

STUDENTS' EXPERIENCES FROM USING AI IN ENGINEERING EDUCATION

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ABSTRACT

A mandatory course, ING101 Technology, Environment and Sustainability, is taught the first year in the Civil and Structural Engineering programme, Computer Engineering programme, Electronics and Electrical engineering programme, Renewable Energy programme and Mechatronics programme at the University of Agder. The students must write a scientific article concerning environment and technology to pass the course. The library and the academic staff collaborated on a new way of solving the task; the students had to use AI in their production of a scientific article and then write a report evaluating the implementation of AI in producing the article. The students were told to evaluate how the use of AI affected the working process, their learning outcome and the final product, the scientific report. The students were able to choose how they wanted to use AI.

This study uses survey data collected from the students in ING101 to investigate the positive and negative perceptions and effects of using AI in engineering education. By looking at the results from the survey and the reported experiences from the students we can evaluate how AI can assist in higher education. This information can be used to influence the way we let our students work on projects, reports, and exams, and to what degree AI should be(come) a learning tool in engineering education.

Keywords: AI, engineering education, survey, ChatGPT

1 INTRODUCTION

Over the past year AI, has become readily available for everyone, including students in higher education. According to an opinion poll conducted in November 2023 [1] 27% of Norwegian students state they use ChatGPT every week or month. Initially, the educational system in Norway did not want the use of AI in their examinational projects due to the fear of reducing the amount of independent work. Teachers filed a report of concern to the Norwegian parliament [2] just one week after ChatGPT was published to the general public [3]. Their main concern was the challenge for examiners to evaluate the difference between self-produced work and AI-produced work. Students have always found creative ways to cheat on exams [4], but with the help of plagiarism control it has been possible to detect this to some degree. However, ChatGPT stands out since it was designed to generate human-like texts [5]. This makes it hard to tell the difference between self-produced and AI-produced content. The detectors for plagiarism in use by universities today cannot identify text generated by ChatGPT [6]. When students are caught cheating using AI, it is because of wrong referencing and quotations that do not exist [7].

Still, AI can be a resourceful tool which can be useful for the students' learning and the products they produce. According to Meyer et al. [8], ChatGPT can assist with research and academic writing, provide immediate feedback and examples, be a source of inspiration and increase student engagement. Kasneci et al. [9] also highlight that Large Language Models (LLMs) can assist in critical thinking and problem-solving skills for university students. Another argument made by Adelshola et al. [10] is that the students might not be subjected to information overload. However, they also warn that relying too much on AI to solve problems might impair the students' cognitive reasoning. Along the same lines, Shidiq [11] subsequently argues that over-reliance on ChatGPT may affect the students' ability to develop critical skills and hinder their creative writing skills.

Based on the popularity and possibilities AI presents in higher education, one could argue that students should be taught how to engage with ChatGPT. Meyer et al. [8] suggest that students can be taught ChatGPT correctly and in line with the ethics of their educational institutions. As Meyer et al. state: "The issue should not be whether the student used ChatGPT, but how." If doing so, the students could be required to submit their ChatGPT transcript, track changes made with ChatGPT, and point out and

address errors made by ChatGPT. One aspect Adeshola et al. [10] mention is that when allowing more use of ChatGPT, the educational systems need to leave room for students to receive guidance from their teachers and mentors to promote student engagement.

The purpose of this paper is to explore the students' experiences with AI being a mandatory tool in their exam. Data for this study was collected using a survey sent out during a compulsory 5 ECTS course, reviewing the course exams provided by the students and comparing some of the results with a Norwegian national student survey "Studiebarometeret" [12]. We want to find out the positives and negatives of AI in engineering education from the students' perspective and discuss the opportunities of AI in engineering education.

2 CASES

The case used in this study was a 5 ECTS mandatory course, ING101 Technology, Environment and Sustainability, taught to first-year engineering students at the University of Agder. This course is compulsory for students within Civil and Structural Engineering programme, Computer Engineering programme, Electronics and Electrical engineering programme, Renewable Energy programme and Mechatronics programme. 333 students were enrolled in the course, 315 students were registered for the exam, 295 students completed the exam, and 256 students passed the course.

The course has a final exam consisting of writing a scientific article and a report. The scientific article was to be written with the assistance of AI/LLMs and the purpose of the report was to evaluate the process of using AI/LLMs. The students still had to follow the university's regulations regarding plagiarism and source referencing. The topic of the scientific article was *technology in a societal perspective*, and it had to be between 900 and 1100 words. The students had to follow a template for both the scientific article and the report. The course is graded as passed or failed.

3 METHODOLOGIES

The methods used in this study were two surveys and the reports made by the students. Every year the course has a course evaluation in the form of a survey distributed to the students. This was modified with questions regarding the students' use of AI/LLMs since 2023 was the first time ING101 used AI in the exam. The questionnaire had 55 questions, but only 4 of the questions concerned AI/LLMs. However, the students also had the opportunity to submit open free-text answers, where some of the comments were relevant for this article. The survey was made with the survey program *SurveyXact* and was distributed on November 21st, 2023, on the learning platform *Canvas*.

The total number of exam reports were 295. A random selection of reports was made by reviewing the first 42 sorted by candidate number. These reports were examined to understand the students' opinion on advantages and challenges with using AI to write an academic report, and how they used AI to solve their exam.

To compare the results from ING101, the results from the Norwegian national student survey "Studiebarometeret" is also used. "Studiebarometeret" [12] is a survey distributed to over 70 000 students in Norway every fall. The survey is given to students in their second year of their bachelor's- or master's degree. This article will use the 2023 results for second-year bachelor students in Civil and Structural Engineering programme, Computer Engineering programme, Electronics and Electrical engineering programme, Renewable Energy programme and Mechatronics programme.

4 RESULTS AND DISCUSSION

Table 1 provides an overview of the data concerning the survey sent out in the course. It was distributed on November 21st, 2023, and contained 55 questions where four of the questions are relevant to this article. The response rate was 27%.

Table 1. Data about the survey

Distribution date	Total number of questions	Number of questions regarding AI	No. of respondents	Response rate
21-nov-23	55	4	90	27%

As illustrated in Figure 1, 19% of the students found it very challenging to use the language model effectively. Most of the students, 58%, found it to be somewhat challenging. A possible explanation of

this could be that this is the first time the first-year students are trying to use AI. Results from “Studiebarometeret” [13-16] show that only 10% of the second-year students at the same study programmes do not use AI at all in their study, except for the Mechatronics students [17] where 35% of the students never use AI in their study.

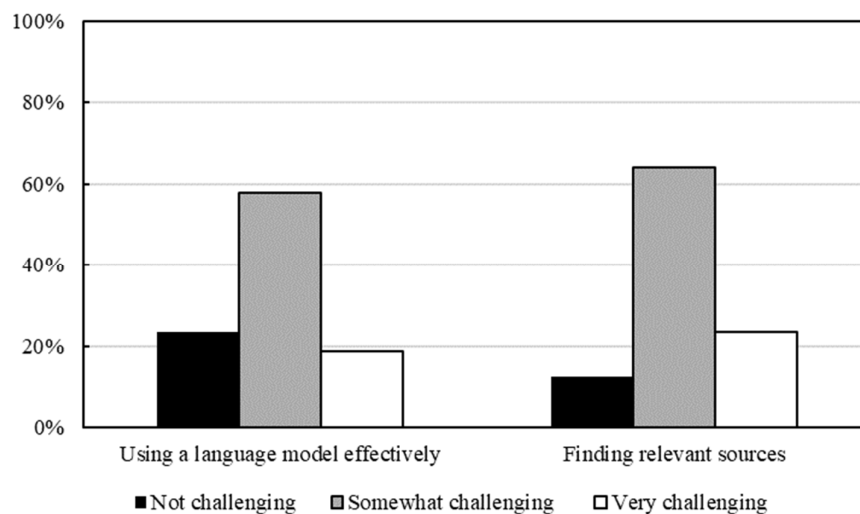


Figure 1. Academic writing: Evaluate the level of difficulty for the following

The answers for the second question on finding relevant sources, illustrated in Figure 1, shows the same tendency in the distribution. 64% find it somewhat challenging and 23% find it very challenging. Of the 42 exam reports, 26 candidates address challenges regarding wrong or non-existent sources when using AI. When using AI, it provides sources that the students have to validate. Some of the sources did not exist and they also had to validate if the statements made from the sources were in fact true. This also accords with Alshater [5], who showed that ChatGPT lacks transparency, making it difficult to hold these technologies accountable for any error they may produce. Although 19 of the reports highlighted that the use of AI can be time saving, this insecurity regarding sources proved to be more time consuming than reading the sources themselves. However, some of the chatbots allow the user to upload sources they want to include – giving the user more control. In the course survey regarding which chatbot the students applied in their exam, 57 out of 57 replied ChatGPT. Most of them used the free version (3.5), but a few invested in the newer version (4.0). Only three out of the 57 also mention another chatbot than ChatGPT. Some of the students pointed out significant differences between the free version and the paid version. In the free version the chatbot sometimes replied that it could not answer, but when prompting the same question in the paid version it gave a fulfilling answer. According to Alshater [5] the chatbots depend on the data they are trained on. Meyer et al. [8] point out that the LLMs reply with confidence regardless of whether the information is true and/or accurate. This can fool the users to rely on the information provided by the chatbots. Blindly trusting the generated information from chatbots, increases the risk of plagiarism, and was also the cause where students were caught cheating [7].

The students grew more sceptical towards using chatbots when they were made a compulsory part of their exam. The students mention that they thought highly of chatbots prior to their exam, but after the project their confidence had diminished. Because of the lack of tracking of sources and made-up quotations the students found it easier to do the work by themselves. They discovered that the chatbots did not discuss the results but simply repeated them. They also mention that when they prompted the chatbot to write within the word limit, it did not stay within the limits. When told to write a full article it tended to repeat itself. However, the students were pleased when the chatbots wrote smaller paragraphs. They still saw the potential to use AI to generate ideas and to formulate relevant research questions. It could also guide them in an applicable direction. When the students were asked to rate their satisfaction with using an LLM for academic writing, 77% answered somewhat or very satisfied, as illustrated in Figure 2. This indicates that although the students found it hard to use the chatbots effectively, as shown in Figure 1, when they learned more about how to prompt and how they worked they were satisfied. Although half of the randomly selected reports noted that they used ChatGPT to

improve the language in their scientific article, they also emphasize that the produced, and intended improved, language was overcomplicated, pompous and somewhat foreign. They still found it beneficial in translating, and still helped the students to formulate and structure their text. Some students also mentioned that they experienced some biased answers from the chatbots. This finding was also reported by Alshater [5], stating that chatbots may have the potential for bias because of the data they are trained on.

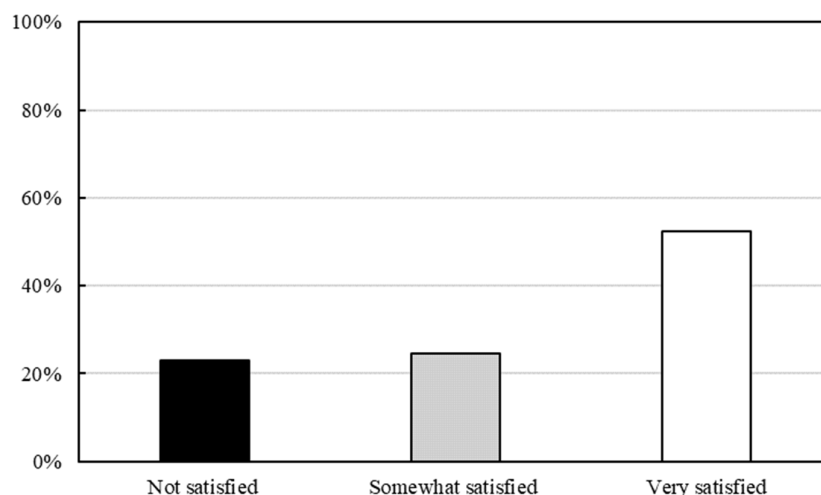


Figure 2. Rate your satisfaction with using a language model for academic writing

The results from “Studiebarometeret” [13-17] show that when asked how the students use AI, a total of 75% have used it to explain the syllabus, concepts, and terminology. This use is the most common use of AI, outscoring the second alternative of generating programming code. Generating summaries and outlines of texts is one of the benefits with LLMs mentioned by Kasneci et al. [9]. This can better the students’ understanding of the main points in a text. Some of the students in ING101 used AI to inform them about the contents and topics in longer articles and books by writing a summary. This could be an effective way of evaluating a large number of sources and avoid the information overload mentioned by Adeshola [10]. As an educational system, we want our students to develop critical thinking and research skills, improve their academic writing, and most importantly learn, but also learn how to learn. Although it may be argued that AI might have a negative impact on creative writing skills, developing critical skills and the students’ cognitive reasoning [10, 11], this paper found that by making the students use AI in their exam they grew more sceptical towards chatbots and their output. Because of many cases of cheating and plagiarism recently reported by the media [18], the students were very careful when using chatbots. This made them more curious on how the chatbots found their sources, and more critical towards the generated information. A consequence of this exam project was also that it made the students more sceptical towards the credibility of the sources used. They also had to divide their scientific article into paragraphs because of the limitations in ChatGPT, giving them smaller amounts of text to evaluate resulting in a better overview of their text. Since the students had to follow the university’s regulations regarding plagiarism and source referencing in their scientific article many of them found it hard to trust AI. This resulted in students using their critical skills by running quality assessments on almost everything generated by the chatbots. Another consequence was the students evaluating the language used by the chatbots. The students found this project to be interesting because they were allowed to use a tool whose legality is discussed by different educational institutions [10]. The future of AI, according to Neumann et al. [6], is addressing the question on how to integrate AI into higher education. We need to follow up on Meyer et al. [8] and not look at whether the students use AI or not, but how they use AI. We should raise the question on how we evaluate exams in the future of AI, if we should include transcripts, track errors and changes made by chatbots. Still, introducing AI to first-year students showed positive results in making them critical to work done by others, and analytical towards structure and linguistic formulations. After exploring the limitations first-hand, the students might be discouraged from abusing AI tools for cheating and plagiarism.

5 CONCLUSIONS

This study set out to investigate the positives and negatives of AI in engineering education from the students' perspective. The students found chatbots useful in helping them formulate academic texts by translating, structuring, and formulating the language. It also helped them discover and summarize potentially relevant sources. Most of the students were satisfied with using AI for academic writing but were inconsistent in their answers if it was time saving or time consuming. The negatives of AI pointed out by the students were first and foremost the lack of transparency when referring to sources. Other negatives were the chatbots' inability to stay within the word limit given in the exam, incapability to discuss and not just repeat results, not being able to write longer texts but only paragraphs, and the possibility of bias. The students also mention that all the chatbots were very dependent on the prompting, giving them better results when they knew how to formulate the appropriate questions. However, there appears to be a significant difference between free and non-free versions of chatbots.

The second aim of the study was to discuss the opportunities of AI in engineering education. Although AI may impair the students' cognitive reasoning, affect the students' ability to develop critical skills and hinder students' creative writing skills, this exam project forced the students to be critical and thorough when using AI. The students therefore used their critical skills by running quality checks, controlling the language and challenged them to be accurate when prompting questions. By allowing the students to use AI, a tool that there is still no consensus of using amongst educational systems, they had the opportunity to familiarize themselves with chatbots, which could encourage student engagement. The students still had to follow the university's regulations regarding plagiarism and source referencing, requiring them to apply their critical thinking skills.

Considerably more work will need to be done to determine how we implement AI in engineering education. Further research might explore how students would prefer to use AI for their projects, reports, or exams. More broadly, understanding how to evaluate student hand-ins must be readdressed if AI becomes a commonly used tool in higher education.

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