the possibilities to collaborate. Kaunas vocational education & training center (Kauno statybos ir paslaugų mokymo centras: http://www.profcentras.lt/pf_web/index.php/11-kita-informacija) particularly focuses on the vocational training of variety of specialties as well as nurses.

Focus group participants were selected based on their motivation, general interest about digital technologies use in the health educational process, their openness to innovations, and their capacity to participate in the focus group.

The main issue for organizing the FG was finding suitable time for meeting together: participants have very hectic shedules.

C. Questions asked during discussions

Pre-defined questions:

3. **Are you a trainer/learner? Please circle**

L – Health Sector Professionals are considered as Learners

T – VET Educators are considered as Trainers

2 participants were trainers, while 5 participants were learners.

2. The table below was filled in by gathering all answers of the participants.

Type of Digital Technology	Knowledgeability (Choose 1 – Very Knowledgeable; or 3 – Knowledgeable; or 5 – Not knowledgeable)	Are you aware of case-studies of such technologies in the health sector? (Choose Y – Yes or N – No)	Would you be willing to learn and see case-studies? (Choose Y – Yes or N – No NS – Not sure)	Which resource(s) would you prefer to facilitate your learning^{L} or training^{T}? (Choose A – face-to-face course; or B – e-learning course; or C) Single page fact sheets; or D) Case-studies; or E) Power-point presentations; or F) Other	Other Comments
CAD/CAM	1 – 3 – 3L+1T 5 – 1T+2L	Yes – 4 (2T+2L) No – 3 L	Y – 2 L N – NS – 5 (2T+3L)	A-1 B -3 E -3	Majority of participants were familiar with the use of CAD/CAM technology and they knew general examples of the use of CAD/CAM in the health sector. Both e-learning course and Power-point presentations learning course were preferred to others. E-learning courses are preferred as they better fit medical specialists' schedules and work constraints.
3D Printing	3 – 1T 5 – 5L+1T	Yes – 3 (2T+1L) No – 4 L	Y – 2(1T+1L) NS – 5 (1T+4L)	B-1 D -1 E-5	Power-point presentations are preferred as learning as well as training resource as the most systematic course for learning/teaching. Participants knew 3D print technology but had no practical knowledge of the use of this technology. All examples of 3D Printing known mostly from social media.

3D Scanning	1- 3 – 1L 5 –2T+4L	Yes – 3 (1T+2L) No – 4 (1T+3L)	Y – 2 (1T+1L) N – 5 (1T+4L)	B - 1 E - 6	Power-point presentations are preferred to others as learning as well as training resource as most acceptable and convenient. Face to face courses evaluated as important teaching method (especially for the practical reasons), but time and work constraints were acknowledge as the impediments for the actual participation in face to face training.
Augmented Reality	1 –1T 3 - 1L 5 –4L+1T	Yes – 2T No - 5L	Y – 1L N - 1T NS – 5 (1T+4L)	A – 1 B - 1 D C E - 5	Information was mainly acquired from online newspapers, social media, etc. Power-point presentations during the courses were noticed as a practical tool.
Virtual Reality	3 – 2T + 1L 5 – 4L	Yes – 2T + 1L No – 4l	Y – 4(1T+3L) N – NS – 3(1T+2L)	A - 2 B - 2 D C E - 3	Expressed the interest of this technology in a medical students training. Power-point presentations during the learning courses are preferred as they could reflect more on practical aspects.
Internet of Things (IOT)	1 – 3 – 1T +2L 5 – 1 T +3 L	Yes – 2T + 1L No – 4L	Y – 1T N – NS – 6(1T+5L)	B-2 D-1 E -4	This information was mainly acquired from online newspapers and social media.
Block chain	1 – 1T 3 – 5 – 1T+5L	Yes– 2T+ 1L No – 4L	Y – 4(1T+3L) N – 1T NS – 2L	A – 3 B – 1 C – 1 E - 2	Face-to-face course was preferred as it is more direct and practical. Technology is seen as difficult and time consuming (to gain knowledge). Participants have limited time to acquire it.

Artificial Intelligence	1 – 3 – 5 – 2T+5L	Yes – 1T No – 1T+ 5L	Y – 1T N – NS – 6(1T + 5L)	B – 3 E - 4	No information on the use of this technology was reported as known. Very brief and generic information was acquired from online newspapers, social media. Power-point presentations during a learning courses is preferred.
Cloud-based Technologies	1 – 3 – 1T+1L 5 – 1T +4L	Yes – 1T + 2L No – 1T +3L	Y – 3(1T + 2L) No– NS – 4(1T+3L)	A – 1 B – 1 E - 5	Mentioned the importance of using cloud-based technologies in the management of medical records and other documents as well as patient's data. Power-point presentations learning courses are preferred.
Robotics	1 – 3 – 1T+1L 5 – 1T+4L	Yes –3L No – 2T+2L	Y – 1L N – NS – 6(2T+4L)	A – 1 B – E - 6	The technology known but not enough practically in the health sector. Power-point presentations learning courses are preferred.
Drones	3 – 1T + 1L 5 – 1T +4L	Yes – 3L No – 2T + 2L	Y – 2L N - NS – 5(2T + 3L)	A – 3 E - 4	The importance of this technology that referred to the use of drones in transferring medical supplies was marked. Power-point presentations learning courses are preferred.
Others – specify Telemedicine	1 – 3 – 1 5 –	Yes – 1 No –	Yes - 1 No – NS –	A	During discussions and the survey, a new one technology - telemedicine for doctors and other specialists was mentioned. The technology is widely used and recognized as an important, quick in time and reliable. This technology allows to share specific health issue the patient has, and ask other specialists over the world for their opinion, practice, advice, etc.

15. Which are the advantages, benefits these digital technologies could offer to trainers/learners? Please elaborate the response on these elements and provide examples

Reported advantages, as the result from the focus group discussions, were summarized (below):

- Improves the competitiveness of health specialists in the work field;
- Improves quality of the work;
- Reduces the time for accomplishing the medical act;
- Facilitates medical training and education;
- Are suitable for training a generation of medical specialists;
- Could be better adapted to patient specific needs.

Participants have agreed on fact that using CAD/CAM, 3DP, AR, VR in the medical sector and their work specifically would make their work results more efficient: results could come faster and be more visible.

CAD/CAM technology was recognized the most knowledgeable. Good quality of outcomes and reduced manufacturing time were mentioned as very important.

Unfortunately, among participants such digital technology as Artificial Intelligence was not knowledgeable. As a fact – participants knew about this technology in general, but their knowledge was only theoretical. Participants of FG stressed out their interest to learn about the practical implementation and explore the possibilities to use it at work.

VR and AR are considered as very good tools for training and education. Participants have mentioned the attractiveness and perspectives of its usage in the learning process on the 21st century. VR and AR tools in education was recognized as mandatory tools.

Also, participants stressed out the importance of Block chain as the digital technology which could be important and interesting in the health sector.

16. Which are the disadvantages, barriers or limitations these technologies could offer to trainers/learners? Please elaborate the response on these elements and provide examples

All participants have agreed on one very important aspect. To their point of view, digital technologies are very useful to support trainers and practitioners, but they shouldn't be used to replace professionals and their skills. Such potential disadvantages were listed:

- Very high costs of implementation;
- Technologies are changing fast;
- Requirement to have updated information on the newest developments of specific technologies;
- Risk of focusing more on the use of technology than on the patient.

Time of developing applications that are based on these technologies makes them more suitable for theoretical education and training and less for practical use.

The use of these technologies requires effective collaboration in the interdisciplinary teams: firstly, new technologies as well as equipment must be installed, and only after that - presented to medicals as a new instrument. Possible difficulties in using the same terminology language (medical and engineers), different levels of knowledge and understanding, as well as time schedules, other restrictions.

Participants have decided that a heavy reliance on the use of technologies in health sector might be risky for the patient.

These possible disadvantages were listed:

- "Computer - computer decision will be just one possible decision"
- "The situation of health every day is going worse, so, human should be one who decides"
- "My basic disadvantage is busyness", etc.

17. **Which specific capacities related with digital technologies should be introduced in the curriculum and encouraged to train for learners? Why?**

Based on focus group discussions participants expressed their needs to use new technologies in the healthcare. But in the same time they stressed out the importance of special knowledge (software, hardware, hands-on courses, etc.) to use these technologies for learning/ teaching as well as to use them in the practice. Only correct understanding the basic concepts related to these technologies allows to go deeper to the training process.

Participants found out the fact of the readiness of teachers to pass knowledge is critically important, because later in the practice it could cost the life of the patient. Case studies as well as other learning courses were emphasized important but are seen as a theoretical knowledge. As the evidence participants have provided such opinions: “I think everything is interesting, trainers and learners should know all the possibilities and decide what to use”, “I am not advanced in technology, but I would like to learn about digital technologies and how I can to use them in healthcare and to introduce this activity to students”; “I don't have specific capacities”.

18. **How can learners be prepared for the rapid and continuous evolution of the new digital technologies in the field of health?**

Training and being informed of these technologies use in medical applications, based on reliable sources, are needed for keeping up to the rapid developments of all the fields involved. Vocational education and training is the key in this sense. Also, early (starting from a first year of medical studies) transferring of information from the first years of medical studies is also a necessity.

Participants expressed the importance of knowledge in the use of new technologies implementation in various learning methods. Also, participants stressed out the importance of well skilled trainers in the training and knowledge transferring processes. As an example of this one opinion is given: “E-learning, conference, case analysis, new reports, new articles, research. Of course, good trainers. Countries health care specialist should share information and other countries should learn from good practice.”

D. Answers to the questions

Main questions asked:

i) Question on knowledge to a particular Digital Technology
ii) Question on case studies awareness related to the certain Technology
iii) Question on willingness to learns case studies about the use of technologies
iv) Question on kind of resource the participants prefer to facilitate their learning/training

Summarizing up the responses of participants, very interesting conclusions have been reached.

i) Figure 10 (below) shows how VET teachers and learners are familiar with knowledge related to a particular Digital Technology. It must be said, that the results were unexpected. Because of some digital technologies such as Artificial Intelligence was recognized as unknowledgeable - 100 % participant stressed out this fact. The reason of this fact as discussed with participants further – the limitation in time as well as their busy schedules (both teachers and learners) as they don't have extra time for studying new technologies or they do this very episodically (depending on time). All general knowledge they have comes from social media, articles, magazines, but have never used it in practice. Majority of mentioned digital technologies including Artificial Intelligence in general were known to participants, but unfortunately in the health sector they don't use these technologies in practice, because there are working according to the confirmed curriculum for VET teachers in the health sector and following strictly the subjects must be taught/learnt. And everything that is new comes according to everyone wishes, curiosity, spare time. Other technologies were found as more or less known and used in practice. Among the participants the most knowledgeable was CAD/CAM. All after all, apart from the clear understanding of all participants how the new technologies, innovative processes could be helpful, useful, more efficient, practically everyone recognized that the person (human) in the health sector is still undoubtedly on the first position. As the evidence were stressed out opinions of participants such like: "The focus should be on patient and not on technologies", another one: "I'm not sure that computer - computer can decide, without the human".

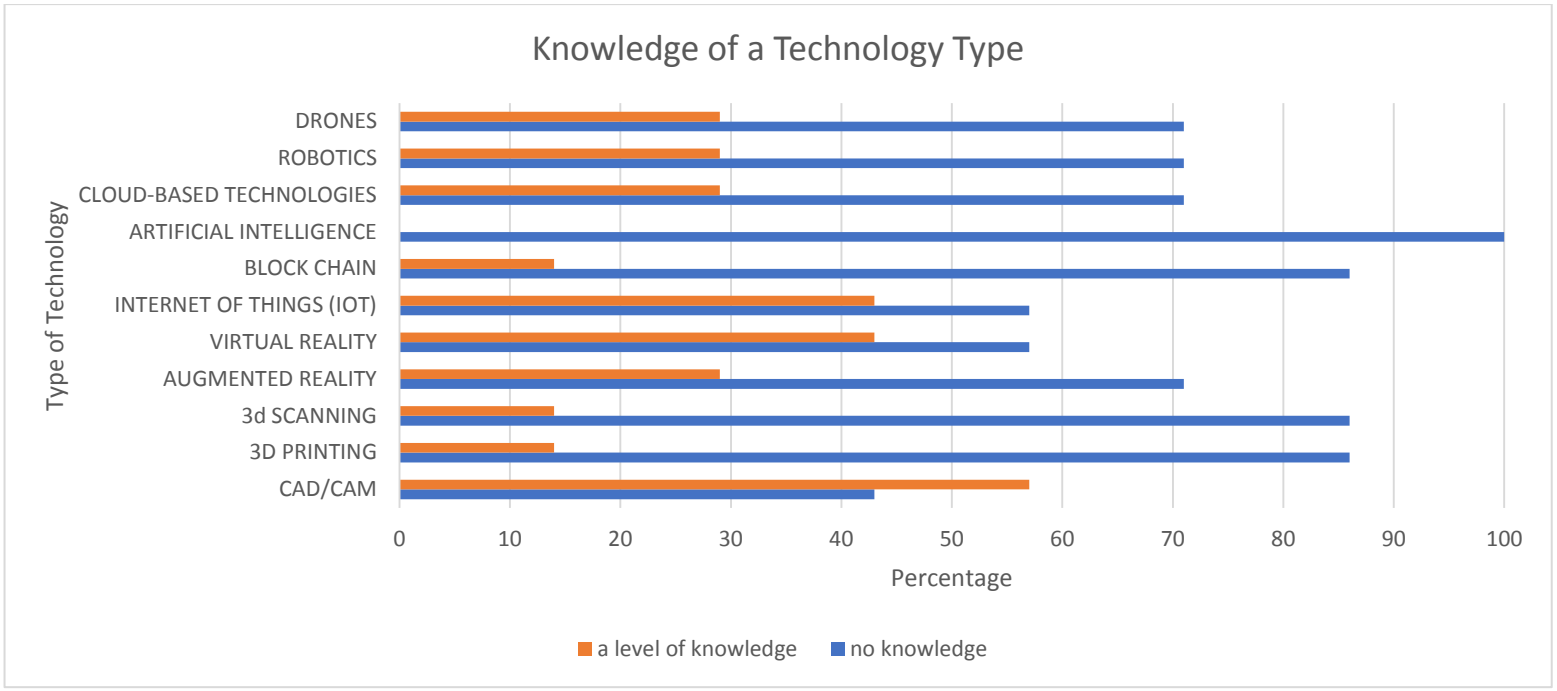


Figure 10. Participants Knowledge of Digital Technologies

Remarks: Legend 'a level of knowledge' means that the respondents had little knowledge of the technology (knowledgeable or very knowledgeable).

ii) Figure 11 (below) illustrates the awareness among participants to learn and see case studies of digital technologies. It must be said that according to the FG data, participants have expressed their wish to gain knowledge through case studies for all the technologies, featured from 14% (Artificial Intelligence) to 57% (CAD/CAM). Case studies in practice are a good chance to pass knowledge to learners and trainers. Unfortunately, some technologies participants found less interesting, and their awareness of knowledge passing through case studies of these technologies was low – 86% (Artificial Intelligence), but no one "NO" has not been recorded.

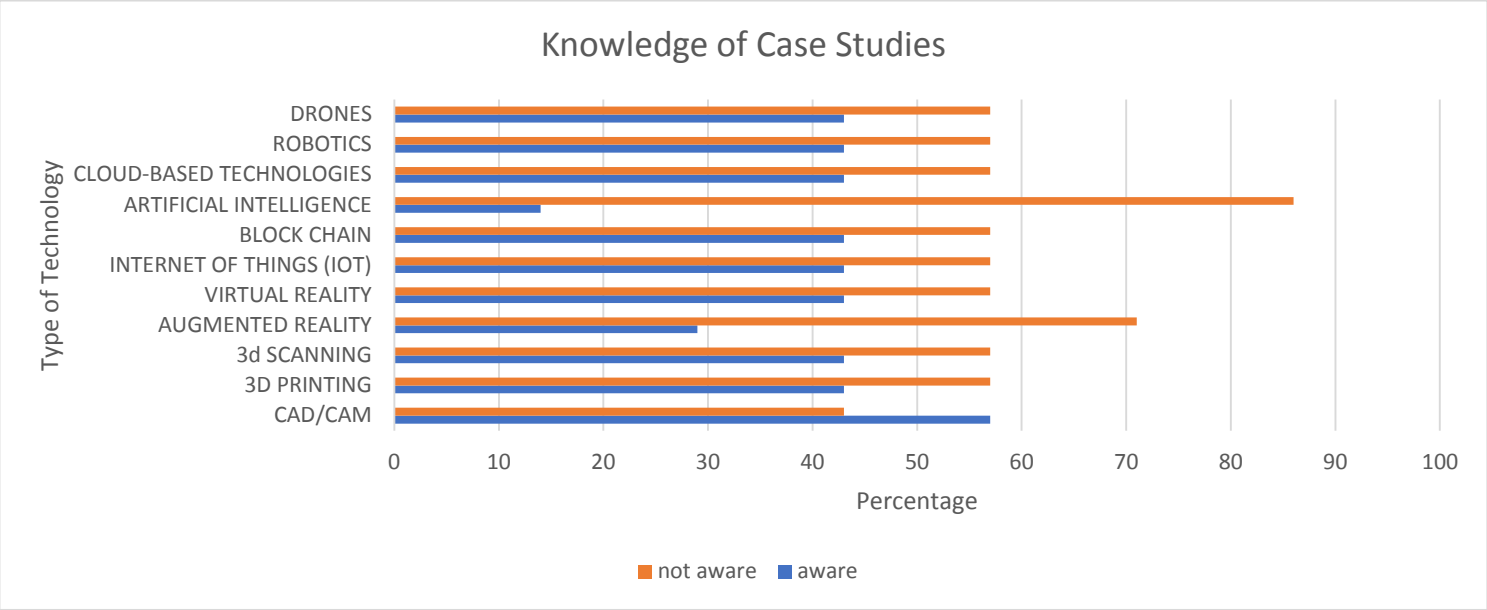


Figure 11. Participants Awareness of Case -Studies in the Health Sector for different Digital Technologies

iii) Figure 12 (below) shows the willingness of participants to learn Digital Technologies. It must be emphasized that some of digital technologies (such as 3D scanning, augmented reality and block chain) participants did not feel necessary or needed in their work, so they did not express their desire to study them either.
Some technologies such as Virtual reality, Block chain and cloud-based technologies participants founds most interesting and necessary and respectively expressed their willingness to see case studies for certain technologies 57% (VR), 57% (BC) and 43% (CBT).

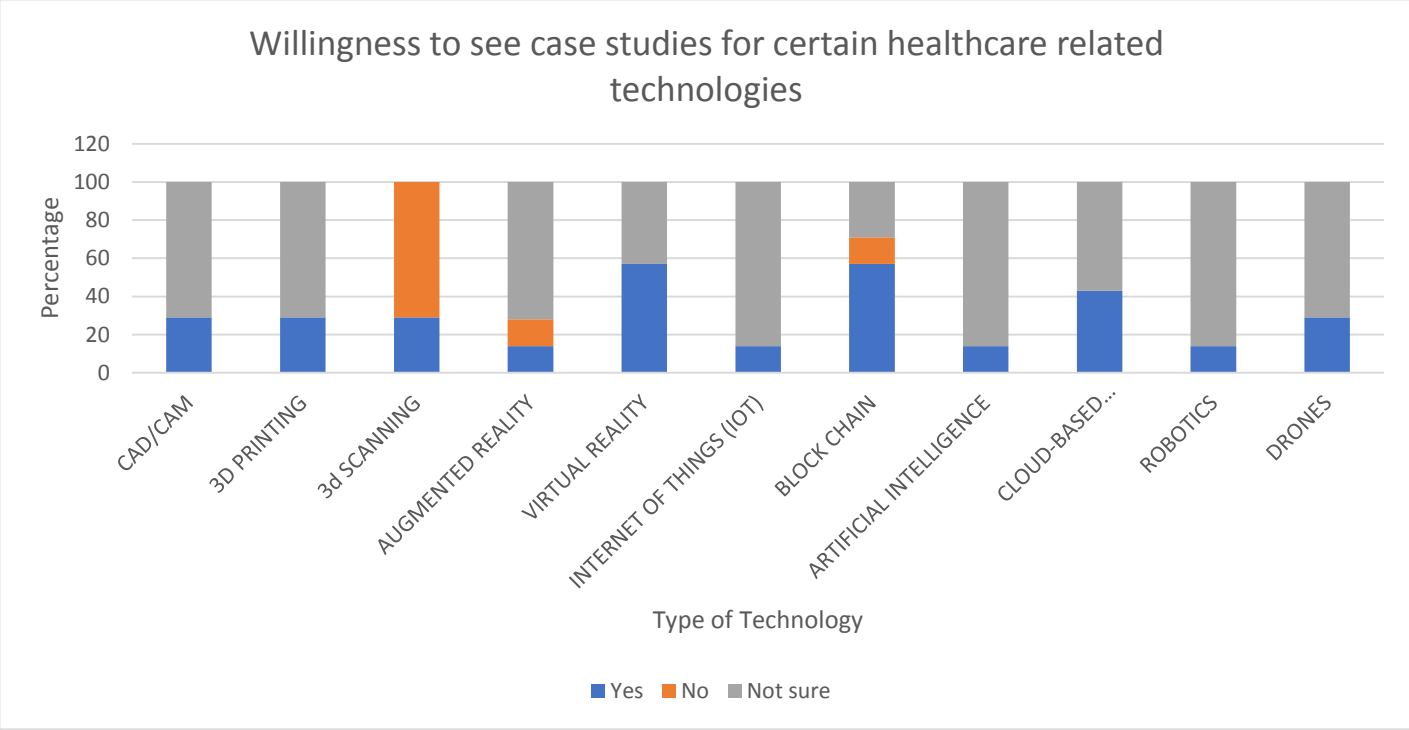


Figure 12. Participants willingness to learn Digital Technologies

iv) Results on kind of resource the participants preferred to facilitate their learning/training are shown on Figure 13 (below). Participants were focused mainly on Power-point presentations learning/training course (61 %) as they found it more systematic, more usual in their practice and understandable. On the second position appeared e-learning course (19 %). Participants expressed their high interest to face-to-face learning course, but unfortunately in the reality it doesn't fit to

their work restrictions and spare time because they are very limited in time. How the distribution of participants on learning course looks according to the certain technology illustrated in Figure 13 B.
It should be emphasized that the FG participants were of different ages (from 18 to 49) and therefore their approach to the digital technologies as well as training process also was different. Elder participants chose mostly face-to-face training/learning course, younger - preferred a more modern e-learning course.

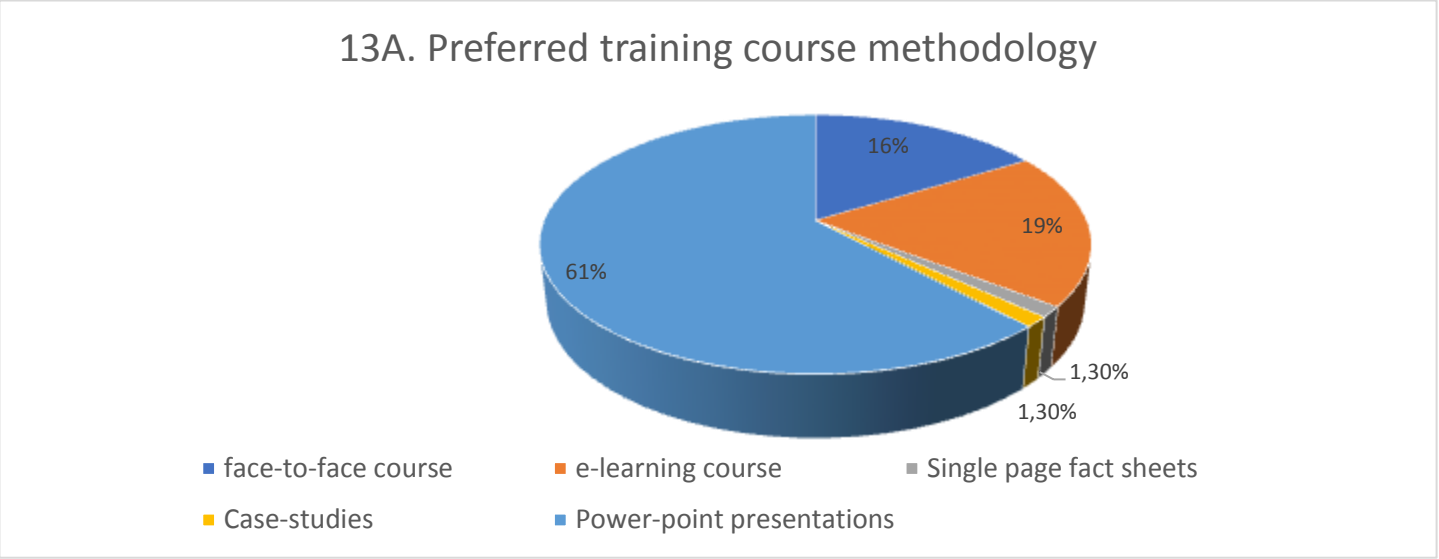


Figure 13A, Preferred training course methodology

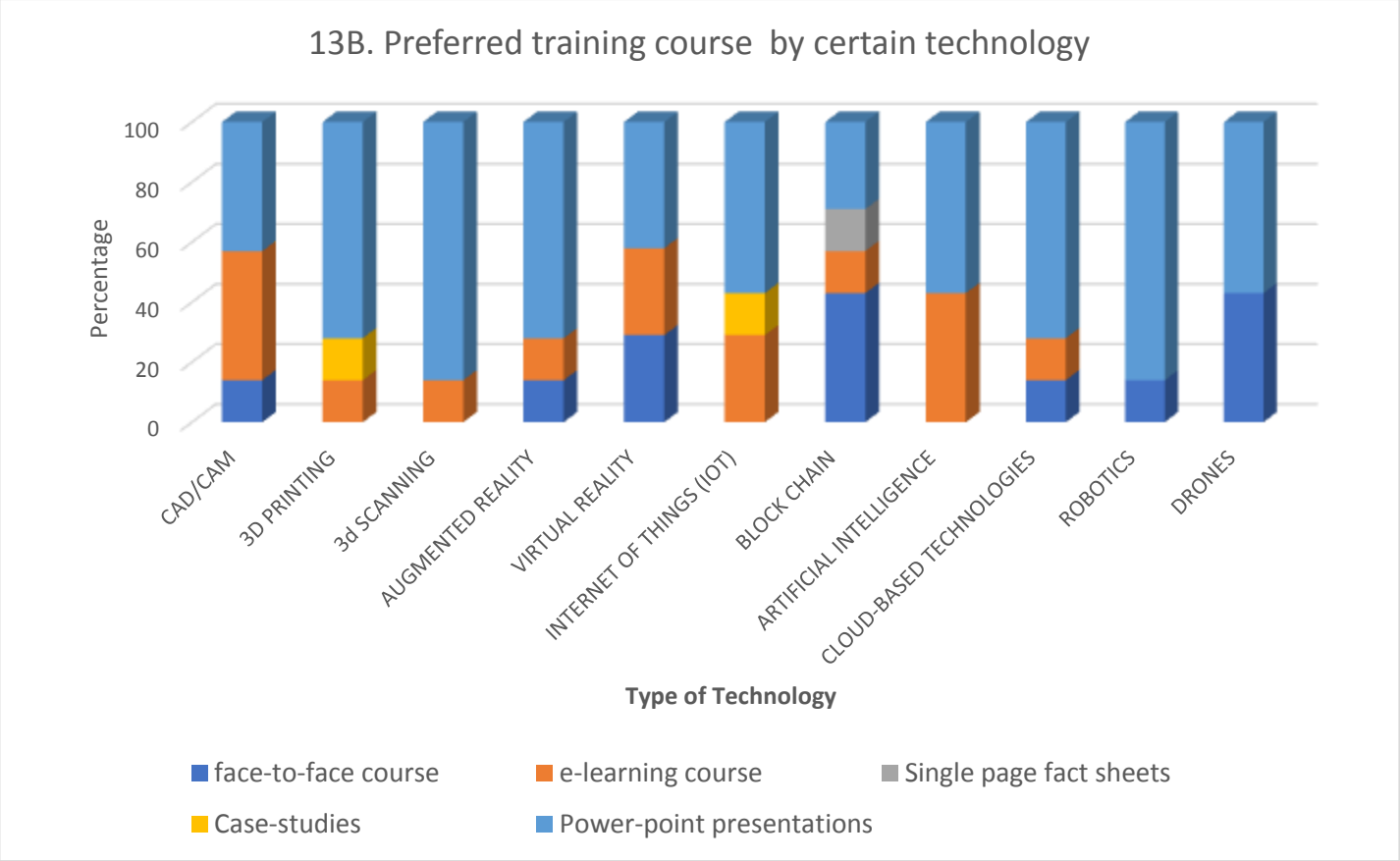


Figure 13B. Preferred training course by certain technology

E. Conclusions

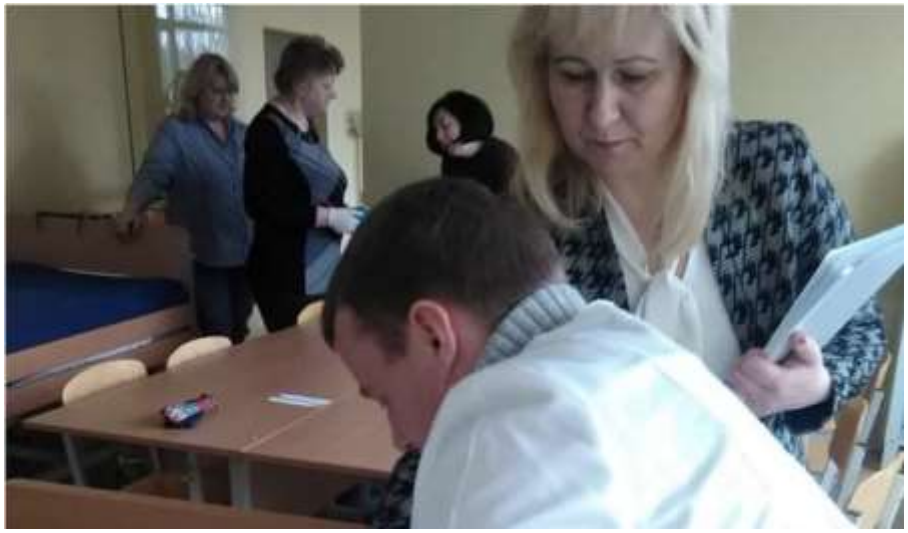
FG agreed on the very strong importance of digital technologies in the health educational process, on the necessity to use them in the healthcare sector which is directly proportional to the quality of the education process, which needs to be always familiar with the newest technologies in the healthcare market.

The importance of this project and their interest on digi4HEALTH results that will be achieved have been stressed out by all FG participants.

F. General remarks

Apart of all preselected digital technologies, FG has proposed introducing a new one technology – Telemedicine, and evaluated it as recognizable, quick in time and reliable.

G. Focus Group Photos



Appendix 5: National Focus Group: Romania

A. Date/place/time that the focus group took place and number of participants

Country:	Romania
Date:	12.12.2019 (focus group 1, FG1), 10.01.2020 (focus group 2, FG2)
Place:	Colentina Clinical Hospital of Bucharest (FG1), University Politehnica of Bucharest (FG2)
Number of participants:	9
Demographic data:	2 trainers (T): F (age 59), M (age 52) - associate professors. Both of them are also orthopedics surgeons 6 learners (L): 2 F (ages 25, 30), 4 M (ages 27, 30, 27, 29): 2 nurses, 1 dentist, 1 cardiologist, 2 orthopedics residents

B. Short description of recruitment process

Briefly describe how the participants were selected. Were there any challenges in organizing the focus group?

As mentioned in the project proposal, first we have contacted our associated partners (Clinical Hospital Colentina and Center for Medical-Military Research) and then we have invited participants working at Bucharest Emergency Hospital, Central Military Emergency University Hospital and also dentists from several private clinics. Participants were selected based on the willingness to participate in focus groups, and also so that to cover as many medical specialties and levels of occupations as possible. The main challenge in organizing the FGs was gathering together all participants due to their very busy schedules and work constraints. Therefore, we have organized two FGs with doctors and nurses from orthopedics, research, dentistry and cardiology fields.

C. Questions asked during discussions

Pre-defined questions:

1. **Are you a trainer/learner? Please circle**

L – Health Sector Professionals are considered as Learners

T – VET Educators are considered as Trainers

2 participants were trainers, while 6 participants were learners.

2. The table below was filled in by gathering all answers of the participants.

Type of Digital Technology	Knowledgeability (Choose 1 – Very Knowledgeable; or 3 – Knowledgeable; or 5 – Not knowledgeable)	Are you aware of case-studies of such technologies in the health sector? (Choose Y – Yes or N – No)	Would you be willing to learn and see case-studies? (Choose Y – Yes or N – No NS – Not sure)	Which resource(s) would you prefer to facilitate your learning[L] or training[T]? (Choose A – face-to-face course; or B – e-learning course; or C) Single page fact sheets; or D) Case-studies; or E) Power-point presentations; or F) Other	Other Comments
CAD/CAM	1 – 2T + 3L 3 – 1L 5 – 3L	Yes – 9	Y – 4 N – 2 NS – 3	B based on E D C	e-learning courses are preferred as they better fit medical specialists schedules and work constraints. Excepting the nurses and the cardiologist, all participants were familiarized with the use of CAD/CAM techniques in their current activities. However, all participants knew general examples of the use of CAD/CAM in the health sector. Mentioned examples referred to prosthesis and implants (especially in dentistry applications).
3D Printing	1 – 2T + 5L 5 – 2L	Yes – 7 No – 2	Y – 7 NS – 2	B based on E D C	e-learning courses are preferred as they better fit medical specialists schedules and work constraints. Mentioned examples referred to the use of 3DP for visualization purposes. Some participants used 3D prints in their work, other participant knew case-studies from social media posts.

3D Scanning	1- 1T + 3L 3 – 1T + 1L 5 – 3L	Yes – 7 No – 2	Y – 9	B based on E A D C	Face to face courses were considered important for the practical aspects of 3D scanning. However, time and work constraints were acknowledge as impediments in actually participating in face to face training.
Augmented Reality	1 – 2T + 5L 5 – 2L	Yes – 2T + 7L	Y - 8 NS -1	B based on E D C	Mentioned examples referred to the use of AR in medical students training (especially general anatomy). This information was mainly acquired from online newspapers and social media. e-learning courses are preferred as they better fit medical specialists schedules and work constraints.
Virtual Reality	1 – 2T + 5L 5 – 2L	Yes – 2T + 7L	Y – 8 NS -1	B based on E D C	Mentioned examples referred to the use of VR in medical students training (especially general anatomy). This information was mainly acquired from online newspapers and social media. e-learning courses are preferred as they better fit medical specialists schedules and work constraints.
Internet of Things (IOT)	1 – 2L 5 – 2T +5L	Yes – 1T + 1L No – 1T + 6L	Y – 4 N – 4 NS – 1	D	This information was mainly acquired from online newspapers and social media.
Block chain	5 – 2T +7L	No – 2T+ 7L	Y – 2 N – 7	D	No information on the use of block chain was reported as known.
Artificial Intelligence	1 – 2T + 3L 3 – 2L 5 – 2L	Yes – 1T + 2L No – 1T + 5L	Y – 2 N – 5 NS – 2	D	Mentioned examples referred to the use of AI in interpreting radiological data. This information was mainly acquired from online newspapers and social media.

Cloud-based Technologies	1 – 2T + 5L 5 – 2L	Yes – 2T + 3L No – 4L	Y – 3 No– 6	D	Mentioned examples referred to the use of cloud-based technologies in the management of medical records and other patient related documents.
Robotics	1 – 2T + 5L 3 – 2L	Yes – 2T + 7L	Y – 6 NS – 3	B based on E D	Mentioned examples referred to the use of da Vinci robot in surgery and also of exoskeletons for rehabilitation. e-learning courses are preferred as they better fit medical specialists schedules and work constraints.
Drones	3 – 1T + 2L 5 – 6L	Yes – 1T+ 1L No – 1T + 6L	Y – 1L N – 2T + 6L	D	Mentioned examples referred to the use of drones in transferring medical supplies.
Others – specify					

19. Which are the advantages, benefits these digital technologies could offer to trainers/learners? Please elaborate the response on these elements and provide examples

Reported advantages, as resulting from the focus group discussions, are summarized below:

- Improve working results for patients
- Better working efficiency
- Reduce the time for accomplishing the medical act
- Facilitate medical training and education
- Are suitable for the training of the new generation of medical specialists
- Are supporting the implementation on personalized medicine, better adapted to patient specific needs

Participants that were aware of the uses of CAD/CAM, 3DP, AR, VR in the medical sector considered that their work results will be better if using these technologies in current activities.

4 participants already used 3D prints in their work and they mentioned their benefits as visualization models and surgical guides. Customization is reported as the most important advantage provided by 3DP technology in medicine.

CAD/CAM technology in dentistry applications was acknowledged by all participants (majority being beneficiary of this technology as patients). Good quality of outcomes and reduce manufacturing time were mentioned as very important.
All participants using cloud-based technologies mentioned their advantages and some of them discussed about a raise in the efficiency of their work related to this technology.
VR and AR are considered very good tools for training and education. Participants mentioned their attractiveness and one participant mention that the concept of gamification is useful for improving the learning curve of the new generation of students.
Difficulty to distinguish between myths and reality regarding the medical applications of these new technologies was noted during focus group discussion. Therefore, education in this field is mandatory.

20. Which are the disadvantages, barriers or limitations these technologies could offer to trainers/learners? Please elaborate the response on these elements and provide examples

The reported disadvantages, barriers and limitations are:

- Risk of focusing on the use of technology rather than on patient
- The need of multidisciplinary teams which are harder to organize
- More and more technical complex (difficult to have updated information on the new developments)
- High costs of implementation

Time of developing applications that are based on these technologies makes them suitable for more for education, training, visualization and surgical rehearsal and less for emergency situations. As the use of these technologies implies working in interdisciplinary teams, disadvantages related to language barriers (between doctors and engineers, for instance) or different working paradigms, time schedules, specific constraints, etc. were mentioned by some participants.
The costs (da Vinci robot, for instance) was considered an important limitation of wider spreading of these technologies in the current activities of Romanian health specialists.
Participants considered that a heavy reliance on the use of these technologies might be risky for the patient, especially in surgical applications. Also, some participants mentioned that the focus should be maintained on patients and not on technology, i.e. to use these technologies when being sure that they improve medical outcomes. Regulations are needed in the medical field for these new technologies.

21. **Which specific capacities related with digital technologies should be introduced in the curriculum and encouraged to train for learners? Why?**
    Based on focus group discussions, 3DP, VR, AR, 3D scanning and robotics are of interest for Romanian participants. Case studies and examples are noted as important to disseminate during this project as many online sources of information are unreliable. Many practical examples and case-studies are desired to supplement the theoretical information.
    New competences to acquire refer to correctly understanding the basic concepts related to these technologies, ability to understand the information presented by other specialists that are using these technologies worldwide based on case-studies and examples, ability to interact with these new technologies, awareness on aspects related to software, hardware for these technologies and their practical use.

22. **How can learners be prepared for the rapid and continuous evolution of the new digital technologies in the field of health?**
    Training and being informed of these technologies uses in medical applications, based on reliable sources, are needed for keeping up to the rapid developments of all the fields involved (medicine, engineering, IT, robotics, sensors, wearables, etc.). Vocational education and training is the key in this sense. Also, early transferring of information from the first years of medical studies is also a necessity. The same goes for engineers and future engineers which should be aware of their responsibilities in this field. In other words, training, education and collaboration are mandatory for being able to understand and use the new technologies.

Other questions that you asked during discussions:
Please fill in other questions you ask, if any, during discussions.
Participants were also asked if they used in practice some of these technologies. In case of AR and VR, questions were also asked if they used these technologies in other applications (such as games).

D. Answers to the questions

Give summarized responses.

- *Where necessary quote responses that show a different minority opinion or highlight an interesting idea.*
- *Quote the most repeated but also meaningful responses and write a short summary of the discussion made for each of the questions mentioned at point 3*

An interesting idea expressed by all participants was the need of using reliable sources of information, in general for all fields, and in particular related to the uses of the new technologies in healthcare sector: “many times when you read social media posts also on medical subjects is difficult to say if they are not fake news”.
An opinion: “The focus should be on patient and not on technologies”. Another opinion: “Things are getting more and more complex with these new technologies”.
Meaningful quotes: “3D printing in medicine is about customization”, “virtual technologies for training are very good for the young generation”, “we have to have knowledge in the new developments in medicine to keep up with the other countries”, “robotics is good, but it is still expensive”, “we have to have engineers as friends and partners”.

E. General remarks

Please report on something else, if any, discussed outside the recommended subjects, that is relevant for the project.
Medical modeling knowledge based on specific software was mentioned as needed for the using the new technologies related to 3D scanning, 3D printing, AR and VR.

F. Focus Group Photos

Appendix 6: National Focus Group: Spain (KVELOCE)

A. Date/place/time that the focus group took place and number of participants

Country:	Spain
Date:	06.02.2020(Focus group), 10.02.2020 and 11.02.2020 (Interviews)
Place:	Individual interviews were held at the SENIOR EUROPA SOCIEDAD LIMITADA office in Valencia. Focus group was held at INSTITUT EDUCACIÓ SECUNDÀRIA POU CLAR in Ontinyent, Valencia.
Number of participants:	16
Demographic data:	8 learners (L). Female:1 odontologist, 1 optometrist (ages; 40,44); 6 VET students (ages;18,19,19,20,20,19). 2 trainers (T). Female: VET Educators (ages; 27,39).

B. Short description of recruitment process

As mentioned in the methodology of the project, partners are invited to use convenience sampling and recruit participants from their local/regional or international networks. Firstly, we have contacted and established a small focus group, with the Institut educació Secundària Pou Car, consisting of 6 VET learners of formal caregivers of dependent persons and 2 VET trainers. They were selected based on the willingness to participate in focus groups and due to geographical proximity. Secondly, we have invited professionals from different health sector fields, an odontologist and an optometrist both with more than 15 years of experience in their fields. They also were selected due to their location and their interest in digital technology focused on health care.

The main issue for organizing the FG was finding suitable time for meeting together due to the busy schedules after the holidays (Christmas time), for this reason we had two extra individual interviews, because we wanted to get information from the professionals as well.

C. Questions asked during discussions

Pre-defined questions:

1. **Are you a trainer/learner? Please circle**

6 participants were learners.

4 participants were trainers

2. The table below was filled in by gathering all answers of the participants.

Type of Digital Technology	**Knowledgeability (Choose 1 – Very Knowledgeable; or 3 – Knowledgeable; or 5 – Not knowledgeable)**	**Are you aware of case-studies of such technologies in the health sector? (Choose Y – Yes or N – No)**	**Would you be willing to learn and see case-studies? (Choose Y – Yes or N – No NS – Not sure)**	**Which resource(s) would you prefer to facilitate your learning^{L} or training^{T}? (Choose A – face-to-face course; or B – e-learning course; or C) Single page fact sheets; or D) Case-studies; or E) Power-point presentations; or F) Other**	**Other Comments**
CAD/CAM	1-3L 3-4L 5-1L 5-2T	Y-3L N-2T N-5L	Y-5L Y-T N-2L NS-L NS-T 60% of participants are interested in learning about CAD/CAM.	A-5L A-T B-T F-L B&D- L E-L The most desired resource is face2face courses.	People who know CAD/CAM have been trained internally when the technology has been acquired.
3D Printing	3-5L 1-L 5-2L 3-2T	Y-4L N-4L N-T Y-T	Y-8L Y-2T 100% of participants are interested in learning about 3D printing.	A-3L A-T D-4L A&B-L A&D-T Most desired resources are face2face courses and case-studies.	A learner would combine face-to-face with online course to optimize times, saving on trarvelling.
Augmented Reality	1-3L 5-2L 3-3L 3-2T	Y-3L N-5L N-2T	Y-8L Y-2T 100% of participants are interested in learning about augmented reality.	A-5L A&B- L A-T B-T D&E-L A&D-L The most desired resource is face2face courses.	They prefer face to face course because is a direct way to learn about something new.

Virtual Reality	3-7L 5-L 3-2T	Y-4L Y-T N-4L N-T	Y-8L Y-2T 100% of participants are interested in learning about virtual reality.	A-5L B-L E-L A&B-L A-T B-T The most desired resource is face2face courses.	
Internet of Things (IOT)	1-5L 1-2T 3-3L	Y-5L N-3L Y-2T	Y-6L N-L NS-L Y-T N-T 70% of participants are interested in learning about internet of things.	A-3L B-L E-3L F-L B-T E-T Most desired resources are face2face courses and power-point presentations.	
Block chain	1-L 3-2L 5-5L 5-2T	Y-5L N-3-L N-2T	Y-5L N-3L N-T Y-T 60% of participants are interested in learning about block chain.	B-4L B-T C-L E-L F-L F-T F&E-L The most desired resource is e-learning courses.	
Artificial Intelligence	1-2L 3-4L 5-2L 3-2T	Y-3L N-5L Y-2T	Y-5L N-2L NS-L Y-2T 70% of participants are interested in learning about artificial intelligence.	A-3L C-2L F-2L B&E-L A-T A&D-T The most desired resource is face2face courses.	To start learning something they prefer face to face courses.

Cloud-based Technologies	1-4L 3-3L 5-L 1-2T	Y-6L N-2L Y-2T	Y-5L NS-2L Y-T N-T N-L 60% of participants are interested in learning about cloud-based technologies.	A-L F-L B-6L B-T E-T The most desired resource is e-learning courses.	
Robotics	1-4L 3-4L 3-2T	Y-5L N-3L N-2T	Y-8L Y-2T 100% of participants are interested in learning about robotics.	A-4L B-L D-L A&B-2L A-T A&D-T The most desired resource is face2face courses.	
Drones	1-6L 3-2L 1-T 3-T	Y-5L N-3L Y-T N-T	Y-8L Y-2T 100% of participants are interested in learning about drones.	A-7L D-L A-T B-T The most desired resource is face2face courses.	
Others – specify					

23. Which are the advantages, benefits these digital technologies could offer to trainers/learners? Please elaborate the response on these elements and provide examples

The advantages, benefits these digital technologies could offer are summarized in:

- In general, better working efficiency.
- Increase the improvement of the quality and accuracy of results.
- Improvement in the patient's understanding of the treatment process.
- Reduces the response times and increase efficiency in making a diagnostic.
- Improved safety in storing patient data.
- Both learners and trainers, agree that the great advantage of digital technology is educational. Benefits to learn new techniques in the health sector. Better educational tools.

24. Which are the disadvantages, barriers or limitations these technologies could offer to trainers/learners? Please elaborate the response on these elements and provide examples

The disadvantages, barriers or limitations these digital technologies could offer are summarized in:

- High costs of implementation, both to purchase and learn about the new technological acquisition.
- There is a lot of information about new technologies and it changes very fast. Sometimes it is difficult to identify whether information on new technologies is true.
- Language barrier, most of the information is in an unknown or little-known language.
- Technological skill barriers.
- Lack of time for learners and trainers to integrate all knowledge quickly.
- Learners feel fear that technology will replace healthcare professionals,

25. Which specific capacities related with digital technologies should be introduced in the curriculum and encouraged to train for learners? Why?

- Easy access to real case-studies of new technologies applied to the health sector**.**
- Include practical training in the curriculum.
- Improve knowledge of the use of IT systems facilitating the implementation of new technologies.
- Use virtual reality to learn some techniques.

26. How can learners be prepared for the rapid and continuous evolution of the new digital technologies in the field of health?

- Through continuous training with courses, case-studies and being informed with fact sheets.
- Keep abreast of rapid developments and evolve along with new digital technology. To have a platform always updated where to be able to access when a doubt arises.
- Free access to courses including face to face and online courses.
- Be informed of the application of new technologies in other countries.

D. Answers to the questions

Everyone is interested in knowing most of the mentioned technologies. The best scores with the 100% of the participants interested in are: augmented reality, virtual reality, 3D printing, robotic and drones, follow by 3D scanning, Internet of things or artificial intelligence while the least chosen technologies have been CAD/CAM, block chain, cloud-based technologies but also with high interest scores.

When participants were asked about the preferred learning methodology, most of them chosen face to face courses followed by e-learning methodology. The main reason is, that participants prefer to learn about something new in a direct way, but they also like e-learning course to optimize times because of their busy schedules. In some cases, a mix of educational resources for training was chosen.

E. General remarks

In general, they are all agree on the advantages brought by new technologies in the health sector such as: speed in response times, accuracy in diagnostics and for the students, technology appears as a good educational tool to be more prepared.

"There is a lot of work ahead with 3D scans, work is done in a more comfortable way with better quality to the patient and more precision of results. In addition, 3D scans are a marketing tool because you can explain to the patient what the treatment process and results will be, so it will make him understand it better. It improves in quality, time and efficiency".

Nevertheless, trainers and learners, stress the great difficulty of being constantly up to date with new technologies due to the continuous changes and the lack of time of the professionals involved. Added to this, they understand that there are barriers such as technological skills, the lack of time and the high cost acquisition of the technology in healthcare systems.

For this reason, the participants in the FG and the people interviewed find it important digi4health project and they are looking forward the results of the study.

F. Photos of the Focus Group Sessions

Appendix 7: National Focus Group: Spain (INHWE)

A. Date/place/time that the focus group took place and number of participants

Country:	Spain and EU
Date:	24th January 2020 (Local) and 17th January 2020 (EU)
Place:	Sant Cugat del Valles and Skype
Number of participants:	6 (local) and 6 (EU)
Demographic data EU:	Educator and paramedic from UK, Educator and nurse from Ireland , Educator and pharmacist from UK Pharmacists from Switzerland, Doctor from Germany, Physician Assistant from Germany
Demographic data local:	Educator and nurse, Educator and occupational therapist , Educator and specialist nurse, Nurse, Occupational therapist, Student Nurse

B. Short description of recruitment process

We identified and invited partners though our free membership network and some selected partners. We used our membership base to ensure good representation at both the local and EU focus groups. The only difficulty was finding a suitable city with which to hold the local meeting, in the end Sant Cugat del Valles was chosen to ensure representation from outside the city of Barcelona (which broadened the views expressed).

C. Questions asked during discussions

1. **Are you a trainer/learner?**
   6 Learners
   6 Trainers

2. The table below was filled in by gathering all answers of the participants.

Type of Digital Technology	Knowledgeability (Choose 1 – Very Knowledgeable; or 3 – Knowledgeable; or 5 – Not knowledgeable)	Are you aware of case-studies of such technologies in the health sector? (Choose Y – Yes or N – No)	Would you be willing to learn and see case-studies? (Choose Y – Yes or N – No NS – Not sure)	Which resource(s) would you prefer to facilitate your learning[L] or training[T]? (Choose A – face-to-face course; or B – e-learning course; or C) Single page fact sheets; or D) Case-studies; or E) Power-point presentations; or F) Other	Other Comments
CAD/CAM	5 4 4 3 3 4 4	Y Y Y N N Y N	Y Y Y Y Y Y Y	Bx2 / Ax3 / Ex2 / Dx3 / Cx2	
3D Printing	5 4 4 3 3 4 2	Y YY N N Y Y	Y Y Y Y Y Y Y	Ax3 / Bx2 / C / Dx3 / E / F (Design)	Very Interested
3D Scanning	4 5 3 3 5 4 4	Y N Y Y Y N N	Y Y Y Y Y NS Y	C Ax4 Ex2 Dx3 B	
Augmented Reality	4 3 3 3 4 1 1	Y N Y Y Y Y Y	Y Y Y Y Y Y Y	D Ax5 E B	Very good to see the products in action.
Virtual Reality	4 3 3 3 5 1 1	Y N Y Y Y Y	Y Y Y Y Y Y Y	Dx2 Ax5 Ex3 B	
Internet of Things (IOT)	4 5 5 5 5 3 5	Y N Y N N Y N	Y Y Y Y Y Y NS	Bx3 Ax3 Ex2	
Block chain	4 5 5 3 4 1 4	N N Y Y N Y Y	Y Y Y Y Y Y Y	Bx4 Ax3 E D C	
Artificial Intelligence	4 3 3 3 5 3 2	Y Y Y Y N Y Y	Y N Y Y Y Y Y	Ax6 Cx2 Ex3 Dx2 Bx2	
Cloud-based Technologies	4 3 1 4 3 2 3	N N Y N N N Y	Y Y Y Y Y N Y	C Ax3 E Bx2	
Robotics	3 3 5 3 3 4 3	Y Y Y Y N N Y	Y Y Y Y Y N Y	Ax5 E Dx2 Bx2	
Drones	4 3 5 3 3 4 4	N N Y N N N Y	Y Y Y Y Y N Y	Cx2 Ax2 Ex2 D Bx2	
Other					

(N.B. Not all partners took part in the data gathering exercise due to late of time / knowledge)

D. Answers to the questions

27. Which are the advantages, benefits these digital technologies could offer to trainers/learners? Please elaborate the response on these elements and provide examples

The answers to this question focused very much on two areas. Firstly, there was a vague agreement between both groups that technology is a benefit to healthcare and a generally positive thing that will improve healthcare delivery and services. However, as you can see from the quotes below, there was very little substantive evidence for this:

"I think there's a lot of benefits and that's why it's coming in."
"The hottest technology is very positive"

The majority of the discussion focused very much on how technology could benefit healthcare educators and enable them to ensure that they produced high quality, excellent healthcare professionals in the future and use CPD to 'upskill' current, working professionals:

"I think for me in my experience with different technology the benefits that they offer is that immersion and that ability to practice something which one may not necessarily encounter from a healthcare point of view on a day-to-day basis."
"So both simulation and virtual reality and the instantaneous reaction of AI and machine learning are scenarios I think can be really helpful and a benefit to the student."
"Increase usefulness and utilitarianism for remote and distance students who may not be physically able to attend brick and mortar classes."
"You're all very familiar with the challenges facing, nurses, doctors, midwives or health professionals in getting away from clinical environments to engage in lifelong learning or for revalidation and other purposes. So we are investing on a project to actually digitalize a lot of the knowledge component curriculum of what will be considered as CPD and lifelong learning for professional development."

Much of the discussion in this section of the focus group often turned to the disadvantages and these findings have been described in the next section.

28. Which are the disadvantages, barriers or limitations these technologies could offer to trainers/learners? Please elaborate the response on these elements and provide examples

Many different disadvantages were outlined by focus group members but four clear areas arose from the discussion. Namely, there were questions asked about the adaptability and cost of technology in healthcare systems; a lack of evidenced based research or patient benefits with some technology; a fear that technology will replace healthcare professionals; and its applicability for use in educational settings.

Participants outlined a very real fear from healthcare professionals that some professions or certain roles will become obsolete in the future. This was confirmed later on in the discussion by a need for technology to be seen a 'tool' to facilitate good care rather than a tool that can provide the care itself:

"One of the fear factors is that there are always going to be certain students certainly that just will not get on board with what we're trying to do or what we're trying to push as a technological agenda."

"People are scared overall of using technology for a couple of reasons: first, we think it's taking jobs away from them. So we get into a whole difficult conversation around professional identity and what professions do so it's a lot about building trust with technology and understanding the benefits that it brings to patient care."

"I think it's really difficult to try and take it into a workforce who are so used to the way that they work that without a change management process or without the innovation coming through and being seen in an educational setting is a really challenging."

A key disadvantage that was constantly identified regardless of where each participant came from, was that of cost and adaptability. The high implementation costs and the possible lack of flexibility with some technologies was seen as a major drawback:

"One of them is thinking about the acceptability and adaptability for it. This could be whether it's maybe even the age group of health workforce itself. How accepting they are."

"I think that is one of the things to look at is new legal issues that arise from it. So whether it's a drone delivery or many of the other things I think those issues and then the funding for that because sometimes I think since cost is already an issue, but I think even when we calculate cost we forget to cost for the legal issues that might arise from it or think ahead."

"I think it's very difficult at the moment, especially in our system to implement it in the health workforce because the time is so limited. There's not even time for correct and good clinical practice at the moment in Germany."

"I've got to say the cost, well, the few hairs I have left on my head, then they fell out at some of the costs associated with it."

"Although we have funds to cover it, it's a scary investment."

"As well as increased operational costs associated with all of these factors."

The educators and trainers also provided examples of where technology is fit for use in practice but not in an education setting. They felt left out of the process and this caused frustrations with new technology and the companies that produce them:

"There needs to be a synergy between the advancements in technology enhanced learning and in digital applications for healthcare delivery."

"I see one of the big barriers being that the technology there is for education is not prepared for teaching students. Although things like EPR systems, EPMA systems are very good and the very useful and they're working really well in clinical practice. Unfortunately, some of the issues that we have is that they don't translate into education very well"

"I suppose essentially we need some way of being able to map out what the differences are between the educational needs are and what clinical practice needs are and see if we can work out how things would work that way and that's probably my major point in terms of a disadvantage I suppose."

"There is a high learning curve for older students and teachers/instructors with new technologies"

"Many people that are working now for these students they focus too much on technology."

Along similar lines, there was a general distrust of the evidence base that some technologies come with:

"Many times they give you like the technology and they won't tell you really what are the benefits. This has to be addressed in order to be able to implement technology in the correct way."

Overall, the general feeling towards technology was that it is having a positive effect on healthcare system and education in general. However, the above challenges, difficulties and barrier we identified as changes that will aid the improvement of technology rather than reasons not continuing to use and introduce technology to healthcare settings.

29. Which specific capacities related with digital technologies should be introduced in the curriculum and encouraged to train for learners? Why?

Participants found it difficult to outline specific skills that would be beneficial to teach in a digital skills and technology curriculum however they did identify three key areas that project partners should consider when designing the training materials. Firstly, it is extremely important to highlight and link to other core competencies and transversal skills that are taught to healthcare professionals, such as communication, ethics and empathy:

"Make the students aware that they are going to need to balance technology with core healthcare competencies and humanistic care because technology has been there for a long time."

"Soft skills, you know again and what Hiten was saying about communication understanding what we actually mean by digital and not having it as a scary word."

"I think the ethical issues also have to be addressed."

"Making professionals aware of critical thinking, leadership and how this works around the technology. I think that's very very important."

"We really need to find balance where we are still caring for the patient taking all their humanity or technology but always trying to remember that there is a patient that's very important."

"To be sensitive to these humanistic approaches the intervention that we want and to build up the adequate applications, adequate for example prosthetics."

Along the same lines, interprofessional and multistakeholder education should be promoted:

"I guess it should be super interprofessional and yes we know so many examples and when people go too much into the technology just substituting and there is always ethical issues."

"We need to make sure that digital technologies can facilitate workflow and also prioritization of care within a multidisciplinary team."

"So in terms of competencies, we've got communication between different healthcare profession, communication with the actual technology itself and also maintaining patient engagement as well while using these technologies."

Attendees from both groups also highlighted that they believed that digital skills should be seen as one unique competency in itself:

"I just think digital competency is a core competency itself. Just because you cannot teach me how every mobile phone works you can teach me how one works and if I've had the competences, I'll be able to translate it to another phone."

"I think it's not only a core competence but it's also basic because maybe you should start from for school environment learning."

"For me, it's important to know which are this list of the skills which are the minimal skills for the students for to be entertained."

"My specialty was the ICU. So and I'm talking years ago when I used to do clinical nursing in the ICU in the UK, I just remember in those days you have all this machines and all this technology. Actually sometimes we literally just forgot that patient observation on the bed"

"One of the words that we're not using at the moment is actually digital resilience."

Lastly, participants cautioned against using generational stereotypes:

"So you're so different than me and we have to bear this in mind."

"People are being branded as Instagram generation or Google generation and having their heads in their phones all the time. We don't want Healthcare professionals to become like that. We want them to be able to utilize the technology and allow it to become part of what we do but not take over"

"The greatest challenge we are facing in Germany is that people overestimate our competencies. We are called "Generation Instagram" because we are the generation that's always on their phones, but that has nothing to do with any digital competence as we need later in our, you know, just in our work and I think that these expectations are a barrier for meeting digital change."

30. How can learners be prepared for the rapid and continuous evolution of the new digital technologies in the field of health?

Colleagues who took part in both focus groups stated how difficult this question was, firstly due to the fast changing nature of digital technologies and the various disadvantages outlined in the previous questions (particularly for the educators and trainers present):

"Technology is just progressing so fast and probably what we make that list technology would be just like behind always."

"Because you don't know what's going to come up in 10 years. That's the thing. You just have to keep on updating what's coming up."

"But it's how you utilize technology and have a robust quality assurance framework around it to make sure that there are clear guidelines and boundaries around when you do and don't use bits of technology."

"So I think what I'd really like to see from the project is all those really good case studies of where it's had an impact where it's really improved care. It's really improved the way people feel about technology. I think I think that could be extremely positive overall."

"Technology is going to continue to change as well so as much as we want everyone to be at the same standard eventually that standard will not be acceptable enough and we're going to have to push the boundary once again."

However, there was a reassuringly strong emphasis on the necessity for the Digi4Health project in general and the way in which the project is set up to produce specific training materials on various different digital technologies. This was particularly welcome:

"Nobody knows but we've got to give it a go and we've got to try and pilot these things whether they're in a small setting and then moving things forward into a larger settings."

"Obviously we can't predict what technologies will be used. Obviously we can try and pick the most state-of-the-art at the moment because they will remain relevant for longer. But from what everyone has said in our outputs, we need to make sure we focus on the core competencies as they are now because as has already been mentioned, okay, there is an iPhone 11 now, but actually if you knew how to use the original iPhone, you can probably still use one if you keep updating your skills."

E. General remarks

The final conclusion drawn from the focus group was that any educational tools must be adaptable for multiple generations (already covered above), professions, students at varying stages of their education and for current professionals. This was given high relevance to both educators and learners alike and some comments and suggestions have been outlined below:

"What I've observed in some undergraduate student towards technology is that probably things like virtual reality, augmented reality, there's some technologies that they think are so cool and they know how it works and they see it's part of their lives and this is going to be used every time. But then when you talk to them about artificial intelligence and there is a lot of resistance"

"My niece she was one year and she was with a book and she was trying to pass the page like this [imitates swiping a tablet] so it could be easier but knowing how to use the everyday technology doesn't mean that you know how to use it for the patient."

"For us it is dilemma for example in the curricula at which point we should introduce this technical skills."

"Just maybe you're doing one subject about something. So for example about all these or so you can add what kind of technologies you can use and how you use it to help. I would not do it just like okay now we're going to do a subject about technologies in health or something like that."

"There's a difference between the way you educate those [current professionals] because with the ones that are already in the healthcare workforce, those people your upscaling which means that they've got a baseline knowledge of how certain systems work already."

"At the same time they're [current students] trying to absorb not only the technological advances that you're trying to push on them, but they're trying to absorb all the other educational facets as well. So they're trying to learn clinical aspect and work them into the digital age."

Both focus groups showed that there is a strong appetite for the aims and outputs being developed by the Digi4Health project. We can see that both locally, in Catalunya, and in countries who are not participating in the project itself, similar thoughts prevail on the advantages, disadvantage and possible actions that must be taken to improve digital skills and knowledge. Interestingly, there seems to be little difference between higher performing healthcare systems and lower performing ones. Equally, there seems to be little difference in economically difference states and systems. This would suggest that project can be successful across Europe and beyond.

Digi4Health Focus Group: Europe Transcript

Participants

Speaker 1: Facilitator
Speaker 2: Educator and paramedic from UK
Speaker 3: Educator and nurse from Ireland
Speaker 4: Educator and pharmacist from UK
Speaker 5: Pharmacists from Switzerland
Speaker 6: Doctor from Germany
Speaker 7: Physician Assistant from Germany

Transcript

Speaker 1: Okay, I will now share my screen very quickly and this should not take too long at all. As I mentioned this is the digi4health focus group and it's run by INHWE as part of the wider project which is run by the Maltese partner for their National Agency. The presentation and what we're going to try and achieve in the focus group will be to look at the fourth industrial. Specifically look at the fourth Industrial revolution in the healthcare sector, now that sounds quite grand but we'll explain what that it is actually very simple and it's a name that the project coordinators have given to what technologies we're looking at within this project. Although I sent the previous email I just want to very quickly talk about what we're hoping to achieve in this focus group. And I will also show you just a couple of minutes of video just so you get an idea of some of the technologies that will be looking at.

So what is the fourth Industrial Revolution? Well, it's basically just where we're at with the digital revolution within wider Society. So all the digital technologies are available in wider society and then how they are used in the health sector is what we call Health 4.0 which is basically the fourth Industrial revolution. For example a technology being used in the household and how that might be changing how systems across Europe. The next slide you´ll see that some of these you would have heard of and some of them you may not such as augmented reality and virtual reality, artificial intelligence, 3D printing, increased automation. Data analytics we have available now and wireless technology have been able to collect data on patients without them having to be there face to face. These are all the kinds of technologies that we're talking about within the scope of the fourth Industrial revolution. The project itself. What we hope to achieve is to develop a digital tool kit for promoting the fourth industrial revolution in the European health care sector and this toolkit will be designed for trainers, mentors and also learners themselves. It is funded by the Erasmus+ funding

scheme and is a two-year project that started in October and it runs until September 2021. We have Partners from Malta, Romania, Lithuania, Greece and Spain what we're hoping to achieve is a curriculum and a number of training materials on specific digital technologies.

So you can see there you have CAD/CAM and Robotics. There will be one on augmented reality virtual reality etc. And this feeds into the toolkit which will be a number of fact/information sheets, with PowerPoint content for educators to use and then various different ways of testing. The focus group is just to bring together a vast array of healthcare professionals, educators and learners which we have here, so that's fantastic. The methodology is very simple, it's open-ended questions and we're really looking to hear your honest view, so please be feel free to be as honest as possible and don't feel like you have to hold anything back. I'm now just going to show you just a few videos to get an idea of the project, how technology is being used now. Hopefully everyone can hear this, but if not, hopefully it'll be relatively self-explanatory as to what's going on. So this is what this first one is on simulation and simulated robotics.

Okay, so that was the presentation. We now have 15 minutes until Thomas needs to leave and 45 minutes to take the discussion with everyone else. So what I'm going to do is basically you've seen two examples of digital technologies that can be used in healthcare and I'm sure you have many more examples that you've encountered in your either your education as a learner your experience as educators or in your professional practice. So the first question is what do you believe are the benefits and advantages of various digital technologies in healthcare? And what could they offer to both educators and learners? The floor is open to whoever wants to take that first.

Speaker 2: Hi David it's Adam happy to start with a few comments if that's helpful.

Speaker 1: Yes, please. Go ahead.

Speaker 2: Yeah, thank you. Hello, everybody, good afternoon and good evening to those of you a little bit later in time than here in the UK. I think for me in my experience with different technology the benefits that they offer is that immersion and that ability to practice something which one may not necessarily encounter from a healthcare point of view on a day-to-day basis. So as a paramedic the options for certain patients when you're on placements, you know, you might not see a cardiac arrest for example, or you might not have the opportunity to properly experience someone who is aggressively violent towards you or needs different kind of surgical interventions, which paramedics are trained upon. So both simulation and virtual reality and the instantaneous reaction of AI and machine learning are scenarios I think can be really helpful and a benefit to the student. I think with that as well, there's a

huge benefit to educational units for exposure and sign off of competencies and skills, which you may not otherwise be able to practice. I think when we try and, you know, often a lot of places do OSCE objective structured clinical examinations, and there isn't a sense of complete realism to them because they are simulated with real people in an environment that you know with people you might know anyway and things like that. Whereas with different technologies you have better learning experience because of that immersion and a wider exposure to different aspects that you may not necessarily see. I think that's the starting point I can think of.

Speaker 2: That's great Adam. Thanks for that. Does anyone else have anything to either answer Adams point or to get to their own just jump in.

Speaker 7: The advantages and benefits of digital technologies include increasing user engagement, heightening application and retention of information for example, using interactive educational delivery, assessment and learning management apps instead of paper or even static computer-based training. Also, these methods increase usefulness and utilitarianism for remote and distance students who may not be physically able to attend brick and mortar classes. Of course, concepts such as 3D printing, graphical simulations and computer assisted modelling, especially when applied to healthcare training, have the potential to increase kinetic and experiential learning processes, especially in disciplines such as the life sciences, informatics and pharmacology. Additionally, these technologies are beneficial to the instructors and trainers as well, assisting them with improved methods for curriculum development, delivery of information, course creation, tracking of student progress, grading, and overall learning management.

Speaker 3: I have a point to build on a David if I can and again greetings from Ireland and I apologize I have to leave shortly. So I'm going to get in a few words if that's okay. And to me the College of Surgeons where I work and the University of Health Sciences that I work in has, as some of you may know because you visited, we have invested a huge amount of money very recently in relation to digital learning in the transformation of enhanced digital and simulated learning environments for all undergraduate and postgraduate students. We've invested heavily in the type of mannequins that you've shown in that video and we've included an appointment of a professor of simulation. So that not only are we investing in terms of the pedagogy. We're also investing in preparing academics to utilize this technology enhanced learning, but also critically going forward to actually conduct research into these modes of learning. The second thing I would say from my own perspective in terms of my own faculty is that we are now going towards project approval to look at how we deliver continuing professional development learning and you're all very familiar with, you know, the challenges facing, nurses, doctors, midwives or health professionals in getting away from clinical environments to engage in lifelong learning or for revalidation and other purposes. So we are investing on a project to actually digitalize a lot of the knowledge component curriculum of what will be considered as CPD and lifelong learning for professional development. And the final thing I would come in

from an Irish perspective only is that I really do believe that there needs to be a synergy between the advancements in technology enhanced learning and in digital applications for healthcare delivery because in Ireland while we have opened in 2013 a very very strong digital platform in relation to health care delivery and electronic records and all that in reality the services are languishing behind. So what I would love to see is from an Irish perspective anyway is a strengthening of the use of that fourth industrial revolution. Not just from perspective of preparing the healthcare professionals of the future but also in terms of the delivery of health care and practice. Thanks.

Speaker 1: Thanks so much Thomas. seeing as you're here with us now I just want to ask you the next question which you kind of briefly touched on at the end of your answer talking about synergies and potential lack of them. The next question is around what do you see as the advantages barriers or limitations to these technologies. So if you have anything to say on that topic before you go, that would be great to hear.

Speaker 3: So it's interesting just before we came online my project coordinator for our digital enhanced development and lifelong learning has sent me quotes from some companies here based in Ireland that work with our IT department so they're well recognized suppliers. What I'm trying to do is I'm trying to balance what is accepted and will be supported within the college and the IT structures within the college and to also bring in things like gamification and all sorts of things which are good. And I've got to say the cost, well, the few hairs I have left on my head, then they fell out at some of the costs associated with it and it might be like anything else. You know, when you're in your new space like this the costs can be challenging. These costs tend to dissipate over time, but certainly some of the initial Investments that we are going to have to make because they believe there is no real alternative. It's the future and it's it was scary and getting some of these quotes, well, the proposals themselves will go to my faculty board the end of this month and some of the costings associated with it will make some of my board members nervous. Although we have funds to cover it, it's a scary investment. So I think first and foremost is you feel sometimes captivated by the expertise in developing these areas of innovation and you feel bound to them, but there's a price to pay literally so that would be the significant issue and it is a wonder significant issues also in terms of the transformation of healthcare delivery and indeed transformation of things like shared electronic patient records. I think it seems to be cost not to mention some challenges with infrastructure in rural and remote parts of Ireland in terms of, you know, the dearth of broadband things like that.

Speaker 1: Thanks so much. Thanks for that answer Thomas and I think whenever we discuss health care in any kind of situation, cost always comes out as a barrier and a disadvantage and it's obviously no different here. If anyone wants to now jump in regarding

the use of the advantages or the disadvantages, that would be great. But I just want to say very quickly, Thomas, thanks for joining us if I don't get to say that before you have to leave. Thank you very much. Really appreciate your time and commitment to this.

Speaker 3: Okay, no problem. Thank you.

Speaker 4: Good evening. My name is Hiten and I'm from the University of Manchester. I represent the medical school at the University and I'm a pharmacist by background. So in terms of my ideas of thinking about technology in the education part of things, I see one of the big barriers being that the technology there is for education is not prepared for teaching students. Although things like EPR systems, EPMA systems are very good and the very useful and they're working really well in clinical practice. Unfortunately, some of the issues that we have is that they don't translate into education very well, unfortunately, so we have things like the fact that once you put something on to a system it is there forever and it's also time stamped as well, which means that time just continues throughout no matter which session you're doing. So, for example, I teach 428 students in our 5th year. We break those down into small groups of 30 and if I have created a clinical scenario of a six-year-old child by the end of the semester that six-year-old child could well be seven years old which means that things like dosage regimes medication that the patient could possibly have, all of that could change within that period which makes it really difficult for educators to actually move forward with utilizing these technologies in the way that they're supposed to be used. We need to have some kind of reset button. I suppose essentially we need some way of being able to map out what the differences are between the educational needs are and what clinical practice needs are and see if we can work out how things would work that way and that's probably my major point in terms of a disadvantage I suppose. Not a disadvantage just a barrier that we need to look to overcome.

Speaker 1: Thank you very much Hiten that's really interesting actually to have a very practical example of a barrier to Educators that the people designing these systems haven't necessarily thought of which is really interesting.

Speaker 7: David, can I say something? I think the major barriers include the high learning curve for older students and teachers/instructors with new technologies also it is a constantly evolving field, which makes current technologies obsolete in very short periods of time while there is inherent disruptiveness of disruptive technologies in an educational setting. This means that consistency and standardization play a large role, especially when certifications or degrees are being conferred in those educational programs. As well as increased operational costs associated with all of these factors.

Speaker 1: Soosmita I think you wanted to go next.

Speaker 5: Thank you David. Hello everyone. Yeah, I think there's a lot of benefits and that's why it's coming in. We see that so I'll touch upon just a few of the disadvantages. One of them is thinking about the acceptability and adaptability for it. This could be whether it's maybe even the age group of health workforce itself. How accepting they are. Like Hiten, I am also a pharmacist and I was practicing for a while and then became a lawyer. I think issues that come in is how the health workforce are educated? And that's why it's important not only to focus on education that comes from school but continuing education to get them up to it or resource strapped areas for a lot of people. You know studying or coming from those areas. How do they adapt to that technology? I think that is one of the things to look at is new legal issues that arise from it. So whether it's a drone delivery or many of the other things I think those issues and then the funding for that because sometimes I think since cost is already an issue, but I think even when we calculate cost we forget to cost for the legal issues that might arise form it or think ahead. So those would be some of the things to think about both from the perspective of education and practice.

Speaker 1: That's really interesting and actually I'd just like to hopefully bring another colleague in if it's okay? One of the other participants Lucas is a medical student at the moment, I believe or newly-qualified. Talking about or thinking about Soosmita's point on digital skills and digital key competencies. Do you believe that current students still have difficulty in using some of these digital technologies or are the younger students coming through now quite confident with these digital technologies and the use of them.

Speaker 6: Good evening everyone. I'm Lucas. I'm from Germany and from the German Medical Students Association and the greatest challenge we are facing in Germany is that people overestimate our competencies. We are called "Generation Instagram" because we are the generation that's always on their phones, but that has nothing to do with any digital competence as we need later in our, you know, just in our work and I think that these expectations are a barrier for meeting digital change. Yeah, just like digital education in our curriculum, which didn't happen in Germany so far, we are currently in Germany in the development of a new learning objective catalogue. And we also have one group for digital competencies, but it hasn't arrived yet and I disagree a bit about the part of educating the health workforce because I think the most sustainable way is to start in the school and to continue it in the health workforce. I think it's very difficult at the moment, especially in our system to implement it in the health workforce because the time is so limited. There's not even time for correct and good clinical practice at the moment in Germany. And yeah, I think it's very difficult to implement it there, but I'm looking forward to your solutions to that.

Speaker 1: That's really interesting Lucas and it's really interesting as it leads me or leads us as a group quite nicely on to the third question, which I'll put in now, but it doesn't stop us going back and talking about the advantages and disadvantages if it comes up

again. But the third question was around what are the specific competencies related to digital technologies, you believe should be introduced? In either our curriculum or as you mentioned possibly before and what do you believe should be encouraged for both educators and learners to ensure that we can use these digital technologies which are coming through.

Speaker 7: Specific capacities with digital technologies include education on data exchange concepts, such as data patient portals, the concepts of cloud computing in healthcare, Big Data, computer and telecommunications infrastructure, security and privacy concepts, virtual/augmented reality. Why is the training of technologies such as these important? Well, they bring both learners and instructors into the forefront of digital technologies and give them the best chance to positively impact healthcare and patient outcomes. Further, learning concepts such as these allow for easy and quick integration of healthcare professionals' expertise with intelligent devices. It promotes interdisciplinary discussions, forms the basis for standardization as well as robust processes and protocols, and heightens the impact of novel techniques on patients and caregivers.

Speaker 4: So I've got quite an extensive list of things that I think would be very useful for everyone to be thinking about when they're thinking about digital content and digital competency. And one of the words that we're not using at the moment is actually digital resilience as something that also needs to be built into the education side of things and I've kind of built these competencies into varying categories. Have based it around digital health so we think about risks and benefits to the patients as well as in terms of other health care staff as well. We need to make sure that digital technologies can facilitate workflow and also prioritization of care within a multidisciplinary team. So bringing this into a professional aspect of things because as we know each discipline utilizes varying degrees and varying aspects of technology, and we need to make sure that all of the teaching and all of the education and the workforce is being taught to a certain standard. I suppose across professions so that everybody is singing from the same hymn sheet, essentially, we need to ensure that the data is being correctly kept and it is accessed appropriately and also by the appropriate people as well. So when we utilize them in their teaching aspect, should we be looking to access real patient records? Should we be looking to create these kinds of different data sets within the technologies that we're using. So it's not only just the data, not only just the technology that we're using but also the underlying data that actually comes with all of that technology as well. We need to make sure that this is also being communicated as well. So from a communication aspect there are different ways that we can build into this. So in terms of competencies, we've got communication between different healthcare profession, communication with the actual technology itself and also maintaining patient engagement as well while using these technologies. We don't want, as you know, Lucas was saying that people are being branded as Instagram generation or Google generation and having their heads in their phones all the time. We don't want Healthcare professionals to become like that. We want them to be able to utilize the technology and allow it to become part of what we do but not take over everything that we do as well. So there's a lot of

things a lot of aspects that need to be built into it in terms of competencies. And the final thing that I think that really needs to be thought about is monitoring it and also auditing what we do as well so that there is room for quality improvement in what we do and also being able to continue this research aspect and ensuring that the that we abide by stay high level.

Speaker 1: Thanks for that Hiten and that's really interesting and what I find particularly interesting was what you just said is a lot of the kind of competencies you mentioned when we're talking about digital skills are just sort of good competencies to have as a healthcare professional in general. I mean when you talk about just a communication, for example, obviously, you know digital technologies can improve communication and having for example having consultations over Skype instead of face-to-face. Or receiving patient data via apps and Fitbit and looking at possible health benefits of that. It's all communication with the patient and the healthcare professional using a digital technology to try and enhance that. I find it quite interesting when we're discussing digital competencies in this project specifically looks at creating a curriculum that focuses from the beginning on certain technologies. Now that to me doesn't necessarily look at competencies in kind of more in a more broader sense as you mentioned, so I guess what would be your comments on how the project is approaching this question of digital Technologies and possibly improving digital skills for health professionals. We'd be really interested to know.

Speaker 6: Yeah, I think that we have three major fields in Germany that are very important to every doctor no matter in which specialization or something like that he works in. That's at first literature research. Our secondary would be clinical decision systems, which are already coming up and the third thing is patient and clinician apps. For example, we adopted a new policy recently which makes it able to prescribe apps to patients which will lead to a lot of apps a lot of new apps on the market which we as doctors have to handle and also we have to advise our patients in it, which we aren't taught at the moment.

Speaker 1: That's very interesting. Does anyone else have any comments?

Speaker 2: I think what Hiten was saying is really bang on in some respect because we commissioned some research with the Institute of Coding in the UK, which is a government funded organisation to look at digital skills across a wide range of sectors and Coventry is responsible for the health care sector of that and that one thing that really highlighted to us was that it's not necessarily about digital skills. So there's Lucas saying people are using digital technology all the time. It's embedded into our lives daily. And so people understand IT, what IT is and it links with what Hiten was saying it's around a change management process. It's about people being given confidence to use technology for patients and I think from an education point of view we have a responsibility to do that for the future workforce. I think it's really difficult to try and take it into a workforce who are so used to the way that they work that

without a change management process or without the innovation coming through and being seen in an educational setting is a really challenging. It challenges the concept of care and it challenges the, you know, the paradigms that exist which suggests that actually I do this my way in this is my professional way whereas if I was taught that concept then I would have that confidence to do it and a lot about the soft skills, you know again and what Hiten was saying about communication understanding what we actually mean by digital and not having it as a scary word. And that's one of the big bits of research that came out from ourselves was actually people are scared overall of using technology for a couple of reasons: first, we think it's taking jobs away from them. So we get into a whole difficult conversation around professional identity and what professions do so it's a lot about building trust with technology and understanding the benefits that it brings to patient care and brings to individual healthcare practitioners, which I strongly believe is we need to do from an educational setting working in partnership with healthcare workplaces to do it together because then the workforce evolves over a period of time. I don't think it's a really quick fix. It needs to be properly integrated from an executive level through an organization and through an executive level within education as well.

Speaker 3: Thanks, Adam. Anyone have any comments regarding what was discussed so far particularly around Adams Point feel free to jump him.

Speaker 4: Yeah, I think Adam you're really right. I think one of the other key aspects of this is well, like piggybacking onto what you and Lucas have both said is that the technology is going to continue to change as well so as much as we want everyone to be at the same standard eventually that standard will not be acceptable enough and we're going to have to push the boundary once again, which basically means that as educators from an undergraduate point of you need to stay on the cusp of that because those that are coming through at that point. They're the ones that will be utilizing the technology at its highest point to its best possible capability those that are already within the healthcare system. They're using technologies, but they may well be using outdated technologies, and eventually those will not just become outdated they'll be completely obsolete and they're the ones that then need to be upscaled as well. There's a difference between the way you educate those because with the ones that are already in the healthcare workforce, those people your upscaling which means that they've got a baseline knowledge of how certain systems work already, whereas in terms of undergraduates or those that have no experience you're starting with an absolute blank page in a certain way that can be fantastic because you can mould them into exactly how you want things to be done. But at the same time they're trying to absorb not only the technological advances that you're trying to push on them, but they're trying to absorb all the other educational facets as well. So they're trying to learn clinical aspect and work them into the digital age. Whereas those that are within the education within the health Workforce setting already. They have that clinical knowledge already. They're able to focus on that. All aspects of the

technological advancement which might be a little bit easier in a certain sense to try and work in and not so much of a big task as opposed as well.

Speaker 3: Thanks Hiten and you've actually you and Adam have already started to answer my last question or the last question of the focus group, which was how can Learners be prepared for the rapid and continuous evolution of the new deck digital technologies in the field of health care. So if anyone else has any specific comments on that, how do we keep the health workforce up-to-date and as Hiten mentioned both new learners coming through having to effectively learn everything from scratch as we've mentioned not only digital skills and digital technologies, but also the core competencies of being a healthcare professional.

Speaker 6: Yes, I'll I start I think it's the same as with medical knowledge as we know the half-life of medical knowledge is currently at around about 6 years or something like that. So medical knowledge in general is something we have to continuously develop for ourselves. And what we are doing with our medical studies is mostly laying a like a ground stone for a competencies that will follow up and which will also teach us how to develop new knowledge in the given. Framework and I think it's the same with digital literacy.

Speaker 1: Yeah, thanks so much. Anyone else want to jump in feel free? If not, that's absolutely fine. I've reached the end of my questions we have tons of information already, which is really interesting and will be extremely useful but there's still 10 to 12 minutes left of our skype call so if you have something to say, please feel free to say it.

Speaker 7: I think leaners can best be prepared by having robust interactive curriculum that integrates the new digital technologies into the training of same. They must be supported by trainers and instructors will the tools and skills needed to transfer knowledge in the best manner needed for information sharing, simulation participation, meaningful interactions, and secure data exchange in both educational as well as healthcare environments. Ultimately, all involved in the process must have the tools necessary to succeed in order to build skills and competence that can be assessed and certificated.

Speaker 2: There's only one more thing that I'd like to mention if I could just thinking about the disadvantages and barriers that I think sometimes come up in an educational settings and appreciate every University is slightly different but it's how you utilize technology and have a robust quality assurance framework around it to make sure that there are clear guidelines and boundaries around when you do and don't use bits of technology or what you use it for from an assessment setting or how you use it within programs and courses to make sure that there is that that robustness for educators as well as the upscaling of those educators to be able to do it which is in a correct way so that we don't go back to some of that change management process and by getting it wrong then we're

putting people off. So I think what I'd really like to see from the project is all those really good case studies of where it's had an impact where it's really improved care. It's really improved the way people feel about technology. I think I think that could be extremely positive overall.

Speaker 1: Thanks so much. Adam.
Speaker 4: Yeah, so finally, I just want to say that I think it's a really great thing that we do try and utilize technology and all of these things that we are moving forward with. One of the fear factors is that there are always going to be certain students certainly that just will not get on board with what we're trying to do or what we're trying to push as a technological agenda. And that's unfortunately always going to be the case, but we've got to try and ensure that we as educators and we as people are trying to move things forward with technology. We look at the bigger picture and we try and move everything forward as much as we can. So where there are barriers there's always going to be barriers, but if we do not try to do this and we do not try and overcome these barriers we're never going to find out and things are just going to stay the way that they are whether this improves things or not. Nobody knows but we've got to give it a go and we've got to try and pilot these things whether they're in a small setting and then moving things forward into a larger settings or by utilizing certain kind of disciplines first, and then trying to move It to other disciplines that's probably the way forward but I think we've got to just ensure that it does actually happen. Really.

Speaker 1: That's great. Any final comments or not? It's completely fine. If not. Well, I think with Hitens final comment there was a nice way to end for both educators and learners that we need to continue to try and make this relevant and to keep pace with digital technologies that are coming in. So that's something that certainly our project is trying to achieve and hopefully we can go some way to improving that. So I just want to say a big thank you to all of you who joined really. I know you've given your time on a Friday evening for this and its really fantastic and the information you've given us as a project will be invaluable particularly as a lot of you who come from sort of Central and Northern Europe European countries where you have a very different ‘national reality’ to the other partners in this project. Obviously, I mentioned we have Spain, Malta, Greece and Romania in this project which are obviously generally Southern or Eastern European States. And I think this will be extremely useful to complement the data. I mention start the call and we will keep you fully informed of the project as it goes along and we will be organizing a final conference. Most likely in somewhere in Spain in 2021. So we will ensure that you're kept in the loop for that and you're invited to that that event and play an important role in that event if you want to as our way of saying thank you. If you have any other questions or comments after this or you think of something extra that you think might be valuable, please just send me an email. The very final thing to say is obviously I did mention at the beginning we also are supposed to take some information via a kind of data gathering exercise about you and your experience of certain technologies. It's a very quick proforma for I think one or one and a half page table just to fill out just with

tick boxes or you answer on a graded scale of various different questions. So I'll send that out. And if you could just send that to me preferably at some point next week. That would be fantastic. Other than that. Yeah. I'll just Echo what Adam said: Thank you so much.

Digi4Health Focus Group: Local Transcript

Participants

Speaker 1: Facilitator
Speaker 2: Educator and nurse
Speaker 3: Educator and occupational therapist
Speaker 4: Learner and occupational therapist
Speaker 5: Educator and specialist nurse
Speaker 6: Learner and nurse
Speaker 7: Learner and nurse

Transcript

Speaker 1: So, I'll explain a little bit about the data gathering exercise which looks at, as I mentioned, the technologies or some of the technologies which can be used in healthcare now and then we'll have the focus group proper which is just four questions, very simple questions, which will be kind of open to debate and discussion and that's where we want to spend the most time doing that. So hopefully we'll have 40 minutes to have that discussion because I think that's the most important thing is those questions which are mainly around advantages disadvantages what educators would want and what learners would want to know and it's really good that you're at different stages as well of your education because there's someone at the end of the their education they want something different than the beginning. I just want to add some ground rules: when we get to those questions if we can try and just speak individually rather than jumping in at the same time. It will make it a lot easier to get a clear answer and transcription afterwards. But until then we can carry on now. Does anyone have any questions or is it quite simple? Hopefully quite simple. Okay, right. So I'll just give the quick presentation.

Speaker 1: PRESENTATION

Speaker 1: When you're answering some of these questions do think of the European reality, but try to focus a little bit more on the local reality here in Barcelona and maybe in Spain if you have other experiences of other areas as well. The main thing to remember

is there is no right or wrong answer in this in this focus group. It really is your personal opinion and we're trying to get as much information as possible. So speaking to the three learners at the moment, you have in this setting just as much importance and value to the focus group as the educator sitting in the room as well. So, please don't feel scared or nervous about speaking up. It's really important that we hear your thoughts of your views as well. And that's also obviously extremely important for the educators, but you knew that anyway.

All Participants: DATA GATHERING EXERCISE

Speaker 1: So for the first question we're looking at these technologies and technology in general in the healthcare setting and we want to know what you think the advantages and benefits of technology could be to both educators and to learners or students. Because I know from the previous EU-wide focus group that we had that it's difficult to just talk about the advantages without talking about the disadvantages and that's the next question. So I'm going to just put those two together. So I think this space now is really what are the advantages and the potential disadvantages and barriers to this increase in digital technology.

Speaker 2: What is the hottest technology is very positive but we have to find the things you said about, you know, generally people that work with this are the technology part. And then we have to be sure in the way we train when we try to teach and everything to make the students aware that they are going to need to balance technology with core healthcare competencies and humanistic care because technology has been there for a long time. It's here to stay and many people that are working now for these students they focus too much on technology. So that would be one of my things to address. Also although we are very like focused on digital skills abilities, I think the ethical issues also have to be addressed and I think that has to be part of the training that drives safety but, you know, data protection how all this and then I think also it has to be at least the awareness part, make the students critical thinkers that they are going to put a lot of technology in front of you that are going to say you have to use it. But you have to be able to demand evidence and results to really, I mean, many times they give you like the technology and they won't tell you really what are the benefits. This has to be addressed in order to be able to implement technology in the correct way.

Speaker 1: Does anyone have anything to add?

Speaker 3: Yeah, I can continue about this for example, in our case. We look a lot about the clinical reasoning we're using in occupational therapy. So in which phases in which cases is it most appropriate to how you can make the most appropriate use of technologies and also in our curricula. We have identified which are the benefits for occupational therapists. For example what we're

making it like matching the technical part if you want to develop some technical divers use, for example, and so on, so for the participation it is implicit for people to participate in the daily life, so you have the spectrum of the things that you can use really in two ways. So from this perspective we said that there is a great necessity in OT, we will disappear if we will not introduce some steps and virtual reality for example, 3D printing in our curriculum because our students have no competencies in those and if you are looking into the fourth industrial revolution skills and the creativity and so on and so we will disappear as professionals. It is not only our clients who need also to be inserted in the labour market but also our students. We need also to be inserted and work in hospitals as professionals and for us it is dilemma for example in the curricula at which point we should introduce this technical skills. So one you should, for example, if you are health care professional to which point you should consult the technical student or to work together to develop new programs or professionals. Yeah to be sensitive to these humanistic approaches the intervention that we want and to build up the adequate applications, adequate for example prosthetics. There is little evidence for the good use for example in free 3D printing because it's just developed. So you need to know many risks and have and develop them to make use of different materials, for example, to adapt to the special specific cases and so on. I see it like it is in development in the healthcare system and the risk is that the technology is established professionals, they don't have this knowledge about the healthcare issues. So they for me the challenge is how we will put them together to work and to develop, I guess it should be super interprofessional and yes we know so many examples and when people go too much into the technology just substituting and there is always ethical issues. Yes, if you are treating the person at the end of life, for example, with dementia and also gamification and using different images and substituting totally the reality of the person how you should balance it with a family life and the things and so on. So, I say that it's super beneficial for the it's a future. It is already here even biotechnology for example, but there are these dilemmas I guess.

Speaker 1: It's very interesting. Just one thing I'd like to take from that is around when it should be introduced to a curriculum or a course would be interesting to hear from the students what they think about this. When do you think you should learn about these digital Technologies, you know in your stage of learning?

Speaker 4: I think maybe it's not one moment. Exactly. Just maybe you're doing one subject about something. So for example about all these or so you can add what kind of technologies you can use and how you use it to help. I would not do it just like okay now we're going to do a subject about technologies in health or something like that. I know I don't know if I'm explaining myself. Also not about this question, but about what we were dividing now, and I think that we try to focus on what people need and people are very different. So you're so different than me and we have to bear this in mind always and sometimes what I've seen doing like practices and things like that it's that we have people in a computer doing some exercise that is beneficial for them. But if the same for different people and there's a lot of people that think that maybe that's not interesting for themselves. Like where we are working a lot with

hands for example, and there are things that we use or I've seen people using that it's just like, well you move your fingers and then when you go ‘click’ the computer moves, but it's like children game, you know, I mean, yeah, and then adults don't really like that sometimes. I've seen a lot of people that are not satisfied with this kind of technologies. So I think that we have to have this but it's very important because it could be beneficial but if you're not satisfied or you don't feel good with what you're doing that it's not quite certain.

Speaker 1: Also, I guess from a professional point of view because one thing from the other focus group we ran was one person said we shouldn't judge all students, the same as in some will want to use the technology more and some will not and I think it goes back to that using both are fine. You know, if you take a more humanist hands-on approach then that's okay and if you take more technological approach then that's also okay as long as you have, you know good results for your for your patient, I guess as well.

Speaker 5: It's not the way I see it. It's not like, you know for the technological or the humanistic balance between them because the trend is to do that whether you are very techie or whether you don't look at the technology so I think if you want to have a very broad process and you have to think of something that will bring together these two. My specialty was the ICU. So and I'm talking years ago when I used to do clinical nursing in the ICU in the UK, I just remember in those days you have all this machines and all this technology. Actually sometimes we literally just forgot that patient observation on the bed. So I know this was years and years ago now with all this technology coming in and all these trails and so probably, you know, I quite agree with that. We really need to find balance where we are still caring for the patient taking all their humanity or technology but always trying to remember that there is a patient that's very important because actually the moment which is type going with more rounds or with the wards or just the monitor which is just tend to forget actually just that far away. It's true that all this technology has some advantages and the main advantage is it minimizes the human error, which is very very important in health, too. So and just to make things specific, group of patients, like, you know, you were saying all will do a scan of hip operations which is going to do through the scanning of his hip that's very specific and that's going to give less side effects. It's going to be perfect. Those are really huge advantages, but we just can go to the other side though. The other thing is when we use technology, let's just say that some people are really used to it. You know, I'm very good with my mobile and you just give me a new mobile, like an iPhone 11, I'll just I'll deal with it but some people are not so the skills really depends. Also, it's like with languages somebody's good with languages, but another one is going to need three or four classes and for driving classes. Maybe I need 40 hours but maybe you just needed more time. So it's pretty much the same isn't it?

Speaker 3: So what kind of skills? I think we definitely need a list of skills to know regarding all these technologies. That we're about to use and actually as you said it's coming whether we like it or not. It's coming and we have to deal with it. I'm probably just knowing

what you said what kind of skills we need. Educators need to choose and obviously the students need to know those skills and no I don't think that is a subject. Well now in our curriculum we have a tech subject, which is very good as an introduction, but I could just teach these kind of skills like transversal skills like you teach the students ethics. Just give it a little bit of ethics course that you just teach them ethics all along the course or professionalism or things like that. And you just, I mean, I'm teaching the cardiac course today, but within that course I could just include effects, you know, professionalism etc, so far that's what I noticed.

Speaker 1: Any comments on this list of skills?

Speaker 5: Yes, then you can create at which level you can the minimum level of the technological skills that you want to give to the students in your healthcare curricula and what is expected of them to know minimally and then well, an example, we have a subject that is pretty different, 3D Printing, and then they have virtual reality training. Very short training and these are very practical things and then sometimes when we were thinking to propose the special final program, the development of the students are really developing themselves. So if somebody is interested in a specific technology they can apply for this and continue. So they have a previous very basic skills and then can explore and develop the final Bachelor thesis based on to a new prototype proposal for example, so you can bring up Innovation with that and working the other one, but for me, it's important to know which are this list of the skills which are the minimal skills for the students for to be entertained. Everybody is different also, so everybody learns with this example quickly.

Speaker 6: Another thing is about now that we're talking about the least and all that how we're going to update those skills because we're moving too fast technology is just progressing so fast and probably what we make that list technology would be just like behind always so, you know, we just need to catch up on there because, you know, technology is going to progress really rapidly and it is coming behind with the list of skills. Well, I think that personally the limit should be to introduce it at the in education. I see it as a good tool because can be used in practice for example and virtual reality or in health care. There's the problem as they said that although you do simple test. You always have this contact with the patient. So if a machine does it instead of you, although it's something very simple you lose this little contact with the patient and I think it shouldn't be substituted by the simplicity of the act of what you're doing but more if you can't achieve something, I mean, for example the hip replacement or drones if you have to deliver first aid. And you can't go there as fast it can be very useful. So it's not as to replace the knowledge that the healthcare professional has but to try to go further and achieve bigger things or reduce time then. It's the same technology a tool like you have some scissors and like you have some whatever technology is at all and you are there really to improve the health of the person or to improve quality of life or and it's very interesting. I mean it's very important, but we have to see it as a tool. Yeah, I mean it shouldn't be a

substitute more a tool to achieve better things or faster things. And in this point also that the problem is also in the learning of the skills to be able to use it because it can be that some professionals can use it and others not so that if the other professional isn't there that you can't provide this aid. I don't know if, for example, when you study it's the best thing because in different hospitals or health care institutions, they may use different technology. So it should be more in the same health care institutions that you learn how to use every tool and if you hear how it is used as different as when you put in practice.

Speaker 1: I just got two things to say, one it's been fantastic so far and two you started answering the next question, which is about capabilities that learners would need moving forward. So the type of skills they need because we often talk about digital skills, but that could mean so many different things. I mean we've seen with the amount of technology that could be available. I mean lots of different skills are needed for different for different specific technologies. But one thing I really like to pick up is the comment around different generations being better or worse because I'd like to direct this to the learners in the room because obviously you are the younger generation coming through, do you believe that's true because obviously you have very good digital skills in terms of mobile phones and you know, you're called the Instagram Generation but in a clinical setting don't do you think you are as prepared as other people, such as older generations?

Speaker 6: What you learn to use or what you see, for example, my father that he is very used to technology. He is much better than me. So it's more not so much of a generation but how much you use it and how much you're interested in it and so on so it's not so much the generation. I think it's only that we had more power, abilities and more chances to use it but that's it.

Speaker 3: What I've observed in some undergraduate student towards technology is that probably things like virtual reality, augmented reality, there's some technologies that they think are so cool and they know how it works and they see it's part of their lives and this is going to be used every time. But then when you talk to them about artificial intelligence and there is a lot of resistance and I think when it comes sometimes it if you know that artificial intelligence is not here to take over humans or whatever but it is here to help you with decision-making. I think professionals with experience are actually less resistance to artificial intelligence than younger ones. It's something that I've observed but it's my experience. And so it's going to be a different approach. Of course it depends on the skills that everybody has been also generations aren't that different to what we have observed. It's only change in the learning process for example from the first year students that they are usually more impulsive I don't know if it's good or bad. It's just the observing the processing the information how the students are processing information. So these competencies also should revise and be present because if we are changing fast something in our curricular we need to revise which competencies we are changing and to go what will quickly because this will be more transversal one. So I need to be more creative in combining

different styles so I have this tool I can improve. But you need to identify these competencies which will be the other level? Maybe you can use it as a tool but then using this tool it was your professional tasks before so a robot professional cannot substitute you why because you need other level of the thinking there. I don't know if I'm explaining.

Speaker 1: So that's actually the next question is capabilities or competencies. What do you think professionals need regarding technology now?

Speaker 4: Yeah, I was thinking that it's possible that for us it could be easier to learn about technologies because we are born with the knowledge. My niece she was one year and she was with a book and she was trying to pass the page like this [imitates swiping a tablet] so it could be easier but knowing how to use the everyday technology doesn't mean that you know how to use it for the patient. So I think that there's a difference and that we have to know it because maybe I know how to use Virtual Reality, but maybe I don't know how to find the benefits for our patients.

Speaker 1: The reason we are asking this question is because often people say digital competencies, but what does that really mean? Are we looking at how we use digital solutions, which is what everyone has said, but what do we need to teach? Are they just core competencies of healthcare used using digital technology. So is it communication, is it leadership, or is it another core competencies that you should have as a health care professional or is it something else the floor is open to whatever you think?

Speaker 5: Let's see what I said in the beginning. Making professionals aware of critical thinking, leadership and how this works around the technology. I think that's very very important. So I'm actually going to say I just think digital competency is a core competency itself. Just because you cannot teach me how every mobile phone works you can teach me how one works and if I've had the competences, I'll be able to translate it to another phone. Similarly, if you teach me about what empathy is you're going to teach by probably just putting an example with a patient, but my competence will help which is to use that competency and put me in an impossible situation with a different patient. So that's why I think that you can compare. It has a number of different technologies that we mentioned here and then some examples of how they can be used why they are used and I guess how you know, you physically use them. So for example, we mention that 3D printing, I mean, obviously a 3D printing expert is going to do the work, but I guess you have the competence and know that this is a possibility and when it´s known then it becomes a digital skill because you can maybe see the process in which the technology can be used.

Speaker 3: I think it's not only a core competence but it's also basic because maybe you should start from for school environment learning. It would be good to have a basic level before the level for the healthcare professionals start learning.

Speaker 1: Do you have any examples of using technology in this way?

Speaker 6: One idea had was when I worked in the ICU in the UK, they told me about mechanical ventilation. So now I just go see any kind of ventilator now even the more advanced ones and I'm able just to touch them. So don't know if that gives you an idea.

Speaker 1: Yes it does! Okay, we have five minutes left. Does anyone need to leave exactly at 1 o'clock as I don't want to keep you for too long. But if we don't need to it would be great if we could continue?

Speaker 2: I think it is important to know how does technology benefit the organisation. Like that would be very helpful. I think it's different because we tend to think about not the results on the patient. I don't like to say patient with the person but there's a lot of technologies that have use purely to professionals So I think it would be interesting in order to learn how it's going to benefit the different type of users. It might also need the interprofessional exchange would be nice and instead of having like for the one profession you can have professionals and also includes such a topic such as a climate change because you cannot put something that will not be ecological. For example. Yeah, or I don't know they which has a damaged impact on gender and gender impact is not there.

Speaker 1: Okay, that's really great. So the final question and this again is very wide-ranging is how can how can we ensure that learners are prepared for the rapid and continuous ever evolving digital world and particularly in in within Healthcare. So obviously you mentioned right at the very beginning. That is constantly changing and that's very difficult for educators to ensure that they are kept up-to-date. I think the main reason for us asking this is to try and give us ideas of future proofing the outcomes that we have of this project because obviously it finishes in two years time and we will have some nice materials, but how can we try and make sure they are relevant in 5-10 years?
Speaker 5: Because you don't know what's going to come up in 10 years. That's the thing. You just have to keep on updating what's coming up. It's like who knew that, you know, like 30 years ago were going to have iPhone 11 there.

Speaker 2: I think also that yeah this similar to other core competence for analytics. For analytic skills and critical thinking about different technologies. It's like for example now we have over 1000 of articles appearing about the evidence base, but we need to

know how to select this articles. I mean the same above the technology if something new appears. You need to know how to which will be more beneficial, which knowledge I can add or how I can improve in learning more about and the ways of how I can obtain this information from whom and why. Because the context is very changeable and the professionals are changing for example with the way we are more mobile now. We are moving all the time. So I need social and critical reasoning skills. It stays embedded down because it's impossible to know might come next and probably the way we learn things. Is going to change absolutely I mean I am not sure if the people working there they know what's coming. I mean, we got to learn absolutely different. I don't even know that they got they always going to be like core. I think each professional will build up their own curriculum, you know, and you have to like there's so much knowledge that super specialization is the easier, you know, it's happening and it's going to be very very specialized. So it's impossible for all the professionals to know everything so you have to decide which part do you want to develop? Keeping that overall vision and saying, you know not to lose certain skills, like you don't see the person but it's again some type of balance.

Speaker 1: Obviously we can't predict what technologies will be used. Obviously we can try and pick the most state-of-the-art at the moment because they will remain relevant for longer. But from what everyone has said in our outputs, we need to make sure we focus on the core competencies as they are now because as has already been mentioned, okay, there is an iPhone 11 now, but actually if you knew how to use the original iPhone, you can probably still use one if you keep updating your skills. That's yeah that's really useful for us I think going for because obviously we don't have yet to have a structure for how we're going to present the data that we that we find within this project and its really useful hearing from you that the core competencies have to remain embedded throughout this because then even if the technologies we talked about become slightly outdated, at least you still have the practical example of how they can be used and when further specialization happens, then you'll probably learn about the most up-to-date technologies within your specialty.

Speaker 1: So I have no more questions. Anyone have anything else that they would like to add anything? No, well thank you all so much for your time.