Spridning av aktuell forskning

How to Support Student Learning via AI and ChatGPT in Education

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Introduction

This short brief dive into artificial intelligence (AI) and ChatGPT in education is an initial attempt to understand what has been published on the topic(s) and to what extent. It is an initial 'browse' for us to land in what we can continue exploring in our teaching hereafter.

Currently AI is fostering the education sector and is considered as a paradigm-shift transforming education and learning at faster pace than expected by society. One definition of AI is the simulation of human intelligence processes by machines, especially computer systems. Specific applications of AI include expert systems, natural language processing, speech recognition and machine vision (Laskowski, 2023). The opportunity lies in how we combine human learning and how we make use of AI tools like a language model such as Chat Generative Pre-Trained Transformer (ChatGPT) by OpenAI (2023).

ChatGPT was released in November 2022. This tool is text-based and function on a probability for a word to occur based on previous words in the sequence. Technically the GPT models are so called 'transformer neural networks' and these models focus on different parts of the input text during each processing step. A transformer model captures more context and improves performance on natural language processing (NLP) tasks. The research conducted on these models can go under what is called Language Technology or Linguistics. These Chat GPT text models are trained on about 45 terabytes (TBs) of text on

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the Internet. Swedish Large Language Models (LLMs) are researched at Wallenberg AI, Autonomous Systems and Software Program (WASP, 2024) and discussed on WARA Media & Language PodCast (2023) where they share a discussion between Swedish LLM researchers. Language models are traditionally trained on smaller datasets then what big companies like Amazon, Facebook, Twitter, Google, Microsoft now have scaled up. To create transparency, we need to know what data these models are trained on, if we do not create our own sub models. There is a demand from the European Union (2023) to show and share transparency in publicly used LLMs. In a near future there will be more language models to come.

First we will shortly introduce what inspired us, secondly look into some current articles to understand and get some answers to where things are at and thirdly explore what initial AI tools are available for education for student learning and teaching. We hope to gain and give some initial insight to what is currently happening in the AI education realm and how we might navigate this together.

National AI meeting and inspiration

The fall of 2023 we joined a national online meeting being arranged by Sveriges Universitet- och Högskoleförbund with the theme AI (Schneider, 2023). Seminars announced by Universitets- och Högskolerådet, Luleå University of Technology, Chalmers and Royal Institute of Technology chaired this online event on 15th of September. The seminar had approximately 1000 online attendees joining where Vice Chancellor Birgitta Bergvall-Kåreborn from Luleå University of Technology coordinated pre-recorded guest speakers and a joint online panel on the topic 'ChatGPT and how it affects education'.

Various topics on the AI theme were presented. One presentation from Karolinska Institutet demonstrated how a method like roleplaying could help reveal actual knowledge besides AI tooling. Linköping University on their side presented a portfolio approach as a possible examination form. Some of the highlighted questions were about how AI could be used and under what forms. It was discussed how to interpret a result generated by AI, the time saving aspect and consistency in grading. AI could offer students to understand and test various roles growing from

reflecting on different role perspectives, oppose roleplaying testing scenarios with different crafted questions and evaluate answers generated by ChatGPT. Further, students preferably can take advantage of AI tools for their own learning with some formal guidance by us staff. The question arose for teaching staff online how we collegially formulate the learning outcome targets and why we do use AI at all. Another aspect was how AI could help and perform repetitive tasks where staff instead can spend quality time with students. Knowledge though, is often based in repetition and iterations so the question is how we use the tools and still build a solid fundament in memory.

We understood and learned how unprepared we are on the whole when this technology has such great impact on our teaching profession as a group. We also understood we have to equip ourselves and the students in a rapid pace. From this background we have a twofold AI path, one where we look at how we can use AI for student purposes and one for us as teaching staff. Here we will use education as one word as a common denominator to cover these two sides at this point in time. We as staff at Kristianstad University (HKR) and elsewhere have to create a joint AI tool framework we can relate to and jointly reference. Using ChatGPT is not just to ask questions and receive answers, it is also how to base the knowledge in actual learning context and problem formulations.

Articles on the Theme

To better understand what has been published on the topic we looked at some articles from 2021 to 2023 to comprehend what already have been written in terms of AI in education and the use of ChatGPT. Here we will briefly present a few studies highlighting various aspects of the ChatGPT and AI based on our keywords *Artificial Intelligence, Education, Chat GPT and Literacy*. We have aimed to capture the central aspect of each paper or an essential statement and indicated this in italic below. Thereafter, we listed these with the purpose to summarize what we read and understood from these articles. Our initial attempt was to understand what has been published in relation to these keywords and how much.

First, we conducted database searches on the Institute of Electrical and Electronics Engineers (IEEE) search engine with the keywords mentioned above. We only had 6 hits on articles written on the topic within this timeframe. Due to the recent release of ChatGPT this might explain the few papers on the topic. The six articles were all published in 2023 and we want to show their titles to communicate current emphasis regarding the subject. The titles are:

- Research on ChatGPT's Strategy to Promote the Digital Transformation of Education (Yinping & Yongxin, 2023)
- An AI Contribution to African Economic Development Through Mother Tongue Education – A Linguistic Evaluation of an African-Based AI Mathematics Tutoring Bot (Butgereit & van Staden, 2023)
- Teaching Information Literacy and Critical Thinking Skills in Chat GPT Time (Vjeran, 2023)
- Blowing Chunks with ChatGPT (Dzomba et al., 2023)
- Augmented Imagination: Exploring Generative AI from the Perspectives of Young Learners (Putjorn & Putjorn, 2023)
- Leveraging ChatGPT and Amazon Alexa to Empower Healthcare Workers in Sierra Leone (Lee at al., 2023)

These articles emphasize needs where AI and ChatGPT can be utilized and support digital learning in remote areas and campus contexts. They also reflect the diverse and innovative ways in which AI technology, particularly conversational and generative AI, is being researched and applied across different fields and regions, from education to healthcare, and in various linguistic and cultural contexts.

Thereafter, we continued to Google Scholar and found 4460 articles on the topic. It showed that 3930 of these were written and published during 2023, which was a tremendous number of articles in comparison to IEEE.

After constraining the IEEE search to only include ‘ChatGPT’ and ‘Education’ we found 148 articles and picked the three top ones which were Tubishat et al. (2023), Neumann et al. (2023), Liu (2023), all

published 2023. We were quite struck by the low number of publications on this topic.

One of these papers focused on a sentiment analysis of Twitter tweets where the authors looked at extracting features from texts and classified these as positive or negative responses of ChatGPT in education, *its potential usage and popularity among students*. From the total 11830 tweets 6179 tweets expressed a positive attitude, and the remaining numbers were neutral and negative (Tubishat et al., 2023).

Further Neumann et al. (2023) argued that scientific writing in Software Engineering is important as it corresponds with underlying skills in argumentation, evaluation and providing scientific ground. They pointed out that AI tools like ChatGPT have *great innovation potential for our primary teaching tasks* where it can provide new ideas for preparing a lecture or for a written assignment. ChatGPT can even handle more complex aspects of scientific writing, such as summarizing literature and paraphrasing text(s) which also can be useful.

Liu (2023) highlighted *a need for shift in teaching style and curriculum design necessary to effectively integrate AI into undergraduate computer science education*. Liu argued a risk of comprehensive understanding when ChatGPT generates information which possibly can lead to inaccuracies in text-based conclusions. To address these challenges, educators must encourage critical evaluation of ChatGPT's output, highlighting its limitations and promoting independent research and reflection. As AI also advances and becomes more prevalent in secondary (and postsecondary) classrooms, the author highlights how new avenues open-up for learning. Liu (2023) claims the AI tools have the potential *to go beyond simply enhancing writing and language skills* and how it also fosters creativity, supporting critical thinking, and aids in research and information analysis.

Leaving the ChatGPT focus we constrained our IEEE search to just include ‘AI’ and ‘Education’ articles to further understand what was in focus. With this search constraint we found approximately 3700 articles and did mostly look at what happens elsewhere outside Sweden. Eremeev et al. (2022) designed a new master’s degree program with

focus on AI and development of AI Systems (AIS) where *ontologies were shown to be important when to present and shape knowledge*. The organization of search operations can lead to an AI "combinatorial explosion" occurring due to the organization of information for all connections in the network. With the rapid development of the Internet, the total amount and update speed of knowledge is also increasing. Caijun et al. (2021) highlighted the application of artificial intelligence in education to promote education equality and improve teaching efficiency for *reformation of the education with advancement in the teaching methods*. The research by Wang (2022) explored the hotspots of AI in education, using Bloom's educational goal classification method to *divide learning effects into cognitive learning, emotional learning, and skill-behavior learning* and analyzing the effects of AI on student's total learning.

Jiang and Mao (2021) looked at the Chinese education reformation realizing education *is no longer limited by national borders and school walls*. Today and in the future the learners can study the world's best courses without leaving home. The important aspect of the AI in educational collaboration reinforce how students can strengthen their theoretical language base, with semantics and syntax. How to avoid the educational discrepancies such as injustice and lack of innovative trend and practices the article investigated the development of educational technology for China's educational reform.

Sun (2023) found that AI is divided into *logical, bionic, and physiological groups*. In essence, we ought to study the use of algorithms to implement intellectual abilities and support disabilities. Sun addresses that there is a huge gap between formal educational practices and the actual improvement of a student's learning outcome. Finally, Chang and Kidman (2023) discussed the role of *AI-powered educational platforms* to tailor learning paths to a student's interests, abilities, and learning style and readiness. Generative AI can also be used to help students learn practical skills through simulations and virtual environments for practice and experimentation.

The central aspects from the articles and the main highlights brought to attention via our keywords are listed below:

1. potential usage and popularity among students
2. great innovation potential for our primary teaching tasks
3. a need for shift in teaching style and curriculum design necessary to effectively integrate AI into undergraduate computer science education
4. standards for the development and deployment of ontologies and ontologies were shown to be important when to present and shape knowledge
5. reformation of the education with advancement in the teaching methods
6. divide learning effects into cognitive learning, emotional learning, and skill-behavior learning
7. is no longer limited by national borders and school walls
8. logical, bionic, and physiological groups
9. AI-powered educational platforms

The central aspects in the articles have given us insight and inspiration how we can possibly form a first baseline in how to progress this into an initial course layout. We need to start with a particular learning task and see how we can break this down and how we can possibly implement it via existing tools. To directly test our list with central aspects we passed it onto ChatGPT. We thought it could be worthwhile to demonstrate how this tool can assist us when writing.

We gave ChatGPT the text prompt “Please summarize the following text. The central aspects from the articles and the main highlights using the highlights from list 1–9” above. The ChatGPT response is provided below. ChatGPT can structure up a text and make it somewhat more cohesive. This shows how it can be used as support, and as a tool in a practical work situation say preparing for a course. The bold headings are formed without instruction and the summary after the list is shaped by the language model (ChatGPT, personal communication, April 2, 2024):

1. **Student Engagement:** AI technologies are increasingly popular among students, indicating their potential to significantly boost engagement and learning outcomes.
2. **Teaching Innovation:** There's a substantial potential for AI to revolutionize primary teaching tasks, suggesting a transformative impact on conventional teaching methods.
3. **Curriculum and Teaching Adaptation:** Effective integration of AI into education necessitates a significant shift in both teaching styles and curriculum design, pointing towards the need for educators to evolve alongside technological advancements.
4. **Importance of Ontologies:** The creation and application of ontologies are highlighted as crucial for structuring and presenting knowledge within AI systems, emphasizing their role in enhancing educational content and delivery.
5. **Educational Reform:** The advancement in teaching methods, facilitated by AI, signals a broader reformation of the educational landscape, indicating a move towards more interactive and personalized learning experiences.
6. **Learning Effects Categorization:** The text advocates for e comprehensive approach to understanding learning outcomes by dividing them into cognitive, emotional, and skill-behavioral learning, suggesting a multi-faceted view of educational impact.
7. **Global and Unrestricted Learning:** AI's role in education transcends geographical and physical boundaries, highlighting its capacity to make learning accessible globally, beyond traditional school settings.
8. **Comprehensive Learning Considerations:** It underscores the necessity of addressing various aspects of learning, including logical, bionic, and physiological groups, advocating for a holistic approach to education.
9. **AI-Powered Platforms:** The development and utilization of AI-powered educational platforms are marked as a significant advancement, offering tools for tailored and effective learning experiences.

These highlights emphasize the transformative impact of AI in education where AI deeply integrates into the educational fabric, necessitating shifts in teaching practices, curriculum design, and the overall approach and perception of education. This integration will make learning more personalized, accessible, and effective, driven by advancements in AI technology.

Using a tool like ChatGPT is one way to work with AI and language models. Via programming and text mining we can also parse and tokenize text for smaller models and analytics purposes.

Possible AI Tooling

Finally, the articles and the highlights above left us curious to look into supporting AI tools beyond ChatGPT only. The cutting-edge tools such as OpenAI's Natural Language Processing construction allows to comprehend and interpret student's inquiries naturally and intuitively. The Kivy frontend framework also mentioned in the online SUHF meeting (Kivy, n.d.) is often used to develop a frontend user interface, ensuring its simplicity and usability, to connect AI frameworks at the back.

In the context of education, ChatGPT can be used by both learners and teachers. A teacher can use it to create content for course outlines, presentations, coding, quizzes, grading, scientific papers and so on. Students can use it as a help in solving questions, writing essays, and getting formative feedback on their work. The potential and possibilities of AI in education opens for a more individualized and effective approach to learning via a possible Self-Paced Mentor (Sunitha et al., 2023). Gupta (2023) argues that "AI in Education" (AIEd) addresses science, technology, engineering, and mathematics (STEM) teaching problems. STEM uses Natural Language Processing (NLP) as one source but also non-language based sources and the challenge is how we combine these different knowledge sources together.

Reddit (n.d.) is a go-to web place for many young people. Below (see figure 1) we briefly introduce various AI tooling, that was presented on Reddit (r/ChatGPTPromptGenius, 2023). We have categorized these

tools in five categories, and you can read the matrix row by row with the main classification title at the far left. It is not only text based (natural language) teaching learning sources but also video (for interactive communication between students and teachers with recorded lectures and online via zoom), design (charts and diagrams), web (students group chat and communication among themselves and with teachers), and code (programming language).

These different sources of tools emphasize various aspects in a multimodal learning, and we need to understand what we use when and why.

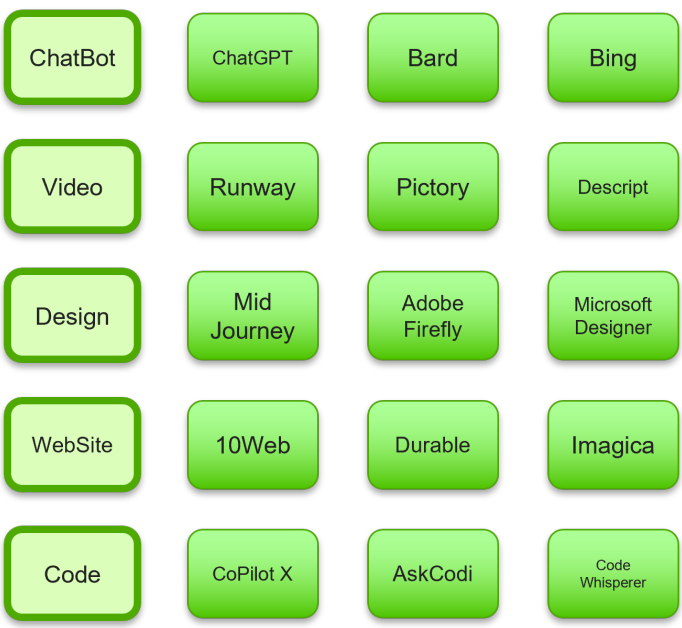

Figure 1. AI tools for education

We can conclude that AI with ChatGPT and other AI tools are quickly forming new ways of teaching and learning and surpassing a classical classroom with a teacher as a central knowledge source. The tendency is to be able to orchestrate multiple sources and combine these with a clear clarified path defining what learning outcomes should be achieved accompanied by a teacher/instructor. The text-based weighing in academia will persist but also open for multimodal non-text-based

opportunities where AI tools can support and bridge comprehension when needed.

In summary, we will continue to see how we can progress in shaping an educational AI tool for our courses in Computer and Data Science with the tools presented above and the listed highlights.[1]

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[1] For further information and further reading on ongoing research please visit International Journal of Educational Technology in Higher Education.

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