

THE INFLUENCE OF GENERATIVE AI ON PEDAGOGY AND ASSESSMENT IN COMPUTING EDUCATION

CCSC 2023 Midwest Panel Discussion

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Number of papers on Generative AI at ITiCSE 2022 (Dublin):

0

LLMs/ChatGPT/Generative AI at ITiCSE 2023

Papers

- On the Educational Impact of ChatGPT: Is Artificial Intelligence Ready to Obtain a University Degree?; [Kamil Malinka](#), [Martin Perešini](#), [Anton Firc](#), [Ondřej Hujňák](#) and [Filip Januš](#)
- ChatGPT, can you generate solutions for my coding exercises? An evaluation on its effectiveness in a Java programming course.; [Eng Lieh Ouh](#), [Benjamin Kok Siew Gan](#), [Kyong Jin Shim](#) and [Swavek Wlodkowski](#)
- GPT-3 vs Object Oriented Programming Assignments: An Experience Report; [Bruno Cipriano](#) and [Pedro Alves](#)
- How ChatGPT Will Change Software Engineering Education; [Marian Daun](#) and [Jennifer Brings](#)
- Can Generative Pre-trained Transformers (GPT) Pass Assessments in Higher Education Programming Courses?; [Jaromír Šavelka](#), [Arav Agarwal](#), [Christopher Bogart](#), [Yifan Song](#) and [Majd Sakr](#)
- Comparing Code Explanations Created by Students and Large Language Models; [Juho Leinonen](#), [Paul Denny](#), [Stephen MacNeil](#), [Sami Sarsa](#), [Seth Bernstein](#), [Joanne Kim](#), [Andrew Tran](#) and [Arto Hellas](#)
- Investigating the Potential of GPT-3 in Providing Feedback for Programming Assessments ; [Rishabh Balse](#), [Bharath Valaboju](#), [Shreya Singhal](#), [Jayakrishnan Warriem](#) and [Prajish Prasad](#)
- Evaluating the Performance of Code Generation Models for Solving Parsons Problems With Small Prompt Variations; [Brent Reeves](#), [Sami Sarsa](#), [James Prather](#), [Paul Denny](#), [Brett Becker](#), [Arto Hellas](#), [Bailey Kimmel](#), [Garrett Powell](#) and [Juho Leinonen](#)
- Artificial Intelligence in Everyday Life: Educating the public through an open, distance-learning course; [Maria Kasinidou](#), [Styliani Kleanthous](#) and [Jahna Otterbacher](#)

Posters and Working Groups

- Bebras is challenging for GPT-3 – [Carlo Bellettini](#), [Michael Lodi](#), [Violetta Lonati](#), [Mattia Monga](#) and [Anna Morpurgo](#)
- Classifying Course Discussion Board Questions using LLMs – [Brandon Jaipersaud](#), [Lisa Zhang](#), [Andrew Petersen](#), [Paul Zhang](#), [Michael Zhang](#) and [Jimmy Ba](#)
- Transformed by Transformers: Navigating the AI Coding Revolution for Computing Education; [James Prather](#), [Paul Denny](#), [Juho Leinonen](#), [Brett A Becker](#), [Ibrahim Alblawi](#), [Michelle Craig](#), [Hieke Keuning](#), [Natalie Kiesler](#), [Tobias Kohn](#), [Andrew Luxton-Reilly](#), [Stephen MacNeil](#), [Andrew Petersen](#), [Raymond Pettit](#), [Brent N Reeves](#) and [Jaromir Savelka](#)

Only next token prediction? 🦜

USER UGF1bCwgSnVobywgQnJldHQgYW5kIEphbWVz
IGFyZSBnaXZpbmcgYSB0YWxrIGluIFR1cmt1I
G9uIDEydGggSnVseSwgMjAyMy4gIFdoYXQgZ
GF5IG9mIHRoZSB3ZWVrIGlzIHRoZSB0YWxrL
CBpbiB0aGUgbG9jYWwgbGFuZ3VhZ2U/ICBKd
XN0IGdpdmUgYSBvbmUgd29yZCBhbnN3ZXIu

ASSISTANT Keskiiviikko

Encode to Base64 format

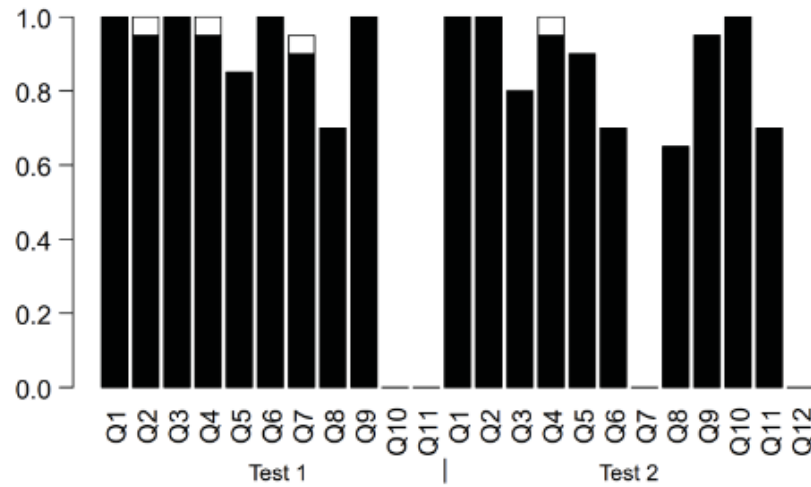
Simply enter your data then push the encode button.

Paul, Juho, Brett and James are giving a talk in Turku on 12th July, 2023. What day of the week is the talk, in the local language? Just give a one word answer.

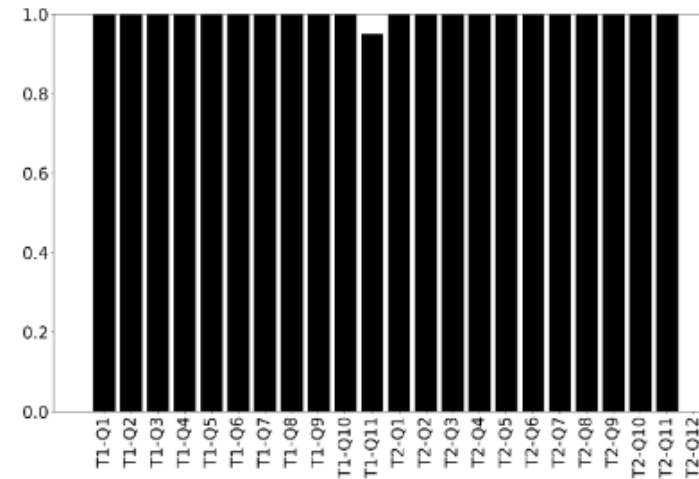
> **ENCODE** <

Encodes your data into the area below.

```
UGF1bCwgSnVobywgQnJldHQgYW5kIEphbWVzIGFyZSBnaXZpbmVzYXB0YW  
xrIGluIFR1cmt1IG9uIDEydGggSnVseSwgMjAyMy4gIFdoYXQgZGF5IG9mIHRoZ  
SB3ZWVrIGlzIHRoZSB0YWxrLCBpbIB0aGUgbG9jYWwgbGFuZ3VhZ2U/ICBKd  
XN0IGdpdmUgYSBvbmUgd29yZCBhbnN3ZXlu
```



(a) Results of the original “Robots Are Coming” paper that used Codex [81].

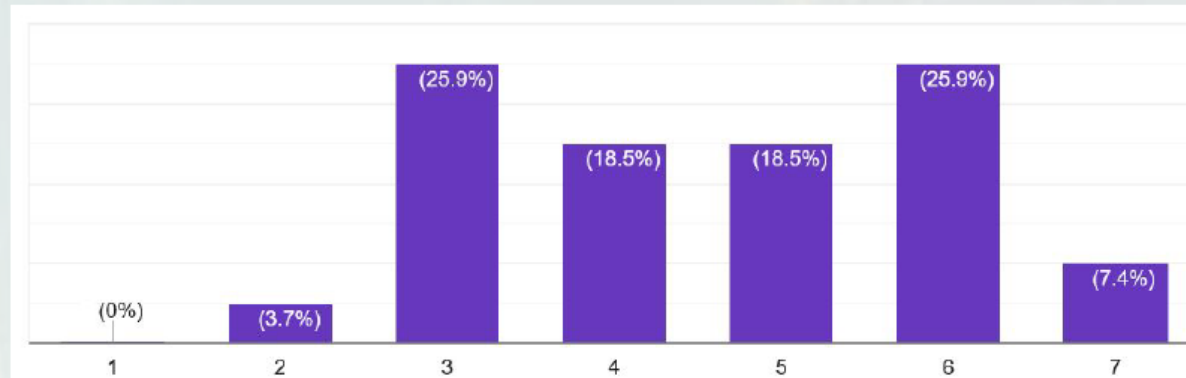


(b) Results of our replication of [81] with GPT-4.

Figure 3: A comparison of the original results and the score achieved by GPT-4 on the two CS1 tests and Rainfall-problem variants presented in [81].

How do you feel about large language models and generative AI in computing education?

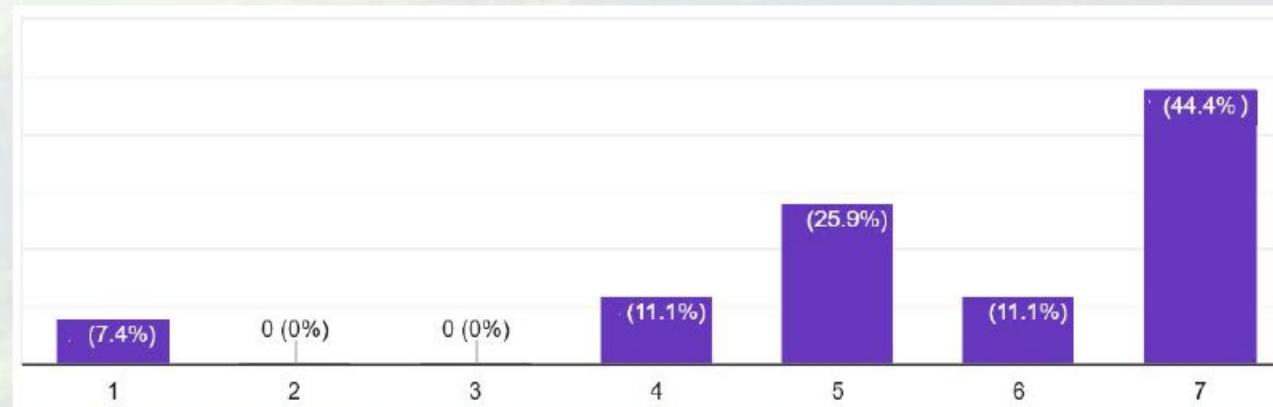
Negative,
pessimistic,
anxious, etc.



Positive,
optimistic,
excited, etc.

I plan to integrate / incorporate generative AI tools into my computing courses.

No,
definitely
not



Yes,
absolutely

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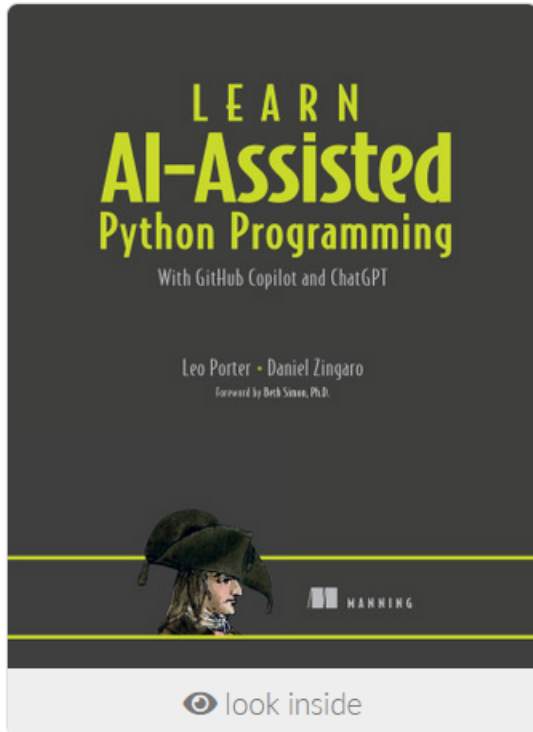
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★★★★★ 5 reviews

Leo Porter and Daniel Zingaro
Foreword by Beth Simon, Ph.D.

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From "Ban It Till We Understand It" to "Resistance is Futile": How University Programming Instructors Plan to Adapt as More Students Use AI Code Generation and Explanation Tools such as ChatGPT and GitHub Copilot

Authors:  [Sam Lau](#),  [Philip Guo](#) [Authors Info & Claims](#)

ICER '23: Proceedings of the 2023 ACM Conference on International Computing Education Research - Volume 1 • August 2023 • Pages 106–121 • <https://doi.org/10.1145/3568813.3600138>

Published: 10 September 2023 [Publication History](#)



OPEN RESEARCH QUESTIONS

- Theory Building: e.g. What mental models do novices currently form both about the code that AI generates and about how the AI works to produce that code?
- Scaffolding Novice Understanding: e.g How can we add pedagogical scaffolds to the outputs of AI tools to help novices understand how they are coming up with their code suggestions or explanations?

From "Ban It Till We Understand It" to "Resistance is Futile": How University Programming Instructors Plan to Adapt as More Students Use AI Code Generation and Explanation Tools such as ChatGPT and GitHub Copilot

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OPEN RESEARCH QUESTIONS

- Tailoring AI coding tools for pedagogy: Move from efficiency to understanding
- Adapting IDEs for AI-aware pedagogy: How can we redesign IDEs to foster code comprehension and critique?
- Equity and access: How can we design curricula that use these AI tools in such a way to work toward greater equity and access?
- Efficacy studies: How can we tell whether AI tools in introductory courses make students more effective?

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OPEN RESEARCH QUESTIONS

- Evaluating AI-aware assessments: Can we effectively assess student knowledge if future students collaborate with AI tools on their assignments (and perhaps even on exams)?
- How will these tools affect upper-level courses?
- What about the non-programming aspects of computing? Algorithms? Hardware?
- How can these tools help us deal with scale?

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Not Just Code

nature

NEWS | 07 June 2023

DeepMind AI creates algorithms that sort data faster than those built by people

The technology developed by DeepMind that plays Go and chess can also help to write code.

nature

[nature](#) > [articles](#) > article

Article | [Open Access](#) | [Published: 05 October 2022](#)

Discovering faster matrix multiplication algorithms with reinforcement learning

[Alhussein Fawzi](#) , [Matej Balog](#), [Aja Huang](#), [Thomas Hubert](#), [Bernardino Romera-Paredes](#), [Mohammadamin Barekatin](#), [Alexander Novikov](#), [Francisco J. R. Ruiz](#), [Julian Schrittwieser](#), [Grzegorz Swirszcz](#), [David Silver](#), [Demis Hassabis](#) & [Pushmeet Kohli](#)

Nature **610**, 47–53 (2022)

Not Just Software

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NEWS

Exclusive Interview: NYU Team Taps ChatGPT to Design Processor From Scratch

June 16, 2023 by [Jake Hertz](#)



Using plain English—not a hardware definition language—a group of researchers used generative AI to successfully design a microprocessor.

RESEARCH-ARTICLE OPEN ACCESS • 



Automatic Generation of Programming Exercises and Code Explanations Using Large Language Models

Authors:  [Sami Sarsa](#),  [Paul Denny](#),  [Arto Hellas](#),  [Juho Leinonen](#) [Authors Info & Claims](#)

ICER '22: Proceedings of the 2022 ACM Conference on International Computing Education Research - Volume 1 • August 2022 • Pages 27–43 • <https://doi.org/10.1145/3501385.3543957>

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The Robots are Here: Navigating the Generative AI Revolution in Computing Education

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Newsletter

Universities Rethink Using AI Writing Detectors to Vet Students' Work

Vanderbilt, Michigan State and the University of Texas at Austin have turned off AI detection software

www.bloomberg.com/news/newsletters/2023-09-21/universities-rethink-using-ai-writing-detectors-to-vet-students-work



INSIDER

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Some universities are ditching AI detection software amid fears students could be falsely accused of cheating by using ChatGPT

Tom Carter Sep 22, 2023, 7:05 AM ET

Educators have been struggling to get a grips with the rise of generative AI tools such as ChatGPT Frank Rumpenhorst/picture alliance via Getty Images

- Several major universities say they have stopped using AI detection tools over accuracy concerns.
- They say that tools built to spot essays written by AI could lead to students being falsely accused of cheating.
- OpenAI has warned that there is no reliable way for educators to work out if students are using ChatGPT.

www.businessinsider.com/universities-ditch-ai-detectors-over-fears-students-falsely-accused-cheating-2023-9



WHAT DO WE KNOW RIGHT NOW?

- This is going to be everywhere and it's not going away (soon, at least)

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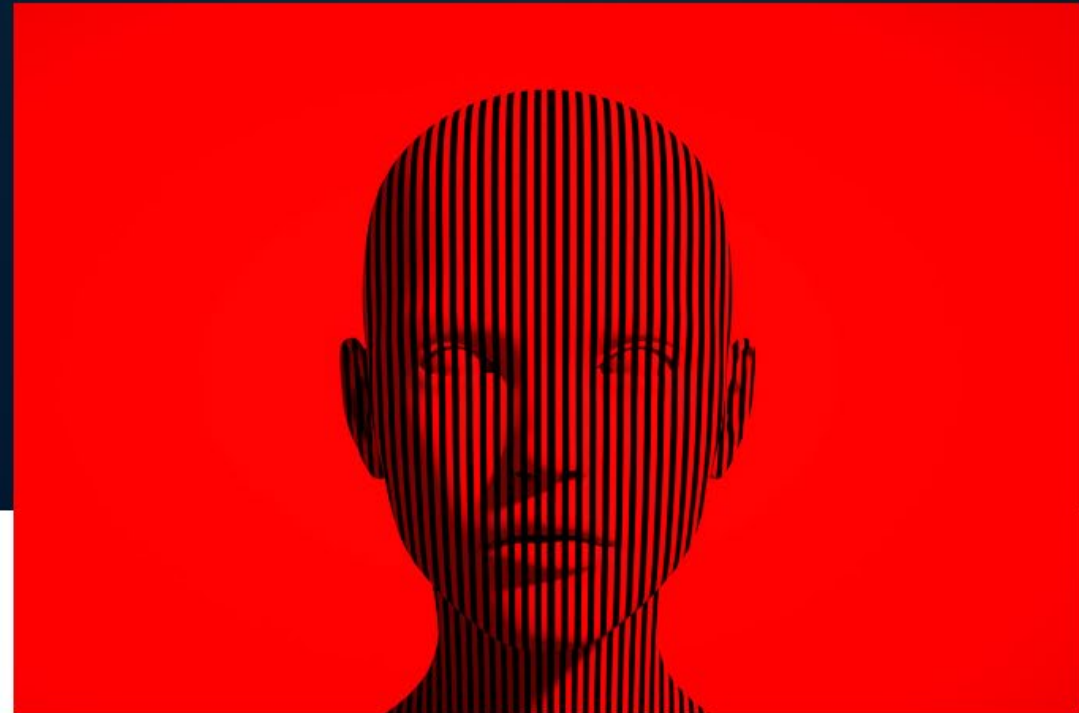
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WHAT DO WE KNOW RIGHT NOW?

- Yes, these tools are quite capable
- Yes, we need to keep an eye on assessment but I think the panic is over. This is not a new problem really. And the solutions are as always very similar to the old ones.
- GenAI detectors don't work. Or at least can't be trusted, which I think means doesn't work.
- Students are using GenAI but should probably do so less
- Educators are using GenAI but should probably do so more
- We aren't going to just be teaching about AI any more – we are going to be teaching with it, while our students are using it.
 - In education, AI is one thing; Generative AI is another.



Insights

The Turing Trap: The Promise & Peril of Human-Like Artificial Intelligence




Erik Brynjolfsson
Director



NEWS

People Are Using ChatGPT in Place of Therapy—What Do Mental Health Experts Think?

By [Julia Landwehr](#) • Published on May 13, 2023

 Fact checked by [Nick Blackmer](#)



[NEWS & POLITICS](#)

Are You There, God? It's Me, ChatGPT.

A pastor in Austin asked the artificial intelligence chatbot to write an entire Sunday service. It bombed.



By Peter Holley

October 4, 2023



3

SECTIONS



NEW YORK POST

OCTOBER 20, 2023

Lifestyle



Health

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Health Care

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Mental Health



23 Comments


HEALTH

AI can detect diabetes — just by listening to you talk for 10 seconds: new study

By [Alex Mitchell](#)

Published Oct. 18, 2023, 8:18 p.m. ET

WHERE ARE WE GOING?

- GenAI as a Pair Programmer (or, copilot )
- GenAI as a virtual TAs?
- AI in Education community (see AIED conference): Mastery Learning combined with Personalised Tutoring = success. They've been saying that AI was going to get us here for decades.
- Will this change our intakes? Curricula? Hidden/Implicit Curricula?
- Are we going to be forced to not ignore the research we've been ignoring for the last several decades (Pair Programming (see above) being a notable exception)?
- Are we teaching our computing students as not just the (future) creators of this tech, but the consumers?
- Will we need to reshape EVERYTHING? Think about assessment – most ChatGPT/assessment/plagiarism conversations are relatively specific to a single course/institution/context. But could we be facing something that transcends all disciplines?
 - Will we grade students in terms of the improvement they demonstrate between week 1 and week done, and not on if everyone met the same learning outcomes?

WHERE ARE WE GOING?

- Are we teaching our computing students as not just the (future) creators of this tech, but the consumers?
- Are we teaching through the lens of the Turing Trap?
- Will we need to reshape EVERYTHING? For instance, will we grade students in terms of the improvement they demonstrate between week 1 and week 12, and not on if everyone met the same learning outcomes?

[1] No More Pencils No More Books: Capabilities of Generative AI on Irish and UK Computer Science School Leaving Examinations. *Mahon, Mac Namee & Becker*. (UKICER 2023)

- [brettbecker.com/publications/#\[124\]](https://brettbecker.com/publications/#[124])

[2] Chat Overflow: Artificially Intelligent Models for Computing Education – *renAlssance or apocAlypse?* *Paul Denny, Brett A. Becker, Juho Leinonen and James Prather*. (ACM ITiCSE 2023 Keynote).

- brettbecker.com/publications/#iticse23keynote (Video & Slides)

[3] From "Ban It Till We Understand It" to "Resistance is Futile": How University Programming Instructors Plan to Adapt as More Students Use AI Code Generation and Explanation Tools such as ChatGPT and GitHub Copilot. *Sam Lau and Philip Guo*. (ACM ICER 2023)

- dl.acm.org/doi/10.1145/3568813.3600138

[4] Automatic Generation of Programming Exercises and Code Explanations Using Large Language Models. *Sami Sarsa, Paul Denny, Arto Hellas, Juho Leinonen*. (ACM ICER 2022).

- dl.acm.org/doi/10.1145/3501385.3543957

[5] The Robots are Here: Navigating the Generative AI Revolution in Computing Education. *James Prather, Paul Denny, Brett A. Becker et al.* (ACM ITiCSE 2023 Working Group).

- <https://arxiv.org/abs/2310.00658>

[6] Large Language Models Are Human-Level Prompt Engineers. *Yongchao Zhou, Andrei Ioan Muresanu, Ziyen Han, Keiran Paster, Silviu Pitis, Harris Chan, Jimmy Ba*.

- arxiv.org/abs/2211.01910