ABSTRACT

Systematic Software Systems for Maximizing Student Learning, Engagement, and Academic Achievement

Jack Ryan Forden

Marquette University, 2025

The rapid expansion of computer science education has placed signi cant strain on educators and students alike, particularly in large introductory programming courses. Traditional assessment methods often fail to balance timely feedback, e ective student engagement, and scalable instructor support. In response, this dissertation presents TA-Bot, a novel automated assessment tool designed to incentivize early engagement, improve code quality, and encourage o ce-hour participation through an adaptive, non-punitive reward system.

TA-Bot integrates a Time Between Submissions mechanism dynamically modulating feedback frequency to discourage trial-and-error programming while fostering thoughtful code development. The system also implements gami cation principles to motivate students to start assignments earlier and interact with course support structures. By shifting away from punitive restrictions and invasive data tracking, this research explores how positive reinforcement strategies can enhance student learning behaviors without discouraging participation.

A longitudinal study was conducted across multiple semesters to evaluate the e ectiveness of TA-Bot. The ndings indicate that students using the system demonstrated higher engagement levels, improved code quality, and greater o ce-hour attendance, leading to better overall retention and performance. This work contributes to the broader discourse on CS education by demonstrating the e cacy of behavioral nudges and incentive-driven assessment tools in fostering productive learning habits.