



## Course and Examination Fact Sheet: Autumn Semester 2023

### 11,202: Digital Therapeutics

ECTS credits: 2

#### Overview examination/s

(binding regulations see below)

decentral - Presentation, Analog, Group work group grade (15%)

Examination time: Term time

decentral - Quiz, Digital, Individual work individual grade (15%)

Examination time: Term time

decentral - Written work, Digital, Group work group grade (70%)

Examination time: Term time

#### Attached courses

Timetable -- Language -- Lecturer

[11,202,1.00 Digital Therapeutics](#) -- English -- [Kowatsch Tobias](#)

#### Course information

#### Course prerequisites

Interest in the **multi-disciplinary** field of **Digital Health** at the intersection of **health economics, information systems research, computer science, and behavioral medicine**.

#### Learning objectives

**Digital Therapeutics from Bench to Bedside** (npj Digital Medicine 2023), **Digital Therapeutics for Mental Health & Addiction** (Elsevier 2023), **Large language model AI chatbots require approval as medical devices** (Nature Medicine 2023), **Benefits, Limits, and Risks of GPT-4 as an AI Chatbot for Medicine** (The New England Journal of Medicine 2023), **Wearable sensors enable personalized predictions of clinical laboratory measurements** (Nature Medicine 2021), **The advent of health technologies associated with artificial intelligence (AI) will be the most radical change in how medical care is delivered in our lifetime** (The Lancet Digital Health, 2023)

What are the **implications** and **rationale** behind the recent developments in **digital therapeutics**?

**Digital therapeutics (DTx)** are software-delivered interventions for **managing** and **treating disease**. DTx may leverage digital biomarkers, digital coaches and healthcare chatbots, telemedicine, mobile and wearable computing, self-tracking, personalized medicine, connected health, smart homes, or smart cars.

In the **20th century**, healthcare systems specialized in **acute care**. In the **21st century**, we now face the challenge of dealing with the specific characteristics of **chronic conditions**. These are now responsible for around 70% of all deaths worldwide and 85% of all deaths in Europe and are associated with an estimated **economic loss of \$7 trillion between 2011 and 2025**. Chronic diseases require an intervention paradigm that focuses on **health-promoting behavior**. Lifestyle (e.g., diet, physical activity, tobacco, or alcohol consumption) can reduce the risk of suffering from a chronic condition. However, a lifestyle change is only implemented by a fraction of those affected, partly because of missing or inadequate interventions or health literacy, partly due to sociocultural influences. Individual personal coaching of these individuals is neither scalable nor financially sustainable.

Against this background, the question arises of how to develop **evidence-based DTx** that allow **medical doctors** and other **caregivers** to **scale** and **tailor long-term treatments** to **individuals** in need at **sustainable costs**. At the intersection of **health economics, information systems research, computer science, and behavioral medicine**, this lecture aims to help **students** and **upcoming healthcare executives** interested in the **multi-disciplinary field** of DTx to understand better the **need, design, assessment, and reimbursement of DTx**.



After the course, students will be able to...

1. understand the importance of DTx for the management of chronic conditions
2. understand the anatomy of DTx
3. know frameworks for the design of DTx
4. know evaluation criteria for DTx
5. know technologies for DTx
6. assess DTx
7. know about reimbursement strategies of DTx
8. discuss the advantages and disadvantages of DTx

## Course content

To reach these learning objectives, the following topics are covered in the lecture and will be discussed based on concrete national and international examples, including those from the **Centre for Digital Health Interventions** ([www.c4dhi.org](http://www.c4dhi.org)), a joint initiative of the Institute for Implementation Science in Health Care, University of Zurich, the Department of Management, Technology, and Economics at ETH Zurich, and the Institute of Technology Management and School of Medicine at the University of St.Gallen:

### 1. Motivation for Digital Therapeutics (DTx)

- The rise of chronic diseases in developed countries
- The discrepancy between acute care and care for chronic diseases
- From excellence of care in healthcare institutions to excellence of care in the everyday life with DTx
- Definition of DTs

### 2. Anatomy of DTx

- Just-in-time adaptive interventions
- Digital biomarker for predicting states of vulnerability
- Digital biomarker for predicting states of receptivity
- Digital coaching and healthcare chatbots

### 3. Design & Evaluation of Digital Health Interventions

- Overview of design frameworks
- Preparation of DTx
- Optimization of DTx
- Evaluation of DTx
- Implementation of DTx

### DTx Technologies

- Technologies for telemedicine
- Mobile medical devices
- Virtual and augmented-reality applications, incl. live demonstrations
- Privacy and regulatory considerations

## Course structure and indications of the learning and teaching design

The lecture is structured in **two parts**, with **on-site sessions** and **complementary online exercises**. In the first part, students will **learn** and **discuss** the topics of the four learning modules in **weekly on-site sessions**. Complementary **learning material** (e.g., video and audio clips), **multiple-choice questions**, and **exercises** are provided **online** via Canvas.

In the second part, **students work in teams** and will use their acquired knowledge to assess DTx critically. Each team will then **present and discuss the assessment findings** with fellow students who provide **peer reviews**. Additional **on-site coaching sessions** are offered to support the teams in preparing their **presentations**.

## Course literature

1. Castro, O., Mair, J. L., ... Kowatsch, T. (2023). Development of "LvL UP 1.0": a smartphone-based, conversational agent-delivered holistic lifestyle intervention for the prevention of non-communicable diseases and common mental



- disorders. *Frontiers in Digital Health*, 5. <https://doi.org/10.3389/fdgth.2023.1039171>
- Collins, L. M. (2018). *Optimization of Behavioral, Biobehavioral, and Biomedical Interventions: The Multiphase Optimization Strategy (MOST)*. Springer. <https://doi.org/10.1007/978-3-319-72206-1>
  - Gilbert, S., Harvey, H., Melvin, T. et al. (2023). Large language model AI chatbots require approval as medical devices. *Nature Medicine*. <https://doi.org/10.1038/s41591-023-02412-6>
  - Jacobson, N., Kowatsch, T., & Marsch, L. (Eds.). (2023). *Digital Therapeutics for Mental Health and Addiction: The State of the Science and Vision for the Future* (1st ed.). Elsevier, Academic Press. <https://doi.org/10.1016/C2020-0-02801-X>.
  - Kowatsch, T., Otto, L., Harperink, S. et al. (2019). A design and evaluation framework for digital health interventions. *Information Technology*, 61(5-6), 253-263. <https://doi.org/10.1515/itit-2019-0019>
  - Kowatsch, T., & Fleisch, E. (2021). Digital Health Interventions. In O. Gassmann & F. Ferrandina (Eds.), *Connected Business: Create Value in a Networked Economy* (pp. 71-95). Springer International Publishing. [https://doi.org/10.1007/978-3-030-76897-3\\_4](https://doi.org/10.1007/978-3-030-76897-3_4)
  - Kowatsch, T., Schachner, T., Harperink, S. et al. (2021). Conversational Agents as Mediating Social Actors in Chronic Disease Management Involving Healthcare Professionals, Patients, and Family Members: Intervention Design and Results from a Multi-site, Single-arm Feasibility Study. *J Med Internet Res*, 23(2). <https://doi.org/10.2196/25060>
  - Kowatsch, T., Lohse, K.-M., Erb, V. et al. (2021). Hybrid Ubiquitous Coaching With a Novel Combination of Mobile and Holographic Conversational Agents Targeting Adherence to Home Exercises: Four Design and Evaluation Studies. *Journal of Medical Internet Research (JMIR)*, 23(2). <https://doi.org/10.2196/23612>
  - Mishra, V., Künzler, F., Kramer, J.-N., Fleisch, E., Kowatsch, T., & Kotz, D. (2021). Detecting Receptivity for mHealth Interventions in the Natural Environment. *Proc. ACM Interact. Mob. Wearable Ubiquitous Technol.*, 5(2), Article 74. <https://doi.org/10.1145/3463492>
  - Nahum-Shani, I., Smith, S. N., Spring, B. J. et al. (2018). Just-in-Time Adaptive Interventions (JITAs) in Mobile Health: Key Components and Design Principles for Ongoing Health Behavior Support. *Ann Behav Med*, 52(6), 446-462. <https://doi.org/10.1007/s12160-016-9830-8>
  - Sim, I. (2019). Mobile Devices and Health. *N Engl J Med*, 381(10), 956-968. <https://doi.org/10.1056/NEJMra1806949>
  - Wang, C., Lee, C., & Shin, H. (2023). Digital therapeutics from bench to bedside. *npj Digital Medicine*, 6(1), 38. <https://doi.org/10.1038/s41746-023-00777-z>

## Mandatory Material

The mandatory material will be provided via the online learning platform.

## Additional course information

--

## Examination information

### Examination sub part/s

#### 1. Examination sub part (1/3)

##### Examination modalities

Examination type	Presentation
Responsible for organisation	decentral
Examination form	Oral examination
Examination mode	Analog
Time of examination	Term time



Examination execution	Asynchronous
Examination location	On Campus
Grading type	Group work group grade
Weighting	15%
Duration	--

## Examination languages

Question language: English

Answer language: English

## Remark

Group presentation

## Examination-aid rule

Free aids provision

Basically, students are free to choose aids. Any restrictions are defined by the faculty members in charge of the examination under supplementary aids.

## Supplementary aids

--

---

## 2. Examination sub part (2/3)

### Examination modalities

Examination type	Quiz
Responsible for organisation	decentral
Examination form	Written exam
Examination mode	Digital
Time of examination	Term time
Examination execution	Asynchronous
Examination location	Off Campus
Grading type	Individual work individual grade
Weighting	15%
Duration	--

### Examination languages

Question language: English

Answer language: English

### Remark

Online assignments (eg multiple choice questions)

### Examination-aid rule

Open Book

Students are free to choose aids, apart from the following restrictions:

- pocket calculator models which are not part of the Texas Instruments TI-30 series, as well as any programmable electronic devices that are capable of communication such as electronic dictionaries, notebooks, tablets, smartphones, headsets, additional screens, etc. are not admissible;
- there is an option for faculty members to explicitly define exceptions under supplementary aids.

Procuring any aids, as well as ensuring their working order, is the exclusive responsibility of students.

### Supplementary aids

--

---



## 3. Examination sub part (3/3)

### Examination modalities

Examination type	Written work
Responsible for organisation	decentral
Examination form	Written work
Examination mode	Digital
Time of examination	Term time
Examination execution	Asynchronous
Examination location	Off Campus
Grading type	Group work group grade
Weighting	70%
Duration	--

### Examination languages

Question language: English

Answer language: English

### Remark

Group presentation document

### Examination-aid rule

Free aids provision

Basically, students are free to choose aids. Any restrictions are defined by the faculty members in charge of the examination under supplementary aids.

### Supplementary aids

--

---

## Examination content

1. Motivation for Digital Therapeutics (DTx)
2. Anatomy of DTx
3. Design & Evaluation of DTx
4. DTx Technologies

## Examination relevant literature

### Mandatory Material

The mandatory material will be provided via the online learning platform.



## Please note

Please note that only this fact sheet and the examination schedule published at the time of bidding are binding and takes precedence over other information, such as information on StudyNet (Canvas), on lecturers' websites and information in lectures etc.

Any references and links to third-party content within the fact sheet are only of a supplementary, informative nature and lie outside the area of responsibility of the University of St.Gallen.

Documents and materials are only relevant for central examinations if they are available by the end of the lecture period (CW51) at the latest. In the case of centrally organised mid-term examinations, the documents and materials up to CW 42 are relevant for testing.

Binding nature of the fact sheets:

- Course information as well as examination date (organised centrally/decentrally) and form of examination: from bidding start in CW 34 (Thursday, 24 August 2023);
- Examination information (supplementary aids, examination contents, examination literature) for decentralised examinations: in CW 42 (Monday, 16 October 2023);
- Examination information (supplementary aids, examination contents, examination literature) for centrally organised mid-term examinations: in CW 45 (Monday, 06 November 2023);
- Examination information (regulations on aids, examination contents, examination literature) for centrally organised examinations: two weeks before the end of the de-registration period in CW 45 (Monday, 06 November 2023).