

AI chatbots as Co-Pilots in Learning During Practical Teaching Activities

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Introduction and Background

Artificial intelligence (AI) has steadily transformed various sectors, including education, where it has introduced innovative tools to enhance the learning experience. Initially, AI in education was limited to basic automated grading systems and personalized learning programs. However, advancements in natural language processing (NLP) have given rise to sophisticated AI chatbots and virtual assistants, such as OpenAI's ChatGPT or Google's Gemini, among many others, are capable of engaging in meaningful dialogues with students.

Effective science education at the university level is underpinned by several key pedagogical principles. One of the foremost is the constructivist approach, which posits that learners build new knowledge upon the foundation of previous learning. This approach encourages active engagement in their learning process. Hands-on activities, problem-based learning, and inquiry-based approaches are integral to this method, fostering critical thinking and deeper understanding. The use of interactive AI chatbots can be framed within this learning theory, as it provides a responsive environment where students can engage in dialogues, thereby constructing their understanding.

Another principle is the importance of formative assessment, which involves continuous feedback and assessment during the learning process. AI chatbots and virtual assistants can provide immediate feedback on students' questions and exercises, helping them understand where they might have gone wrong and guiding them toward the correct

understanding. This helps identify students' misconceptions and learning gaps early on, allowing for timely interventions.

A key concept from Vygotsky's work (Vygotsky, L. S. (1978) that is particularly relevant to the integration of AI chatbots in education is the Zone of Proximal Development (ZPD). The ZPD refers to the difference between what a learner can do independently and what they can achieve with guidance and support. Vygotsky emphasized that learning is most effective when students are challenged just beyond their current abilities but can succeed with appropriate assistance. Again, AI chatbots can function within this framework by providing scaffolded support to students, as it may help students overcome immediate obstacles and promote independent problem-solving skills.

Motivation and Purpose

Students often struggle with engagement due to the abstract nature of many scientific concepts and the difficulty in relating these concepts to real-world applications. Complex topics such as those discussed here including advanced ecological systems or intricate biochemical processes can be daunting, leading to frustration and disengagement. Furthermore, the diversity in students' learning styles and paces necessitates individualized support, which is often constrained by limited teaching resources and time.

AI chatbots have the potential to address these challenges effectively by providing instant personalized assistance and enhancing student engagement. These tools can tailor responses to individual student needs, offering explanations that match their learning style, and provide additional resources. In light of this and the ever-increasing presence of AI in our personal and professional lives, we sought to explore the possibility of including AI chatbots as co-pilots during practical teaching activities - here in both pharmaceutical sciences (A), silviculture (B) and ecology (C).

Implementation In Practical Teaching Activities

We introduce and present the three interventions (A/B/C) in which AI chatbots were integrated into university teaching classes and exercises followed by a shared discussion and conclusion.

ChatGPT as an interactive tutor in cook-book-like computer exercises

Medicinal and Biostructural Chemistry at Pharma - Alexander S. Hauser

Context and Objectives: The course “Medicinal and Biostructural Chemistry” is compulsory for MSc students enrolled in pharmacy, medicinal chemistry, and pharmaceutical sciences. The participants, most often between 200-250 students, get the theoretical knowledge around protein sequences, 3D models of protein structures, and applications for artificial intelligence (AI) in drug discovery through several lectures. These are preparing the students for three practical workshops, in which 15-20 students at the time are going through several online quizzes. Students are put into groups of 2 or 3. The aim of the exercises is for the students to learn how to engage with different computational tools and to employ basic concepts in bioinformatics and systems biology, while consolidating their theoretical knowledge. The first practical is named “Sequence Alignment I”, where students will be presented with a short DNA sequence from a patient, which contains a disease mutation they subsequently analyze in the context of species sequence alignments. The second practical is named “Protein structures II”. Here, students are using a software tool on their laptops as well as web server-based tools to visualise and analyze molecular protein structures including how the discovered disease mutations impact protein function on an atomistic structural level. In the last practical named “AI in Drug Discovery III”, students get exposed to a Python programming environment following a notebook on Google Colab. Everything is already implemented and guided through the documentation, while more experienced students in programming are encouraged to investigate additional questions.

The intervention: The exercises are structured as cookbook-like tutorials embedded in Absalon. In order to pass, every quiz needs to be

completed 100% correctly. Students can use as many attempts as they need. Most questions are multiple-choice, but there are also some free-text possibilities for single numbers they need to obtain after analysis and calculations. Students usually require 3-4 hours to complete the exercises. I am accompanied by another teacher, often a PhD student from my group, to help and support where necessary. Hence, the exercises are, to a large extent, level 0 in openness according to the model by Tamir (1989), as the problem and instructions as to how to arrive at the exact answers are given.

Usually, the students just log in to Absalon and go ahead with the first exercise. This time, I prepared a short presentation introducing the workshop, the objectives, and some examples of how ChatGPT or other AI chatbots could be used during the exercises. For the protein structural practical, I presented two examples following the tutorial and frequently asked questions (Figure 1) in interacting with the protein visualization software PyMol. The ‘AI in Drug Discovery’ practical follows a python coding workflow, so I chose two examples on how one could further explore or explain the given code for ones own understanding or further learning (Figure 2).

A

You
I am in a protein structure exercise using pymol. What are these red crosses I am seeing everywhere?

DALL-E
In PyMOL, red crosses typically represent the positions of water molecules, often shown as "wat" or "HOH" in the molecular structure files. These water molecules are usually part of the crystal structure of the protein and are resolved during the X-ray crystallography process. They can play important roles in the protein's structure and function, such as being involved in hydrogen bonding or helping to stabilize the protein's tertiary or quaternary structure.

B

You
I have a structure with the PDBid 1t46, how would I show the residue range 822-834 in red and as simple ribbon? Give me only the code solution.
< 4 / 4 >

DALL-E
Certainly, here's the PyMOL script to display residues 822-834 in red and as a simple ribbon for the structure with PDB ID '1t46':

```
python
fetch 1t46
hide everything, 1t46
show ribbon, 1t46
color white, 1t46
select resi_range, /1t46//A/822-834
color red, resi_range
show ribbon, resi_range
```

Figure 1: Intervention suggestion – protein structure practical (II). Two typical and repeated questions from the protein structure practical (II) on A) understanding what is displayed in a specific software tool (here PyMOL, a

molecular visualization system that can produce high-quality 3D images of small molecules and biological macromolecules) and B) how to effectively interact with the software without having detailed knowledge on the coding syntax.

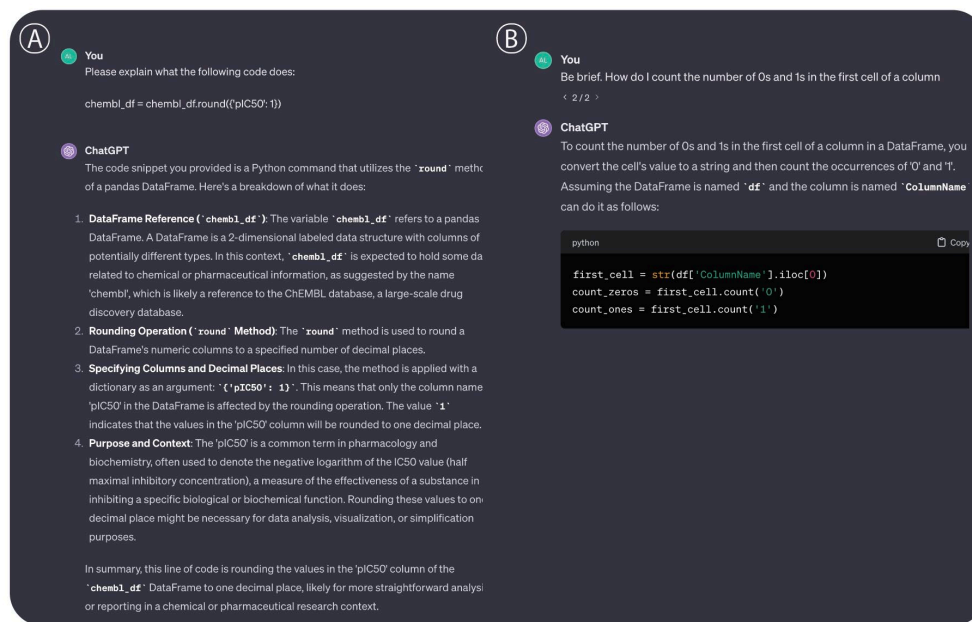


Figure 2: Intervention suggestion – AI practical (III). Two suggested chatbot interactions to A) help understand specific code examples and B) provide possible coding solutions to arrive faster at a quiz question.

Perceived Learning Outcomes, Challenges, and Student Feedback: As students follow the detailed instructions in their practical manual, they can use the AI chatbot to receive real-time, step-by-step guidance. If they encounter any difficulties or confusion with a particular step, they can ask the chatbot for clarification or further explanation in simpler terms as they would otherwise ask the teacher (see example below). Besides helping in the immediate course protocol, it additionally has the advantage of giving further confidence in the interaction with AI chatbots in independent learning beyond the classroom.

Example Interaction

Student: "I'm stuck on step 4 where we need to align DNA sequences using Clustal Omega. What should I do if the sequences are not aligning properly?"

ChatGPT: "Let's troubleshoot this step together. First, ensure that your input sequences are in the correct format required by Clustal Omega. They should be in FASTA format. If they are, check for any non-nucleotide characters that might be causing issues. You can also try adjusting the alignment parameters to see if that resolves the problem. If these steps don't work, please provide more details about the error message or the output you are getting."

While executing bioinformatics tasks, students may encounter errors or unexpected results. The AI chatbot can help diagnose common errors, suggest possible solutions, and guide students on correcting their mistakes, thus reducing frustration and downtime. Students can use the chatbot to obtain supplementary information about the tools and databases they are using as well as provide background information, usage tips, and best practices. Interestingly, this closer resembles real-world research projects, rather than pure execution of a protocol.

The chatbot can pose thought-provoking questions related to the practical tasks, encouraging students to think critically about the data they are analyzing and the methods they are using. This helps in developing a deeper understanding and promotes analytical skills. Understanding the biological context and real-world application is crucial for student motivation. The chatbot can help students connect the practical exercises to real-world applications, such as how the techniques they are learning are used in research and industry, thereby increasing their engagement and interest.

Different students have different levels of prior knowledge and learning paces. The chatbot can tailor its responses to the individual needs of each student, providing more in-depth explanations for those who need it and more advanced challenges for those who are ready to move ahead. It can further help with language translation or cultural differences a student would otherwise be less likely to ask the teacher.

In group settings, the chatbot can facilitate collaboration by helping students share insights and solutions. For example, if one student figures out a solution to a common problem, they can ask the chatbot to help them explain it to their peers, fostering a collaborative learning environment.

The feedback on the introduction to AIChatbot helpers was positive, indicating that they provided a more structured beginning and demonstrated commitment to student engagement. Observationally, students seemed to collaborate more leading to more interesting teacher conversations with the students. The short survey indicated that students are already equipped to use AT Chatbots in various settings foremost in 'Explanation and Elaboration' as well as "Assistance/understanding with Coding", but less with 'Discussion Facilitation' (Figure 3). Highlighted are some quotes from the students, which underline i) lowering the bar for asking, ii) catering to a diverse student population, and iii) expanding, not replacing, the teacher's learning support.

However, attendance at the practical sessions decreased throughout the three non-mandatory workshops. Potentially, because students could solve the quizzes by themselves even more so now with the help of AI chatbots. This observation suggests a need to reevaluate the course structure, perhaps by consolidating the workshops into larger, more engaging groups.

The cookbook-like exercises were designed to deepen students' understanding by integrating theoretical knowledge with practical observations and calculations. This approach provides immediate feedback to students, enhancing their learning experience effectively. While multiple-choice questions offer quick feedback, they tend to encourage surface-level learning, as they might not require students to engage deeply with the material or to discuss their findings. In light of Noel Entwistle (2007), teaching methods should be adapted to encourage deeper, more meaningful learning experiences. A more interactive experience guided by AI as well as adding more challenging prompts to empower students with more decision-making could potentially further enrich this learning process.

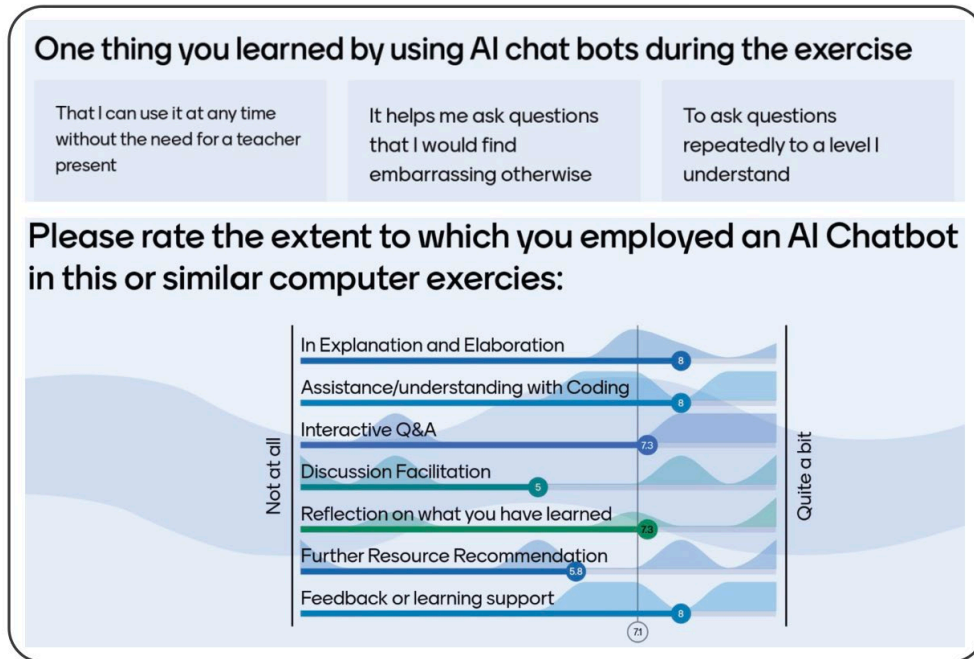


Figure 3: Student feedback and evaluation. Students' reflections on the use of AI chatbots during exercises. The top panel shows key quotes. The bottom panel is a survey rating the extent to which students employed AI chatbots across various tasks. The survey was taken during a practical with 10-20 students.

How ChatGPT answers of different silvicultural systems correspond with Danish textbooks

Survey on Professional Bachelor Students' Experiences with AI among Forest and Landscape Engineering Students in their 2nd year - Ulrik Kragh Hansen

Before the study, the students (Forest and Landscape students in their 2nd year at the Forest School Djursland) had classroom instruction where they used ChatGPT to investigate various forest management systems. The investigated forest management systems were clear-cutting, shelterwood cutting, selective cutting, shelterwood system, and group regeneration. The students were tasked with comparing the answers from ChatGPT with Danish forestry literature.

The exercise in the class yielded the following results. The answers from ChatGPT were very general and had a more international character rather than fitting into a Danish context. Not all answers were

good. It requires a lot of prior knowledge to assess the answers. Many questions need to be re-asked to get a reasonable answer. The answers are influenced by current trends around sustainability and biodiversity.

The survey was conducted in June 2024. There were 21 responses, corresponding to a response rate of 95%. The majority of the students are between 20 and 30 years old. Not all students answered the question about age, so no data has been compiled for that. In the survey, the answers are divided by gender and there are only answers in the category's woman and man.

The answers to the question about previous work with AI or machine learning (Figure 4) show that 83% of the men had worked with AI before they were introduced to AI in the forest cultivation course while only 33% of the women had worked with AI before. The differences shown in gender disappear in the question about the use of AI in connection with task solving (Figure 4). Since AI is used in teaching, 75% of the men and 78% of the women have used AI in connection with tasks.

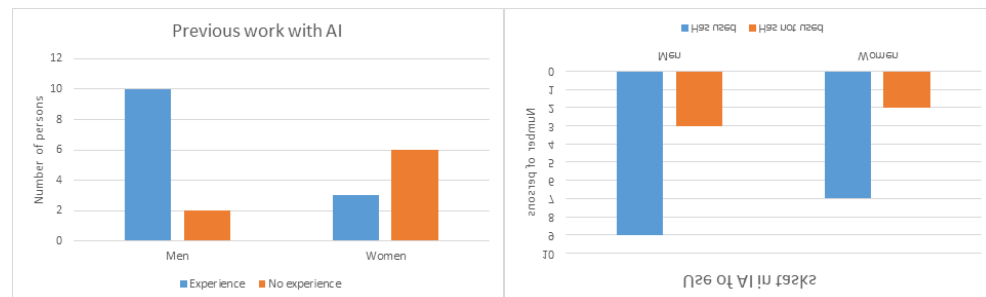


Figure 4: Proportion of men and women who have previously worked with AI (left) and proportion of men and women who have used AI in connection with study tasks (right).

There is a pronounced skepticism in the use of AI. As shown in figure 6, only 14% of the respondents answered that AI can be used directly without further assessment, while 19% answered that AI is direct cheating and the remaining 67% answered that AI is a help, which needs to be assessed before use, as AI answers can be erroneous. The answers in understanding of the AI concept (Figure 5) were distributed with one-third each to a low or very low understanding, one-third to moderate understanding and one-third to high or very high understanding of the concept. However, there was a difference that 2/3 of the women had a

moderate understanding of the concept - the middle answer, while the men were distributed with 42% in each of the answers low understanding and high understanding. It was a bit either or with the men. In the questionnaire, there were also questions about suggestions and hopes for the use of AI in the last 2 years of study.

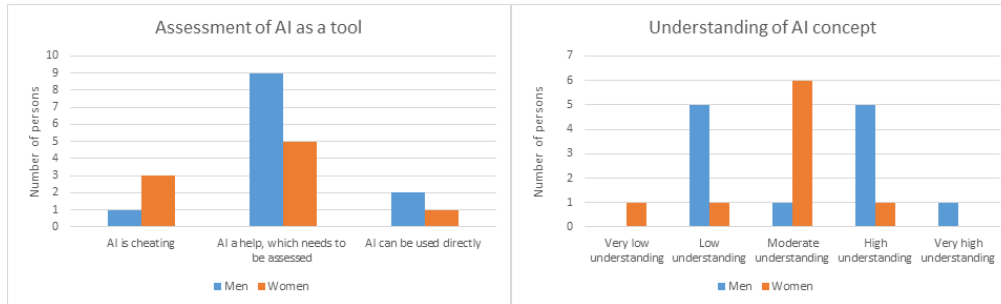


Figure 5: How AI is assessed as a tool in connection with study tasks (left) and respondents’ understanding of the AI concept (right).

It ended up with the following for the use of AI in the last year of education in Forest and Landscape Engineering: i) Help to self-study, ii) As a tool for systematizing notes and iii) Assignment writing.

The last questions gave the following answers, which were more general in nature with the use of AI. The answers are divided into reservations and opportunities.

Table 1. Pros and cons concerning the use of AI in Forest and Landscape Engineering education.

Reservations	Opportunities
Lack of overview of the opportunities and challenges	May be an inspiration when bachelor thesis begins
AI provides Hope AI is not used much in the internship period AI needs to be tested more, so you learn strengths and weaknesses	As writing help with formulations and translations
Difficult to see AI in teaching situations	Condense, create overview and systematize information
Do not want to use it	AI as a source of information
	The use of AI is in its infancy in education.

	Summary
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This survey shows that female students are less inclined to explore AI on their own initiative, whereas most men have previously worked with AI. The survey also shows that the students have a healthy skepticism towards AI. AI should not be used uncritically, as there is a possibility of incorrect answers. It is an advantage to know your subject in order to be able to assess the answers. There is no doubt that both students and teachers need a more thorough introduction to the use of AI.

These results are in agreement with the survey of Ofem Usani Joseph et al (2024), who conclude the following points:

Awareness and Perception: Male students tend to have a higher level of awareness and a more positive perception of AI tools compared to female students. This difference can influence how frequently and effectively they use these tools in their studies.

Utilization: While both male and female students use AI tools, male students generally report higher usage rates. However, female students often show stronger engagement when they do use AI tools.

Academic Research: In academic research, male students are more likely to use AI tools for data analysis and coding assistance, while female students might use them more for writing and editing support.

These differences highlight the importance of ensuring equal access and training for all students to maximize the benefits of AI in education.

Use of AI/chat GPT in ecology

Three educational scenarios where AI has been implemented for testing are described below:

AI in soil education with first-year students at the forest- and landscape engineers education.

In the forest and landscape engineering study (SLing) in the first year in ecology, the teaching of soil science is an important part. The

teaching includes a large number of concepts that the students must first learn and then apply when analyzing soil at a location of their choice. The teaching flow is that the many concepts are presented by blackboard teaching, where there is alternating lecture and questions to be answered in small groups. Then the students must choose a location where two soil holes will be dug, which represent two ends of a gradient or two contrasts that can be compared. Gradients could, for example, be wet/dry or high/low, while opposites could be foliage/needle, plowed/unplowed, etc. By setting up hypotheses or expectations about the soil and then examining the soil, the hypothesis about the diversity of the holes is confirmed or rejected. AI dodged twice in the lesson about land.

The first time AI was integrated was at the beginning of the ground course, where the many concepts had not yet been presented (situation 1). The AI task was that in groups of 2-3 pairs had to find different ways to describe soil and the properties of the soil. The purpose was for the groups to use AI to propose soil parameters that corresponded to the concepts that would be presented later in the course, and in that way have a more precise expectation of the teaching. The AI study was introduced as a direct reference to ChatGPT, with the expectation that each group could present a range of parameters for describing soil. The result was that all groups searched the Internet for solutions, while some groups used ChatGPT. Common to all groups was that it was difficult to search for soil parameters. There was a predominance of application-oriented advice and products and far between descriptive parameters. The groups using ChatGPT had to specify their search over several rounds before getting useful answers. Compared to the groups that Googled, the ChatGPT users got more manageable results, e.g. soil parameters set up in point form. Another obstacle to searching for descriptive parameters was that the Danish searches got limited answers, while the English searches got deeper answers, but with a clear international influence on the limited relevance in relation to Danish soil. The evaluation of the exercise is that several groups deliberately did not use AI despite clear instructions. There was significant resistance to AI as a help in solving the task. Despite the fact that ChatGPT could deliver soil parameters set up in a clear form, the requirements for the search and the subsequent evaluation

of ChatGPT's search results were such a big obstacle that the positive aspects were overlooked.

The second time (situation 2) the students were referred to ChatGPT was after the soil lessons, but before they had to work on analyzing the soil from their excavated soil profiles. The analysis work is carried out based on a precise exercise guide, which contains all parameters and their execution. Before the work started, the students were encouraged to read the exercise guide and think about all parameters, their performance in the laboratory, the strengths and weaknesses of the test and the expected result using ChatGPT. The purpose of the task was that everyone was aware of the completion of each test and was prepared to evaluate whether the test result was realistic. By being aware of the expected test result, and being aware of sources of error, the group's own results can be interpreted and communicated. The group's considerations of all parameters had to be written into the mandatory soil report that the group had to make. The evaluation of the task is that none of the groups has managed to convey a consideration of each parameter. Everyone has done the analysis work and everyone has evaluated the analysis results, but no one has used ChatGPT to make a conscious advance thought about each analysis. When asked why the task has not been solved, the students reply that they have read through the exercise instructions and thought about each test but did not use ChatGPT to evaluate the test. The media leap between the very concrete and punk-shaped exercise guide and the more abstract ChatGPT work felt too big. Furthermore, it is mentioned that the eagerness to get started with the practical laboratory work with his own soil samples in focus was so great that a ChatGPT task simply slipped out of consciousness.

A third teaching situation (situation 3) with AI was with team 26D, which is also part of Ulrik's work, and thus is not the same team as described above. The topic was biodiversity in forests. The teaching structure was that each team of approx. 4 people had to choose a topic of great importance for biodiversity in forests. The group had to deal with the subject in approx. 2 hours and make a presentation of approx. 15 minutes for the rest of the team. The task was to first find a heading and write it on the board so that the groups have different topics. Then generate an AI response to the topic. Finally, the group must evaluate the

AI answer and supplement with their own thoughts. The latter was expected to make up the majority of the preparation time.

All groups used AI for their presentations. Most gave a short intro to AI's result and briefly evaluated whether the result was relevant. The group's own results were then presented. One group had created an AI-generated image of grazing forest and presented the development in search criteria and image content. The keyword development was 1) forest 2) forest with saplings 3) forest with dead wood and saplings. 4) as a final change, oak forest with dead wood and sedges. The image process illustrated very clearly that it is important to deliver the right keywords into the AI's generation. In most cases, the AI result was fine and relevant but not adequate. In general, the answers were influenced by 1) non-Danish factors 2) a mixture of scientific and more emotion-oriented answers 3) significant shortcomings. It was clear that the AI result was more relevant to Danish conditions when searching in Danish. At the same time, the answers were more limited in scope and thus more marked by significant shortcomings. Both Danish and English keywords led to aesthetic and/or attitudinal results which were completely outside the purpose.

Summary of the experiences

Situation 1 (Before introduction to soil parameters)

The use of AI meets significant resistance among students. There is no widespread knowledge of the tool's advantages and disadvantages. There is a common sentiment that one must not use AI in a study context. Applying AI to an unknown subject is difficult because the students' ability to evaluate results is limited. The use of Danish keywords gives insufficient results, while English keywords give results that are not relevant to Danish conditions. Difficult to apply AI to unknown substances, as the skills to assess the result are lacking.

Situation 2 (Method evaluation for soil analyses)

No one used AI to evaluate the analysis methods. All teams worked from the instructions and described error sources in a classic way. Again, great opposition to AI.

Situation 3 (Factors for biodiversity in forests)

The task was accepted, and AI was included in all groups' presentations. Clearly, there were major problems with the AI-generated responses. Either the answers were incomplete or contained non-relevant points. Especially in relation to image generation, it was clear that the keywords were extremely important for the image's relevance.

Comparative Analysis and Shared Discussion

The integration of AI chatbots in education has opened new avenues for enhancing student engagement and personalized learning. This comparative analysis examines three distinct interventions (A, B, and C) where AI chatbots were incorporated into practical teaching activities across different disciplines: Medicinal and Biostructural Chemistry (A), Silviculture (B), and Ecology (C). By exploring the contexts, implementations, outcomes, challenges, and student feedback of each intervention, we aim to identify common themes and unique insights that can inform future educational practices.

The three interventions utilized ChatGPT in different ways. In intervention A, AI was used to answer short, specific questions and to guide learning interactions during practical exercises. In contrast, interventions B and C involved posing complex questions that required multi-point answers from the AI. Another difference was the regionality. In coding the same answer is relevant all over the world, in contrast to the two nature-based interventions, where the relevant answers include awareness of the specific region. These differences are important in relation to the overall success of using AI.

Another significant difference was the issue of regionality. In coding and computational tasks, as in intervention A, the same answers are relevant worldwide. However, in the two nature-based interventions (B and C), relevant answers require awareness of the specific regional context. These differences are important concerning the overall success of using AI.

We noticed stark discrepancies in student feedback. While students in the pharmaceutical sciences perceived the overall use of AI chatbots positively, feedback from students in forestry was dominated by

skepticism—both regarding the educational use and the content provided by AI. These differences could be related to the kind of use, where parameters such as internal versus external use and the complexity of questions play important roles.

Enhancing student interest and engagement

The differing applications of AI chatbots in interventions A, B, and C had notable impacts on student interest and engagement. In intervention A, students often encountered specific obstacles during their practical exercises—for example, interpreting what a specific representation represents in a molecular visualization tool. AI chatbots provided immediate, precise assistance, helping students overcome these hurdles and maintain momentum in their learning process. This direct support not only facilitated problem-solving but also enhanced students' understanding, thereby increasing their engagement with the material and deeper questions and learning objectives.

In contrast, the scientific outcomes of using AI in interventions B and C were less significant. In these cases, the AI-generated answers served more as discussion counterparts rather than reliable sources of objective information. Students used their newly acquired knowledge to evaluate and critique the AI's responses, which fostered critical thinking but did not necessarily enhance engagement in the same way. The AI answers were often general and lacked the regional specificity required for topics in silviculture and ecology, limiting their usefulness.

In intervention C, students resisted using AI for several reasons. A primary factor was their desire to contribute their own knowledge rather than rely on AI-generated results, which they perceived as potentially unsatisfactory, inaccurate, or even cheating. This reluctance suggests that students valued personal understanding and active participation over the passive reception of information from AI tools. The AI's limitations in the specific areas led to skepticism and reduced engagement among students.

These observations indicate that the effectiveness of AI chatbots in enhancing student interest and engagement depends largely on how they are integrated into the learning process and the nature of the subject

matter. In intervention A, where AI was used internally to support specific learning tasks with universally applicable answers, students experienced a harmonious and beneficial interaction with the technology. The AI's ability to provide immediate, relevant assistance contributed positively to their engagement.

This highlights that the successful incorporation of AI Chatbots requires thoughtful implementation that considers the nature of the subject and the way students interact with the technology.

Lessons learned and best practices

The integration of AI chatbots like ChatGPT into practical teaching activities offers valuable opportunities but also presents challenges that educators need to navigate carefully.

A key lesson is the importance of clearly communicating the role and expectations of AI use. In intervention C, students were hesitant to use AI due to uncertainty about its appropriateness and concerns that it might be "illegal" or against academic policies. It became evident that educators need to explicitly state that the use of AI tools is encouraged and integrated into the learning plan. This clarity can alleviate student concerns and promote the legitimate use of AI as a learning aid.

Another insight is the need to acknowledge and address student skepticism. In interventions A and C, while some students were eager to try AI tools, others doubted their usefulness for specific problems and preferred relying on the teacher's expertise. Educators should recognize these reservations and provide demonstrations of how AI can be beneficial. By sharing success stories and offering hands-on experiences, teachers can create a supportive environment where students feel comfortable experimenting with AI tools.

Ensuring that AI content is relevant and context-specific is crucial for its effectiveness. In interventions B and C, AI-generated results were often too general or lacked regional specificity, leading to irrelevant or incomplete answers—especially in subjects like soil properties and forest management that require local knowledge. Guiding students on how to craft precise, context-aware prompts and encouraging the use of special keywords can enhance the relevance of AI outputs.

Using AI as a supplementary tool rather than a replacement for personal understanding and teacher guidance is also important. For instance, In intervention C, students preferred to rely on their own knowledge rather than on AI-generated results that might be unsatisfactory or incomplete. Encouraging critical thinking and evaluation of AI outputs is essential for meaningful learning. Promoting an approach where students critically assess AI-generated content, verify information against credible sources, and use AI responses as a basis for deeper investigation fosters analytical skills and deeper understanding.

Conclusion and future perspectives

Successfully integrating AI chatbots like ChatGPT into teaching depends on factors such as student demographics, language skills, and the subject matter. For AI to be effective, it must be an expected and integral part of assignments—not seen as cheating. Clear communication is essential so students understand that reasonable usage of AI Chatbots is encouraged. Teachers should provide introductions to AI, ensuring all students have basic skills to use it effectively, and demonstrate both its advantages and limitations. In this context it becomes evident that we also need to educate the teachers to stay up-to-date with the latest models and advancements in AI. Moreover, AI-generated content should be viewed as suggestions requiring evaluation, not as objective facts. Assignments should be suitable for AI's capabilities, emphasizing the importance of critically assessing AI outputs. By addressing student skepticism, ensuring content relevance, and providing support, educators can enhance engagement and prepare students for an increasingly AI-integrated educational landscape.

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