CS 889 F25

CS 889 W25 - Research Methods in HCI

INSTRUCTOR

Dr. Jian Zhao, Associate Professor, Cheriton School of Computer Science

CONTACT

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OFFICE HOURS

By appointment

WHEN AND WHERE

Wednesdays 1:00pm-3:50pm, DC 2568

Course Communication

MS Teams: for announcements, Q & A, access to class materials, team communication, etc. Download

Zoom: for remote class meetings and office hours when necessary. Download

Announcements

- If you want to apply for a permission number to enroll the course, please fill in this form.
- Please let the instructor know immediately if you have difficulty to access the MS Teams course channels within the first week.

Overview

Human-Computer Interaction (HCI) is a multidisciplinary field focused on the design, evaluation, and implementation of interactive computing systems for human use. At its core, HCI examines the interaction between humans and computers, striving to create seamless, intuitive, and effective interfaces that enhance user experience. By integrating aspects of psychology, design,

ergonomics, computer science, and usability, HCI aims to understand user behaviors, preferences, and needs, ultimately crafting interfaces and systems that accommodate diverse users while optimizing efficiency, accessibility, and satisfaction. In this seminar-style course, students will obtain an overview of typical methodologies in HCI research and learn how to design, develop, and evaluate HCI techniques. For more details, please see the course information (for marking scheme and graded components) and course schedule (for readings, seminars, exercises, and project deadlines). Also check the resources page for useful materials.

Course Policies

Course Enrollment

Enrollment to the course *after the first week* needs an instructor's approval, since this is a project-based course which requires teams to be formed by the second week.

Participation and Late Panelties

A student is required to attend all the classes, and participation grade will be partially based on how many classes are missed. However, special situations can be accommodated (e.g., academic travel, illness, and emergencies). Students must notify the instructor regarding their absence and provide the necessary justification. Moreover, students must inform the instructor if they have to miss a deadline for such special situations. For other cases, the general policy is that late work will be *deducted 10% of the total marks* per calendar day late. The instructor reserves the right to accept late work or not.

Note on using ChatGPT and other GenAI Models

A student is allowed to use text-generating Artificial Intelligence (GenAI) such as ChatGPT to improve the writing of their assignments. However, a clear description on why and how it is used needs to be declared. Blindly copying and pasting a large chunk of text from the GenAI is prohibited. In addition, all the prompts used with the GenAI need to be submitted along with the assignments. Failing to comply with this policy may result in an academic offense as outlined in Policy 71, Student Discipline. Check the University Guidelines for more information.

Academic Integrity

In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. Check the Office of Academic Integrity for more information.

Grievance

A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4. When in doubt, please be certain to contact the department's administrative assistant who will provide further assistance.

Discipline

A student is expected to know what constitutes academic integrity to avoid committing an academic offence, and to take responsibility for his/her actions. [Check the Office of Academic Integrity for more information.] A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate associate dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline. For typical penalties, check Guidelines for the Assessment of Penalties.

Appeals

A decision made or penalty imposed under Policy 70, Student Petitions and Grievances (other than a petition) or Policy 71, Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72, Student Appeals.

Turnitin

Text matching software (Turnitin) may be used to screen assignments in this course. Turnitin is used to verify that all materials and sources in assignments are documented. Students' submissions are stored on a U.S. server, therefore students must be given an alternative (e.g., scaffolded assignment or annotated bibliography), if they are concerned about their privacy and/or security. Students will be given due notice, in the first week of the term and/or at the time assignment details are provided, about arrangements and alternatives for the use of Turnitin in this course.

It is the responsibility of the student to notify the instructor if they, in the first week of term or at the time assignment details are provided, wish to submit alternate assignment.

Mental Health Supports

At the University of Waterloo, we are dedicated to supporting your mental and emotional well-being. Our Counselling Services offer confidential support, including individual counselling, workshops, and crisis support. If you're struggling, please reach out for help at 519-888-4096 or visit their website for more information.

Accessibility Services

The University of Waterloo recognizes its obligations under the Ontario Human Rights Code to accommodate students with known or suspected disabilities and disabling conditions (e.g. medical conditions, injuries, impacts of trauma such as from violence or discrimination) to the point of undue hardship. To support this obligation, AccessAbility Services (AAS) collaborates with all academic departments and schools to facilitate academic accommodations for students with disabilities and disabling conditions without compromising the academic integrity of the curriculum. If you believe you may require academic accommodations (e.g., testing accommodation, classroom accommodation), register with AAS as early in the term as possible by completing the online application. Students already registered with AAS must activate their accommodations for each of their courses at the beginning of each term using AAS' online system. If you require assistance, contact AAS by phone (519-888-4567 ext. 35082), email (access@uwaterloo.ca) or in-person (Needles Hall North, 1st Floor, Room 1401).

Intellectual Property

Students should be aware that this course contains the intellectual property of their instructor, TA, and/or the University of Waterloo. Intellectual property includes items such as:

- Lecture content, spoken and written (and any audio/video recording thereof);
- Lecture handouts, presentations, and other materials prepared for the course (e.g., PowerPoint slides);
- Questions or solution sets from various types of assessments (e.g., assignments, quizzes, tests, final exams); and
- Work protected by copyright (e.g., any work authored by the instructor or TA or used by the instructor or TA with permission of the copyright owner).

Course materials and the intellectual property contained therein, are used to enhance a student's educational experience. However, sharing this intellectual property without the intellectual property owner's permission is a violation of intellectual property rights. For this reason, it is necessary to ask the instructor, TA and/or the University of Waterloo for permission before uploading and sharing the intellectual property of others online (e.g., to an online repository).

Permission from an instructor, TA or the University is also necessary before sharing the intellectual property of others from completed courses with students taking the same/similar courses in subsequent terms/years. In many cases, instructors might be happy to allow distribution of certain materials. However, doing so without expressed permission is considered a violation of intellectual property rights.

Please alert the instructor if you become aware of intellectual property belonging to others (past or present) circulating, either through the student body or online. The intellectual property rights owner deserves to know (and may have already given their consent).

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Textbooks

There are no textbooks required for this course. Students are expected to read the lecture notes and attend class. However, the following textbooks/websites are recommended for reference:

- Koji Yatani, Statistical Methods for HCI Research
- Jonathan Lazar, Jinjuan Heidi Feng, Harry Hochheiser, Research Methods in Human-Computer Interaction
- Judy Robertson, Maurits Kaptein, Modern Statistical Methods for HCI

Grading

- Participation and Preparation
  - Project Teams
  - Ethic Training
- Experimental Design Exercise
- Experimental Design Review
- Micro Paper Reviews (MR)
- Class Seminar
- Class Project
  - Project Proposal
  - Project Presentation
  - Final Paper and Video Figure

The format of the course is mainly a seminar style. It will contain lectures by the instructor, paper discussion seminars by students, and presentations of group projects. Students will be evaluated by the quality of their in-class participation, assignments, paper presentations, and class projects.

This course consists of a mixture of individual and group work. Students will work individually or in pairs to complete a term-long class project. In addition, students will work on a concrete experimental design exercise, weekly paper readings and reviews, as well as a seminar of paper presentation and discussion. The philosophy of this seminar based course is *learning by doing and learning together*.

The grading components of the course include:

10%	Participation and preparation (individual)
14%	Micro paper reviews (individual)
16%	Experimental design exercise (individual)
5%	Experimental design review (individual)
15%	Class seminar (group)
40%	Class project (group)

Students' work is graded based on a *10-point scale with a 0.5-point increment*, summed and rescaled based on the below details, where in general 0 = not participate, 2 = poor, 5 = fair, 8 = good, 10 = excellent.

Participation and Preparation

Attendance, team building, ethics training, and in-class activities such as group discussion, paper critiques, and feedback to other students' work. Students are required to attend every class and actively participate in discussions. As a rule of thumb, you are expected to contribute to class discussion *at least 2 times* each class: ask a question, comment on a topic, clarify a point, etc. Your attendance and participation level will be recorded during the class.

PROJECT TEAMS

While students can work *individually or in pairs* (i.e., a team) for the group work, a maximum of *14 teams* can be formed in this term due to the capacity. At the beginning of the term, students will be given time to find a partner. Students who propose to work individually may not always be satisfied. The expectation for working individually or in pairs remains the same.

No grade is assigned for this sub-component, but all students must be in teams to continue the course. After finalizing a team, register your team (even though just yourself) using the Team Information form (link will be shared on MS Teams).

ETHIC TRAINING

The TCPS 2 Tutorial Course on Research Ethics (CORE), also known as the TCPS2 tutorial, is mandatory for all researchers who intend to engage in research with human participants. In this course, you will conduct user experiments. Before contacting users and conducting the studies, you are required to complete the ethics tutorial. Each student needs to complete the ethics

tutorial individually. If you have taken this tutorial previously in other courses or activities, you do not need to take it again.

From the Welcome Page, click on the "Login to Core / Create Account" button on the right. Click "Create new account here" and fill in the required fields; make sure you register using your *uwaterloo.ca* email address. A confirmation email will be sent to the email address that you provide (check spam if you do not see it in your mailbox). Click on the activation link only once to activate your account. Once your account is activated, you can log in and begin the tutorial. It can take up to 3 hours take to complete CORE, depending on how many examples and activities you explore. You can go through the modules at your own pace; your progress is automatically saved, and you can log out and in again to resume your session. If you experience any difficulties, refer to TCPS 2: CORE Frequently Asked Questions.

While no grade is assigned for this sub-component, marks under Participation and Preparation will be deducted if it is completed late. All students must complete this training (if you have not done this before); otherwise, you cannot continue the course. Submit the certificate of completion with your name on it to the corresponding LEARN Dropbox.

Experimental Design Exercise

One (1) experimental design exercise for understanding a concrete research problem. Using *mainly qualitative research methods*, students need to select a research problem as well as design and conduct studies to understand the research problem. The research problem must NOT be overlapped with or closely related to their class project topics. Students need to write an experimental design report describing the study.

In specific, the study should use *surveys and interviews* to understand the chosen research problem. The survey/ questionnaire should include: 1) pre-screening questions that help recruit suitable participants for your study, 2) demographic questions that help collect essential information from participants, and 3) *at least 10* actual questions that aim to address the research problem. The interview should include *at least 10* meaningful questions. The whole study needs to involve *at least 6* participants.

Please refer to what you learn during the class to craft a high-quality study protocol. A recommended process is: according to the research problem, define one to three concrete research questions and/or study (sub-)objectives, and for each of them, design a couple of questions concerned to that specific research question and/or objective, which form a complete list of questions.

The experimental design report (*less than 4000 words* around 6-9 pages, excluding references) should include the following parts:

1. *Background:* A brief description of the relevant contextual information for understanding the domain and the problem that you are investigating.
2. *Research Question(s):* One to three clearly defined, concrete, and measurable questions and/or objectives that your study focuses on.
3. *Study Design:* A detailed description of the recruited participants, what apparatus/systems/tools were used (if any), what the study procedure was like, what types of data were collected; justify how the study protocol could address the research questions you ask.
4. *Study Results:* A detailed description of the results obtained from the study; refer to the papers read in the class on how to analyze and report qualitative data (e.g., thematic analysis).
5. *Study Materials:* Designed study materials (i.e., survey and interview questions) used in the study, as attachments (i.e., does not count towards the word limit).

Each experimental design exercise is graded using the following marking scheme:

7 marks	quality and degree of completion of study design report
3 marks	quality of study materials

The writing must use the ACM Latex or Word template with the `\documentclass[acmsmall,screen]{acmart}` option. The study materials can be in any format (e.g., Google Form, Qualtrics, or plain text), as long as they are clear.

Submit your study design document and materials in a single zip file, named `[your last name]_[your student ID]_ED[n].zip`, to the corresponding LEARN Dropbox by the posted deadlines.

Experimental Design Review

One (1) critical review of fellow students' experimental design exercise. As a follow-up of the experimental design exercise, students need to review others' submissions and provide critics/ recommendations. Students will be randomly assigned a submission to review. You must give *at least 5* concrete critics or actionable recommendations based on what you learn in the class regarding the HCI methods.

Each critical review is graded using the following marking scheme:

3 marks	number of critics/ recommendations
7 marks	quality of critics/ recommendations

Submit your critics/ recommendations in a single PDF file, named `[your last name]_[your student ID]_EDR[n].pdf`, to the corresponding LEARN Dropbox by the posted deadlines.

Micro Paper Reviews (MR)

Seven (7) weekly reading assignments of papers provided by the instructor. Students are required to submit micro reviews for the assigned papers every week (two per week). A micro paper review (around *500 words*) must include the following four parts:

1. *Summary:* One or two sentences to summarize the paper's key contributions.
2. *Strengths:* Two or three specific strengths of the paper, with rationales.
3. *Weaknesses:* Two or three specific weaknesses of the paper, with rationales.
4. *Future work:* One or two sentences to state any work that could be done to extend or build on this.

You should consider the following aspects when writing your micro reviews:

- Be specific and provide details.
- Do not simply paraphrase the paper content: your goal is to demonstrate your read the paper and thought about it.
- Do not comment on the quality of writing or paper presentation: your goal is to focus on the research described in the paper.
- Use grammatically correct English writing.

Each micro paper review is graded using the following marking scheme:

3 marks	style and grammar
7 marks	quality of content (addressing each aspect well)

Submit your micro paper reviews as PDF files with a predefined template or a similar format, named `[your last name]_[your student ID]_MR[n].pdf`, under the appropriate directory in the shared folder on MS Teams by the posted deadlines. All micro reviews will be made public to the class prior to that week's class to foster discussions; late submission of micro reviews will NOT be accepted.

Class Seminar

One (1) seminar of discussing a designated research topic from the list provided by the instructor. Each team must lead a seminar on a specific topic during one week of the class,

including presenting a designated paper and moderating the discussion of the paper (see the schedule for details regarding the papers and topics). Students must fill in the Seminar Schedule form (link will be shared on MS Teams) at the beginning of the class, to select which topics/weeks they will present for the seminars. All the team members need to contribute to the paper presentation, although not every student needs to present. When working in pairs, please include a *contribution slide* in the end to indicate the task distribution among team members.

The paper presentation needs to clearly demonstrate the problem, approach, and key results of the paper. More importantly, you should use the paper content and examples as a way to *introduce and address problems beyond the paper*, related to the week's topic and other papers. You could consider the following questions:

- What is the problem area? What is the relevant background? Why do we care?
- What is the idea and what are the main contributions?
- What are the key related works? What are the differences and similarities?
- What are the core technical approach and results?

In addition, you are responsible for *answering questions* regarding the paper and *leading a discussion* after the presentation. To facilitate the discussion, you will have access to all students' micro reviews 24 hours before the class, so budget some time to scan through them, in order to *motivate individuals* in the class during the discussion to expand or justify their responses. You have to *manage the class*, by keeping people on topic, encouraging everyone to speak, and making sure the discussion is not dominated by a few people.

You must use a *group discussion style*. That is, divide the class into three to five groups depending on the class size, assign each group a discussion point, guide each group to express their perspectives, and manage the discussion across the whole class. You should carefully prepare the discussion points, for example:

- How well are the HCI methods used in the paper?
- What are the strengths and weaknesses of the paper?
- What are potential extensions and future work?
- What critical reflections could we have?

The paper presentation is graded using the following marking scheme:

2 marks	length and delivery (clear speaking, clear slides)

4 marks	quality of paper presentation (more critique than summary with relevant and insightful comments)
4 marks	quality of discussion (prepared questions, reading others' summaries, class management)

Each paper presentation should last about *40 minutes*, roughly *20 minutes* for the presentation and *20 minutes* for the discussion. Remember that you do not need to cover every nitty gritty details about the paper, because the whole class also read the paper beforehand; aim for a profound thinking rather than an on-surface description of the paper.

Upload your presentation slides for the class seminar, named `W[week#]_[team name]_seminar.[pdf/pptx]`, under the appropriate directory in the shared folder on MS Teams by EOD on the day of the class during that week.

Class Project

One (1) term-long research project on designing, implementing, running, and analyzing a controlled experiment. As a central part of the project, each team needs to conduct a controlled experiment on evaluating an HCI technique or system. Students can choose one of the following themes:

1. Replicate the Fitts' Law study in a new environment (e.g., new context, devices, or conditions).
2. Compare two existing interaction techniques, interfaces, or systems.
3. Assess a new self-developed technique or interface comparing against a suitable existing baseline.

You need to define research hypotheses that bring contributions to the state of the art. You are free to use any language and toolkit for your project. The controlled experiment needs to involve *at least 8* participants. You can conduct the experiment with either students in the class or users out of the class; regardless, you need to follow the ethics and consent process using the materials on the Resources page.

The class project is split into different components as the following:

5%	Project proposal
10%	Project presentation
25%	Final paper and video figure

The writing must use the ACM Latex or Word template with the `\documentclass[acmsmall,screen]{acmart}` option. When working in pairs, please include an *Acknowledgement section* that briefly describes what each team member contributes to the overall assignment when appropriate (e.g., roles and task distributions; not necessarily everyone has to contribute to the writing).

Submit your writing, slides, or video, named `[team name]_[proposal/presentation/final_paper/video].[pdf/pptx/mp4]`, to the corresponding LEARN Dropbox by the posted deadlines.

PROJECT PROPOSAL

Each team needs to write a brief proposal (*less than 1500 words* around 2-4 pages, excluding references) that outlines the project idea. You should start thinking about your project early. You are encouraged to talk to the instructor before finalizing the topic. The proposal should contain the following parts:

- *Title:* The title should be catchy, short, and descriptive.
- *Abstract:* The abstract should be less than 150 words and summarize your paper, including contributions, approach, and results. You could use the following template:
  - 1) context and background (1 sentence),
  - 2) challenges and problems to solve (1 sentence),
  - 3) your proposed approach and main contributions (1-3 sentences), and
  - 4) expected results (1-2 sentences).
- *Introduction:* The goal of the introduction is to provide the context, deliver the motivation, summarize the paper, basically, why do you do it, and how? You could use this template:
  - 1) provide the background or context of the research and present the unaddressed research problems or questions (1 paragraph),
  - 2) summarize a few key relevant work and why they do not work for your problem (1 paragraph),
  - 3) describe your approach and how it addresses the problem (1-2 paragraphs), and
  - 4) list 1-3 key contributions of the paper (1 paragraph).
- *Approach:* This section describes the high level technical approach and/or design, languages/libraries/toolkits you plan to use, and how you will address the research questions or problems using controlled experiments (e.g., your initial hypotheses, experimental protocol, and data measurements). Try to be as detailed as possible and include sketches or figures if it makes explaining your approach easier.

The marking scheme is:

3 marks	style (academic writing style, correct grammar, formatting)
7 marks	quality of content (completion of all sections, clarity of description)

PROJECT PRESENTATION

Each team is required to present the work in class, answer questions, and get feedback from other students, in a style of academic conferences/workshops. Each presentation session is limited to a *10-minute talk* and a *5-minute Q & A*, in total, *15 minutes maximum*. The presentation should include the *motivation, research problem/questions, key related works, technical approach, and initial results* of the project. When working in pairs, please include a *contribution slide* in the end to indicate the task distribution among team members.

The marking scheme is:

3 marks	length and delivery (clear speaking, clear slides)
4 marks	quality of project presentation (all aspects included, questions answered)
3 marks	quality of idea or demo/video (complete and clear)

FINAL PAPER AND VIDEO FIGURE

Each team needs to write an academic paper (*less than 6000 words* around 9 to 12 pages, excluding references and supplementary materials) that describes the entire class project in detail. The ideal final paper should be in a quality that is ready to submit to a conference workshop. You need to refine the project proposal and extend it by summarizing the work throughout the term. Besides a revised *Introduction*, you need to have the following parts in your final paper:

- *Related Work:* The literature review should include scholarly articles, industry and trade articles (as appropriate), books and magazines, and a review of existing products (where applicable). As a general rule of thumb, you should survey at least *15 related references*. You need to summarize each related work concisely and emphasize the differences or novelty of your idea. You want your literature survey to:
  - 1) Be comprehensive in breadth and depth and related theories have been investigated;
  - 2) Point out aspects of the problem space that have not been solved or examined in detail; and
  - 3) Distinguish your work from the state of the art and emphasize the novelty.

- *Technical Approach:* You need to extend the *Approach* of your proposal with more details. The proposed new technique or aspects of an existing technique should be described in a *human-computer interaction perspective*, e.g., what people see when they use it, what it can be used for, why it is interesting or useful, etc. You should also include sufficient details that someone could reproduce it themselves. You are encouraged to provide diagrams and figures to demonstrate your technical approach.
- *Experiment and Results:* This describes the participants, apparatus, design, tasks, and procedure in your controlled experiment. You should provide enough details so that someone else can replicate your experiment. Also, you need to analyze the data using appropriate statistical analysis and present the results using charts.
- *Discussion:* This reflects on what was done, implications for designers and researchers, some issues or problems encountered in the evaluation, and limitations of the approach. This section is your chance to reflect on any lessons learned.
- *Future Work:* This presents advice and directions for others doing work similar to your project, suggesting how things could be improved or better.

In addition, each team need to submit a video figure (*less than four minutes*) to demonstrate your developed technique(s) and/or experimental task(s). Ensure your video is encoded with MPEG-4 using H.264 (check Handbrake for encoding/re-encoding your video). The video could be made public on YouTube or the class website.

The marking scheme is:

1 mark	style (academic writing style, correct grammar, formatting)
7 marks	quality of content (completion of all sections, clarity of description, sufficient details)
2 marks	quality of video (compete and clear)
