



Introduction

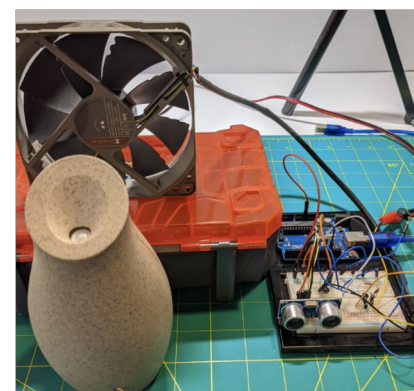
Coding has been **traditionally taught** using audiovisual materials, the blackboard, one-on-one tutoring, etc., and more recently using video conference tools in online courses.

Artificial intelligence (AI)-based software tools have supported code development, helping learners to **conduct more efficient software testing, develop user interfaces (UI) faster, and help code debugging**, among other applications, avoiding tedious and repetitive coding tasks.



Emerging AI Applications for Teaching Coding

- ChatGPT, a natural language processing tool driven by generative AI technology, can **generate code in multiple computer languages**, including C, Java, and Python.
- Python programming language and Scratch (a game development tool) have been successfully used for **teaching AI coding**.
- **AI programming in microcontrollers** (small computers on a chip) using C++ language has been positively taught.



Problem

- AI-based tools can **support students learning code** (e.g., generating code examples), **BUT** some students can **use AI tools to cheat in assignments and online exams**, generating code with minimal adaptation.
- AI-assisted code generation used by students can have ethical dimensions and integrity issues.
- AI-generated code may contain errors (bugs) (Yetistiren et al., 2023).

Considerations for Using AI tools in Code Teaching

- Explain students the **limitations of AI tools** (e.g. AI can generate non-efficient code).
- **ChatGPT may run slowly** due to high demand.
- Be **very specific** about writing coding assignments. Define specific code requirements.
- **Look for “almost perfect” code** that may be generated by AI.
- Ask students to do **code refactoring** (restructuring code without changing its external behavior), and ask them to demonstrate its process.
- Student perception of **coding AI applications is generally positive**.
- The **student evaluation of the code quality** of AI-generated code can help them learn programming skills.



Conclusions

- AI tools (e.g., ChatGPT) can be used to support students learning code, but **students can use it improperly in online exams and assignments**.
- AI-based software tools can **help students identify code bugs and test software**.
- Teaching how to code AI applications can **motivate students**.
- Future work: Development and use of **chatbots as learning companions and teaching assistants** to support learning coding.



Selected References

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- Yetiştirilen, B., Özsoy, I., Ayerdem, M., & Tüzün, E. (2023). Evaluating the Code Quality of AI-Assisted Code Generation Tools: An Empirical Study on GitHub Copilot, Amazon CodeWhisperer, and ChatGPT. arXiv preprint arXiv:2304.10778.

Acknowledgements

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