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DIGITAL HEALTH IN MEDICAL EDUCATION

A STUDENTS' TOOLKIT

Prepared by: The EMSA Student Task Force for Digital Health
The European Medical Student's Association (EMSA)
- Association Européenne des Étudiants en Médecine
c/o CPME, Rue Guimard 15 1040 Brussels, Belgium
www.emsa-europe.eu

THE AUTHORS

LINA MOSCH
Berlin, Germany

FELIX MACHLEID
Munich, Germany

SOPHIA HODGKINSON
Turin, Italy

LEU HUANG
Berlin, Germany

MARIA ROQUE
Lisbon, Portugal

ORHAN SELIM ERGIN
Istanbul, Turkey

ROBERT KACZMARCZYK
Munich, Germany

UMUT YÜCEL
Istanbul, Turkey

PAULIUS POVILONIS
Kaunas, Lithuania

THE EUROPEAN MEDICAL STUDENTS' ASSOCIATION

The European Medical Students' Association (EMSA) is a non-profit, non-governmental organisation representing medical students from all across Europe. Founded 1990 in Brussels, it is the only voice of students within the European Medical Organisations. EMSA is recognised by the European Parliament, the European Commission and the World Health Organization. The association provides a platform for high-level advocacy, projects, trainings, workshops and international meetings. Its activities gather around Medical Education, Medical Ethics and Human Rights, Health Policy, Public Health, Medical Science and European Integration and Culture.

FOREWORD

Dear reader,

The digital transformation of health care represents one of the greatest challenges modern health care systems are facing today. Thus, it inevitably affects the key actors at the front line keeping the health system running: the healthcare professionals. Knowledge on the technological advances in healthcare, the awareness of ethical and legal implications of new digital tools as well as different communicative competencies will become indispensable for future health workers.
How does the digital transformation of health care change the daily routine of a healthcare professional? Which knowledge and skills will healthcare professionals need? Are universities in Europe preparing their students well enough to work within a digitised health system?

In front of you lies a toolkit encouraging you - as future healthcare professionals - to put the digitalisation of health care into practise. It provides you with an insightful context, an introduction to the topic of digital health and a framework to inspire you to start activities and discussions at your university.

Enjoy the read!
Europeanly yours,

The EMSA Student Task Force for Digital Health

CONTENT

DR. BERTALAN MESKÓ
Director of The Medical Futurist Institute

“The advancement of digital health technologies, IT and the appearance of the internet with social media channels set profound changes in healthcare in motion. The high walls of the ivory tower of medicine started to crumble:
vast sources of knowledge became available for anyone online, and social media channels have connected patients of many backgrounds with similar symptoms. The power of online communities, as well as empowered patients, appeared, pushing for a more equal-level doctor-patient relationship. As patients are more informed and more inclined to ask questions, they need a different type of rapport with their doctors as before. For a successful leap from the hierarchical patterns towards the 21st century doctor-patient relationship, the future generation of physicians should be trained differently and should be prepared for all the above-described changes."

TANYA HERFURTH
Founding board member at Young Leaders for Health e.v.

"The continous digitalisation of healthcare systems has the potential to transform our common understanding of good health and well-being. It can facilitate the necessary shift from our current disease-treatment system to an effective healthcare *system. In order to induce an inclusive and equitable digital transformation a multi-stakeholder approach is necessary. It is important to underline that only those who are digitally skilled are able to actively contribute to the design and implementation of our digital health systems. Hence, it is essential that future healthcare professionals need to undergo long-term intensive training on how to use and create knowledge from electronic sources to solve and prevent health problems, becoming digitally health literate."*

THE DIGITAL TRANSFORMATION OF HEALTHCARE

”E-health is an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology.” *(Eysenbach, 2001)*

While this pioneering definition from G. Eysenbach describes e-Health as an “emerging field”, technological development and progress of the last two decades have inevitably led to new perspectives. The digital transformation of healthcare has become our reality.

Smart devices and mobile apps to monitor fitness and search engines empower people to engage with their own health in a new extent.

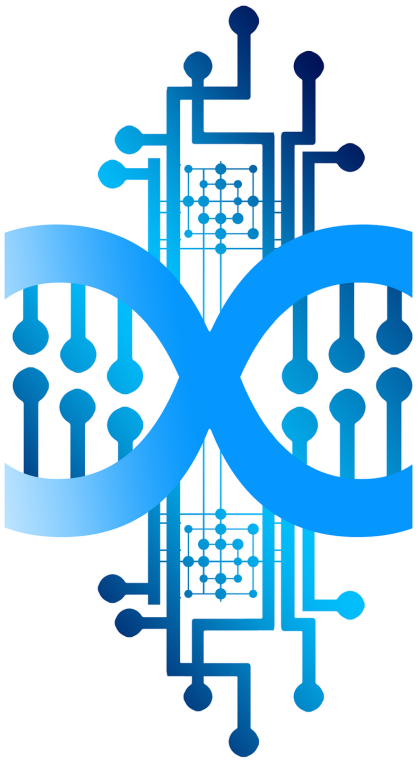
The collection and analysis of personal health data comes along with individualized recommendations and treatment options in terms of precision medicine, but also poses challenges with regard to data privacy and security. And it is not only the patients who gain access to new opportunities and encounter new challenges. Healthcare professionals (HCPs) play a major role in implementing digital health into clinical settings. They are now confronted to use and apply new technologies such as clinical decision support systems based on algorithms, robotic surgery, electronic health records and telehealth consultations into their daily work routine to enhance patient care.

A growing global digital health market *(Statista, 2016)* as well as increased access to internet *(Roser, Ritchie and Ortiz-Ospina, 2015)* and mobile devices imply strong potential coming from both industry and society to leverage healthcare with the support of technologies. The World Health Organization (WHO) emphasizes the role of digital health towards universal health coverage by improving healthcare systems through enhancing quality, accessibility and affordability of health services and other health-related challenges within the Sustainable Development Goals (SDGs). Further advantages are increased health data accuracy, better coordination of care delivery and a shift of responsibilities and tasks for the healthcare workforce *(World Health Organization, 2019)*.

To shape the development of digital health and make use of the expected advantages various challenges and barriers have to be overcome by all stakeholders of healthcare ecosystems *(Katz and Moyer 2004; Ross et al. 2016)*. A major responsibility for successful implementation lies within the healthcare workforce *(Gagnon et al., 2016)*, whether it is as a primary user of electronic health records *(Elizabeth et al., 2011)*, as a consultant for the increasing number of informed patients, as a driver for research or as an enabler for the improvement of technologies.

Digital health literacy and skills in working with new technologies will become prerequisite competencies for future health care professionals *(Norman and Skinner, 2006)*. It is long overdue to integrate these aspects into the education of medical professionals *(Otto and Kushniruk, 2009; Hammoud et al., 2012; Pageler et al., 2013; Wald et al., 2014)*.

We aim to raise awareness for this shortcoming in medical education. This toolkit shall support students in learning about digital health „not only [as] a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care […]“ *(Eysenbach, 2001)*.



EMSA SURVEY ON EHEALTH

EMSA created a survey investigating the opinions of students regarding eHealth and its implementation in medical education. In total, 451 medical students from 39 countries of the European region answered the survey between April and July 2018. The EMSA survey on eHealth reveals a significant gap between the overall willingness of students to become key players in a meaningful digitisation of healthcare and the competencies and skills they have acquired through their learning.

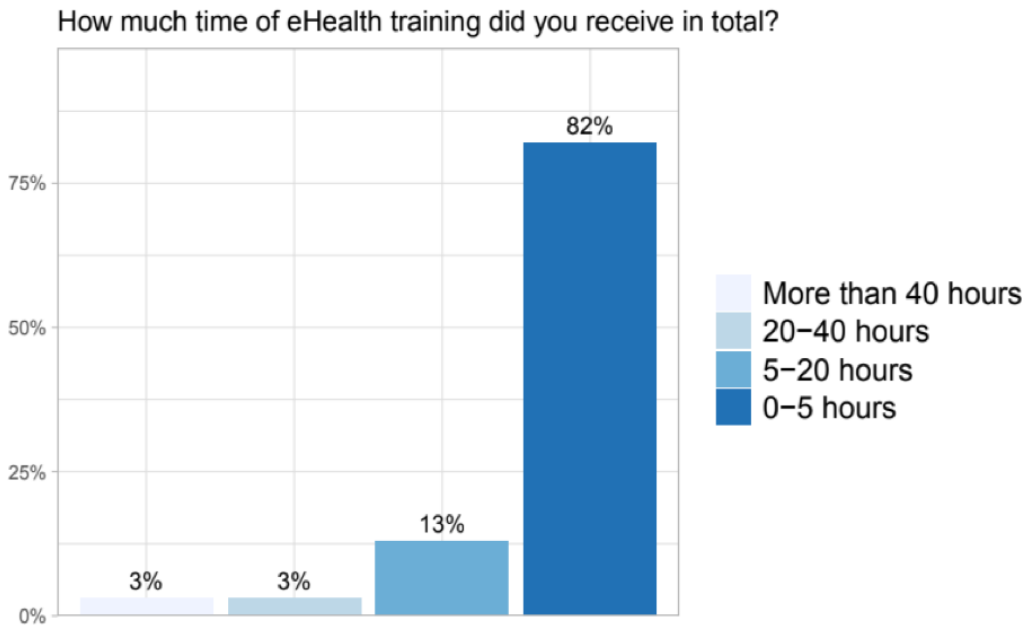


Figure 1: Total time of eHealth training received by survey participants (y-axis). Source: EMSA survey on eHealth

85%

would like **eHealth to be more implemented** in the curriculum.

52%

consider their **eHealth literacy very poor, poor or acceptable.**

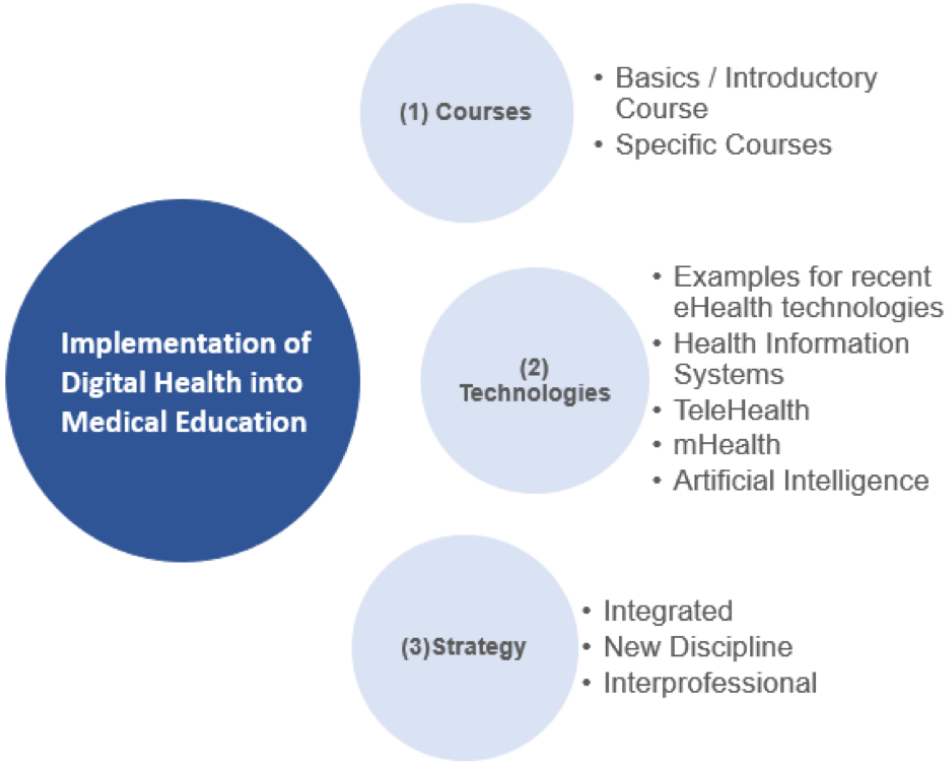


Figure 2: answers to the question "What specific eHealth courses would you like to be implemented in your university's curriculum? Students' suggestions for which technologies they wish to learn about, what courses they wish to be introduced and how to implement them in their curriculum.
Source: *EMSA survey on eHealth, 2018.*

HOW TO TAKE ACTION

A NEW CORE COMPONENT OF EDUCATION

Both educators' and students' awareness for and their trust in the importance and the multiple dimensions of digital health are key factors in paving the way for renewing healthcare education in the digital age. Consequently, encouraging the dialogue between teachers and students to assess the necessities of improvement and strategies to implement change is essential *(Mosch et al., 2019)*.

The implementation of digital health into the medical curriculum as a new core component of training for future and current doctors has to be progressive and adapted to the year of studies. This means that for the first years of medical education the basics of digital health (e.g. the terminology) should be taught in an introductory lecture or module *(Mesko, Győrffy and Kollár, 2015).*

WHAT SHOULD BE TAUGHT?

Universities that train and educate future health professionals must ensure that formats on digital health are prominent in their curricula.
In order to open opportunities for students to apply their knowledge in both research and clinical practice, free access to according ressources (e.g. statistical software, simulators, corresponding online courses, etc.) for healthcare students is crucial.

CONTENT ON THEORETICAL KNOWLEDGE AND PRACTICAL SKILLS

- **Telemedicine**
- **Electronic health records (EHR) and clinical decision support systems (CDSS)**
- **Bioinformatics, genomics and precision medicine**
- **Smart health devices and mHealth**
- **Statistics for data analytics in healthcare**
- **Basic knowledge on artificial Intelligence and neural networks**
- **Serious gaming, augmented reality (AR) and virtual reality (VR)**
- **Ethical and legal aspects of implementing digital health technologies**
- **Patient empowerment and communication**

HOW SHOULD IT BE TAUGHT?

Ensure the competence of your trainers and educators

Practising health professionals are educators. They teach their students in clinical rotations, and bedside-teaching lessons. Your educator's proficiency in digital health has a direct impact on your learning outcomes as a student. As a matter of fact, Li et al. found that "ensuring the competence for educators could impact on the IT skill improvement most" *(Li et al., 2019)*. Ultimately, teaching of digital health literacy and skills must follow a holistic approach and be integrated equally into undergraduate and continuing medical education.

Promote interprofessional collaboration in digital health education

Healthcare, evolving through the disruptive changes brought about by digitalisation, engages numerous different professions, now more than ever. Thus, interprofessional collaboration is a substantial part of a future-proof health curriculum. Areas such as engineering, computer science and entrepreneurship have become increasingly important for healthcare graduates and therefore should be part of undergraduate healthcare education *(Nelson and Staggers 2018; Salminen et al., 2014).*

GET INVOLVED

EDUCATE YOURSELF!

There are a lot of opportunities to learn more about digital health and its dimensions, even if your university is lagging behind with implementing these topics in your curriculum. From online courses and modules to summer schools on artificial intelligence in healthcare, we have collected links and information about education initiatives and offers at the end of this document (see page 18). Feel free to share them with your colleagues and friends!

BUILD CAPACITY!

Organise an event!

An event at your university is a great way to raise your fellow students' awareness for digital health and to draw the attention of educators and curriculum developers to the topic. There is a wide range of options on the type of event of which some ideas are listed below. If you would like to share an activity you have organized with us and other students enthusiastic about digital health, please do not hesitate to contact us!

Workshops

Through organising a workshop (or a series of workshops) for fellow healthcare students on digital health and its dimensions you can dive deeper into the matter and not only learn more about digital health but also how to design and deliver a session and improve your public speaking skills. We have prepared two workshops (1) *Introduction to eHealth* and (2) *eHealth and universal health coverage* which you can use as a starting point. Their outlines and additional material can be found here:
http://tiny.cc/ehealthworkshop

World Café Method

The World Cafe method is a simple, effective and flexible format for hosting a dialogue between large groups. There are round tables surrounded up to five chairs, a computer or a block of papers on each table and coloured pen if necessary. In several rounds of conversation, participants write, doodle and draw their ideas on paper while moving from table to table. One person remains at each table as "table host" for the next round. Participants can brainstorm and link ideas and questions related to a specific topic. In the last round people return to their first table, summarise their findings and share their discoveries. For example, set out different challenges related to the implementation of digital health at the tables and let the participants come up with solutions on different levels (local, national, international).

Scientific journal / policy club

In a journal or policy club you can meet on a regular basis and present scientific articles, case studies, reviews or policy documents about digital health to each other and discuss potential benefits and challenges. It may help to designate a leader who takes on the responsibility to organise the meeting, moderate the discussion and make sure everyone can express their opinion. You should create some kind of community in which all members feel safe to share their thoughts and ask questions. To keep the club fresh and exciting you could also invite an external speaker to present their work from time to time.

Lecture / speaker series

Organising a lecture series enables you to cover a lot of different aspects (ethical, social, entrepreneurial, scientific, technological) related to digital health. With a lecture series you might also reach out to other parts of the population and not only students; therefore it is helpful to identify and address the needs of your target audience. When planning and inviting external speakers, try to create some continuity between the events so that the audience sees the bigger picture. Each event should be thematically connected somehow to the previous and following. Afterwards you can plan smaller gatherings and networking events to keep the attendees engaged.

HOW CAN YOU GET INVOLVED?

DISTRIBUTE KNOWLEDGE

Education is a basic activity towards creating an impact. Thus you need to ensure that your colleagues and target group are educated on the particular topic which you want to tackle. Inform yourself and learn more about the specific topic you are concerned with and come up with solutions. Then, campaigning and PR can be used to educate fellow healthcare students or other target groups (other healthcare professionals, patients) to build capacity in a certain area. More information on effective campaigning can be found in this guide: *http://tiny.cc/campaigning*

SET UP A DIGITAL HEALTH ELECTIVE!

Do you want to contact researchers from your university, invite external speakers or lead the lectures/seminars yourself? An elective can be part of the “official” curriculum at your university, implying that students receive credits for it and have to pass an exam in the end. On the other hand, an elective can also be a voluntary module students choose to take in addition to the regular courses. At most universities, organising an “official” elective is impossible without engaging professors and educators in planning and execution. Experience has shown that this decision depends very much on local conditions, formal structures, the number of participants and financial resources to the respective universities.

YOUR ELECTIVE CAN HAVE DIFFERENT FORMATS

Student-led elective
you can decide on methods, materials and topics. For example, you can use videos and various freely accessible online courses. You may also introduce interactive discussion formats such as a fishbowl discussion or a world cafe without having to rely on your teachers' willingness to experiment. This format, however, requires a high degree of initiative and long-term commitment on your part.

Cooperation
You do not necessarily have to design your own teaching. You can also "just" think about the concept and then invite suitable speakers to give the respective lessons. Maybe there is an academic institute, a political group (political party, think tank), a non-state actor (NGO, student organisation, patient group, foundation), or company working on digital health or health innovation etc.) to which you can hand over the responsibilities. This has the advantage that the implementation of the offered elective is rather long-term - even over many semesters.

Mixed approach
Student-led and guest speakers. You can alternate a mixture of content such as film evenings, discussions evenings or peer-group learning with sessions with external speakers.

INCLUDE DIGITAL HEALTH ASPECTS IN ESTABLISHED CLINICAL SUBJECTS

The goal of our efforts should be the longitudinal implementation of digital health into the core curriculum of healthcare education programs.
Interprofessional and interdisciplinary approaches are playing a key role in this process. Until then, students can make efforts that they become systematically implemented. For instance, lectures or seminars on artificial intelligence-supported image recognition to improve diagnosis can be taught within the radiology or cardiology module; robotic-assisted surgery in the surgery module and different digital devices and applications to manage non-communicable diseases (NCDs) in internal medicine.
To promote such formats you need to talk to entities and people involved in developing and managing the medical curriculum such as the administrative staff, the dean, heads of courses and individual teachers.

ADVOCACY

You can make a difference in the improvement of healthcare education by directly contributing to the curriculum at your university. For instance, get involved with your EMSA Faculty Member Organisation or your students' council to help improve the digital health literacy of your community and push for the implementation into your curriculum.

The following tips will help you to get started:

- **Collect data supporting your claims:** scientific papers, policy documents (e.g. the EMSA policy statement on digital health in the medical curriculum), reports and press releases by official bodies (e.g. the World Health Organization, the European Commission…). Advocate with the EMSA eHealth survey results for initiating the implementation of digital health into your education. You might also think about issuing a similar survey at your university.
  For further information check the useful links and contacts section!

- **Get support**: Join forces with other (local) students' and professional organisations and start working towards mutual goals.
  For further information check the useful links and contacts section!

- **Advocate:** Meet with the dean's office or the curriculum development and explain the importance of digital health literacy and skills and the need to implement them in the curriculum.

BEST PRACTICES

Around Europe, several universities have been updating their curricula and integrating digital health related courses. Those pioneer universities show us different ways of approaching digital health in the medical curriculum and share with us some of the challenges they faced during implementation. (We bring you these examples as inspirational models for you to start the implementation in your own school!)

SEMMELWEIS UNIVERSITY

Budapest, Hungary

Course: Lessons in digital health
Key topics: general introduction, ethics, communication

Description: 10 seminars - Each seminar consists of 10 minutes of lecture and 80 minutes of workshop, online tasks, writing essays and using digital technologies in person.

Specific Topics:

- Challenges of privacy in the technological world;
- Digital health in underdeveloped regions;
- The new generation of e-patients;
- Implementing technologies into everyday healthcare;
- Health management and challenges about data;
- The evolution of disruptive technologies;
- Ethical questions related to the future of medicine through science fiction.

ERASMUS MC

Rotterdam, the Netherlands

Three courses: Image Processing, Advanced Image Processing and Machine Learning

Key topics: analytics
Description: Joint degree between the medical and the technical university, gathering students with both more technical and more medical knowledge. Feedback from students shows that they feel experienced enough to apply the knowledge and the skills in internships and in their master projects. These courses are planned to be introduced in the medical curriculum as mandatory.

CHARITÉ UNIVERSITÄTSMEDIZIN

Berlin, Germany

Course: Digital Health: From the app to the intelligent hospital

Key topics: basic terminology, analytics, telemedicine, medical training, ethics, communication, entrepreneurship

Description:

- The goal of the course is to prepare medical students to deal with digital innovation and the implementation of new technologies into their future work life.
- A multi professional team of clinicians and external experts such as lawyers and IT-researchers provides various perspectives from building solutions over regulatory barriers to implementation into clinical contexts.
- Students receive the chance to try and experience solutions (e.g. AR/VR, mobile applications) in hands-on sessions and off-campus trips (smart hospitals, innovative laboratories, startups).
- Soft skill workshops (design thinking, innovation, teambuilding, etc.) and a mini hackathon accompany the elective next to the 3 weeks of hard knowledge transfer - students develop their own solutions and pitch/ present them by the end of the elective.
- The class is being evaluated using questionnaires and expert interviews to ensure a constant feedback loop and up-to-dateness.

The introduction of new courses takes time and effort. Introducing digital health courses is no exception, therefore these universities shared with us some of the challenges they faced and afterwards overcame in order to start their innovative courses. Here is the sum up of the challenges:

- Acceptance of the course by the board
- Creating demand and enthusiasm, identifying possible partners
- The varying entrance levels of the students;
- Estimating how much knowledge/skills the students could absorb

If you wish to get more information on how these courses are working and how these challenges were overcome, contact stf.policy@emsa-europe.eu and we will get you in touch with these universities.

CONTACT & USEFUL LINKS

EMSA Student Taskforce for Digital Health:
stf.policy@emsa-europe.eu

- **EIT Health education initiatives:** Online courses, Apps and summer schools dealing with digital health, created in collaboration with renowned European universities. *https://eithealth.eu/what-we-do/education*

- **WHO Guideline: recommendations on digital interventions for health system strengthening:** recommendations based on a critical evaluation of the evidence on emerging digital health interventions that are contributing to health system improvements, based on an assessment of the benefits, harms, acceptability, feasibility, resource use and equity considerations. *https://apps.who.int/iris/rest/bitstreams/1238054/retrieve (World Health Organization, 2019)*

- **The Medical Futurist:** The Medical Futurist is a platform with many up-to-date publications about how digital technologies, artificial intelligence and innovation shapes the future of healthcare. *https://medicalfuturist.com/*

- **Digital Health Today** provides podcasts and materials for informative purposes but they also employ people as "Ambassadors" of Digital Health Today. There are also partnerships available for contact for the young entrepreneurs of Digital Health. *https://digitalhealthtoday.com/*

- **Elements of AI:** The Elements of AI is a series of free online courses created by Reaktor and the University of Helsinki. We want to encourage as broad a group of people as possible to learn what AI is, what can (and can't) be done with AI, and how to start creating AI methods. The courses combine theory with practical exercises and can be completed at your own pace. *https://www.elementsofai.com/*

WORKSHOP TEMPLATES

- We have prepared two workshops **(1) Introduction to eHealth** and **(2) eHealth and universal health coverage** which you can use as a starting point. Their outlines and additional material can be found here: *http://tiny.cc/ehealthworkshop*

ADVOCACY

- **EMSA policy statement 'Digital Health in the Medical Curriculum: Addressing the Needs of the Future Health Workforce':** EMSA's policy statement featuring evidence of the eHealth survey and our most important calls. *https://emsa-europe.eu/wp-content/uploads/2019/09/Digital-Health-in-the-Medical-Curriculum_-Addressing-the-Needs-of-the-Future-Health-Workforce.pdf (European Medical Students' Association, 2019)*

- **Recommendations by the Deans' Meeting Training Future-Proof Doctors for the digital society:** Training in digital knowledge and skills should become a new core component of training for future and current doctors in all Member States: this was agreed by representatives of students/junior doctors and deans, gathered at the initiative of the European Commission and Erasmus University Medical Center on 12 April in Rotterdam. A set of recommendations for action were developed at this meeting, and participants committed themselves to taking them forward in their own national context to raise policy makers' awareness. *https://ec.europa.eu/digital-single-market/en/news/digital-transforming-medical-doctors-daily-work-deans-and-student-doctors-agree-common (European Commission, 2019)*

- **The Topol Review:** Great source of information for advocacy at your local faculty. The review was published by the NHS in 2019 and it explores how to prepare the healthcare workforce, through education and training, to deliver the digital future. *https://topol.hee.nhs.uk/*

- **The WHO Draft Global Strategy for Digital Health:** *https://www.who.int/docs/default-source/documents/gs4dhdaa2a9f352b0445bafbc79ca799dce4d.pdf?sfvrsn=f112ede5_36 (World Health Organization, 2020)*

- **AMEE guideline 'Artificial intelligence in medical education':** AMEE The Association for Medical Education in Europe (AMEE) is a worldwide organisation with members in 90 countries on five continents. AMEE promotes international excellence in education in the health professions across the continuum of undergraduate, postgraduate and continuing education. The association published a guideline on artificial intelligence in medical education in 2019. *https://doi.org/10.1080/0142159X.2019.1595557 (Masters, 2019)*

DEFINITIONS

- **Artificial Intelligence (AI):** Refers to a broad field of science encompassing not only computer science but also psychology, philosophy, linguistics and other areas. AI is concerned with getting computers to do tasks that would normally require humanIntelligence. *(van Duin and Bakhshi, 2017)*

    - **Machine Learning:** Machine learning is a branch of artificial intelligence that allows computer systems to learn directly from examples, data and experience. Through enabling computers to perform specific tasks intelligently, machine learning systems can carry out complex processes by learning from data, rather than following pre-programmed rules. *(The Royal Society, 2017)*

    - **Neural network:** A computer architecture in which a number of processors are interconnected in a manner suggestive of the connections between neurons in a human brain and which is able to learn by a process of trial and error *(Merriam-Webster, n.d.)*

- **Big data:** A collection of data sets so large and complex that it becomes difficult to process using traditional data processing and management methods.It is originally characterised by 4 V's:
    - Volume - high/large amount of data
    - Variety - data comes from many different sources in different types and structures
    - Velocity - data is generated or updated continuously with a high speed
    - Value - the added economical and social value that comes with the new insights provided by big data analysis *(De Mauro, Greco and Grimaldi, 2016)*

- **Digital health / eHealth:** The connection of health, health provision, life and society with digital technologies to improve the efficiency of health care and to apply health services more individually and effectively. Further, the term includes the use of both information and communication technologies (ICTs) to address the health problems of patients. *(Bhavnani, Narula and Sengupta, 2016)*

- **Digital health literacy:** The ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem *(Norman and Skinner, 2006)*

- **Digital therapeutics:** An intervention based on software," for example, apps or online interventions, "as the key ingredient", rather than drugs. Can also be described in terms of digital medicine and is sometimes referred to as "digiceuticals. *(McKinsey, 2018)*

- **Medical Informatics:** The intersection of information science, computer science, and health care. This field deals with the resources, devices, and methods required to optimize the acquisition, storage, retrieval, and use of information in health and biomedicine. *(Michigan Technical University, n.d.)*

- **Personalised medicine:** Personalised medicine refers to a medical model using characterisation of individuals' phenotypes and genotypes (e.g. molecular profiling, medical imaging, lifestyle data) for tailoring the right therapeutic strategy for the right person at the right time, and/or to determine the predisposition to disease and/or to deliver timely and targeted prevention. *(Council of the European Union, 2015)*

- **Robotics:** Technology dealing with the design, construction, and operation of robots in automation *(Merriam-Webster, n.d.)*

- **Telemedicine:**
  - *Client-to-Provider Telemedicine*: Provision of health services at adistance; delivery of health services where clients/patients and health workers are separated by distance
  - *Provider-to-Provider Telemedicine:* Provision of health- services at adistance; delivery of health services where two or more health workers are separated by distance *(World Health Organization, 2019)*

- **Technology enhanced learning (TEL):** Uses technology as part of the learning process. That use needs to be effective and appropriate in order to enhance the learning of healthcare professionals for the benefit of patients. *(Health Education England, 2017)*

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