BME1540: Designing and testing gaming technologies for rehabilitation

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Teaching Assistant: TBA
Contact:

Meeting dates: Mondays; Lecture from 1 to 3pm.
Location: TBA

Course Summary:

Rehabilitation helps people overcome limitations in functioning, activities and participation to promote well-being. Salient challenges in rehabilitation include: ensuring equitable access to services, promoting engagement and sustained behaviour change, providing opportunities for home practice and self-management. Gaming technologies and innovations have immense potential to tackle these challenges. The design of effective gaming technologies for rehabilitation requires integrated knowledge of clinical practice, psychology, and technology, creatively applied. The evaluation of gaming technologies in rehabilitation requires careful consideration of common limitations, for example: small and heterogeneous samples, understanding and integrating divergent data sources. This course will introduce the concept of gamification in the context of rehabilitation. We will discuss topics relevant to the design, testing and translation of gaming technologies for rehabilitation including: introduction to gamification, co-design and stakeholder engagement, theoretical frameworks, and prototype testing with a focus on mixed methods. This overview course will introduce students to key theoretical and methodological concepts to support research and development of gaming technologies for rehabilitation.

Note: Knowledge in game programming is not required for this course. Game design will be carried out using Whimiscal (or similar wireframe and prototyping tool) that can be accessed freely on the web. No high performance computing resources are required.

Learning Outcomes

By the end of this course, students will be able to:

- Identify diverse applications for gamification in rehabilitation
- Define and conduct co-design using approaches that promote principles in equity, diversity and inclusion.
- Identify and understand a selection of key theories in gamification and how they apply to the design of rehabilitation gaming technologies
- Wireframe game design ideas for the purpose of rapid prototyping and co-design
- Communicate and defend game design concepts
- Understand the difference between multi-methods and mixed methods and applications for prototype testing
- Work cooperatively in a small group and/or with knowledge holders to understand and design for user needs.

Lecture format:

One 2-hour lecture every week with group discussion and interactive activities.

Outline of lectures:

Lecture	Topic
1	Introduction to gamification and gaming technologies for rehabilitation for diverse goals and applications (e.g. motor therapy, cognitive training, speech and voice, single switch access, play and leisure)
2	Co-design and knowledge holder engagement: What is it? Why is it important? How to do it? a. Identifying the right knowledge holders: promoting EDI, mitigating bias b. Models for knowledge holder engagement
3	Understanding and identifying user needs a. User Personas *b.* User needs statement *c.* Environmental scans
4	Engagement in rehabilitation; Key theories related to gamification (e.g. Self-Determination Theory)
5	Facilitated working session and interactive activities focused on Assignment #1
6	Feedback in rehabilitation; Design consideration related to gamification. Assignment #1 due Feb 14.
READING WEEK - NO CLASS	
7	Translating design requirements into a game: Bootle Boot Camp
8	Facilitated working session and interactive activities focused on Assignment 2
9	Translating design requirements into a game: R2Play. ****AT HOLLAND BLOORVIEW KIDS REHABILITATION HOSPITAL****
10	Testing prototypes - Collecting data with and about rehabilitation gaming technologies. An overview of methods will be provided, their strengths and weaknesses, how they can be used together to enhance reliability, interpretability, and generalizability. a. Quantitative methods b. Qualitative methods
11	*Game pitch day – students to share their game ideas; hand in Assignment #2*
12	Testing prototypes: An introduction to mixed methods and relevance to gaming technologies for rehabilitation a. Iterative convergent mixed methods usability testing
13	Facilitated working session and interactive activities (Assignment 3)
April 14	*No class. Hand in Assignment #3*

Evaluation and Course Deliverables:

In small groups, students will choose a rehabilitation application/challenge to address through gamification. Building on the lectures and activities outlined above, the course project will entail 3 deliverables:

(1) Co-design: identifying user personnas and user needs statements; conducting an environmental scan; EDI considerations. Deliverable: Report(35%)

(2) A one-page game design document and wireframe describing the proposed game with design decisions and directions justified with reference to theoretical frameworks and learnings. Deliverables: Report + Presentation/question period (35%)

(3) Written assignment (short-answer responses) on the application of mixed methods interative convergent usability testing for prototype testing. (30%)

Policy on AI tools:

Students may use generative AI tools to:

- Contribute to their understanding of course materials.
- As learning aids or to help produce assignments. However, students are ultimately accountable for the work they submit.
- **Students must submit, as an appendix with their assignments, any content produced by an artificial intelligence tool, and the prompt used to generate the content.** The documentation should include what tool(s) were used, how they were used, and how the results from the AI were incorporated into the submitted work.
- Any content produced by an artificial intelligence tool must be cited appropriately. Many organizations that publish standard citation formats are now providing information on citing generative AI (e.g., MLA: https://style.mla.org/citing-generative-ai/).

Note: please restrict use of AI tools to those that are freely available or available through university resources. This is to ensure that no student is at a disadvantage if they are unable to access AI applications that require a subscription fee. If you have any concerns about privacy, security or other issues related to the technology, please do not feel any pressure to use them in this course.

Accommodations

The University of Toronto supports accommodations for students with diverse learning needs, which may be associated with mental health conditions, learning disabilities, autism spectrum, ADHD, mobility impairments, functional/fine motor impairments, concussion or head injury, visual impairments, chronic health conditions, addictions, D/deaf, deafened or hard of hearing, communication disorders and/or temporary disabilities, such as fractures and severe sprains, or recovery from an operation.

If you have a learning need requiring an accommodation the University of Toronto recommends that students register with Accessibility Services as soon as possible.

We know that many students may be hesitant to reach out to Accessibility Services for accommodations. The purpose of academic accommodations is to support students in accessing their academics by helping to remove unfair disadvantages. We can assess your situation, develop an accommodation plan with you, and support you in requesting accommodation for your course work. The process of accommodation is private; we will not share details of your needs or condition with any instructor.

If you feel hesitant to register with us, we encourage you to reach out for further information and resources on how we can support. It may feel difficult to ask for help, but it can make all the difference

during your time here.

Phone: 416-978-8060

Email: accessibility.services@utoronto.ca

Equity, Diversity and Inclusion

Looking for community? Feeling isolated? Not being understood or heard?

You are not alone. You can talk to anyone in the Faculty that you feel comfortable approaching, anytime – professors, instructors, teaching assistants, first-year or upper years academic advisors, student leaders or the Assistant Dean of Diversity, Inclusion and Professionalism.

You belong here. In this class, the participation and perspectives of everyone is invited and encouraged. The broad range of identities and the intersections of those identities are valued and create an inclusive team environment that will help you achieve academic success. You can read the evidence for this approach here.

You have rights. The University Code of Student Conduct and the Ontario Human Rights Code protect you against all forms of harassment or discrimination, including but not limited to acts of racism, sexism, Islamophobia, antisemitism, homophobia, transphobia, ableism, classism and ageism. Engineering denounces unprofessionalism or intolerance in language, actions or interactions, in person or online, on- or off-campus. Engineering takes these concerns extremely seriously and you can confidentially disclose directly to the Assistant Dean for help here.

Resource List:

- Engineering Equity, Diversity & Inclusion Groups, Initiatives & Student Resources
- Engineering Positive Space Resources
- Request a religious-based accommodation here
- Email Marisa Sterling, P.Eng, the Assistant Dean, Diversity, Inclusion &Professionalism here
- Make a confidential disclosure of harassment, discrimination or unprofessionalism here or email disclosure.engineering@utoronto.ca or call 416.946.3986
- Email the Engineering Society Equity & Inclusivity Director here
- U of T Equity Offices & First Nations House Resources

References:

[1] Masterson D, Areskoug Josefsson K, Robert G, Nylander E, Kjellström S. Mapping definitions of co-production and co-design in health and social care: A systematic scoping review providing lessons for the future. Heal Expect [Internet]. 2022 Mar 23;(November 2021).

[2] Krath, Jeanine, Linda Schürmann, and Harald FO Von Korflesch. "Revealing the theoretical basis of gamification: A systematic review and analysis of theory in research on gamification, serious games and game-based learning." Computers in Human Behavior 125 (2021): 106963.

[3] Alwashmi, Meshari F., et al. "The iterative convergent design for mobile health usability testing: mixed methods approach." JMIR mHealth and uHealth 7.4 (2019): e11656.

[4] Guetterman, Timothy C., Michael D. Fetters, and John W. Creswell. "Integrating quantitative and qualitative results in health science mixed methods research through joint displays." The Annals of Family Medicine 13.6 (2015): 554-561.