



Project Code: Woodruff

APD 1210 RESEARCH PRACTICUM COURSE

PROJECT DESCRIPTIONS 2026-27

FALL/WINTER

Name and Title: *Earl Woodruff*

Lab Website: <https://www.oise.utoronto.ca/site/elo>

TITLE OF RESEARCH PROJECT: Decoding Learning in the Moment for Gen AI tutoring

NUMBER OF STUDENT PLACES AVAILABLE: *Six (6)*

PRIMARY MODE OF RESEARCH PLACEMENT PARTICIPATION (circle one option and describe):

 x *IN PERSON*

OBJECTIVES AND METHODOLOGY: We are developing **Abel Tutor**, an affect-aware generative AI tutor that can sense and respond to students' learning states in real time. Using only the built-in camera and microphone on standard devices, Abel Tutor will look for subtle cues in facial expressions, voice patterns, pupil changes, and facial blood flow to estimate whether a student is just beginning to understand, is feeling confused, is developing a clearer idea, or is reaching a deeper understanding. The aim is to move beyond ordinary AI tutoring systems that respond mainly to typed answers, so that the tutor can provide support that is better matched to how the student is actually thinking and feeling.

This project integrates cognitive psychology, education, machine learning, affective computing, robotics, speech science, data science, and even methods from astronomy to detect faint signals in complex data. By combining these approaches, Abel Tutor will model students' cognitive and emotional trajectories and adapt its teaching moment by moment—for example, by offering encouragement, giving a hint, asking a guiding question, slowing down, or increasing the level of challenge. The broader goal is to create a more responsive and emotionally intelligent AI tutor that supports deep learning, self-regulation, and more equitable access to personalized education.

DESCRIPTION OF STUDENT PARTICIPATION: MEd students will work closely with PhD students using data that has already been collected for the Abel Tutor project. Their role will be to bring a unique educational lens to these data, examining how students' learning states, emotional cues, and tutoring interactions can be understood in relation to classroom learning, student support, and instructional design. With guidance, MEd students will help run data



analyses, interpret the results, and write up focused studies that contribute to the larger project while also allowing them to develop their own distinct research questions.

There will also be opportunities for MEd students to contribute to the project's broader development. They may assist with scoping reviews of relevant literature, such as research on AI tutoring, confusion and learning, affect-aware technologies, or multimodal learning analytics. In addition, they may be involved in designing new studies and in shaping research questions, learning tasks, interview protocols, or classroom applications. In this way, MEd students will gain hands-on experience with an interdisciplinary research project while making an original contribution to understanding how emotionally responsive AI can support student learning. Students are expected to spend 8-10 hours per week on these lab activities.

DESCRIPTION OF PREFERRED SKILLS/BACKGROUND (OPTIONAL): Preferred students will have an interest in learning, cognition, educational technology, AI-supported tutoring, and the role of emotion and confusion in student understanding. Some experience with research methods, data analysis, statistics, qualitative coding, literature reviews, or academic writing would be valuable, though advanced technical expertise is not required. Familiarity with tools such as Excel, SPSS, R, Python, NVivo, or other analysis software would be an asset. Students should be willing to learn to work with existing datasets, run guided analyses, interpret findings, and contribute to writing up studies for presentation or publication.

We are especially seeking students who are curious, thoughtful, reliable, and comfortable working as part of an interdisciplinary team. Strong candidates will think carefully about educational meaning, not just numerical results, and will be interested in exploring how AI systems can better support real learners. Important qualities include attention to detail, openness to feedback, ethical sensitivity when working with student data, strong communication skills, and a willingness to engage with both theoretical literature and practical research tasks. Students who enjoy collaborating with PhD students while developing their own focused contribution would be particularly well-suited to the project.

DAY AND TIMES OF LAB MEETINGS: *Weekly lab meeting times will be set to accommodate schedules during the first lab meeting, the week before classes start. The date and time of the first meeting will be determined in August.*