

EVALUATING THE EFFECTIVENESS OF STRUCTURED AI-ASSISTED FEEDBACK IN SECONDARY SCHOOL COMPUTING EDUCATION

Research Proposal Presentation
MSc Software Engineering & AI



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RESEARCH CONTEXT AND BACKGROUND

- ARTIFICIAL INTELLIGENCE IS INCREASINGLY INTEGRATED INTO EDUCATIONAL ENVIRONMENTS, WITH RAPID GROWTH IN AI-SUPPORTED LEARNING TOOLS ACROSS EDUCATION SECTORS [1].
- SYSTEMATIC EVIDENCE HIGHLIGHTS EXPANDING RESEARCH INTO AI APPLICATIONS WITHIN PRIMARY AND SECONDARY SCHOOL SETTINGS, YET STRUCTURED CLASSROOM-ALIGNED IMPLEMENTATIONS REMAIN LIMITED [2].
- PROGRAMMING IS WIDELY RECOGNISED AS CHALLENGING FOR BEGINNER LEARNERS, PARTICULARLY WHEN INTERPRETING TECHNICAL COMPILER FEEDBACK [3].
- STRUCTURED AND FORMATIVE FEEDBACK PLAYS A CRITICAL ROLE IN IMPROVING LEARNING OUTCOMES AND STUDENT CONFIDENCE [4].
- HOWEVER, THERE REMAINS LIMITED EMPIRICAL RESEARCH EVALUATING STRUCTURED AI-ASSISTED FEEDBACK WITHIN SECONDARY SCHOOL COMPUTING EDUCATION.

RESEARCH PROBLEM AND LITERATURE GAP

EXISTING RESEARCH DEMONSTRATES GROWING AI INTEGRATION WITHIN EDUCATIONAL CONTEXTS [1], [2].

HOWEVER, EMPIRICAL FOCUS HAS LARGELY CENTRED ON HIGHER EDUCATION OR GENERAL AI APPLICATIONS, WITH LIMITED EVALUATION OF STRUCTURED AI FEEDBACK WITHIN SECONDARY COMPUTING EDUCATION.

BEGINNER COMPUTING LEARNERS FREQUENTLY STRUGGLE WITH DEBUGGING AND INTERPRETING TECHNICAL FEEDBACK [3].

WHILE STRUCTURED FORMATIVE FEEDBACK IMPROVES LEARNING OUTCOMES [4], ITS IMPLEMENTATION THROUGH AI SYSTEMS IN SECONDARY COMPUTING CLASSROOMS REMAINS UNDER-EXAMINED.

THERE IS THEREFORE A NEED TO EMPIRICALLY EVALUATE WHETHER STRUCTURED AI-ASSISTED FEEDBACK CAN IMPROVE UNDERSTANDING AND CONFIDENCE AMONG SECONDARY SCHOOL COMPUTING STUDENTS



**Feedback for
Performance**

RESEARCH AIM AND OBJECTIVES

Aim - To design and evaluate a structured AI-assisted feedback system and examine its impact on understanding and confidence in secondary school computing students.

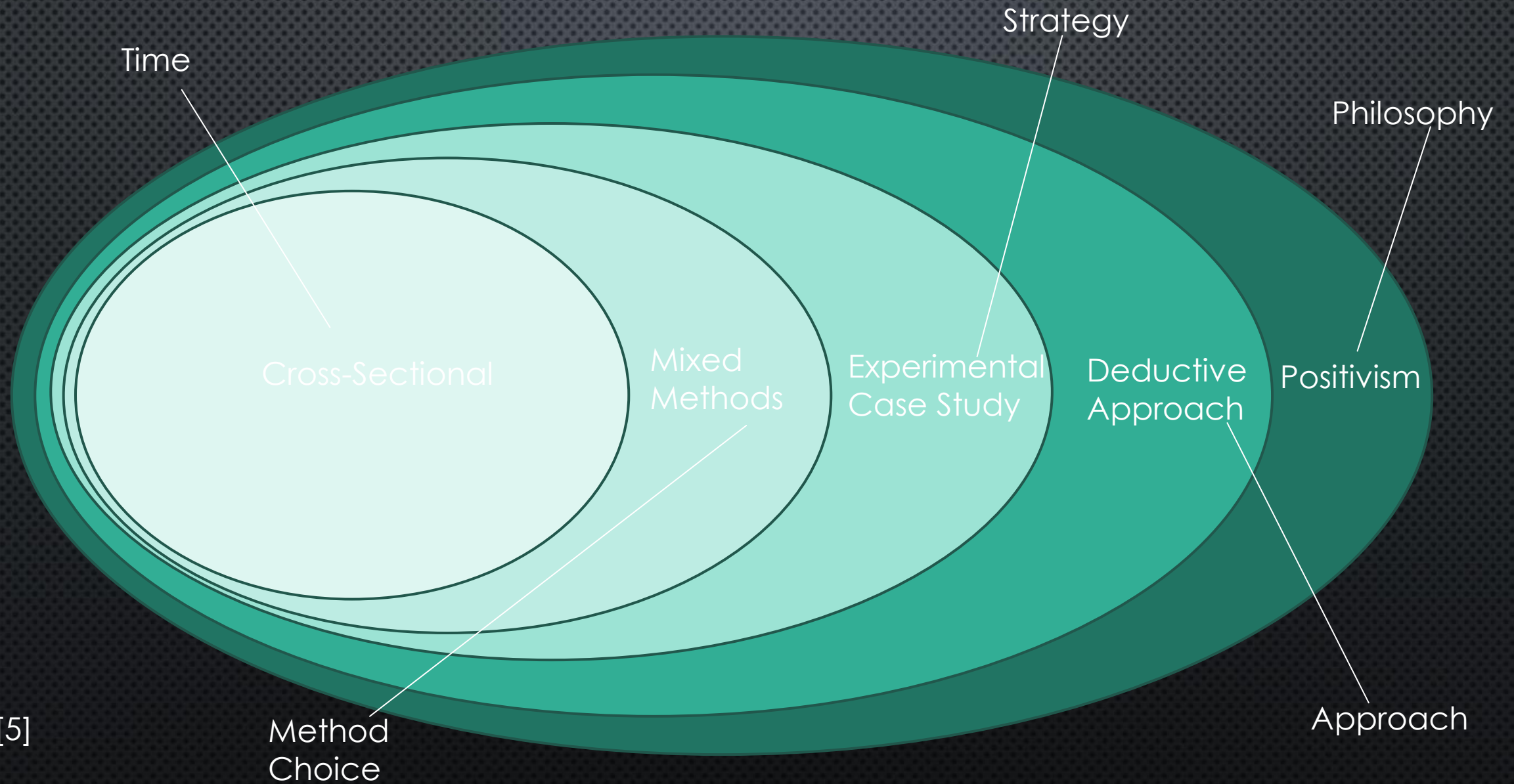
Research Objectives

- To conduct a structured literature review on AI in education, programming education, and feedback theory.
- To identify common debugging and feedback challenges experienced by secondary school computing students.
- To design and develop a prototype system delivering structured AI-assisted feedback aligned with educational principles.
- To implement and test the prototype with secondary-level computing learners.
- To collect and analyse quantitative and qualitative data measuring perceived understanding, confidence, and usability.
- To evaluate the effectiveness of structured AI-assisted feedback compared to standard technical feedback.



RESEARCH METHODOLOGY

RESEARCH ONION FRAMEWORK



DATA COLLECTION & EVALUATION

Experimental Design

Students will complete computing tasks under two conditions:

- Standard technical feedback
- Structured AI-assisted feedback

This enables comparison between feedback types.

Participants

Secondary-level computing students



Data Collection

Quantitative Data:

Confidence rating scales

Perceived

understanding scores

System usability ratings

Qualitative Data:

Short reflective responses

Views on usefulness and trust

Data Analysis

Numerical data will be analysed using descriptive statistics and appropriate comparison tests.

Written responses will be analysed thematically to identify common patterns.

PROJECT PLANNING

Phase 1 – Literature Review & Ethics (March–April 2026)

- Structured literature review
- Finalise research design
- Submit and obtain ethical approval

Phase 2 – Prototype Design & Development (May–June 2026)

- Design structured AI feedback framework
- Develop and internally test prototype
- Iterative refinement of prototype

Phase 3 – Data Collection (July 2026)

- Recruit secondary-level participants
- Conduct controlled experimental sessions
- Collect quantitative and qualitative data
- Contingency planning for participant recruitment

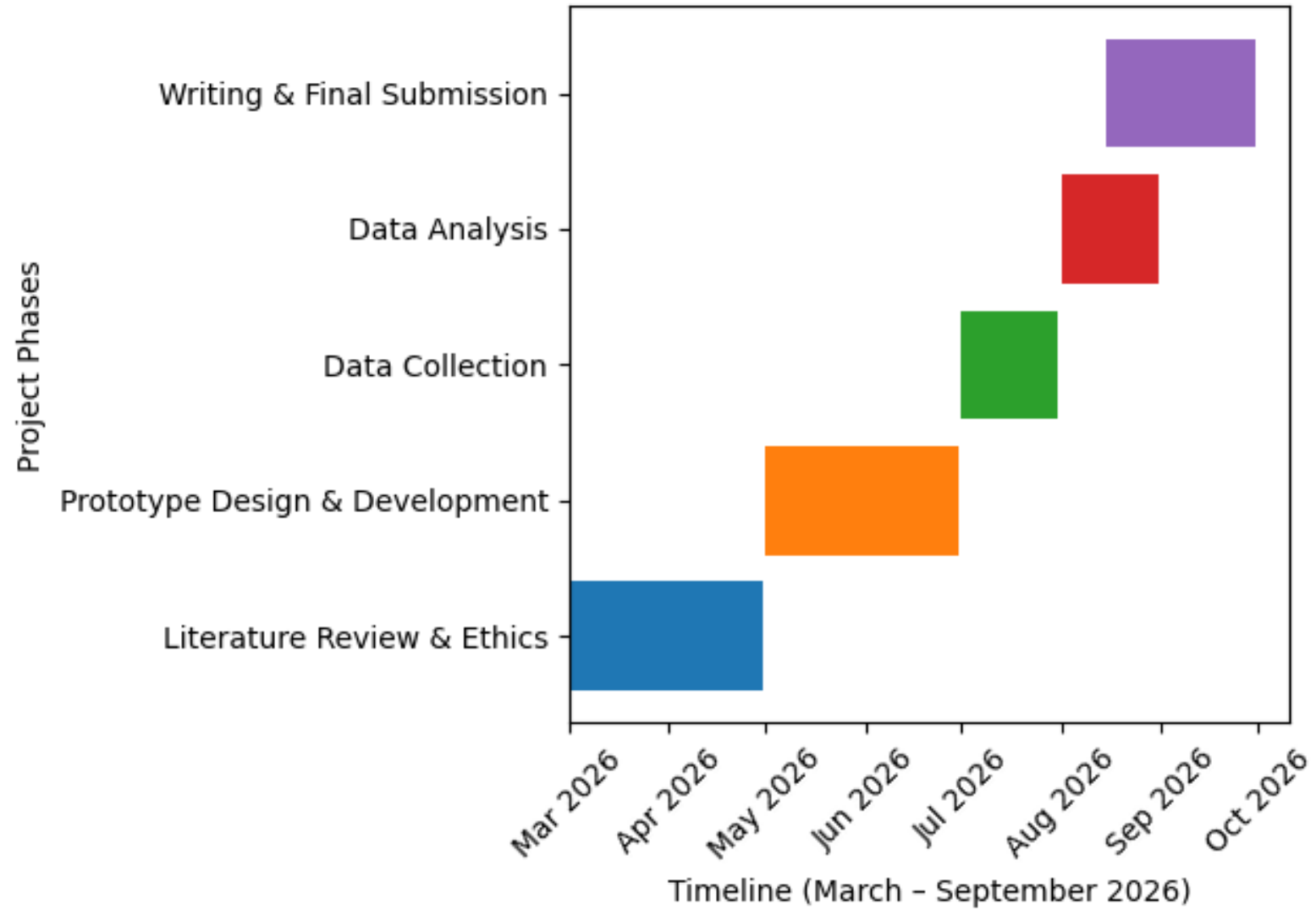
Phase 4 – Data Analysis (August 2026)

- Statistical analysis
- Conduct thematic analysis of qualitative responses
- Interpret findings

Phase 5 – Writing & Final Submission (September 2026)

- Complete dissertation
 - Edit and refine
 - Final submission

MSc Dissertation Gantt Chart



PROJECT RESOURCES AND MANAGEMENT

Prototype Development

- **Visual Studio Code** – code development environment
- **HTML, CSS and JavaScript** – prototype interface development
- **Node.js** – backend functionality
- **GitHub** – version control and project management

Data Collection Tools

- **Google Forms** – participant questionnaires and confidence ratings
- **Task-based programming exercises** – controlled computing tasks for participants
- **Observation notes during participant tasks** – capturing participant interaction

Data Analysis Tools

- **Microsoft Excel** – descriptive statistics and comparison analysis
- **Python (Jupyter Notebook)** – statistical analysis and data visualisation
- **Thematic analysis** – qualitative coding of written responses

Ethics and Data Management

- **University ethics approval process**
- **Participant consent forms**
- **Secure storage using university OneDrive**
- **Compliance with GDPR and institutional data protection policies**

Participants

- **Secondary school computing students (ages 11–16)**
- **Recruitment through local schools**

PROJECT IMPACT AND LIMITATIONS

Project Impact and Limitations

- AI-assisted feedback tools may improve understanding of programming concepts
- Structured feedback may help students interpret technical errors more clearly, improving learning confidence.
- The project could provide evidence on how AI tools may support computing education rather than replace teachers.
- Findings may help inform future classroom use of AI-supported learning tools in computing education.

Limitations

- The study will involve a relatively small participant sample, which may limit generalisability.
- The prototype system will be simplified and experimental, rather than a full production system.
- Results will be based on short-term interaction with the system, rather than long-term learning outcomes.
- Participant responses may include subjective perceptions, which may influence qualitative findings.

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