



# COLLEGE of ENGINEERING AND PHYSICAL SCIENCES

SCHOOL OF COMPUTER SCIENCE

## PhD Seminar 2

**Wednesday June 7, 2023 at 2pm via Zoom [Remote]**

**James Fraser**

*Learning to Code: Examining Student Profiles in Novice Programming*

**Advisor:** Dr. Judi McCuaig

**Co-Advisor:** Dr. Dan Gillis

**Advisory:** Dr. Michael Wirth

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### **Abstract:**

Recently, online learning environments have played a mandatory and critical role at all levels of education. This abrupt technological shift has highlighted the importance of online education accessibility and resources. Historically, introductory computer science, specifically programming courses, has demonstrated high failure and drop-out rates in university and online studies. Previous research has examined the key factors leading to these higher attrition rates in early programming courses and identified several potential impactors, such as content complexity, lack of problem-solving skills, feedback quality, and self-regulation strategies.

Novice programmers, typically 1st and 2nd-year university students, tend to quickly evaluate the task and start coding the problem rather than understanding the scope of the requirements or task. This problem-solving strategy gears students toward a trial-and-error methodology for which success depends on assessment and feedback quality. For students, this creates two problems that involve resolving the requirements and complexity of the problem while attempting to understand the syntax and semantics of a programming language and decipher debugging feedback from a compiler.

This research examines novice programming students' actions and effort levels during the semester toward identifying student profiles that differentiate successful and unsuccessful behaviours. To analyze students' online programming behaviours, we developed the IFS (Immediate Feedback System), a voluntary and supplementary online educational platform for which students submit programming coursework snapshots for automatic assessment. The IFS monitors students' online actions, collects students' submissions, and provides assessment feedback. In addition, students may complete psychological surveys and self-assessments to communicate their personal development on course outcomes.

This public seminar explores high-level data collected from IFS in 1st and 2nd year programming courses occurring from 2017 until 2019. We examine the development of identifiable student profiles through the relationship between students' interaction patterns, course submissions, and assessment outcomes. Additionally, we explore the relationships between student profiles and their overall course performance to determine critical factors relating to course outcomes.

This research uses automated formative feedback to analyze student profiles to differentiate between successful and unsuccessful students. By analyzing specific student behaviours, we can understand the critical points of students' progression to provide awareness for educational intervention opportunities when unsuccessful behaviour may lead to disengagement, failure, or even drop-out.