Design and Development of an Integrated Learning Infrastructure to Support Programming Education

Project Team

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Short Introduction

This project was conducted as the final thesis of Majid Salehi, an Engineering Doctorate (EngD) candidate in Software Technology at TU/e. The work focused on improving programming education through the design of a personalized and autonomous learning infrastructure. Building upon the existing SABER platform, the project aimed to make learning more adaptive and interactive for students while reducing the manual workload of educators.

The main deliverable was a functional prototype system and its architecture and design decisions, not a full-scale product. This prototype demonstrates key features of a customizable and interactive learning system based on Python programming materials, designed to align with various course needs across different institutions.

Activities

Stakeholder Engagement: Conducted interviews with university educators from six Dutch technical universities to identify system requirements.

Requirements Analysis: Combined interview data with a literature review to derive and prioritize system needs.

Design & Prototyping: Built a Django-based web platform that integrates with GitLab and uses PostgreSQL for managing content and user data.

Iterative Development: Developed a working prototype by May 2024, refined by July 2024 with advanced features, and finalized in August 2024 after feedback.

Pilot Testing: Conducted pilot testing with real users; analyzed usability using System Usability Scale (SUS) and thematic analysis.

Documentation and Presentation: Compiled findings in the EngD thesis report and presented the work during the final EngD defense.

Achieved Results and Impact

Personalized Course Content: Educators can now generate multiple customized versions of the SABER Reference Book aligned with specific course objectives.

Improved Student Engagement: Inline exercises and automated feedback (through potential integration with TU/e's Momotor system) encourage autonomy. The platform prototype enables students to engage with live, inline exercises, fostering autonomy and practical understanding.

Scalability and Usability: A web-based, user-friendly dashboard significantly reduces technical barriers for educators.

Collaborative Content Development: Educators share and improve teaching materials collaboratively through GitLab.

Pilot Success: Positive feedback from pilot users indicates the platform's usability, flexibility, and potential for wider adoption in educational settings. While not a production-ready system, the prototype validates the feasibility of such a platform and lays the groundwork for future development.

Broader Educational Value: Contributes to the field by offering a model for future development of adaptive, scalable educational technologies.