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UNLOCKING THE POWER OF GENERATIVE AI MODELS AND SYSTEMS SUCH AS GPT-4 AND CHATGPT FOR HIGHER EDUCATION

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Unlocking the Power of Generative AI Models and Systems such as GPT-4 and ChatGPT for Higher Education

A Guide for Students and Lecturers



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Unlocking the Power of Generative AI Models and Systems such as GPT-4 and ChatGPT for Higher Education

A Guide for Students and Lecturers

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March 20, 2023

Executive Summary

Generative AI technologies, such as large language models, have the potential to revolutionize much of our higher education teaching and learning. ChatGPT is an impressive, easy-to-use, publicly accessible system demonstrating the power of large language models such as GPT-4. Other comparable generative models are available for text processing, images, audio, video, and other outputs – and we expect a massive further performance increase, integration in larger software systems, and diffusion in the coming years.

This technological development triggers substantial uncertainty and change in university-level teaching and learning. Students ask questions like: How can ChatGPT or other artificial intelligence tools support me? Am I allowed to use ChatGPT for a seminar or final paper, or is that cheating? How exactly do I use ChatGPT best? Are there other ways to access models such as GPT-4? Given that such tools are here to stay, what skills should I acquire, and what is obsolete?

Lecturers ask similar questions from a different perspective: What skills should I teach? How can I test students' competencies rather than their ability to prompt generative AI models? How can I use ChatGPT and other systems based on generative AI to increase my efficiency or even improve my students' learning experience and outcomes? Even if the current discussion revolves around ChatGPT and GPT-4, these are only the forerunners of what we can expect from future generative AI-based models and tools. So even if you think ChatGPT is not yet technically mature, it is worth looking into its impact on higher education.

This is where this whitepaper comes in. It looks at ChatGPT as a contemporary example of a conversational user interface that leverages large language models. The whitepaper looks at ChatGPT from the perspective of students and lecturers. It focuses on everyday areas of higher education: teaching courses, learning for an exam, crafting seminar papers and theses, and assessing students' learning outcomes and performance. For this purpose, we consider the chances and concrete application possibilities, the limits and risks of ChatGPT, and the underlying large language models. This serves two purposes:

- First, we aim to provide concrete examples and guidance for individual students and lecturers to find their way of dealing with ChatGPT and similar tools.
- Second, this whitepaper shall inform the more extensive organizational sensemaking processes on embracing and enclosing large language models or related tools in higher education.

We wrote this whitepaper based on our experience in information systems, computer science, management, and sociology. We have hands-on experience in using generative AI tools. As professors, postdocs, doctoral candidates, and students, we constantly innovate our teaching and learning. Fully embracing the chances and challenges of generative AI requires adding further perspectives from scholars in various other disciplines (focusing on didactics of higher education and legal aspects), university administrations, and broader student groups.

Overall, we have a positive picture of generative AI models and tools such as GPT-4 and ChatGPT. As always, there is light and dark, and change is difficult. However, if we issue clear guidelines on the part of the universities, faculties, and individual lecturers, and if lecturers and students use such systems efficiently and responsibly, our higher education system may improve. We see a great chance for that if we embrace and manage the change appropriately.

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About this Whitepaper

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The logos of our institutions on the cover page shall acknowledge the academic environment that shapes our thinking.

In writing this piece, the authors used ChatGPT (Ver. Feb. 13 and Mar. 14, 2023), Grammarly (Ver. 6.8.261), DeepL (Ver. 4.4.2.7961), and Microsoft Word to improve the linguistic presentation of their thoughts. Full responsibility for the contents lies with the authors.

Further readings

This whitepaper is not the first information about generative AI, large language models, and ChatGPT in higher education. We strongly recommend reading and listening more broadly. For example, engage with the educator considerations for ChatGPT provided by OpenAI at <https://platform.openai.com/docs/chatgpt-education/>, whitepapers such as [Vogelgesang et al. \(2023\)](#), news reports such as <https://www.forbes.com/sites/tedladd/2023/01/21/teaching-in-the-age-of-artificial-intelligence-and-chatgpt/>, university websites such as <https://www.lmu.de/en/newsroom/news-overview/news/what-should-we-make-of-the-chatbot-chatgpt.html>, blog posts such as on <https://hochschulforumdigitalisierung.de/en/>, and videos such as <https://youtu.be/bbB9Ve4BzSY>. In addition, [Dwivedi et al. \(2023\)](#) provide a broad overview of ChatGPT in research and practice. Further, this whitepaper cannot and should not bypass the need for ministries, universities, and faculties to deeply think about supporting students in acquiring the right skills and leveraging tools, and how to set clear policies and guidelines. Instead, the whitepaper shall complement and inform such discussions. In addition, it shall inform students in reflecting on their assessment and potential usage of ChatGPT and related systems.

Further use

This whitepaper is part of the Hohenheim Discussion Papers in Business, Economics and Social Sciences with ISSN 2364-2084.

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Feedback

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About the Projects ABBA, DeLLFi, and S3G

[ABBA stands for “AI for Business | Business for AI.”](#) It is a publicly funded joint project to establish a cross-university, modular offer for developing AI competencies of students in management, business administration, economics, information systems, and related fields.

Using artificial intelligence (AI) technologies in business requires specific skills. In addition to technical expertise, the business world requires knowledge to embed AI technologies in business processes, work systems, products and services, design and evaluate business cases, and manage AI-based information systems in the long term. This bridge-building role falls primarily to managers as the central decision-makers in the company. Therefore, the joint project's target group includes business administration, information systems, and other courses of study relating to socio-economic and socio-technical topics.

The goals of the joint project are developing and providing a modular teaching toolkit for AI, which teaches business students interdisciplinary AI competencies in a scientifically sound and practice-oriented manner. The modular toolkit supports teaching for bachelor, master, executive master, and doctoral students at research universities and universities of applied sciences.

To achieve that goal, the joint project unites twelve professorships from three research universities and one university of applied sciences, who share the focus on supporting the development of AI competencies: University of Hohenheim, University of Bayreuth, Frankfurt University of Applied Sciences, Karlsruhe Institute of Technology. Fraunhofer FIT is an associated partner. Teaching contents and formats are jointly developed, mutually used, and in part made publicly available. Compared to individual creation by each university and professorship, this substantially strengthens the breadth and depth of the offering and the efficiency and quality of teaching. The German Ministry of Education and Research and the State ministries for science in Baden-Württemberg, Bavaria, and Hesse support ABBA financially.

[DeLLFi is a project at the University of Hohenheim](#) funded by the Foundation for Innovation in University Teaching. It stands for integrating digitalization along teaching, learning, and research. The project integrates three departments of the Faculty of Business, Economics and Social Sciences, the CareerCenter Hohenheim, and, with the Office for University Didactics and Humboldt reloaded, two organizational units that support teaching.

S3G stands for Smart Sustainability Simulation Game and is a cooperative project between the University of Hohenheim, the University of Bayreuth, and the Augsburg University of Applied Sciences. S3G develops a student-centered teaching program that focuses on techno-economic competencies in the context of the central business challenges of our time: Digital transformation and sustainable transformation. The focus is on applying machine learning in different cases of an industrial company. Teamwork, gamification, and competitive elements are incorporated in authentic challenge situations. The Foundation for Innovation in University Teaching funds S3G.

All three projects share one thing: they investigate and implement concrete AI-centered innovations in higher education. This whitepaper's authors work for at least one of the partners in ABBA, DeLLFi, and S3G.

1. Introduction



CHAT

1. Introduction

“Would ChatGPT get a Wharton MBA?” This headline circulated in the media at the beginning of 2023, causing universities worldwide to sound the alarm, but also justified? On March 14, 2023, OpenAI launched GPT-4 as a model that can power ChatGPT. This substantially improves performance over what has been discussed regarding ChatGPT over the last months. GPT-4 markedly outperforms the previous model GPT-3.5, for example, by scoring a higher approximate percentage among test takers on the uniform bar exam (OpenAI, 2023b). This underscores the relevance of whether ChatGPT based on GPT-4 would get a Wharton MBA or other degrees.

ChatGPT is an artificial intelligence (AI)-based conversational agent that can write college-level essays. “Conversational agent” is an umbrella term for software that uses natural language to interact with its user, either text-based (as chatbots) or speech-based (as virtual assistants) (Gnewuch, Morana, & Mädche, 2017; McTear, Callejas, & Griol, 2016). Due to recent technological advances in AI, conversational agents are already used in some contexts (Feidakis et al., 2019). Even before the release of ChatGPT, higher education has been an emerging application area for the deployment of conversational agents (Al Muid et al., 2021). These tools can provide the advantages of being permanently available, scalable, and location-independently accessible, leveraging the potential to address multiple learners’ concerns simultaneously while adapting to their individual needs (Elshan & Ebel, 2020; Hobert, 2019).

Then came ChatGPT. OpenAI launched ChatGPT as a research preview on November 30, 2022. ChatGPT has already reached a new level of conversation between humans and conversational agents since it was introduced with GPT-3.5 as the underlying model. Now GPT-4 further expands this. Despite the general knowledge of the potentially disruptive power of conversational agents in higher education, ChatGPT brought the discussion to a new level for several reasons. The quality of results produced by the underlying large language models exceeds what most people thought possible. ChatGPT, as a user interface to these models, is very easy to use for most people. OpenAI offered access to ChatGPT for free. In effect, many people who had not interacted with conversational agents before or perceived them as relatively unsophisticated machines could get first-hand experience with an advanced conversational agent generating stunningly high-quality texts. This swirled up the field of higher education and many other domains within just a couple of weeks.

Much of higher education is teaching and learning how to apply state-of-the-art knowledge and create meaningful, valuable new knowledge. Both application and creation of knowledge frequently manifest in text, images, or other representations that can be easily communicated, stored, processed, and the like. Generative AI systems can generate text, images, or other representations with relatively little human input. Hence, it is not surprising that the advent of generative AI fundamentally challenges accepted knowledge, assumptions, and behaviors in higher education. Questions arise regarding the division of labor between humans and machines, learning goals, and forms of assessing student performance.

Large language models are a specific machine learning approach with superior performance on NLP tasks (OpenAI, 2023c; Vaswani et al., 2017). GPT-4 is an example of such large language model. Such models and the systems built on top of them, like ChatGPT, are impressive but disputed. After its release, ChatGPT became the fastest-growing consumer application in history, reaching over 100 million monthly users just two months after launch (Hu, 2023). The media has dubbed ChatGPT as part of “the generative-AI eruption” (Benson, 2023) that may revolutionize the way we work, think, and approach human creativity (Benson, 2023). However, opinions from the context of higher education demonstrate a sharp divide between those who are enthusiastic about the technology and

those who are heavily concerned. Professor Ute Schmid from the University of Bamberg pointed out that the GPT-3 model has a deeper problem: the inability to trace the sources of each statement and the process used to create them (Schmidt, 2023). Professor Jochen Schiller from the Free University of Berlin further highlighted that the program sometimes produces nonsensical output (Schiller, 2023). Decker (2022) suggested: “If people using the generated material are not careful and responsible (and let us be honest, not everyone is), we may be flooded with a barrage of half-truths, misrepresentations, and simply falsehoods, all of which seem plausible and are written using perfect language.” Despite these concerns, there is a broad consensus that ChatGPT can potentially transform how we learn and teach, as it can be utilized for various applications, including writing, translation, professional communication, and personalized learning (Atlas, 2023).

This whitepaper is relevant beyond ChatGPT. ChatGPT is a specific user interface for specific large language models. We frequently refer specifically to ChatGPT, which is at the forefront of the current debate among students, lecturers, and other higher education stakeholders. Besides ChatGPT, other conversational agents and applications using large language models have similar or complementary text processing and generative capabilities. Further, numerous other AI tools support other aspects of teaching and learning. An excellent overview of tools for text generation, text translation, audio-to-text transcription, image generation, image manipulation, slide generation, audio and music generation, audio and music processing, video generation and processing, programming, mathematics, and other elements of learning and teaching is provided by Professor Albrecht Schmidt from LMU Munich at <https://www.hcilab.org/ai-tools-directory/>. The frequent and specific discussion of ChatGPT in this whitepaper should not obscure the consideration that many of the aspects and recommendations we discuss here are more broadly relevant for large language models and other generative AI systems in higher education.


A brief look at the history of higher education and experience from other domains shows that expected innovations are often exaggerated in the short run (Rudolph, Tan, & Tan, 2023). A recent example are MOOCs (Massive Open Online Courses). Although they have been called “the death of higher education” (Rudolph, 2014), the present shows that university courses and certificates continue to be highly valued by students (Rudolph et al., 2023). So, what does the rise of AI tools, as another relevant digital innovation step, mean to higher education? First and foremost, we should not make either of two possible mistakes: For one, we should not panic in light of questions about whether such systems would pass university entrance tests, whether they would get an MBA, or whether they annul the relevance of university lectures, exams, or master theses.

Further, we should not neglect their importance for higher education and prohibit their use. It is good that students no longer write their theses using pen and paper or a typewriter. It is good that they do not calculate all statistics by hand or with a pocket calculator. Spell check and grammar support or auto-completion of words by Microsoft Word’s built-in editing functions are standard. Likewise, using advanced, machine learning (ML)-based translation programs such as [DeepL Translator](#) or [Google Translate](#) is standard. [Grammarly](#), [DeepL Write](#), [Hemingway](#), and other NLP-based services improve linguistic quality. [Google Scholar](#) algorithmically supports navigating the scholarly literature. Software such as [R](#), [Stata](#), and [SmartPLS](#) support data analytics. Software libraries, software development environments, and online discussion forums support students in developing software code. Both students and lecturers routinely use these tools, and – despite some potential downsides – the net effect of using such IT tools in higher education is overwhelmingly positive.

Some stakeholders in higher education discuss whether the use of ChatGPT by students should be prohibited. Others counter that it should not be prohibited because universities cannot monitor and enforce the ban. The latter is true, but it is not the primary reason why ChatGPT should not be

banned. The primary reason is that ChatGPT and other generative AI tools can improve higher education. They have become part of the everyday life for lecturers and students in their domains of life beyond higher level education. Therefore, we should all join forces to ensure these students are as prepared as possible for their future careers. At the university, students need to learn how to use ChatGPT and similar tools purposefully, productively, and responsibly. We should neither panic nor wait calmly and prevent innovation. Instead, we should focus on how we can innovate education to harvest the potential of AI in teaching and learning.

In this whitepaper, we reflect on the tremendous opportunities of generative AI tools in higher education and the potentially harmful effects of their increasing use. The whitepaper can guide students and lecturers to reflect on their learning and teaching to make sense of the generative AI disruption in higher education. To this end, we focus on the "teaching-learning trifecta" between students, lecturers, and technological tools. We focus on teaching courses, learning for exams, writing seminar papers and theses, and assessing student learning and performance. Further potential for using large language models exists throughout the student lifecycle and in other areas of higher education administration and operations.



Overview on Generative AI,
2. Large Language Models, and
ChatGPT

ChatGPT

2. Overview on Generative AI, Large Language Models, and ChatGPT

One of the most relevant conversational agents right now is ChatGPT, a tool released by the US company OpenAI on Nov. 30, 2022. Before we go into more detail about why ChatGPT has gained so much attention in a relatively short time, we will first go into the technical basics of ChatGPT and clarify terms and key constructs accordingly. The relation of these constructs is sketched schematically in Figure 1.

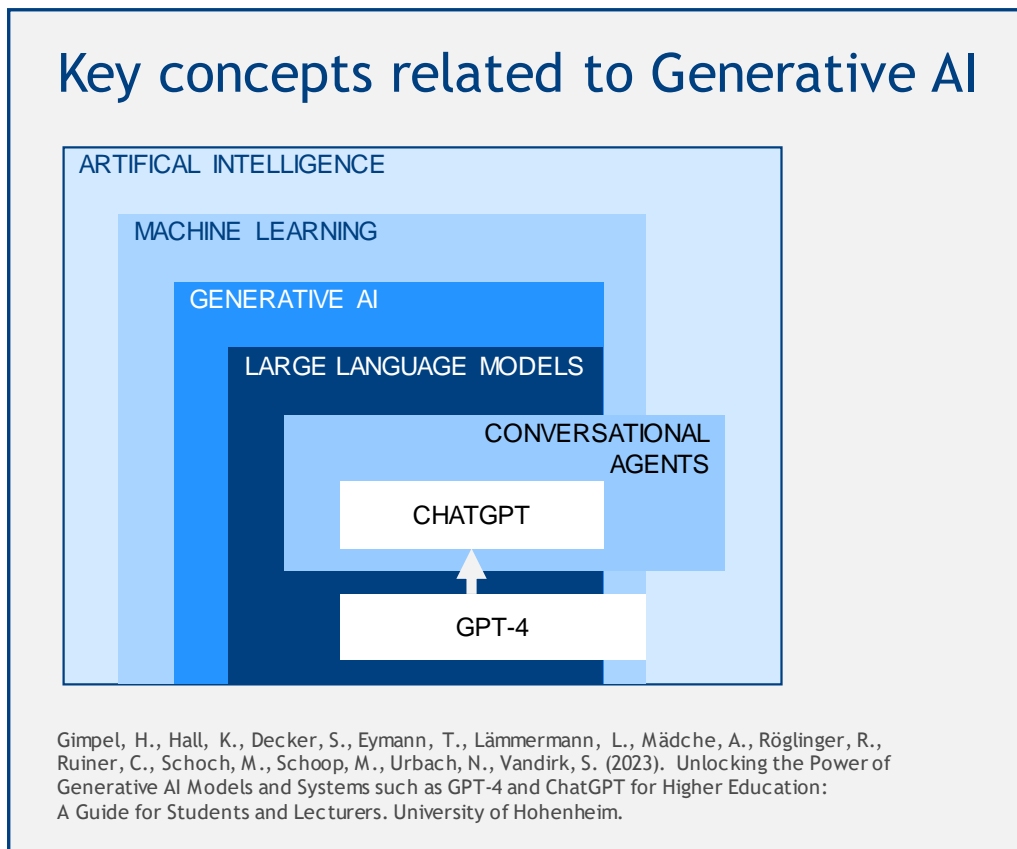


Figure 1. Depicting key concepts as nested sets

Artificial intelligence (AI) is a broad field encompassing various techniques and approaches to create intelligent machines that perceive their environment and take actions. *Machine learning* is a subfield of AI that allows computers to learn and improve their performance on a task without being explicitly programmed using algorithms that can identify patterns and make predictions based on data. *Generative AI* refers to AI systems that generate new data or outputs, such as images, music, or text, rather than classify or process existing data. Typically, generative AI uses machine learning. *Large language models (LLMs)* are a type of machine learning model that can process and generate natural language text. LLMs are a type of generative AI because they can produce novel text outputs based on patterns and learn from large amounts of input data.

Conversational agents, also known as chatbots or virtual assistants, are AI systems designed to engage in natural language conversations with humans. Conversational agents can use LLMs as a component to generate text responses that mimic human-like language and style.

[ChatGPT](#) is a conversational agent that uses the LLM GPT-3.5 or [GPT-4](#). GPT stands for Generative Pre-Trained Transformer. It is OpenAI’s acronym used in the name of large language models trained on data available on the Internet. The earliest of such models, GPT-1, was published by OpenAI in 2018; the most recent one – GPT-4 – on March 14, 2023. ChatGPT is a user interface to the models GPT-3.5 and GPT-4. The free ChatGPT research preview allows access to GPT-3.5. Since March 14, 2023, the fee-based premium version ChatGPT Plus additionally provides access to GPT-4. The GPT models are also available via an application programming interface (API).

In July 2022, OpenAI unveiled [DALL-E 2](#), a cutting-edge text-to-image model. Soon after, Stability.AI released a related open-source version: [Stable Diffusion](#). Both these systems gained popularity and demonstrated impressive capabilities in terms of converting user-generated text prompts to images. These are examples of generative AI beyond large language models.

Machine learning technology is used in software systems to develop models which are embedded in other software systems, such as conversational agents or word-processing software. Innovation in higher education does not come from technology or models in general but from using software systems built on top of technologies and models. Figure 2 provides a rough sketch of this interrelation of technologies, models, and systems. The specific software systems, like ChatGPT, are essential for students and lectures. Hence, we frequently refer to ChatGPT as a specific example of a generative AI system. ChatGPT is impressive and topical. However, it is neither the only nor the last generative AI system. Hence, university policies should not clarify the use of ChatGPT specifically but generative AI systems in general.

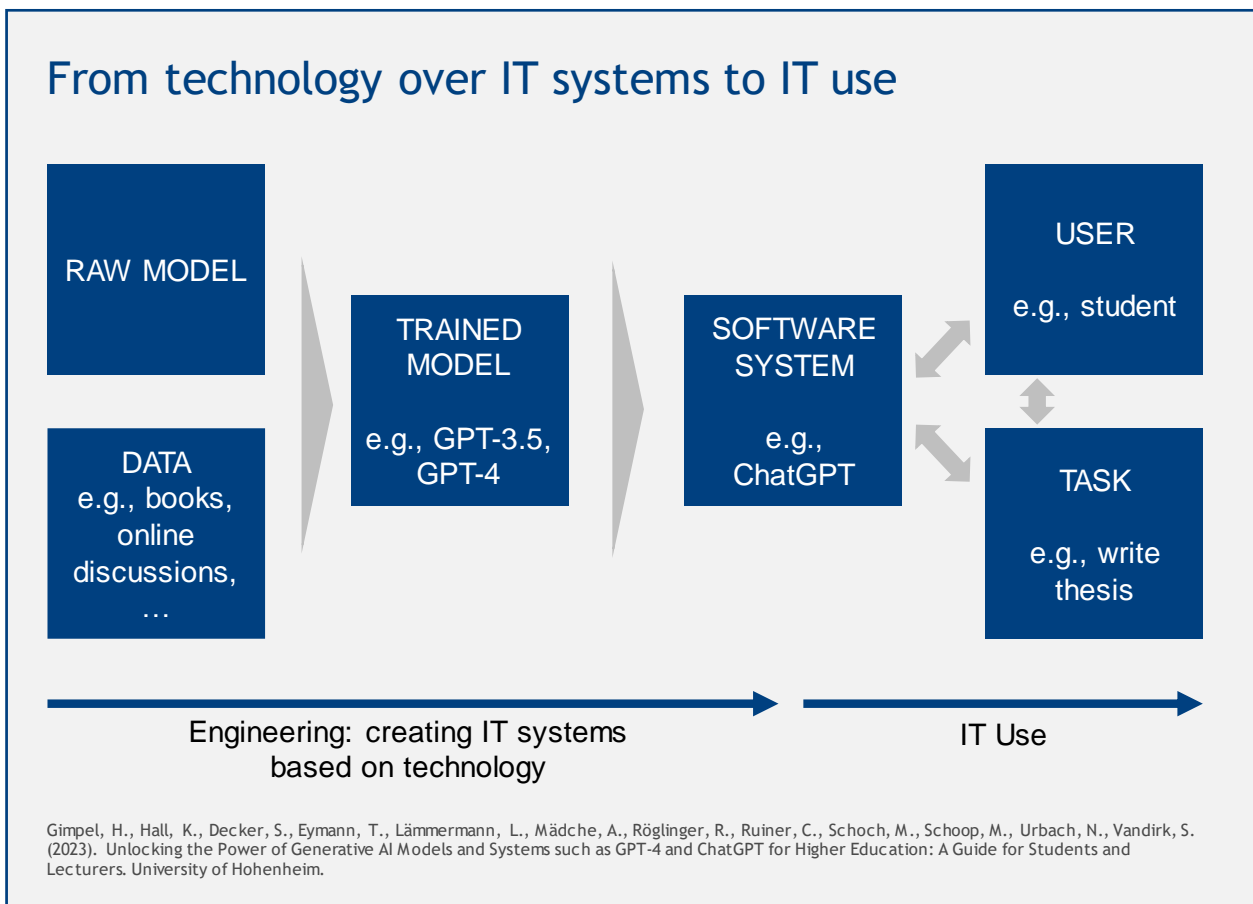


Figure 2. From technology over IT systems to IT use

Now, why is ChatGPT becoming so prevalent in such a short period? Due to its high popularity, there is no surprise that the World Economic Forum in Davos, Switzerland, focused on the rise of AI, specifically the text-generator ChatGPT. In this context, Ina Fried, author of *Axios Login* states: “*Forget crypto and blockchain: The tech conversation at this year’s World Economic Forum in Davos is all about the rise of artificial intelligence, particularly the text-generator ChatGPT*” (Fried, 2023).

One main advantage of large language models such as GPT-3.5 and GPT-4 underlying ChatGPT is their ability to process and contextualize text information and generate appropriate responses (Susnjak, 2022). GPT-3.5 is purely text-based: it accepts text input and produces text output. This text can be natural language or computer code. Beyond that, GPT-4 also accepts images as part of the input prompt. That could be documents with text and photographs, diagrams, or screenshots (OpenAI, 2023a). Hence, GPT-4 includes elements of computer vision and is more than a pure large language model. The models’ performance and accuracy are significantly affected by the difference in the number of model parameters and the training data size. A larger training dataset leads to a more extensive and diverse language model, resulting in enhanced proficiency. According to OpenAI, GPT-3.5 is based on a deep neural network model with 175 billion parameters, which are adjusted through machine learning (Vogelgesang, Bleher, Krupitzer, Stein, & Jung, 2023). In contrast to the previous models from OpenAI, GPT-1 and GPT-2, which aimed to generate human-like conversations, GPT-3 was already considered the most advanced and capable of the models due to its significantly larger size and the scaling up of data and parameters used in its training (Shreya, 2023). GPT-3.5 is the successor of GPT-3. GPT-4 is the next evolutionary step. Both models work in English, German, and many other languages. According to OpenAI (2023a), they applied GPT-3.5 and GPT-4 to bar exams designed for human test takers. GPT-3.5’s score was around the bottom 10% of humans typically taking the exam. GPT-4’s score is more around the top 10% of test takers. However, as any IT system (and any human), ChatGPT and the underlying models are not perfect. One fundamental limitation to keep in mind is that while the output might sound convincing, it is not necessarily factually correct. The GPT models and, hence, ChatGPT sometimes “hallucinate.” Natural text, academic references and the like might look perfect at first sight but lack truth or refer to non-existent objects or prior texts. For example, it may make up fake academic papers using new configurations of existing titles, outlets, and authors (Smerdon, 2023). While this concern applies to all GPT models, our initial tests suggest that GPT-4 has substantially fewer hallucinations than GPT-3.5.

One of the essential features of GPT-3.5 and GPT-4 is their capability to consider contextual information of a conversation when generating the response. This allows ChatGPT to maintain a conversational flow, yet its ability to maintain that flow continuously is limited. This is possible using a so-called “self-attention mechanism” (OpenAI, 2023c; Vaswani et al., 2017), meaning that the models can weigh the importance of different words and phrases in the input text based on their perceived relevance. The extent of the models’ context is given by the number of so-called input tokens. GPT-3.5 has a token limit of around 4,000 tokens (relating to about 3,000 words in the prompts and the model’s answers), GPT-4 an impressive 32,000 tokens. Hence, GPT-4 is substantially more robust in considering context affecting the length of text that can reasonably be generated. Based on GPT-3.5, ChatGPT can – depending on the topic and the prompt – reasonably produce a paragraph of text or a few paragraphs. Leveraging GPT-4, ChatGPT can potentially produce entire chapters. It is easy to foresee that such models will eventually be able to create text in the length of a whole bachelor’s or master’s thesis. However, even if the text is linguistically perfect, its content does not necessarily show the same quality. Furthermore, ChatGPT cannot fully appreciate the nuances of subtleties of a conversation since it is still a machine learning model and is just trained on large amounts of input data (Azaria, 2022).

A benefit of ChatGPT is its easy application, which is possible through a simple user interface that does not require knowledge of using an API (Figure 3). ChatGPT is a ready-to-use service made available as a dialogue system with which one can easily interact. Immediately after prompting ChatGPT, the user is presented with relevant information about the topic of interest. Currently, OpenAI provisions ChatGPT based on a freemium pricing model: ChatGPT usage is free of charge if the user accepts GPT-3.5 as the underlying model, somewhat tardy replies, and non-availability at times of high demand. A premium version with higher capacity is now available for a fee to handle a large volume of requests while ensuring fast response times. Further, the premium version allows access to GPT-4 with its advanced ability to consider context and the option for image-based prompts. Microsoft and others use the API provided by OpenAI to integrate the large language models in other software systems beyond ChatGPT.

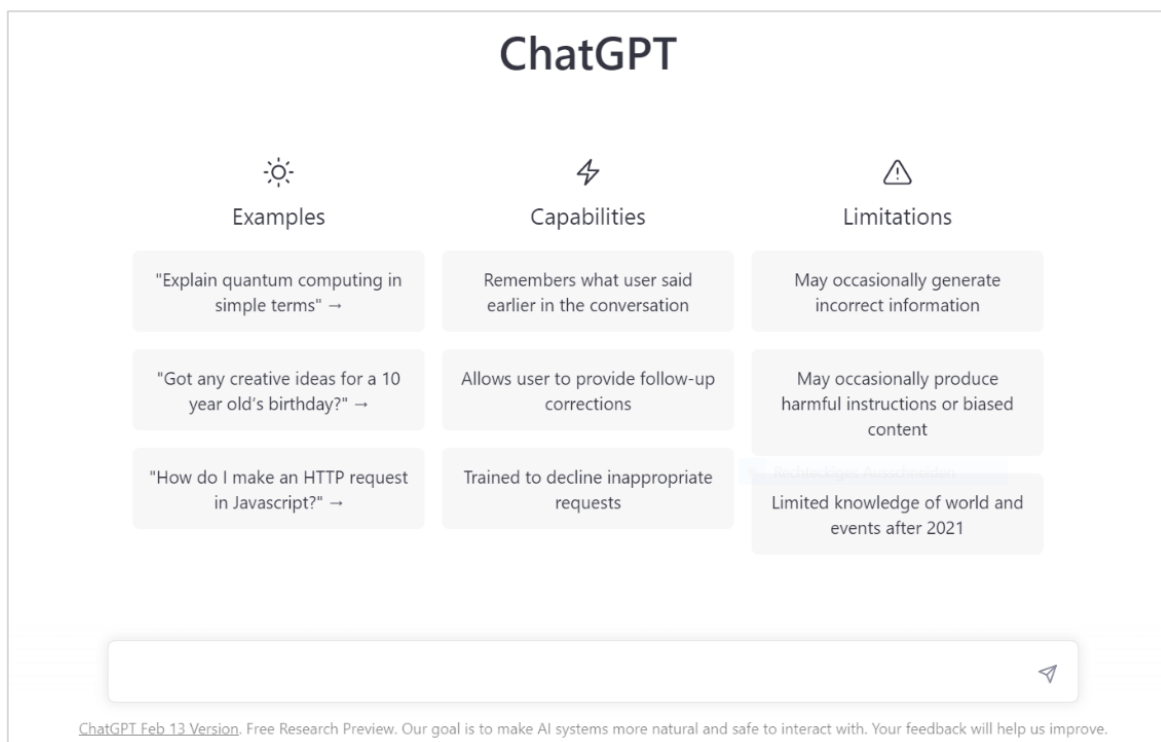
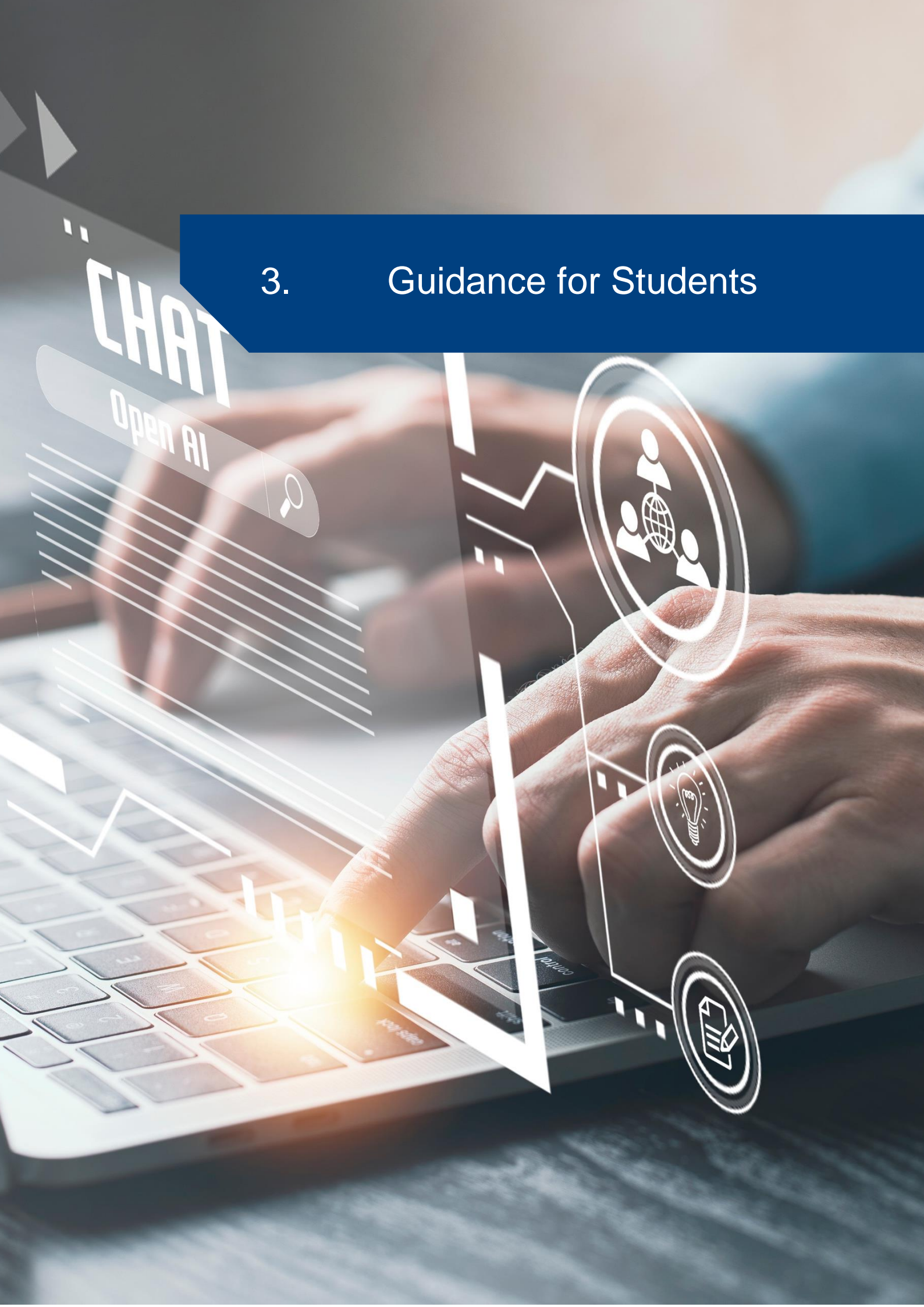


Figure 3. ChatGPT user interface (screenshot from Feb. 28, 2023)

The potential applications of ChatGPT are extensive. Particularly in higher education, its capability to comprehend and react naturally to language input renders it valuable for various tasks. ChatGPT can be helpful for students in various tasks, such as writing assignments, summarizing, paraphrasing text, making grammatical corrections on text, and translating text. For lecturers, ChatGPT can help collaborate on written work, engage in intellectually stimulating conversations, conduct research, and assist with administrative tasks such as report writing (Atlas, 2023).

As a student and lecturer, there are various factors to consider when incorporating ChatGPT into higher education, including productivity and efficiency benefits, learning objectives and didactics, as well as ethical considerations and concerns about the impact on human job roles and intellectual property. It is essential to approach the integration of ChatGPT with thoughtful consideration and a holistic perspective, considering all relevant factors. In this sense, it is crucial to consider the limitations and risks of using ChatGPT in higher education, such as data bias, plagiarism, or quality of the produced text. In the following sections, we will provide guidance for effectively using ChatGPT and identifying areas for innovation in education.

3. Guidance for Students



3. Guidance for Students

Conversational agents are valuable tools for university students, aiding with academic work, saving time, offering accessibility, improving critical thinking skills, and improving language skills (Atlas, 2023). In this section, we critically reflect on how students can (and should) use ChatGPT, an example of a tool based on large language models, to maximize its potential benefits and avoid risks. This includes us also highlighting the limitations and dangers of ChatGPT. In summary, we have nine recommendations for students, as summarized in Figure 4. In the following, we detail these recommendations.

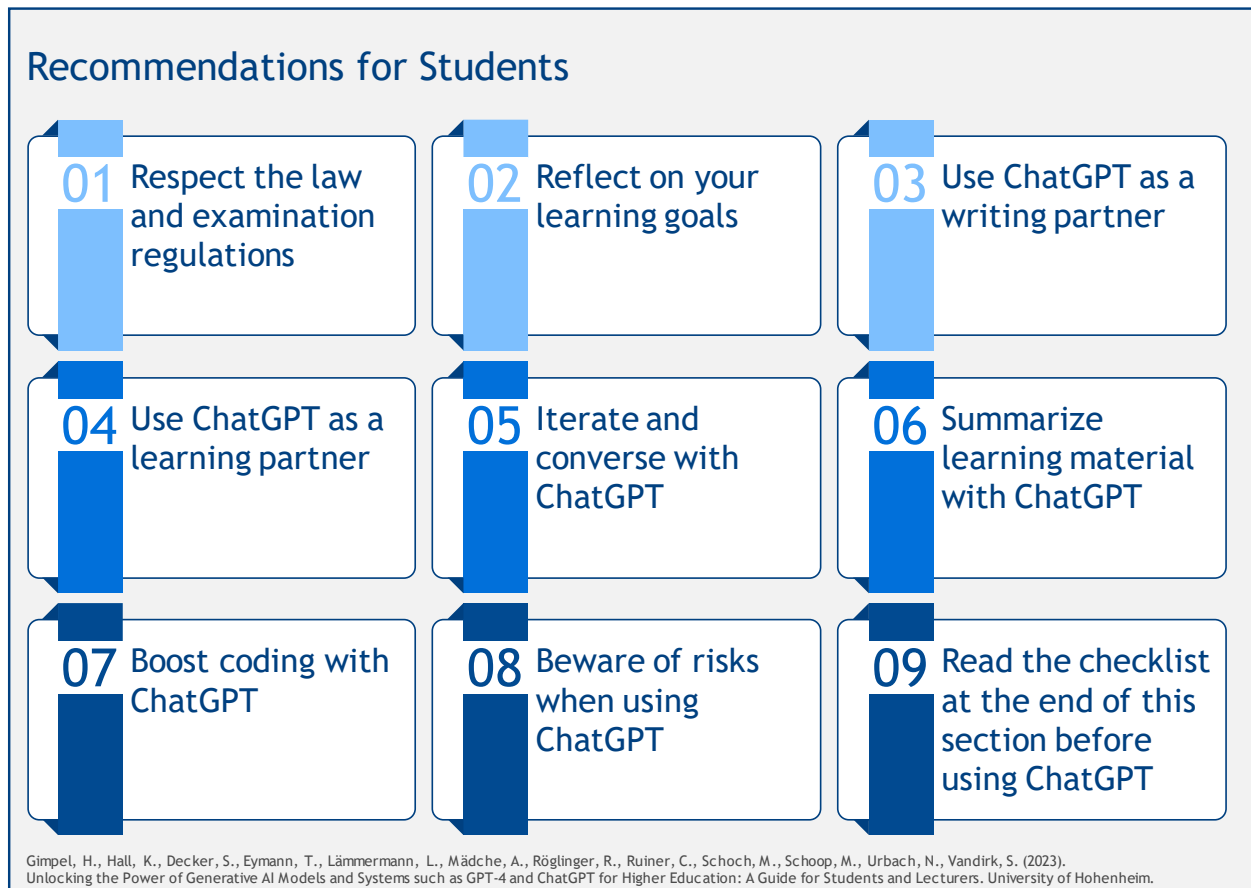


Figure 4. Summary of recommendations for students

Recommendation 1: Respect the law and examination regulations

Before discussing the possibilities of working efficiently with ChatGPT or other AI-based tools, we would like to highlight the need to respect the relevant national and regional legislation and the individual examination regulations of each university, school, and course of study. Students must comply with these and observe any instructions in the examination regulations on using AI-based tools. Furthermore, students must follow the rules regarding quotations and good scientific practice. Eventually, they need to indicate whether a text is created by AI or even which information was given to the AI.

Recommendation 2: Reflect on your learning goals

Higher education is more than acquiring domain-specific skills. It also includes cultivating and enhancing essential skills such as critical and structured thinking. Generative AI increases the need for these skills and affects the chances of developing them during your studies. Critical thinking refers to the ability to evaluate information, ideas, and arguments systematically and rationally. It involves questioning assumptions, analyzing evidence, and considering multiple perspectives to arrive at well-reasoned conclusions. Given that generative AI systems like ChatGPT produce large volumes of linguistically polished text, which may need to be revised in content, critically engaging with texts is more important than ever. Using ChatGPT as a writing partner (see recommendation 3 below) requires critically inspecting your partner's contributions before further processing them.

Structured thinking refers to the process of organizing and categorizing information logically and coherently. It involves breaking down complex concepts into smaller components, identifying patterns and relationships, and using this framework to generate new insights and solve problems. ChatGPT is good at elaborating short text of a few sentences or a paragraph on a given topic. ChatGPT is not (yet) good at developing a long text that builds up an argument step by step or analyzes an issue from multiple perspectives in detail. Here, structured thinking is required for developing the scaffolding (potentially with support by generative AI), which can be filled step by step with ChatGPT. Since ChatGPT makes it easier to put clear thoughts into beautiful text and increases the linguistic quality, students can focus more on the thoughts and structure and less on formulating prose.

In addition, the skillful use of tools such as ChatGPT requires that you know which prompts will get you valuable results. Skillfully interviewing people so that you get the information you are looking for is an art. Optimizing individual search terms and entire search strategies for an Internet search is an art. Likewise, it is crucial to understand how to properly prompt ChatGPT and other generative AI tools so that they effectively assist you in each task. On that account, prompt engineering emerges as a new, valuable skill.

In short, with the advent of generative AI, critical thinking, structured thinking, the evaluation of text and other media, and prompt engineering gain in importance, the initial creation of text and other media becomes less important. By reflecting on the desired learning outcomes, students can, in the next step, determine how to integrate ChatGPT into their education best and use it to supplement and enhance their learning experience. Further, their learning goals and the offerings of different courses should guide their selection of specific courses.

Recommendation 3: Use ChatGPT as a writing partner

When promoting ChatGPT and asking if one can use it for writing assignments for students, the AI noted that it could not replace critical thinking and creativity, which are essential components of writing assignments (Figure 5). Therefore, students in higher education should only use ChatGPT as a supplementary tool, such as Wikipedia, Google, or translation programs such as DeepL (Spannagel, 2023). Therefore, ChatGPT will never be the author of a work, and the responsibility for the written content will always lie with the human author, in this case, the student (arXiv, 2023). Since ChatGPT is not an author, ChatGPT cannot be cited as a source. Furthermore, because ChatGPT can always generate new data, the answers it provides are not verifiable. Thus, students should adhere to the principles of good scientific practice issued by each university. We will elaborate more on this issue in the assessment section (see Guidance for Lectures, Assessments, Recommendation 6).

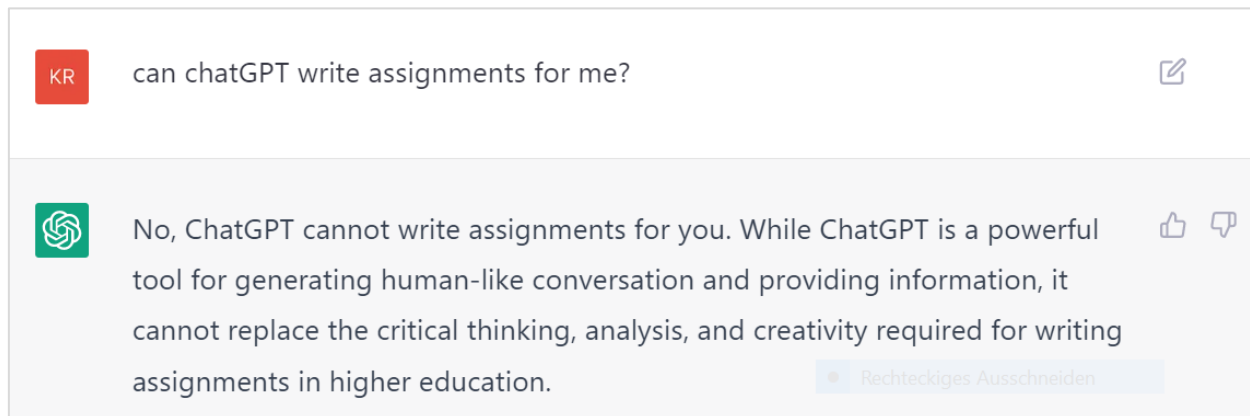


Figure 5. Answer from ChatGPT on writing assignments (screenshot from 08.03.2023)

Weßels (2022) emphasizes that ChatGPT might be (only) a good writing partner. This means that although ChatGPT provides some topics and perspectives on a given topic, the user is still required to add further knowledge and creativity, which is a large part of creating essays or theses. Further, despite the daily increase in technological advancements in large language models, there are also limitations to the technology. The underlying models of ChatGPT were primarily trained on data up to September 2021. A typical claim is that ChatGPT is not obtaining new training data from the Internet, which restricts it to the data set and information it was trained on and what users feed into it. That is not always comprehensive, as can be seen by, for example, prompting ChatGPT: “Please tell me a few sentences about the earthquakes in Turkey and Syria in 2023”. ChatGPT is not able to answer with any specifics about the event.

Also of concern is that while a text generated by ChatGPT may sound plausible, it may also contain hallucinations, false information, or meaningless information. In addition, ChatGPT can generate sources that seem very realistic in appearance and syntax; however, being entirely fabricated. This can be dangerous for students who rely on it for literature research. Although ChatGPT, with the underlying model GPT-4, is now capable of generating sources with an attached Digital Object Identifier (DOI), there is still plenty of room for erroneous outputs. Partially, the DOIs are also completely fabricated; partially, they exist but refer to a different paper than ChatGPT’s text output. Nonetheless, it may only be a matter of time before ChatGPT is connected to Internet search engines (such as Bing, Google), and services providing bibliographic information (such as Google Scholar, Scopus, Web of Science). In fact, Microsoft already combines ChatGPT with [Bing](#) and the [ChatGPT for Google](#) browser extension for Chrome and Firefox shows ChatGPT answers alongside search results from Google, Baidu, DuckDuckGo and others. Other AI-based language models (e.g., [Perplexity](#)) can even aid in literature research, as they link citations to their sources.

Consequently, students and lecturers must verify any information they receive from the AI-generated content. Otherwise, there might be the risk that students use incorrect information or false citations to create user-generated content. Further, the AI model could be trained on false information and thus recreate a spiral of misinformation on these platforms.

To effectively use AI-based writing tools for scientific topics, students must have a basic understanding of the topic and the limitations of the technology. Once this understanding is achieved, tools such as ChatGPT can assist in providing ideas and a basic text structure (Friedrich, 2023). For this, ChatGPT can be accessed with [OpenAI’s ChatGPT website](#) or via integration into Google Docs or Microsoft Word (e.g., with [docGPT](#)).

Table 1 presents exemplary use cases, following Atlas (2023), where ChatGPT can act as a “co-partner” for formulating text on a high linguistic level.

Table 1. Exemplary prompts on writing text

Activity to be supported	Exemplary prompts
Generate a headline for an essay	"Generate five headlines for an essay about [paste your text] "
Summarizing	"Summarize the following text in two sentences: [paste your text] "
Paraphrasing	"Paraphrase this sentence: [paste your text] "
Correction	"Act as a professional spelling and grammar corrector and improver" → Wait for response [Paste your text]
Proofreading and editing	"Please revise the following sentence to make it clearer and more concise: [Paste your text] "

Recommendation 4: Use ChatGPT as a learning partner

Another useful application of ChatGPT is as a learning partner for university students. Since prominent conversational agents such as ChatGPT are accessible 24/7, they provide students with numerous opportunities to help them acquire new knowledge or test existing knowledge. Since many best practices are already circulating on the internet, we compiled and tested what we consider to be the most helpful ones in a short table (Table 2).

A good example of how the integration of AI models such as GPT-4 into existing learning apps can succeed has been shown by the language learning app Duolingo. The app uses the new GPT-4 model to provide the user with new features such as "Roleplay" or "Explain my Answer." With Roleplay, users can practice real-world conversation skills with fictitious characters. "Explain my answers" offers learners the opportunity to receive an explanation of why their answer was right or wrong. Further, they can ask for further clarification or examples (Duolingo Team, 2023). These feedback mechanisms might also be possible with ChatGPT if students choose the right prompts to convert with ChatGPT (notice the prompt on "Self-testing of specific knowledge").

Table 2. Exemplary prompts on learning with ChatGPT

Activity to be supported	Exemplary prompts
Generation of pattern solutions from old exam tasks	“Please generate a pattern solution for the following task: [paste your task] ”
Create a mind map to gain a quick overview of a new topic	[paste your topic] “Create a mind map on the topic above, list the central idea, main branches, and sub-branches”
Explanation of concepts (e.g., mathematical equations)	“I want you to act as a math teacher. I will provide some mathematical equations or concepts, and it will be your job to explain them in easy-to-understand terms. My first question is: I need help to understand how [paste your concept] works”
Vocabulary acquisition	“Could you please provide me with terms related to [paste your text] ”
Create flashcards	“Topic: [paste your topic] Please help me create a two-column spreadsheet with questions and corresponding answers on the topic above”
Self-testing of specific knowledge	“Topic: [paste your topic] Please ask me five questions on the topic above. I will then respond to it. After my response, you will tell me if my answer was right or wrong and provide an explanation”

Recommendation 5: Iterate and converse with ChatGPT

When using ChatGPT, it is sometimes unclear how to use it effectively. Providing ChatGPT with accurate and specific information is crucial to obtain the desired text and information. Since ChatGPT relies solely on prompts and words, providing additional information and context, including the intended purpose and information on the target audience, unique position, and intended tone, is essential. If the text or result is unsatisfactory, users can request more information and provide detailed feedback to improve the model’s response and generate a better match for their requirements (Atlas, 2023). Possible prompts from Atlas (2023) that are consistent with these principles include:

“Summarize this text and highlight why [X] has a relevant role”

“Write a text on the topic [A] from the perspective [B] with the target audience [C] in a [D] tone”

“Rewrite the text to make it sound more like [A] and highlight the benefits of [B] more”

Further, ChatGPT offers a “Regenerate Response” option. If one is unsatisfied with the result, this option produces a new response for the same prompt. In addition, one can manually adapt the prompt or continue conversations with prompts like:

“Please shorten the summary to 150 words”

“Please elaborate the second point”

“Tell me more about the last argument in your previous answer”

Recommendation 6: Summarize learning material with ChatGPT

You may use ChatGPT’s functionality with videos and texts, like lengthy notes from a lecture or a difficult-to-read, lengthy paper. This may be a helpful way to skim learning materials and identify important aspects of the material. In doing so, one should be aware that a summary always misses details and that these details might be necessary. Therefore, this functionality should be used with caution.

A nice gimmick is automatically summarizing the automatically generated transcript from a (YouTube) video. Several third-party browser plug-ins (e.g., [YouTube Summary with ChatGPT](#)) provide students with an opportunity to generate summaries of YouTube videos based on ChatGPT. The plug-in accesses and exports the standard YouTube transcript and transmits it to ChatGPT, requesting a summary which is then presented to the user via the browser plug-in. The browser plug-ins are available for Chrome, Safari, and Firefox. After installation, the plug-in enables students to access the transcript of the video and utilize ChatGPT to create a summary. The extension also facilitates easy navigation to the current time frame of the video and permits the copying of transcripts. The plug-ins support multiple languages and allow for the customization of prompts to improve the accuracy of the summary, as shown in Figure 6.

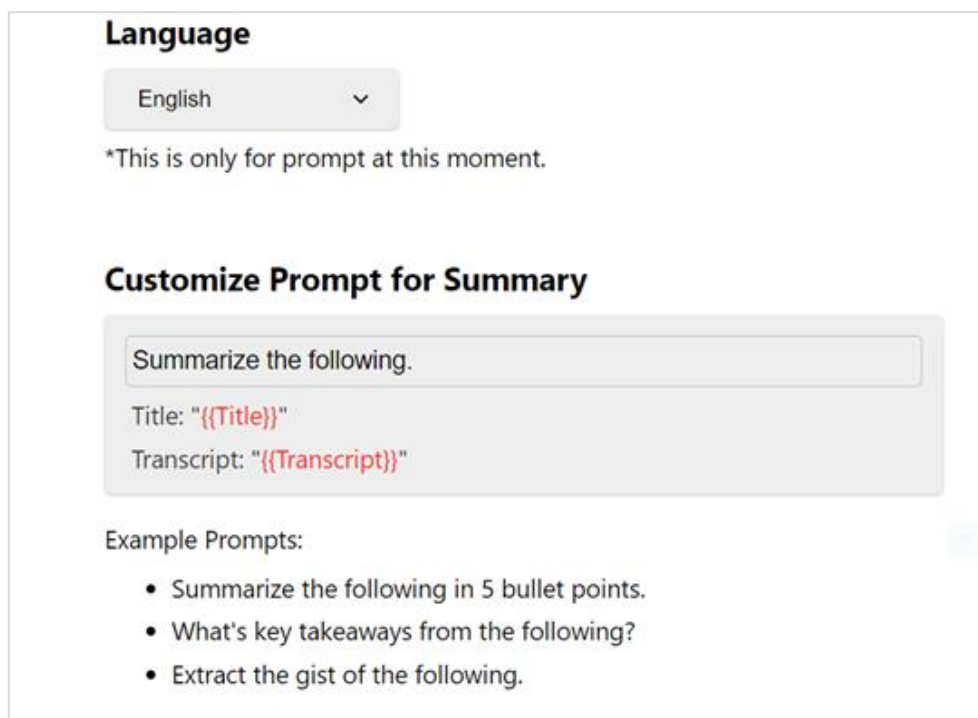


Figure 6. Customize prompt for YouTube summary (screenshot from 08.03.2023)

Recommendation 7: Boost coding with ChatGPT

ChatGPT can be used not only as a learning or writing partner but also as a partner to generate or correct codes. With the right prompt, ChatGPT can give students suggestions on coding. In Figure 7, we depict a potential prompt with code as the response, which we retrieved and modified from an expert talk at HCUM Munich (Hauck-Thum et al., 2023). These code snippets can then be used as a starting point for a project or task. ChatGPT can be an excellent tool to assist in debugging code. Students can share their code with ChatGPT, and the model can help identify errors and suggest possible solutions. Furthermore, ChatGPT can assist in optimizing code to make it more efficient by suggesting better data structures and algorithms.

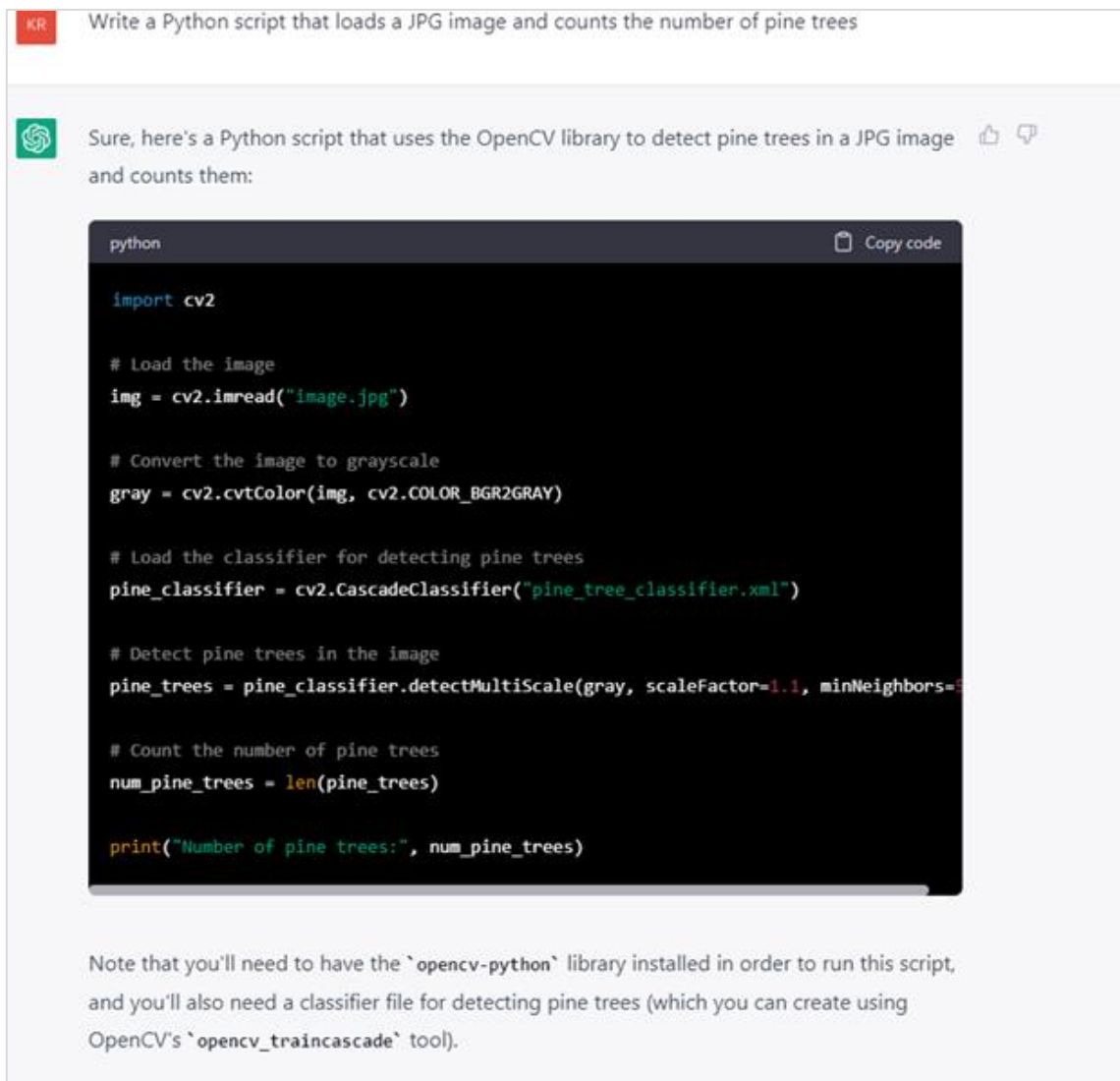


Figure 7. Exemplary prompt for code generation with ChatGPT (screenshot from 08.03.2023)

Table 3 provides examples of prompts that students can use to improve their code. Additionally, OpenAI has developed a more advanced tool called GitHub Copilot, which can help write code faster and with less effort than ChatGPT. [GitHub Copilot](#) is an AI pair programmer that utilizes a generative pre-trained language model created by OpenAI. By analyzing the comments and code, it instantly suggests individual lines and entire functions to improve the code.

Table 3. Exemplary prompts on coding with ChatGPT

Activity to be supported	Exemplary prompts
Help with syntax	"What is the syntax [paste your text] in Python?"
Coding examples	"Please give me an example of how to use the [paste your function] in JavaScript?"
Programming tips	"What are some tips for [paste your text] ?"
Debugging help	"How can I fix the [<code>'TypeError: 'int' object is not subscriptable'</code> error] in my Python code"
Explaining codes	"Can you explain the code for me step by step: [paste your code] ?"

Recommendation 8: Beware of risks when using ChatGPT

In addition to the advantages of utilizing ChatGPT for creating scientific text, users should be aware of potential sources of error and misconduct. Thus, although we recommend using AI-based tools, such as ChatGPT, for creating scientific text (if there is no explicit prohibition by the examination regulations or the university), we encourage students to reflect on each AI-generated outcome. This applies not only to text but also to code generated by ChatGPT.

Rademacher (2023) and others discovered issues with accurate citation of ChatGPT-generated sources. In some instances, ChatGPT created non-existent sources, posing a risk of propagating false information. Thus, students must verify each statement made by ChatGPT, which is a considerable workload.

Further, there are substantial risks relating to accidental plagiarism and copyright infringements. Please see our discussion relating to recommendation 6 for lectures in section 4 below for details.

One is responsible for writing if one submits a work under one's name (e.g., a seminar paper or a thesis). One is still responsible for the work if one uses content generated by ChatGPT or similar tools and includes them in one's work. One accepts the praise if the work gets praise (e.g., a good grade). One must accept the blame and other negative consequences if the work triggers blame – e.g., for plagiarism, copyright infringement, unethical discrimination, unlawful content, or errors. For good or for bad, the author is responsible for her or his use of tools.

Recommendation 9: Read this checklist before using ChatGPT

ChatGPT and other tools based on generative AI will change how students learn, write exams, and study for tests. In the following, we summarize example recommendations that should be considered while working with ChatGPT:

- Review the university's rules and regulations regarding generative AI, Large Language Models, and ChatGPT (considering policies for usage, acknowledgments, citations, etc.).
- Understand the capabilities and limitations of ChatGPT
- Check if the use of ChatGPT is clever or if the task requires the learning of basic knowledge
- Verify that the results given by ChatGPT are trustworthy and accurate and reflect the findings (Atlas, 2023)
- Consider which topics could be cleverly linked to produce novel insights.

The variety of smart use cases of ChatGPT is enormous, and with time new ways of using it are sure to come. Students should empower themselves to use ChatGPT responsibly so that the first reflex of the (public) perception is not the possibility of cheating but the possibility of learning new things that will lead to mature students being prepared for digital work.

The background of the slide features a close-up of a person's hands typing on a laptop keyboard. The scene is overlaid with various digital and AI-themed graphics. On the left, there is a large white gear with the letters 'AI' inside, surrounded by circuit-like patterns. Above the gear are several white speech bubble icons. In the center, a white outline of a human head is shown in profile, facing right. To the right of the head, there is a white rounded rectangular button with the text 'CHAT AI' and a right-pointing arrow. The overall color palette is a mix of dark blues, light blues, and warm oranges from the lighting on the hands and keyboard.

4. Guidance for Lecturers

CHAT AI ➤

4. Guidance for Lecturers

The emergence of new educational technologies often arouses strong emotions, ranging from doomsday predictions to endless euphoria (Rudolph et al., 2023). In the case of ChatGPT, experts also speak of an “educator’s dilemma” between banning these technologies or promoting their use (Teubner, Flath, Weinhardt, van der Aalst, & Hinz, 2023). Although the use of conversational agents and ChatGPT, particularly in higher education, is diverse, we aim to examine two main areas of application for teachers and lecturers in more detail: (1) the teaching process and the (2) the assessment process.

4.1 Teaching

There are numerous potentials for the teaching side across all stages of teaching-related activities, from planning and implementation to evaluation. In the following, we present different recommendations where generative AI systems, and especially ChatGPT, can support lecturers in their teaching activities. We illustrate this with five recommendations for lecturers regarding teaching, as summarized in Figure 8. In the following, we detail these recommendations.

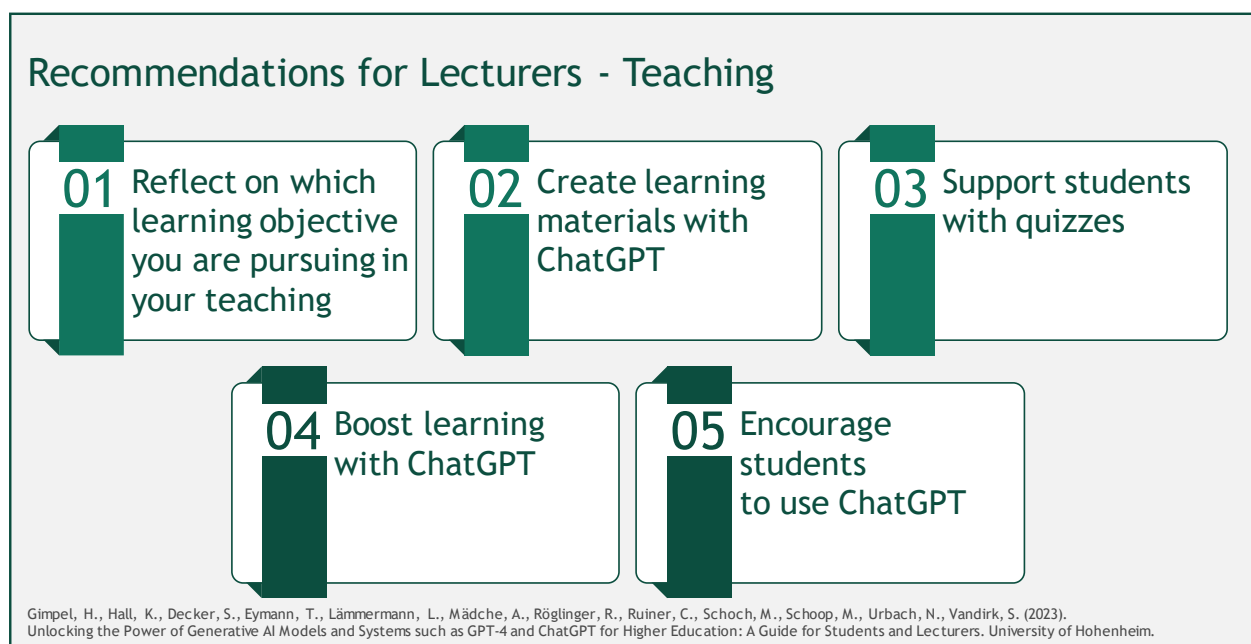


Figure 8. Summary of recommendations for lecturers regarding teaching

Recommendation 1: Reflect on which learning objective you are pursuing in your teaching

Before considering how to use ChatGPT to support your teaching, it is essential to determine the actual learning objectives of your course. As mentioned earlier in the student section, learning objectives in higher education may vary depending on the field of study and subject matter. While critical thinking and structured thinking are considered essential goals in higher education, you can utilize ChatGPT to develop these skills in your students by utilizing the limitations of generative AI, such as the potential for false information or the potential to receive text of low quality. By reflecting on the output generated by AI tools and providing ChatGPT with purposeful prompts and sufficient information, students can practice structuring their arguments logically, which is an essential component of structured thinking. This interaction with generative AI can effectively develop students’

skills in critical reflection and structured thinking in an iterative manner. Today, generating high-quality output with ChatGPT depends on creating the correct prompts. The ability to create and refine prompts that are tailored to specific tasks or goals can be crucial in achieving the desired outcome. This makes domain-specific prompt engineering expertise a valuable skill for the future.

Recommendation 2: Create learning materials with ChatGPT

ChatGPT can be a valuable tool for personalized learning in higher education. In addition to supporting lecturers with various classroom tasks, ChatGPT can create custom exercises and quizzes, offer feedback, and generate tailored educational materials that align with a student's learning style and progress. Moreover, ChatGPT can assist in developing lecture ideas, drafting seminar plans and module descriptions, and crafting announcement texts. Another possible application of ChatGPT is to assess students' prior knowledge using AI. In Figure 9, we illustrate a ChatGPT-prompt that can be used to create a lesson plan on a specific topic.

Furthermore, as mentioned in the students' section, lecturers can utilize the "YouTube Summary with ChatGPT" feature to summarize video transcripts and design classroom elements. YouTube automatically generates transcripts of videos (be it learning videos produced by the lecturer or third-party videos). A click on the plug-in button sends the transcript to ChatGPT with a prompt to provide a summary.

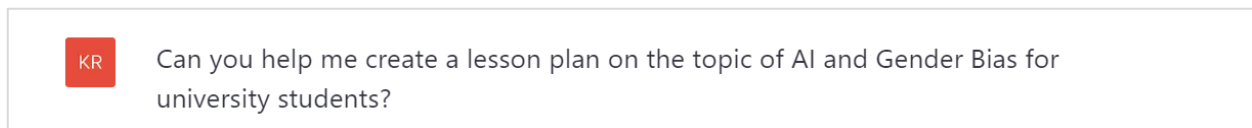


Figure 9. Prompt to ChatGPT: Create a lesson plan (screenshot from 28.02.2023)

Recommendation 3: Support students with quizzes

Quizzes on a course's contents can support students and assess their level of learning. ChatGPT prompts can help lecturers in creating quizzes. Figure 10 represents an example of a suitable prompt with the ChatGPT answer.

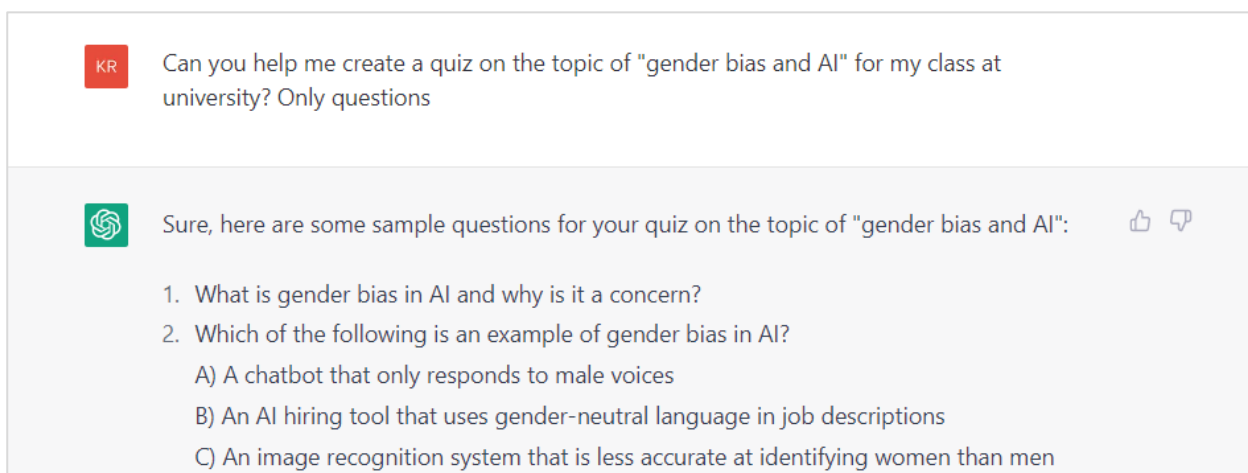


Figure 10. Prompt to ChatGPT: Quiz (screenshot from 08.03.2023)

To stay close to the lecture’s content, some lecturers first provide transcripts of their lectures to ChatGPT (e.g., via “YouTube Summary with ChatGPT”) and then use prompts such as “Please generate a single choice exam question about this content with four potential answers, exactly one of them being correct.”

Such prompts can (and likely will) also be used to generate exam questions. While this might be an exciting feature to spur ideas regarding exam questions, lecturers cannot rely on the questions and suggested answers being correct. Therefore, they should do more than accept and use them. This is true for all uses of ChatGPT, but it is essential when it comes to exams.

Recommendation 4: Boost learning with ChatGPT

ChatGPT cannot just help lecturers in designing course materials but also boost learning by overcoming three challenges that are typically hard to address in classrooms: helping students apply their knowledge to new situations, showing them that they may not know as much as they think they do; and teaching them how to think critically about information (Mollick & Mollick, 2022). One way to overcome the challenges in teaching is to incorporate ChatGPT as a learning tool. This approach allows for utilizing AI’s strengths and weaknesses to enhance the learning experience. In Table 4, and according to Mollick and Mollick (2022), we present three ways to integrate ChatGPT into the curriculum.

Table 4. How to boost learning with ChatGPT

Learning Objectives	ChatGPT Task	Students’ Task
Train transfer with ChatGPT	ChatGPT can be used to demonstrate and clarify concepts and to transfer them to a different context. However, AI is limited in understanding complex relationships and combining information from different sources.	The task of the students is to evaluate the AI’s response as it transfers a concept to a different context. Further, students should apply strategies to improve AI’s output.
Train evaluation with ChatGPT	ChatGPT can be used to write essays about a particular topic. Although AI is good at simplifying text, it has weaknesses in providing insightful analysis.	The task of the students is to continuously improve the AI-created essay by providing further prompts to the AI, adding new information, or clarifying points.
Help students to identify and close gaps in their knowledge with ChatGPT	ChatGPT can be utilized to outline the steps involved in a specific process. However, the AI-generated process might not be complete.	The task of the students is to evaluate and improve the AI’s output by adding information from different sources

Recommendation 5: Encourage students to use ChatGPT

The way teaching is done in higher education should adapt to the technological developments and the various possibilities they offer. In this sense, ChatGPT is seen as a support rather than a threat. Lecturers should encourage students to use ChatGPT creatively and critically to improve, expand or vary their own texts, but not to replace or plagiarize them. This whitepaper might help inform students about the possibilities and risks of using ChatGPT and similar tools. By teaching students how to effectively use these tools, educators can equip them with important skills for their future careers, while also emphasizing the importance of academic integrity and originality.

4.2 Assessments (exams, seminar papers, theses, and the like)

One of the most common concerns with using ChatGPT is the fear that essays will become increasingly obsolete as an assessment method in higher education. Some lecturers are concerned that written assignments are being outsourced to ChatGPT without being detected by a plagiarism detector. Further, lecturers see the challenge that generated text reads naturally. While traditional plagiarism detection tools can identify copied and pasted text from scientific sources, they are not equipped to identify text generated by AI models such as ChatGPT (Khalil & Er, 2023). Tools such as the OpenAI Text Classifier, which have been developed to address the issue of false claims that a human wrote AI-generated text, are currently improving. However, the current success rate of the tool in recognizing texts generated from large language models is only around 26%. While this is still a remarkable achievement, it highlights the limitations of existing plagiarism detection software in its current state (Wiggers, 2023).

Traditionally, some lecturers might have taken the linguistic quality of a text as an indicator of its content quality. However questionable such a shortcut might always have been – with increasingly advanced language models, the potential link between linguistic quality and content quality is no longer there. These concerns only arise when lecturers do not engage in changing assessment formats and criteria. However, there is already a debate about the suitability of written essays to test students' knowledge.

The second fear is related to the inability of ChatGPT to truly understand the context and interpret text since ChatGPT is just predicting the probability of the next word in a sequence that has already been monitored (Arif, Munaf, & UI-Haque, 2023). As a result, institutions concerned about AI's output could take this as legitimacy for implementing policies that prohibit the use of AI for quality reasons. Given the rapid technological development of AI applications and their prospects, such as the integration of ChatGPT into widely used Microsoft products, it quickly becomes apparent that there is no alternative to using AI applications in the university context (Salz, 2023). Universities and lecturers should therefore focus on ensuring responsible use by addressing potential challenges related to ChatGPT rather than implementing policies that restrict use (Brown et al., 2020; Vogelgesang et al., 2023). Below, we present several ways teachers can turn the challenges associated with ChatGPT and assessment formats into opportunities to adapt to emerging changes in higher education. Exams, seminar papers, and bachelor or master theses are the assessment formats mainly concerned about.

In summary, we have eight recommendations for lecturers regarding assessments, as summarized in Figure 11. In the following, we detail these recommendations.

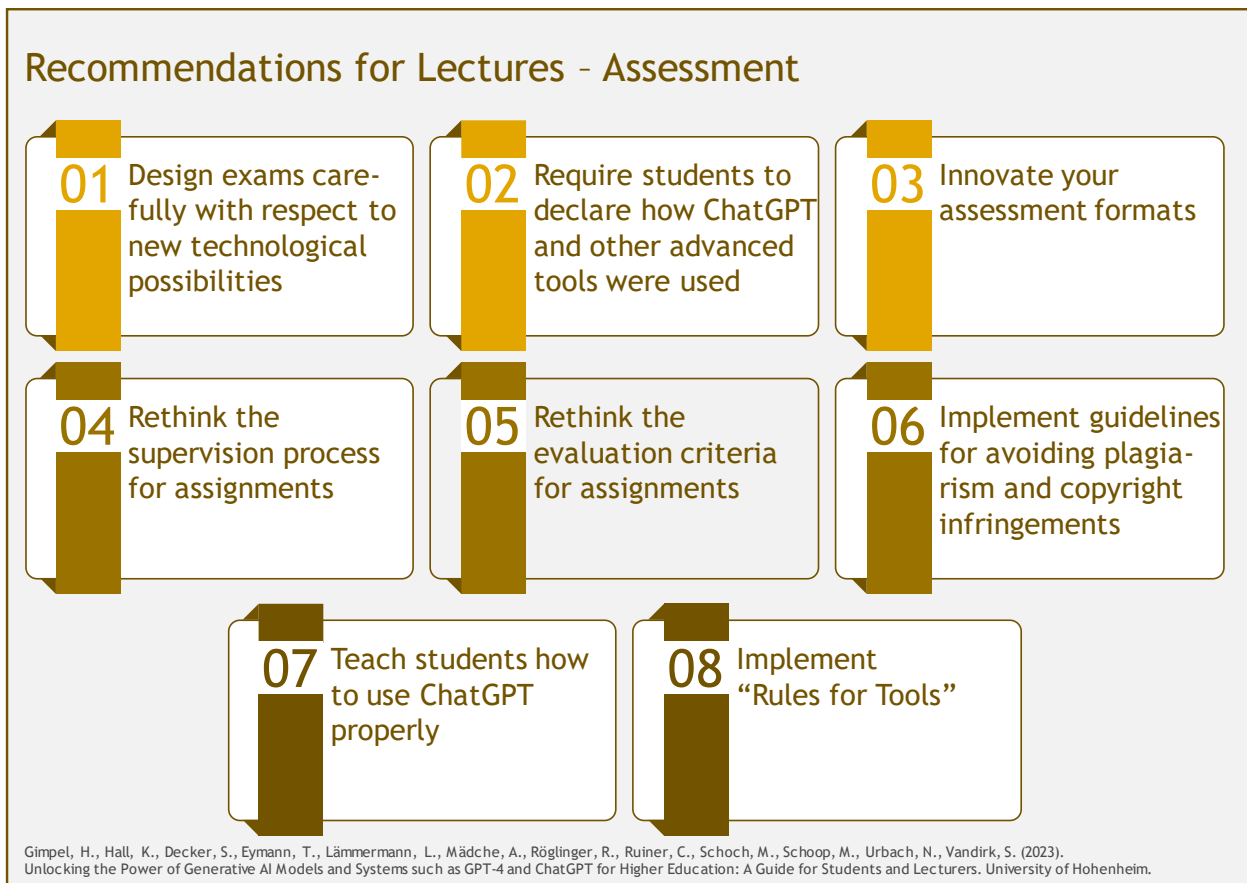


Figure 11. Summary of recommendations for lecturers regarding assessments

Recommendation 1: Design exams carefully with respect to new technological possibilities

Closed book exams, where the students write by hand, using only pen and paper, or using a computer in a controlled environment and a kiosk mode without Internet access, might be the easiest way to test the student's knowledge in the future. ChatGPT is no more of a threat to the assessment process in such a setting than traditional paper-based cheat sheets. However, such an assessment approach might be antiquated since students acquire much knowledge shortly before the exam that is subsequently forgotten.

Thus, we notice a trend in higher education, not least driven by the Covid-19 pandemic, from "pen-and-paper-only" exams to "open exams" or "take at-home exams". When creating open exams where technical aids are also allowed, care should be taken to test the exam questions in advance with ChatGPT. In case of excellent results, the questions should be discarded; in case of not good results, "regenerate" if there is still room for improvement, keep the question. The following are additional items to consider when administering exams that can help prevent student misconduct (Koenders & Prins, 2023).

- Ask for personal reflection in your exam.
- Focus your exam questions on very recent events. ChatGPT, in its current version, was trained on data up to September 2021. Thus, it is not informative on more recent events.
- State on the exam which tools are allowed (e.g., Stata) and which are not (e.g., ChatGPT).

All these suggestions have limitations. Assessing the correctness or quality of personal reflections takes much work and is only possible to a certain degree. It is easy to foresee that their limits not

being up-to-date will be annulled in the future with continuous updates of the models or integration of Internet search and language models. Despite these limitations, the general recommendation to critically rethink exams in light of generative AI remains.

Recommendation 2: Require students to declare how ChatGPT and other advanced tools were used

Monitoring which tools are used in a take-home exam is impossible, and not all students might be truthful. However, explicit declarations about whether special tools were used or not increase the binding nature and the consequences in case of misconduct, as is also standard practice in declarations of independence in, for example, theses.

Cambridge University Press and other publishers have already implemented guidelines that require authors to disclose their use of AI-based tools, such as ChatGPT, when writing articles. The publisher has announced that these guidelines protect authors who wish to utilize ChatGPT and similar AI-based programs, encouraging them to do so (Forschung & Lehre, 2023). Hence, we suggest that universities develop such declarations of independence that explicitly address the usage of generative AI tools. At best, such declarations are not binary regarding using tools such as ChatGPT (e.g., “I used ChatGPT”) but are differentiated like author contribution statements in some academic journals. The statements should highlight which steps in the research and writing process ChatGPT and other tools were used for (e.g., developing an outline or proofreading). Further, such declarations should include a statement of student responsibility regarding potential errors, copyright violations, or plagiarism that technical tools inserted in their work.

Further, lectures might require students to provide a list of prompts used. Even further, they might require students to provide a full transcript of the conversations with ChatGPT that informed the student’s work. Browser plug-ins exist that allow to export and share a conversation with ChatGPT.

Recommendation 3: Innovate your assessment formats

ChatGPT has raised many concerns about its potential to undermine the effectiveness of assignments as an assessment method. This concern has been present since the early days of its implementation. ChatGPT has the potential to be a significant innovation in higher education by enabling lecturers to use assessment as a tool for their teaching. However, few lecturers currently possess the necessary skills, making AI a potential educational milestone to take the assessment as a learning (Earl, 2012). One possibility to innovate assessment formats arises from the fact that ChatGPT has a restricted capacity for creativity. ChatGPT is trained on specific patterns and existing text, limiting its ability to generate original content or ideas. As a result, ChatGPT can only replicate what it has been trained on and what already exists and needs to be more capable of thinking creatively (Susnjak, 2022). Consequently, there is potential for lecturers to explore innovative assessment formats that demand thinking beyond traditional boundaries. These assessment formats could lead to new outcomes through students’ creative linking of topics.

Therefore, our recommendation is to steer clear of standardized assessments that could quickly be completed by a computer, as suggested by Herman (2022), and instead design assessments that promote students’ abilities to think creatively and critically, as advocated by Brookfield et al. (2019). Here are some examples to innovate your assessment formats:

- Administer specific assessments only during class (Rudolph et al., 2023).
- Encourage oral presentations to assess students’ public speaking skills, as well as their understanding of the material (McCormack, 2023).

- Encourage collaborative group projects where students work in small teams to complete a specific task or project (McCormack, 2023).
- Promote critical thinking by requiring students to reflect on their learning through written or oral reflection.
- Let students prepare other forms of materials, for example, webpages, videos, and animations that express critical thinking (McCormack, 2023).

None of these formats is a silver bullet. In one form or the other, they favor students being able to participate in person in the classroom, deal well with high time pressure, or have good oral communication skills. Assessing individual contributions in group work is challenging, as is evaluating individual reflections. Further, ChatGPT and other AI tools can also support creating webpages, videos, and animations. Nevertheless, lectures should consider innovating their assessment formats in light of students' ability to use generative AI tools and in light of the potentially changes learning goals to account for the diffusion of generative AI tools. In changing the assessment formats, lecturers must consider the time required for the assessments. Potentially, the staffing needs to be increased to allow for meaningful assessments.

Recommendation 4: Rethink the supervision process for assignments

Since ChatGPT is particularly good at formulating text, it is almost impossible to detect whether AI or students wrote specific text passages of assignments. Thus, we encourage teachers to emphasize the supervision process more than the written assignment. Thus, teachers can better evaluate how the assignment was created and whether students acquire specific expertise during the creation process. We thus align with the suggestions of Frölich-Steffen (2023) and propose to consider the following steps:

- No assignments without supervision process.
- Require information on work steps during the process.
- Place significant emphasis on study design and the careful execution of the study in empirical works.
- Require the use of ChatGPT as a work step including a clear indication of what ChatGPT was used for.
- If possible, add a presentation and oral defense of the results, as this shows how far the student has mastered the contents.

As with recommendation 3 above, improving the supervision process might require additional time and, thus, staffing.

Recommendation 5: Rethink the evaluation criteria for assignments

Given AI tools' exceptional ability to generate and compose a text, higher education must establish novel assessment criteria that surpass the mere formulation of text for evaluating assignments. Although ChatGPT occasionally makes mistakes in its content, its writing is often convincing. Therefore, students can assess the content of the text while placing less emphasis on the structure and writing style, which are areas where language models tend to excel. Hence, the following evaluation criteria should be considered more seriously in cases where ChatGPT is not explicitly forbidden (Frölich-Steffen, 2023).

- Quality and individuality of the research question as well as fit to the assigned topic
- Quality of the theoretical background, including proper references
- Coherence of the presentation

- Alignment of the research question, theories used, methods used, and results
- Unique (theoretical, empirical, or technical) contributions beyond summarizing literature
- Inclusion of personal reflections, such as a learning log or personal statement

Recommendation 6: Implement guidelines for avoiding plagiarism and copyright infringements

One of the most significant challenges in higher education will be detecting plagiarism. In 2000, The Guardian warned of a "plagiarism epidemic" and raised concerns that Google, Wikipedia, and Co. will make students "stupid." Over 20 years later, we all know that none of these technology-driven developments made students stupid but brought innovations to higher education's teaching and learning process. However, with easy access to electronic texts at a massive scale, plagiarism became easier (e.g., copy & paste). Many universities use plagiarism detection software that matches a newly submitted text against previously known texts to fight that. This is good for detecting blunt, direct plagiarism.

Recent advancements in automatic translations and large language models ease the task of wrongdoers and complicate plagiarism detection. Automated translations (e.g., using tools such as DeepL or Google Translate) of preexisting texts into the language of the assignment evades direct text comparison. For some years, some students have used translation chains to paraphrase text. An example: You take an English text from literature, and automatically translate it to German, then to Spanish, then to Russian, and back to English. Even within a single service, the resulting text paraphrases the original. The discrepancy between original and paraphrased text likely increases when switching between translation services. This task could be more convenient for students. Large language models such as ChatGPT – unfortunately – ease this task. Students may, for example, prompt ChatGPT, "Please paraphrase the following text: "Even if not direct but paraphrased: If the source is not credited, this is plagiarism. However, it is more difficult to detect.

A more fundamental concern regarding plagiarism is whether ChatGPT might provide it without disclosing it or the user noticing it. ChatGPT was trained on pre-existing texts and learned typical flows of text. It can quickly happen that text generated by ChatGPT is in parts identical to pre-existing text. With human writers, it can happen by chance that one writer produces a short piece of text fully independent of the other, just by chance. However, with language models trained on the text and then reproducing some of that text, this is not by chance a type of plagiarism. Likely, this will not recreate large portions of a single text but may lead to what is known as patchwork plagiarism or mosaic plagiarism, where multiple different sources are interwoven without adequately referencing them. Further, ChatGPT is accused of copyright infringements. Thus, copying text generated by ChatGPT into a document one drafts puts one at risk of plagiarism and copyright infringement. Responsibility for such violations of legal regulations or good scientific practice lies with the human author(s) of a work (arXiv, 2023). Even if one might argue that this is accidental plagiarism from the users' perspective, users of tools such as ChatGPT should be aware of the risks and not be negligent. A new legal framework called "learningright" is already being discussed as an alternative to "copyright" (Malone, 2023). This legal concept aims to balance the need to protect creators' intellectual property rights while still allowing AI systems to learn from and build upon existing knowledge. This responsibility of the human user relates not only to plagiarism and copyright infringement but also to "biased content, errors, mistakes, incorrect references, or misleading content" (arXiv, 2023).

Lecturers should inform their students about the risks and their responsibility for texts they submit under their names. Further, to prevent plagiarism, lecturers can implement guidelines to encourage students to deal responsibly with literature sources, for example, by forcing them to provide detailed notes or screenshots/photos of the literature base (Frölich-Steffen, 2023). In summary, the handling of plagiarism should be consistent with the regulations of the university policy and their guidelines.

Finally, some consider the use of text generated by ChatGPT as plagiarism, as not the student developed the text, but someone else, namely ChatGPT. Instead, we take the perspective that using ChatGPT and other tools is not a problem per se. However, using advanced tools such as ChatGPT requires transparency on tool use. Various “ChatGPT Content Detectors” or “AI Content Detectors” are already available to distinguish between human-written and machine-written text. Like plagiarism detection software, they analyze text, highlight dubious sections (in this case, likely computer generated), and typically provide a percent value of how much of the text is computer generated or how likely it is computer generated. Currently, these detectors are far from perfect. They will improve in the future just like other systems try to avoid correct classifications. These imperfect content detector tools may be used to check the plausibility of the students’ disclosure.

Recommendation 7: Teach students how to use ChatGPT properly

Incorporating AI tools such as ChatGPT in higher education is not merely a threat to conventional assessment methods but can also aid in enhancing students’ academic performance. As not all learners possess strong writing skills or might encounter linguistic obstacles, utilizing large language models such as ChatGPT can promote equity and fairness in the educational setting. By providing learners with a tool to generate well-composed texts, students can demonstrate their knowledge and comprehension of a subject matter rather than being handicapped by writing deficiencies or language barriers. Therefore, AI technology can be pivotal in promoting inclusivity and excellence in higher education.

Although AI can assist in creating substantial and insightful content, it is not a simple task and demands proficiency in both technical skills and knowledge of ethical considerations. Students need to be made aware of, for instance, stereotypical ChatGPT answers. As ChatGPT is trained on a large dataset of text, it is very likely that the data used to train ChatGPT may contain societal biases (Dahmen et al., 2023). Consequently, the model will reflect these biases in the output data and, thus, reinforce existing societal issues and discrimination (Atlas, 2023). Therefore, when using ChatGPT in higher education, students should be aware of this potential bias and critically reflect on each statement created by ChatGPT.

Further issues of copyright and intellectual property need to be discussed with students. The media recently reported that leading AI developers such as Microsoft, OpenAI, StabilityAI, and Midjourney are increasingly facing lawsuits over alleged copyright infringement in their programs’ outputs and the data they are trained on (Wiggers, 2023). Students and lecturers who reuse AI-generated texts or other content risk infringing the original authors’ copyright if the AI was trained on data and information subject to copyright, leading to incalculable legal consequences.

To help students master the use of AI, lecturers can redefine their curriculum and, thus, explicitly teach the use of AI. This may include:

- Include subject-specific reflection on the impact of AI into the curriculum.
- Develop study programs focused on AI in science, ethical implications of AI use, and knowledge creation through AI systems.
- Redefine core competencies in classes and reflect on what should be tested within each subject.

Recommendation 8: Implement “Rules for Tools”

AI tools such as ChatGPT have immense potential for uncovering novel approaches to pedagogy. Nonetheless, while proficiently generating plausible information, AI risks disseminating false data, fabricated quotes, inaccurate information, plagiarism, and the like. Learners must possess adequate knowledge of the subject under scrutiny to achieve satisfactory outcomes. Establishing a transparent policy governing AI implementation in higher education represents a crucial stride toward fostering a learning setting wherein AI is embraced with accountability and candor. Thereby, “Rules for Tools” can help build an AI policy (Spannagel, 2023). Based on Spannagel (2023) and in line with what we describe in other parts of this whitepaper, rules for tools may include:

- In general, students may use all types of media and tools, with the use of said tools subject to the course requirements.
- Students are accountable for their achievements, as AI tools, such as ChatGPT, while capable of generating well-composed texts, can still contain mistakes and violate regulations or norms.
- It is mandatory for students to report the aids used during a course, for example, listing the tools, the fields of application of these tools, and recording, for example, the prompts when using AI tools such as ChatGPT.
- Exceptions can be made to the rules outlined, such as prohibiting tools in specific learning or assessment situations, which will be communicated to the students in advance.

5. Outlook



5. Outlook

As AI becomes more prevalent in daily life, it will be impossible to ignore that students will use AI-based tools to succeed in higher education (Jacobsen, 2023). Furthermore, they should use AI tools to be productive and acquire important digital skills. Although higher education is not the fastest-moving field, it is forced to innovate its inherent educational structures as technological improvements are rapid and vast. Consequently, there is no doubt that teaching and learning will change drastically. The media coverage has mainly focused on “cheating” and how universities can put policies and procedures in place to manage “the AI problem.” We argue for a more positive view on technological advancements such as generative AI. The debate and the innovation should focus on the potential benefits of generative AI, such as improved learning, teaching, and the creation of equal opportunities for different groups of students.

On the side of technologies and generative AI systems, it is straightforward to assume further rapid developments. Ever more potent GPT-x models by OpenAI, comparable models by other vendors, more multimodal input and output to generative AI models, different interfaces to such models beyond conversational agents, and integration with other classes of IT systems are clear paths ahead. OpenAI, Microsoft, and many others in academia and industry are working in these directions. Hence, what we see with the current version of ChatGPT is likely only the first small step on a big road towards increasingly powerful generative AI tools in higher education and beyond.

Conversational agents are an essential resource that lecturers and students can and should use in teaching and learning already today. However, innovating teaching, assessing, and learning is only one field in a more complex higher educational landscape. As the technology develops, the potential of generative AI goes beyond the “teaching-learning trifecta” between students, lecturers, and technical tools. It will transform the entire student lifecycle, including admissions, enrollment, career services, and further areas of higher education management, as exemplified in Figure 12.

The easy access and fast dissemination of ChatGPT, along with the associated challenges in learning, assessing, and teaching, have shown how quickly traditional patterns can be disrupted by technology. As we deliberately focus on the impact of ChatGPT and related tools on teaching and learning in this whitepaper, we consciously exclude other parts of higher education. However, we believe that we should seize the opportunity presented by technological developments in AI to rethink the world of higher education as a whole. In this context, we should be aware that ChatGPT may change the expectations of future AI technologies, especially conversational agents, whether in terms of interaction or information quality.

On a macro level, universities must watch out for potential social inequality when tools such as ChatGPT are only available for a service fee. On the other hand, we should not expect that every IT-based service provided via the Internet is for free. From a societal perspective, it is crucial to ensure that all students can access the same tools and resources to complete their education successfully. However, it is uncertain how long a free version of ChatGPT will be available. In addition to the free version of ChatGPT, OpenAI released the premium version – ChatGPT Plus – for 20 USD per month (OpenAI, 2023c). It promises improved availability, unrestricted usage, and access to GPT-4. As this new AI model boasts advantages over its predecessor, GPT3.5, we conclude that users who can afford the premium version will enjoy advantages in utilizing ChatGPT. Thus, it is questionable whether this premium version's availability is already compromising the principle of equal opportunities for all students.

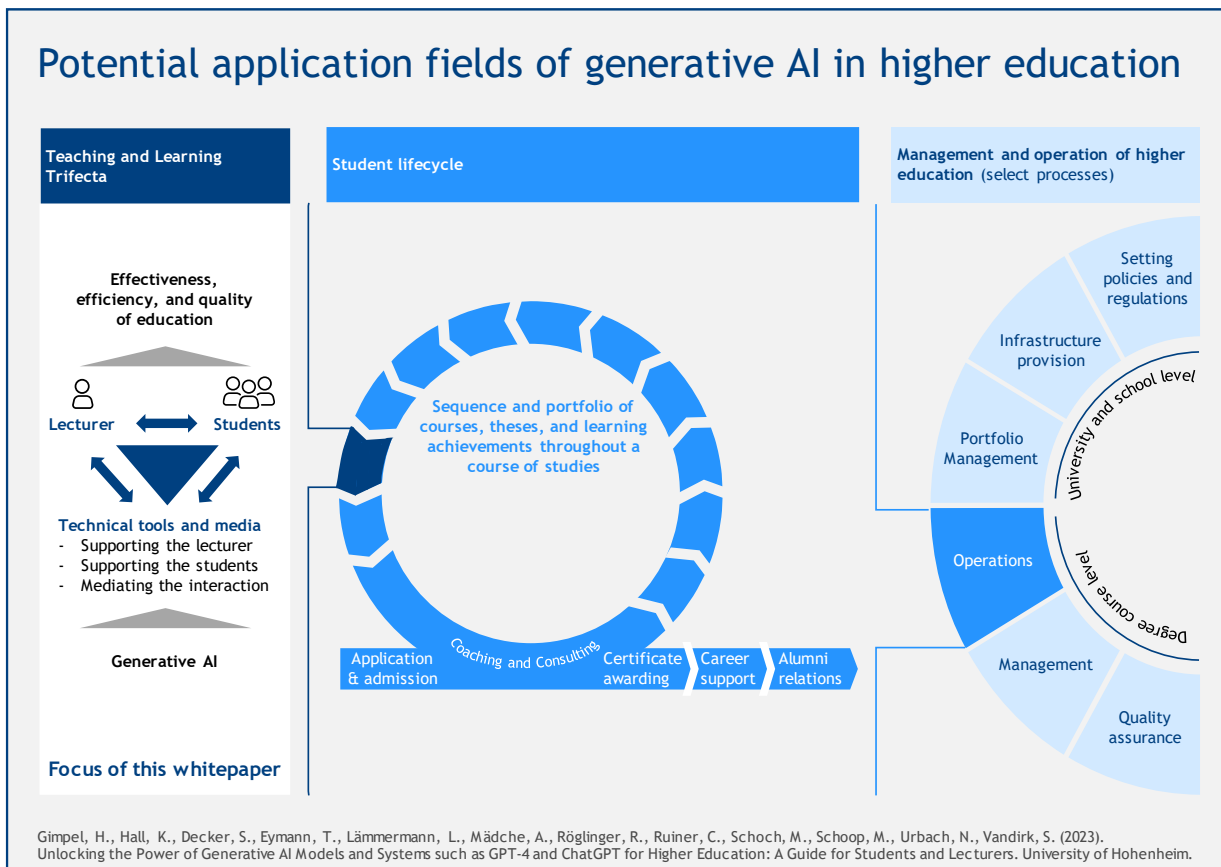


Figure 12. Potential application fields of generative AI in higher education

To ensure equal access to education, universities might consider providing fee-based tools, such as the premium version of ChatGPT, free of charge or at a significantly reduced rate for students. This may require substantial financial funds for the campus license. With ChatGPT Plus at 20 USD per month before academic discounts, the monthly fees for a university of 10.000 students might add up to 200.000 USD, summing up yearly to over 2,4 million USD. With a growing number of necessary cloud-based tools requiring license fees rather than open-source software installed on-premise in the University’s data centers, ChatGPT adds to an ongoing discussion about funding digital transformation in higher education.

Another key question beyond the individual course is which competencies students should develop in higher education. Domain-specific skills always have been important and remain important. From our point of view, transferable skills such as cognitive, metacognitive, and socio-emotional skills as well as digital skills are becoming increasingly important. These skills include logical reasoning, structured and critical thinking, problem-solving, collaboration, and emotion regulation. Not least, students should have the ability to develop and use AI-based tools responsibly. Such skills will help students succeed in an interconnected and fast-paced digital world. Students will succeed in an interconnected and fast-paced digital world. Aoun (2018) describes the necessary mindset as “robot-proof,” focusing on unique cognitive human capabilities like critical thinking, systems thinking, entrepreneurship, and cultural agility.

As generative AI continues to advance, it is crucial to explore how it impacts the development of these skills in higher education. With AI’s ability to generate and provide information, there is a risk that students may become passive recipients of information rather than active thinkers. For instance, to ensure that critical thinking remains an essential education component, higher education must actively develop strategies to foster critical thinking in their classes. Thus, expanding the current curriculum by including lectures on how AI can be used to support critical thinking is crucial. Higher

education must incorporate tasks and activities that promote critical thinking and develop assessment methods that measure the student's development of critical thinking skills in the context of generative AI. Ultimately, the challenge is to ensure that students continue to develop the skills they need to make informed decisions and solve complex problems in a world where AI is increasingly prevalent, as these skills are highly appreciated in the business context and highly needed in society.

The focus of this whitepaper is on students and lecturers. Nevertheless, we see a clear need for action beyond the level of individual students and lecturers. Universities should encourage broad, multi-perspective dialogue among many stakeholders in higher education.

- They should include all faculties and disciplines since different fields have different traditions, requirements, and opportunities, which should be reflected in any university's approach to generative AI.
- They should involve their own experts from information systems, computer science, data science, and related disciplines, who have been researching IT-based innovations and digital transformation for years and decades and, in many cases, also research generative AI. They can contribute to the knowledge of the technologies and the transformation process and have first-hand experience in teaching at their university.
- They should involve their career centers and representatives from industry and society to inform the dialogue with perspectives on the required educational profiles and skills.
- They should involve students who contribute their perspectives on learning objectives, formats, and study conditions.
- They should involve experts on university didactics, who bring important perspectives on learning objectives, teaching-learning formats, assessments, and the like.
- They should involve legal experts to examine the legal possibilities offered by the current legislation and university regulations and the changes required to make the desired use of generative AI tools possible and legally sound.
- They should involve the university's divisions that administrate study and teaching. These are important to the processes that should deliver fair, efficient, and high-quality teaching.
- They should involve the university's IT department, which can consult on access, infrastructure, licenses, IT security, and the like.

Together with all these stakeholders, universities should engage in a dialogue on how to promote and leverage ChatGPT in the short term and other generative AI tools in the medium term. The results of the dialogue should lead to multi-perspective insights that result in regulations, guidelines, handouts, tutorials, and implementations. If appropriate, it may be helpful to talk to external experts, exchange experiences with other universities, speak to the responsible supervisory authority and politics, and demand the necessary resources for excellent university education.

To summarize, integrating generative AI tools such as ChatGPT in higher education requires a significant educational transformation that cannot be achieved overnight. While there are plenty of ideas and discussions on managing and leveraging such tools, lecturers should first learn how ChatGPT and comparable tools operate and modify their teaching methods, contents, and processes accordingly. Additionally, changes to examination formats cannot happen immediately but rather require careful development and adaptation following examination regulations. As such, integrating ChatGPT into higher education will require patience and careful planning to ensure its successful implementation. Students should not wait for the university-level discourse to end and for the lecturers to have adapted. Instead, we suggest that students actively engage with generative AI. If they did not use ChatGPT yet, they should get a free account and gain first-hand experience with the possibilities and limits. They should reflect on their learning goals, methods, and processes and

engage with other stakeholders in higher education to shape the dialogue on AI-powered higher education.

As we call lecturers and students to action regarding ChatGPT and provide recommendations for them, it is important to stress that their use of ChatGPT should comply with legislation, university regulations, good scientific practices, and OpenAI's terms and conditions. If this is the case, this whitepaper hopefully provides food for thought regarding using generative AI, large language models such as GPT-4, and tools such as ChatGPT in higher education.

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