



Educational Robotics as a Catalyst for Student Engagement and Computational Thinking in Smart Schools: A Research Proposal

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Background

Educational Robotics is increasingly recognized as a key component of Smart Schools, promoting active, hands-on learning through problem-solving, creativity, and collaboration. By integrating STEM education with Artificial Intelligence, it enhances computational thinking, student engagement, and the development of technical and cognitive skills, supporting future-ready education.

Research Gap

- Limited integration between Educational Robotics and Artificial Intelligence
- Fragmented implementation across educational environments
- Lack of Smart School ecosystem frameworks
- Limited connection between robotics, learning analytics, school management, and AI
- Insufficient evidence regarding sustainable implementation models

Research Objectives

- 01
- Investigate the role of Educational Robotics in enhancing student engagement
- 02
- Explore the contribution of robotics to computational thinking development
- 03
- Examine how Educational Robotics can be integrated into AI-supported educational environments
- 04
- Propose a conceptual framework for robotics-enabled Smart School ecosystems

References

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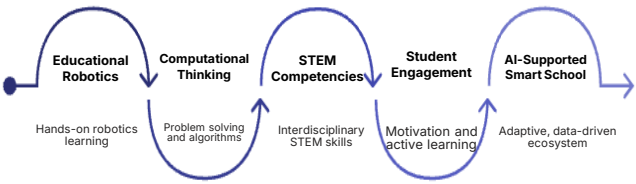
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Conceptual Framework

The framework links Educational Robotics with computational thinking, STEM competencies, and student engagement within an AI-supported Smart School ecosystem. It also emphasizes the contribution of teachers, learning analytics, innovation, and digital transformation to successful implementation.



Expected Outcomes

- Increased engagement in STEM learning through active, hands-on pedagogies
- Strengthened STEM competencies, including computational thinking and algorithmic reasoning
- Enhanced digital literacy and technological fluency
- Greater readiness for AI-enhanced learning environments

Proposed Methodology

Design-Based Research with Mixed-Methods Approach

- 01
- Phase 1: Literature Review and Theoretical Grounding
- 02
- Phase 2: Needs Analysis and Context Mapping
- 03
- Phase 3: Conceptual Framework Design
- 04
- Phase 4: Educational Robotics Integration Planning
- 05
- Phase 5: Pilot Testing and Data Collection
- 06
- Phase 6: Evaluation and Framework Refinement

Expected Impact

- Students**
Enhanced engagement, computational thinking, future-ready skills
- Teachers**
Pedagogical innovation, professional development, technological confidence
- Schools**
Improved learning outcomes, innovative reputation, digital transformation
- Educational Administrators**
Data-driven insights, strategic planning, resource optimization
- Educational Policy Makers**
Evidence-based guidance, informed educational reforms
- Educational Technology Innovation**
New models, product development, market insights

Conclusions & Future Research

- Educational Robotics has the potential to enhance student engagement and computational thinking in Smart Schools through the integration of robotics, AI, and digital transformation.
- This research provides a conceptual foundation for robotics-enabled Smart School ecosystems and informs future work on sustainable implementation, scalability, and contextual adaptability.