

# INVITE THE ELEPHANT INTO THE ROOM: AN ANALYSIS OF DESIGN STUDENTS' CHATGPT USE IN A SCIENTIFIC ARTICLE WRITING COURSE

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## ABSTRACT

The rise of ChatGPT poses challenges for teaching courses in which the final assignment is a written essay. This paper shares experiences with such a course, by analysing review articles written by students in which they were requested to include statements on how they used AI tools. The analysis shows that they use this as language checker, as discussion partner, as information simplifier, as translator and as search engine, and reflections are shared about pros and cons of doing so, both from a student and a course organisation perspective. The analysis of students' articles suggests that the majority of students either use ChatGPT responsibly or not at all, but that there is also suspicion of students cutting corners. One interesting effect of using ChatGPT is that time spent in the course seems to move from spending time on finding sources and writing approaches, to selecting the most meaningful sources to read and considering which approach to choose.

*Keywords: Design education, artificial intelligence, research ethics, ChatGPT*

## 1 INTRODUCTION

Artificial intelligence has the potential to substantially transform education. With students being able to generate unique texts within a short time frame based on a few prompts, there is considerable debate online about the pedagogical consequences of this new situation. Some authors are positive, and highlight immediate, interactive, flexible, and personalized learning and feedback, flexible learning [1-3], improved explicit reasoning, knowledge retention, and improved student engagement in general [2]. At the same time, the emergence of AI tools like ChatGPT challenges traditional assessment methods that would be prone to cheating [4,5]. Some even state that there is room for written essays in higher education anymore [6] and that the 'essay assignment is dead, really' [7]. It has also been stated that pedagogy will change from the present dominance of constructivism (obtaining a good personal understanding of a subject) to constructionism (to be able play and tinker with a subject, to learn how to iteratively take apart and put together again) [1].

At the Norwegian University of Science and Technology (NTNU) there was no formal basis for regulating the use of AI when ChatGPT became available online in November 2022, other than quite general guidelines which mostly address plagiarism, and a comment that 'potential challenges and opportunities that would result from using chatbots vary from discipline to discipline and course to course'. Later that semester, NTNU made available some material that is aimed to help teachers to discuss AI with students [8], which can be considered quite useful although it remains the teacher's responsibility to evaluate the relevance for courses being taught.

As course descriptions for the 2023/2024 academic year were already finalised before ChatGPT was launched, teachers had to address the use of AI in courses based on their own ideas of what was appropriate use of chatbots and the like. One such course is TPD4505 Design Theory, in which students are required to write a scientific review article, in the last year of master programs in Industrial Design Engineering and Interaction Design. In the autumn 2023 edition of this course, which has continuously run since 2001, 75 students were tasked to write a 10-page review article on a topic of their personal interest, in conjunction with a design course where students are tasked to do a design project founded on state-of-the-art theoretical understanding in a relevant field. Instead of ignoring the issue and hoping that students would not misuse AI tools in their assignments, the elephant was invited in the room by organising a workshop at the beginning of the course, to address specifically the use of AI when writing

a review article, and to provide clear guidelines for students on how to approach this issue. Subsequently, all students were requested to include, either in the methodology section of their review article or in an appendix, to explain how and why they did (or did not) use AI-based tools in doing the research for their article and during the writing process.

The method used to analyse the students' responses is explained in section 2. Section 3 and 4 explain the pedagogical philosophy for the course and the content of the workshop at the start of the semester which challenged students to navigate the landscape of appropriate, undesirable, inappropriate and unacceptable use of AI tools like ChatGPT towards the preparation of their review article. Sections 5 and 6 analyse the students' responses and discuss lessons drawn from them.

## **2 METHOD**

The Design Theory course was taken by approximately 58 students from the 5-year integrated Industrial Design Engineering and 2-year international Industrial Design master program at NTNU, located at Gløshaugen campus in Trondheim, in addition to 17 students from the 2-year master program in Interaction Design, which are located at the NTNU Gjøvik campus. The empirical data which is analysed in this paper, and which is the main basis for discussion was collected from the 58 papers written by students in Trondheim, by extracting those sections (ranging from one sentence to ca. a half A4) in which explained how students had, or had not, used AI in the preparation of their article. Data was extracted from 43 of those 58 student assignments; due to administrative reasons it was not possible to extract data from the other 15 assignments. Seven out of 43 assignment did not include any reference to the use of AI during preparation of the article; most likely because students either forgot or did not perceive the explicit request to do so as a compulsory item (which was essentially correct) and chose not to address it. This resulted in 36 articles with useful data for the analysis provided in section 5 of this paper.

The excerpts were in their entirety put in a database. They were thoroughly read and subsequently sorted in categories, which developed during the process; initially, detailed categories were made for each individual purpose AI was said to be used for, but gradually, categories were merged to some extent since students used different phrasing to essentially say the same. This process resulted in five categories: Using AI as discussion partner, language checker, information simplifier, search engine and translator. Statements and reflections from assignments that were considered particularly interesting were highlighted and pre-sorted for easy tracking during the writing process of this article.

It is acknowledged that interpretation of students' explanations is subject to bias, which is another reason why further granulation of the categorisation is not considered as meaningful. For example, students used ChatGPT for 'brainstorming', 'discussion', to suggest 'structure', 'topics to include', 'headings' et cetera, this was all compiled under the same heading 'ChatGPT as discussion partner', regardless of what the discussion was exactly about.

It should be noted that no AI was used whatsoever in the writing process of this E&PDE 2024 article.

## **3 COURSE BACKGROUND AND PEDAGOGICAL PHILOSOPHY**

The formal learning goals of the TPD4505 design theory course is to challenge students to extend their knowledge about scientific and theoretical approaches used in design research, in particular related to a topic which has their special interest, and to obtain skills for scientifically reporting such knowledge by writing a scientific review article in English. Key abilities that students should practice are: 1) choosing, defining and refine a research topic for further scientific study, 2) using scientific research methodologies related to design research, 3) selecting, reviewing, and interpreting relevant literature, and deriving implications for future research. In addition, the course aims to help the students to see the value of doing research, and making them experience how obtaining a theoretical background can inform and complement the decisions they make in design process, in addition to using design tools and methods, talent, intuition, gut feeling, etc. A third aspect of the chosen pedagogy and examination form is to prepare students for the practicalities and challenges which they will meet when doing their master thesis project (usually the next semester). For most students, writing a review article is something highly outside their comfort zone, as so far in the study program, they have been mostly working in groups, using familiar tools methods, giving them the possibility to excel in areas in which they already comfortable with. In practice, for many students this means that they experience uncertainty, frustration, and decision refusal during the course, and hesitate to ask for feedback (they need to organise tutoring sessions with their supervisor themselves). But they also experience the joy of overcoming an obstacle,

and pride of accomplishing something they were dreading; all very useful preparation and experience before starting their master project, and for becoming an independent and critical thinker who is prepared for a professional career. With all three learning goals in mind, the key element of the course has always been to search, gather, and sort scientific literature, to gnaw through and chew on articles during the analysis process, before considering the best ways to categorise and present insights. With the rise of AI tools such as ChatGPT, much of the searching, sorting, gnawing and chewing can be outsourced, which potentially severely undermines the aforementioned learning goals. This is why the autumn 2023 edition of the course was complemented with a workshop on how to address the use of AI in the course.

#### 4 PRE-ASSIGNMENT WORKSHOP

The workshop was organised in a way that the teacher first introduced the topic and laid out a proposal for the ground rules, which were then discussed with the students, and to form the basis for the ground rules in the course. Table 1 shows how appropriate and inappropriate (meaning: unacceptable) use of AI was formulated, but also what was considered to be ‘in the grey zone’: use of AI which is not forbidden but potentially compromising the students’ learning.

Table 1. *Appropriate and inappropriate use of AI*

<p><b>Appropriate use</b></p> <ul style="list-style-type: none"> <li>• Brainstorming for ideas</li> <li>• As discussing partner</li> <li>• Improvement of English text)</li> <li>• Let AI suggest sources, with are then of course checked by the students</li> </ul>	<p><b>Inappropriate/unacceptable use</b></p> <ul style="list-style-type: none"> <li>• Present AI-generated text as own text</li> <li>• Copy and paste AI-generated text in an article without proper citation (including letting AI paraphrase text)</li> <li>• Relying on AI-generated text to replace critical analysis of the sources used for that text</li> </ul>
<p><b>Grey zone</b></p> <ul style="list-style-type: none"> <li>• Let AI generate research questions and review approach without a good own understanding of the literature.</li> <li>• Let AI generate drafts of text based on a just a limited input from your side.</li> <li>• Let AI summarise of large amount of text (like articles)</li> </ul>	

During the workshop also benefits and drawbacks of using AI when doing research for and writing a scientific research article were discussed, as shown in Table 2.

Table 2. *Benefits and drawbacks of using AI*

<p><b>Benefits</b></p> <ul style="list-style-type: none"> <li>• With AI a student can perhaps cover more ground and/or work faster</li> <li>• Using AI a student may feel less alone and have a discussion partner.</li> <li>• AI can provide suggestions for things to read (although search engines can do that as well)</li> <li>• Probably most importantly: Using AI will provide students with a first-hand experience to reflect over its potential and its dangers</li> </ul>	<p><b>Drawbacks</b></p> <ul style="list-style-type: none"> <li>• AI cannot replace original and critical thinking.</li> <li>• It may compromise motivation for original and critical thinking.</li> <li>• Reading and chewing on what they read instead of letting AI do it for them makes students think and be creative. They may miss out on that when they let AI do this for them.</li> <li>• Using AI may make students confuse someone else’s opinion and values related to a topic for their own (they may become a robot themselves...)</li> <li>• The temptation of using shortcuts may hinder academic growth and even compromise ethical values.</li> <li>• Students may feel less proud of their article after completion</li> </ul>
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In the workshop it was also discussed how in particular ChatGPT-generated text may be recognized by those who grade the final articles, such as:

- Lack of a clear link to literature sources and/or use of unexpected, niche and/or obscure sources
- When text is very formal and consistent in tone and style and lacks ‘human’ variation, (excessive or lack of) nuance, argumentation style.
- Repetition, verbosity, unnecessary sentences with empty meaning
- Political correctness, an overly balanced tone (when ChatGPT sounds like a politician)
- Unnecessary value-based comments, like that something is important or rewarding or necessary for the survival of humanity.
- Text produced by a student in a suspiciously short time.
- Text which simply does not feel like something an inexperienced student could have written.

The workshop resulted in establishing a contract between students and responsible teachers, intended to provide a clear set of rules and frame of reference for students to navigate in. The workshop also provided a stage to share fears, both from the side of the students and the teachers, for example about how to take up possible accusations or being unjustly accused of unacceptable AI use.

## 5 ANALYSES OF ASSIGNMENTS

This section analyses the extracted sections reviewed for this paper. Students almost exclusively stated to have used the OpenAI chatbot ChatGPT, which is why ‘using AI’ and ‘using ChatGPT’ is interchangeably in this paper. Table 3 shows the percentage of articles in which it was stated how ChatGPT was used for different purposes. No significant differences were observed between gender.

Table 3. Purposes of ChatGPT

Purpose	Number of students using ChatGPT for this purpose	Percentage of 36 articles in which ChatGPT was used for this purpose
ChatGPT as language checker	20	56 %
ChatGPT as discussion partner	18	50 %
ChatGPT as information simplifier	13	36 %
ChatGPT as translator	7	19 %
ChatGPT as search engine	5	14 %

### 5.1 ChatGPT as language checker

The most common use for ChatGPT was as language checker; 56% of all students indicated that they had used it for this purpose. Phrases that students used for indicated this use include ‘enhancing language’, ‘rectifying writing errors’, ‘improve sentence structure’, ‘proofreading’, ‘improve readability and clarity’, ‘making subtle adjustments’, ‘changing some words’, and ‘to convey the message more effectively’. A few students also used Grammarly and/or DeepL. One student explained in detail how ChatGPT was used to refine language, by providing examples of alternatives for words or phrases that easily become repetitive, like ‘however’ or ‘a big challenge’. They stated to prefer using ChatGPT because it was an effective way to get suggestions without having to use a manual dictionary. Another student explained how they experienced that using ChatGPT for language improvement leads to restructuring of sentences that no longer convey the intended meaning, and that using it implies the need to carefully review and check each word afterwards. What several students do not seem to understand that using ChatGPT in many cases resulted in somewhat ‘over the top’ language, such as writing ‘*I leveraged the capabilities of ChatGPT for the purpose of (...)*’ instead of ‘*I used ChatGPT for (...)*’.

### 5.2 ChatGPT as discussion partner

Half of the students indicated that they had used ChatGPT as discussion or brainstorm partner, in some way. This included ‘*for suggesting and refining research questions*’, ‘*as writing assistant*’, ‘*to shorten paragraphs*’, ‘*for general advice for composing and structuring a literature review*’, ‘*to shed light on specific aspects to consider*’, ‘*to find topics and ideas to include*’, ‘*to suggest headings for paragraphs*’, ‘*for framing, choosing and sharpening scope and focus*’, and ‘*to find perspectives that might have been overlooked*’. Most students stated that they found this very useful, in particular at times when they felt stuck in the process. One student compared using AI with teaming up with a smart student and achieving better results collectively, instead of stealing the homework from that brainy classmate, and that way ‘*let it contribute to making you a better and more effective version of yourself*’. However, there was also some criticism of students who stated that *ChatGPT offered only superficial suggestions that did not contribute substantial value to the article*’.

### 5.3 ChatGPT as information simplifier

In 36% of all review articles, students indicated that they had used ChatGPT as a tool to process information, such as for simplifying original texts for better understanding, synthesizing, or summarizing findings from literature, explaining difficult terminologies and themes, or getting input on whether potentially relevant articles said something about a specific topic before reading the whole article. One student explained how ChatGPT was used to create a timeline of events of when companies had introduced new products and features.

#### **5.4 ChatGPT as translator**

Next, in 19% of the articles it was indicated that students had used ChatGPT as a tool for translation, mostly for translating Norwegian into English for better understanding of English texts, or for translating their own Norwegian draft texts into English. It is not clear why students preferred to use ChatGPT for this purpose instead of regular translating services (although it can be assumed that services such as Google Translate were used by some), but it can be assumed that once ChatGPT is used for other purposes already, it is convenient to use it also as a translator.

#### **5.5 ChatGPT as search engine**

Finally, ChatGPT was used in 14% of the articles as a search engine, for example to identify relevant literature, or to identify good search teams. It should be noted that the course also includes a lecture on tools and techniques to search for relevant literature, as well as a library course specifically targeted for design students, where students are taught when and how to use tools such as Scopus, Google Scholar and Oria (a Norwegian service for digitally searching Norwegian academic research libraries). Students are also recommended to search the repositories of the Design Society and Delft University of Technology (since this university houses one of the largest Industrial Design Engineering study programs and as such includes many master theses which are not necessarily accessible using other databases). In the method sections of their articles, students normally also indicate that they have use one or more of these services, and there is therefore no indication that they have used ChatGPT to replace them. As one student put it, *'ChatGPT was used to identify some key literature in speculative design, but the suggestions were mostly literature I already had identified'*. One way of smart use of ChatGPT was by a student who indicated that ChatGPT was used to suggest examples of companies which had introduced application of certain technologies (so not scientific sources), and who had asked why certain companies had done so, which provided sources that were then cross checked, by looking for original sources which were then included and properly cited in the article.

#### **5.6 Not using ChatGPT at all**

Only two of the 36 students explicitly stated that they did refrain completely from using ChatGPT, to *'prevent using data that can be affected by algorithmic bias'*, and because *'it had value (...) to experience how easy or difficult it was to find literature with high quality through more traditional search methods'*. Seven students explicitly stated that they did not use it for reasons to improve content but only for language improvement, and that they meant that doing 'manual work' provided invaluable insights and learning even though it was time consuming. As one student put it: *'If AI was used to find sources, insights gotten during the search for relevant articles could have been missed out on.'*

#### **5.7 Broader reflections from students**

Some students expressed explicitly fear that becoming comfortable with the use of AI may compromise their own ability to be creative and to draw independent conclusions. At the same time this posed a dilemma for them, considering that AI is here to stay, and refraining from using may have negative consequences as well. One student wrote that it was used very initially in the writing process, but that it only contributed with confusion, and that they therefore discontinued using it from the first draft of the article. Several wrote that they have only used the tool after a complete draft was finalised, before using the tool to improve the text. Another interesting comment was that the ChatGPT *'was especially interesting for having feedback and suggestions in between tutoring sessions and allowed for a more varied exploration of the topic. It has made that I used a more iterative approach that what I would have gone through without the use of the tool'*.

### **6 DISCUSSIONS**

Experiences with the workshop and the analysis of students' self-reported use of AI in their review articles pose no immediate grounds for concern. Most students seem to have reflected well over opportunities and challenges that come with using ChatGPT. An important point to consider is whether students have reported the truth instead of socially desirable reflections. There have in some instances been concerns with students who seemingly (or even rather obviously in two single cases) had used ChatGPT without mentioning this. For example, a student who sent an article draft which looked very mature at first sight, but with a comment that they had 'no clue whatsoever about writing an article'. It has also occurred that students, when confronted with a suspicion about inappropriate ChatGPT use,

first denied this, before admitting that they may have crossed into a grey zone. At one instance, a teacher expressed that it is challenging to devote considerable time to reviewing an early article draft which is obviously 'heavily inspired' by brainstorming with ChatGPT.

Overall, results suggest that ChatGPT makes diligent students consider a wider range of literature and suggestions, and that students actually follow up checking out these suggestions: time use shifts from looking for sources, to reading those sources. This may be considered a good thing. However, ChatGPT may make lazier students choose articles and theories which are far from obvious or even obscure. Revealing this is simple when graders are familiar with the topic of the article, but less so if they are not. This is a concern. Also, the course is rather time-consuming for students which makes ChatGPT attractive for cutting corners. On the other hand, several students indicated that using ChatGPT as a tool was more time-consuming than they thought, given the many directions and suggestions potentially worth exploring, but that it was generally worth it. This may lead to unnecessary time spent, and even to decision refusal. For example, spending time looking for and choosing between 10 or 15 suggestions for synonyms for a phrase like '*it was a challenge to...*' is essentially unnecessary, as the level of written English is expected to be that of an average pre-AI-era student. And when students end up choosing with '*it became a profoundly arduous undertaking to...*', it is not necessarily an improvement either.

## 7 CONCLUSIONS

Based on this evaluation, students' use of ChatGPT turned out to be less problematic than feared, even though some students most likely have taken shortcuts. As such, there is no immediate reason to do away with the current course format, nor to accept that there is room for written essays in higher education anymore [6]. However, it is currently under consideration to redesign future runs of the course in a way that grading is based on an oral exam, testing students on their familiarity with a partially prescribed, and partially self-chosen reading list, and/or evaluating them based on a mini lecture that they need to prepare on a theoretical subject. This may take care of some concerns related to AI. Another reason is that it would likely reduce the time required for supervision, which has increased considerably after student numbers increased from 25 to 80 in only a few years. The insights reported in this paper will contribute to fine-tuning this course and will hopefully also inform and possibly inspire those who are responsible for courses with similar assignments that explicitly or implicitly invite to use ChatGPT.

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## REFERENCES

- [1] Firat M. (2023). How chat GPT can transform autodidactic experiences and open education. *Department of Distance Education, Open Education Faculty, Anadolu Unive.*
- [2] Deng X. and Yu Z. A Meta-Analysis and Systematic Review of the Effect of Chatbot Technology Use in Sustainable Education. *Sustainability*. 2023; 15(4):2940.
- [3] Baidoo-Anu D. and Ansah L. O. (2023). Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning. *Journal of AI*, 7(1), 52-62.
- [4] Sullivan M., Kelly A. and McLaughlan P. "ChatGPT in higher education: Considerations for academic integrity and student learning," *J. Appl. Learn. Teach.*, vol. 6, no. 1, Mar. 2023,
- [5] Tossell C. C., Tenhundfeld N. L., Momen A., Cooley K. and de Visser E. J. "Student Perceptions of ChatGPT Use in a College Essay Assignment: Implications for Learning, Grading, and Trust in Artificial Intelligence," in *IEEE Transactions on Learning Technologies*, vol. 17, pp. 1069-1081, 2024.
- [6] Marche S. "The college essay is dead," *The Atlantic*, Dec. 2022. <https://www.theatlantic.com/technology/archive/2022/12/chatgpt-ai-writing-college-student-essays/672371/>
- [7] Stokel-Walker, C. (2022). AI bot ChatGPT writes smart essays-should academics worry? *Nature*, 09 Dec 2022.
- [8] <https://i.ntnu.no/wiki/-/wiki/English/Discussing+artificial+intelligence+with+your+students>