

## Using ChatGPT in teaching

Version: 01.02.2023



## Content

What is ChatGPT?.....	2
How does ChatGPT work? .....	2
How important is it to have a good-quality question? .....	3
What are the current limitations of ChatGPT?.....	5
How could ChatGPT be used in teaching?.....	5
What challenges should be considered when using ChatGPT in teaching?.....	7
What is the impact of ChatGPT on exams? .....	8
Further materials and readings .....	15

There's a lot of buzz surrounding the new "game-changer" in education, and it goes by the name of ChatGPT. But not everyone is thrilled as the program from OpenAI also hints at some potential challenges for universities and colleges worldwide.

In this guide, we'd like to give you a quick overview of how ChatGPT works, highlight the opportunities as well as the challenges it presents for teaching, and provide ideas and inspiration for how you can incorporate it into your teaching in a constructive way.



This work is licensed under a [Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License](https://creativecommons.org/licenses/by-nc-nd/4.0/).

## What is ChatGPT?

ChatGPT is a new artificial intelligence program, developed by OpenAI, that works like a chatbot. You can ask it questions or give it tasks, and it will give you a response. It's specifically designed to process language and uses machine learning to understand and respond to natural language. While chatbots have been around for a while, ChatGPT is a new and unique technology. The responses it gives are usually of extremely high quality - [it can even complete entire exams](#) (link is in German). And the program is (at least for now) completely free to use.

## How does ChatGPT work?

When using ChatGPT, the process can be broken down into four basic steps:

- First, the user inputs a text, also known as a "prompt," into the ChatGPT interface. This could be anything from a question to a request for information or even a casual statement. While ChatGPT is primarily used in English and provides the best results in that language, it can also be used in German, French, Spanish, Chinese and Japanese.

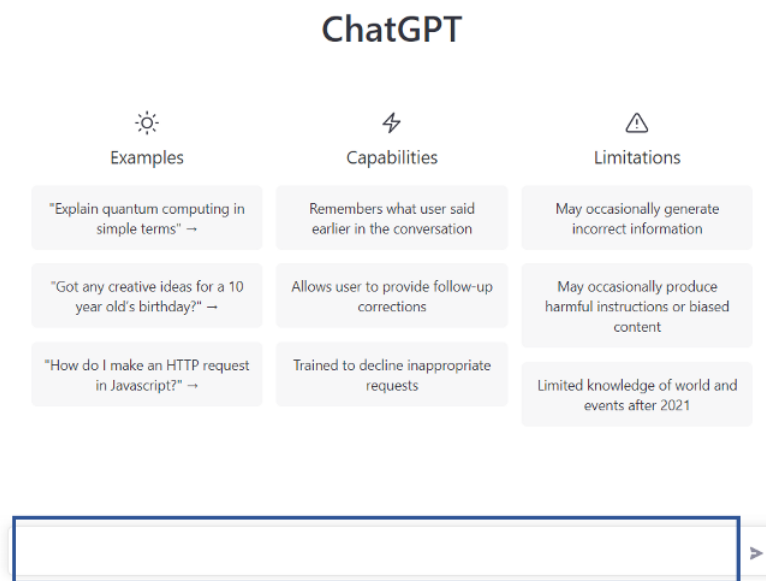


Figure 1: ChatGPT interface with input field.

- The ChatGPT system analyzes the input and uses machine learning algorithms to generate a response. It uses the patterns and structures it learned during training to create new words and sentences that resemble natural language.
- The response is then sent back to the user as text.

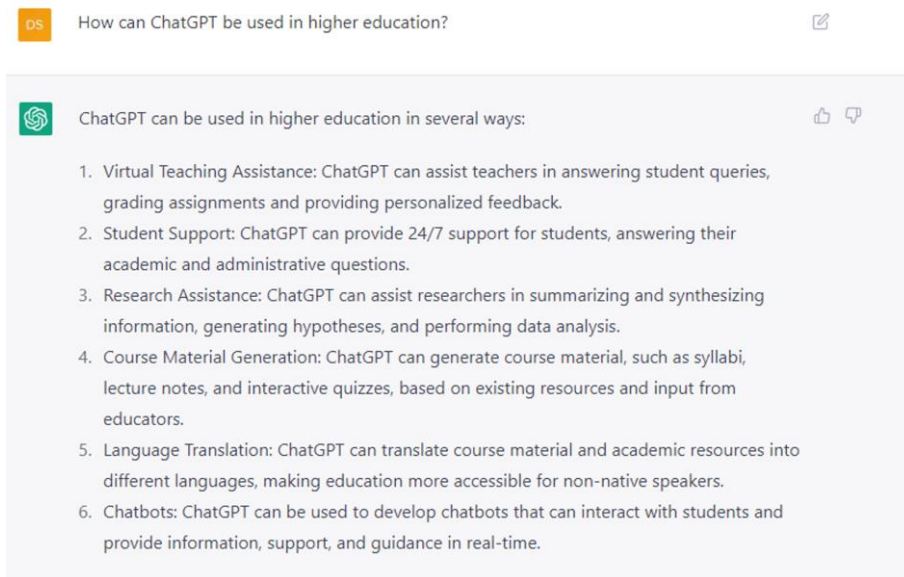


Figure 2: Chat session with ChatGPT on the question "How can ChatGPT be used in higher education teaching?"

- The user can then type in a new text or write something that builds off of the previous input and output. The ChatGPT system will then analyze and respond to this message. This process will continue until the conversation is over. We've provided an example of what a conversation with ChatGPT might look like in chapter "Examples for the use with ChatGPT".

## How important is it to have a good-quality question?

Asking the right questions is key. The more specific and clear the instructions you give to the chatbot, the better the results will be. For example, if you ask ChatGPT to write a story, the more information you provide and the more specific the task, the better it'll perform. Using the example of "Explain to me what an MRI is," we'll demonstrate in the table below how different the answers can be depending on the instructions.

*Note:* Please keep in mind that the answers provided are the original responses from ChatGPT. There may be instances where words or sentences are incomplete or incorrect. This can happen for a variety of reasons, such as issues during training, server overload, or exceeding the maximum answer length.

A helpful starting point for prompts is to begin with "Act like a [specific profession or role]..." This results in much more targeted answers from ChatGPT than they'd otherwise be with a general question. It's becoming clear that there's a growing market for good prompts that can be purchased.

[You can find ideas on how to improve the answers from ChatGPT here.](#)

Table 1: Comparison of the different questioning techniques (prompts) for the question "What is an MRI?"

What is an MRI?	Explain to my five-year-old son what an MRI is.	I'd like you to act like a university professor with knowledge in the field of nuclear physics and radiology. With that said, you should be able to explain subject matter in a way that is tailored to the target audience. Your target audience is first-semester medical students. How would you explain an MRI to them?
<p>An MRI, or magnetic resonance imaging, is a medical imaging technique that uses a magnetic field and radio waves to create detailed images of the inside of the body. It is a non-invasive and painless procedure that is commonly used to diagnose and monitor a wide range of medical conditions, including tumors, injuries, and diseases of the organs and blood vessels. MRI machines typically consist of a large cylinder-shaped magnet and a table that the patient lies on while the images are being taken.</p>	<p>An MRI is like a big camera that helps doctors take pictures of the inside of our bodies. It uses special magnets and sounds to take these pictures. Just like how you take a picture with your camera, the doctor can see inside your body and check to make sure everything is okay. It doesn't hurt and you have to lie very still on a table while the pictures are being taken. It's kind of like when you have to sit very still for a picture, but it's inside your body instead of just your face.</p>	<p>Magnetic Resonance Imaging, or MRI, is a diagnostic imaging technique that utilizes the properties of atomic nuclei to produce detailed images of internal structures of the body. This method is based on the principle of nuclear magnetic resonance (NMR) which is the absorption and emission of electromagnetic radiation by the nuclei of certain atoms, such as hydrogen, when they are placed in a magnetic field.</p> <p>In an MRI machine, a large magnetic field is created by superconducting coils, and the patient is placed inside the bore of the magnet. The magnetic field causes the hydrogen nuclei in the body to align themselves with the magnetic field, and they are then subjected to a radiofrequency pulse that causes them to emit a signal. This signal is then detected by the MRI machine and used to create an image of the body.</p> <p>One of the most significant advantages of MRI over other imaging techniques is its ability to produce high-resolution images without the use of ionizing radiation, unlike X-ray or CT scans. Additionally, MRI allows for the acquisition of images in any plane, and it can be used to image a wide range of soft tissue structures, including the brain, spinal cord, muscles, tendons, ligaments, and blood vessels.</p> <p>It's worth to mention that MRI is a non-invasive technique, which means that it doesn't require any surgical procedures to be performed, and it doesn't cause any pain. However, it is not suitable for everyone, particularly for people with pacemakers, aneurysm clips, or other metal implants, which can be affected by the magnetic field.</p> <p>Overall, MRI is a powerful diagnostic tool that plays a vital role in the diagnosis and management of many medical conditions, and as a medical student, it is crucial to understand the principles and applications of this technology.</p>

## What are the current limitations of ChatGPT?

Despite all the excitement around ChatGPT, it's important to keep in mind that it still has its limitations. The emphasis here is clearly on "still." Since we're talking about artificial intelligence, it's only a matter of time before these limitations will be pushed further and further.

- The program was trained with data up until 2021, so the AI isn't aware of any knowledge or developments after that point.
- Another limitation is when the program is unsure of an answer. Instead of saying "I'm sorry, I can't provide an answer" like other algorithms, this new AI will always give a response. The question is whether it's correct. The chatbot is skilled at inventing things and providing information that seems logical at first glance. This is a significant challenge that you and your students should be aware of and discuss. We'd recommend always double-checking the written material.
- ChatGPT is also purely text-based. It can only process and produce text. This can lead to confusion as it may offer to create videos and images, for example, even though it's not able to do that yet. But what it can do is generate a "script" for a video for you.
- Keep in mind that errors can also slip into the text, primarily in the form of incomplete words or sentences. This can be partly due to OpenAI's server overload. ChatGPT also cites data bias, limited knowledge, and faulty training as additional reasons for the errors or interruptions.
- If you ask ChatGPT to generate text for you, you may notice some word repetition. If you'd like a more varied text structure with fewer repetitions, we'd recommend that you look over the text again.
- Additionally, issues have come up with literature reviews or research on different topics. Here, too, the bot may invent literature and list them as sources that don't actually exist.
- It's also worth considering that when using ChatGPT to gather arguments, the program isn't able to prioritize them. It simply lists pros and cons when asked. This could lead to a key argument (perhaps crucial in a debate) being overlooked or perceived as only a minor point.

Interestingly, the question of "Give examples from your personal experience" or something similar is no longer a limitation - as was the case a few weeks ago. Here, ChatGPT points out that it's an AI and doesn't have its own experiences, but it can provide examples of experiences that humans may have.

It's important to keep these limitations in mind when working with ChatGPT. Particularly in teaching, it might be tempting to use it to generate lecture content and scripts, but it isn't possible (at least not yet). Nonetheless, there are already many ways to integrate ChatGPT into your teaching and use it to support you in the classroom. In the following section, we'll give you a number of ideas on how you can get started.

## How could ChatGPT be used in teaching?

If ChatGPT is seen as an opportunity for use in university teaching, a whole new field of design possibilities opens up: Whether specifically for designing courses, for accompanying the learning process, or generally for new competencies that become relevant and learnable for students, the possible applications are diverse.

We asked ChatGPT about its possible uses in teaching. We have included more ideas for implementation and elaborated an example of how you can work out ideas together with ChatGPT in a concrete way. These you will find in chapter “Examples for working with ChatGPT”.

- Some examples include supporting students' self-learning activities by providing them with learning materials and resources, helping students plan and monitor their learning, and encouraging them to learn more about the topics covered.

*You can find a concrete example how to use ChatGPT as a learning guide in Chapter “Concrete examples for use in university teaching – 1. Use as a learning guide.”*

- Another area of application is in formative assessment. ChatGPT can be used to survey students during the learning process to monitor their progress and provide them with targeted feedback. In this way, instructors can quickly identify where students are struggling and provide targeted intervention.

*You will find a concrete example of a quiz in Chapter “Concrete examples for use in university teaching – 2. Quiz on Maxwell's equations.”*

- Another example is the creation of interactive learning games and exercises that can increase student motivation and support content delivery. ChatGPT can also be used to create personalized learning plans for students by analyzing their individual strengths and weaknesses and providing targeted learning recommendations.

*An example of how ChatGPT can be used to create interactive simulations can be found in Chapter “Concrete examples for use in university teaching – 3. Create interactive simulations.”*

- Another area of application is the support of project work, in that ChatGPT assists students in the planning, execution and presentation of their projects. ChatGPT can also facilitate the creation of multimedia content, such as videos or audios, to make university teaching content more vivid and interactive.

*A concrete example of a presentation outline can be found in Chapter “Concrete examples for use in university teaching – Outline of a presentation on storytelling with data”.*

- An absolute strength of ChatGPT is the creation of code and the handling of programming languages. This could completely revolutionize practical formats where program codes are to be created. For example, ChatGPT can output code with explanations. The interesting aspect once more is what prompts to use to get a working code.

*An example of how such a coding task could look like and the output of ChatGPT for it can be found in Chapter “Concrete examples for use in university teaching – Code in R for binomial distribution”.*

The examples show that ChatGPT can be used directly by teachers and can lead to inspiration and time savings. On the other hand, students can also use ChatGPT to support their learning process or to use the chatbot as a peer, proofreader or brainstorming partner.

## What challenges should be considered when using ChatGPT in teaching?

There are some challenges that should be taken into consideration when using ChatGPT in higher education.

- One of the biggest challenges is teaching customization. ChatGPT can create materials and content at the click of a button that would take instructors and students hours, days, or even weeks. It is important to ask: what competencies do students really need to acquire, how can I make sure that students have actually acquired the competency and ChatGPT has not solved the task for them?
- Students also need to be made aware of the limitations of ChatGPT. What is a responsible use of this new tool? How do I handle the content generated?
- Following on from this, an important challenge is ensuring the quality of the content generated. As described with the limits, the bot is quite capable of inventing content. This can look like ChatGPT citing or listing invented literature. Or in summaries, e.g. of books, things are added. Therefore, it is essential that the generated content is not taken over without control. We strongly recommend that you, as a teacher, check the content for various criteria (correctness, relevance and methodical meaningfulness) and adjust it if necessary.
- Closely related to this is that the processes of how ChatGPT generates content take place in a kind of "black box". Thus, it is practically impossible to check where this information exactly comes from. If we look at our MRT example and ask where ChatGPT got the information from, we get the following answer:

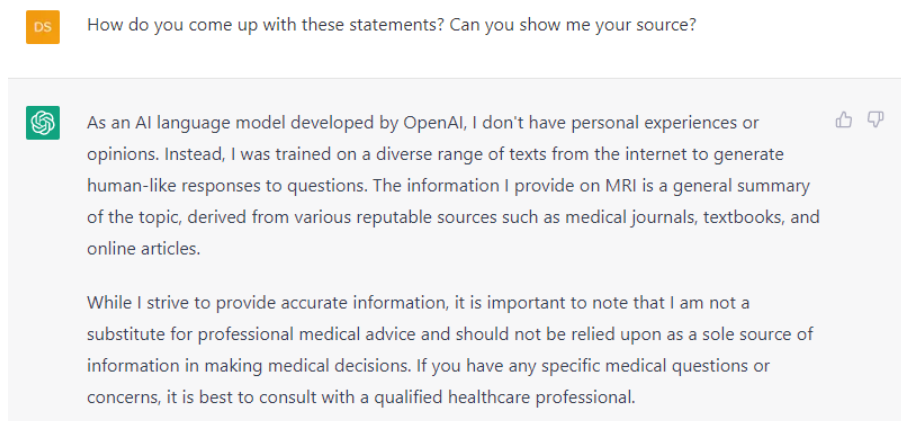


Figure 3: Excerpt from chat session with ChatGPT on its sources for the responses in Table 1 "What is an MRI?"

- The chatbot's response shows that it is difficult to verify the results because it does not indicate the specific sources. This should definitely be taken into account for the deployment.
- Another point is that the quality of the answer depends on the training datasets of the artificial intelligence. This can lead to the program having a bias and prejudices on certain topics. This is evident when ChatGPT asks you for opinions. The bot may or may not respond to this for political opinions or critical topics, but this is (unfortunately) relatively easy to work around.
- Additionally, privacy and data security aspects should be considered, as ChatGPT accesses large amounts of data. Therefore, sensitive data should not be entered into ChatGPT. It is also not yet clear, for example, what the copyright situation is for use in theses. For this you should sensitize your students in any case, because it sounds tempting to have whole theses written by ChatGPT.

## What is the impact of ChatGPT on exams?

The development of ChatGPT also has a great impact on the way summative exams are designed. Unsupervised exams, for example, could be answered quite well with the help of the chatbot without having learned anything for the exam.

Two different approaches to dealing with ChatGPT on exams are primarily conceivable:

- Control: ban ChatGPT, more plagiarism checking, more restrictions and sanctions.
- Integration: Use ChatGPT as a tool, make it a part of the exam and work with it concretely.

The control approach quickly reaches its limits. It is true that there is software that indicates how high the probability is that the text at hand was written with an AI. But even this can be easily tricked and cannot be brought forward as a recognized plagiarism check in case of suspicion. Therefore, design exams with content that is significant or interesting enough to students that they do not feel the need to use ChatGPT. You can also - where permitted by examination law - extend written examinations to include the examination of a behavioral aspect or some kind of oral examination. Thus, the mere use of ChatGPT is not sufficient to achieve a very good grade. Students must be able to explain or apply what they have worked on. In general, it can be assumed that creative, competence-oriented and communicative forms of examination are less affected by the new possibilities opened up by ChatGPT.

The approach to accept and integrate ChatGPT is promising. First ideas and thoughts on this would be:


- Use ChatGPT yourself to have exam questions generated. Check the ideas for usefulness and fit to your intended learning outcomes.
- Allow ChatGPT for special use scenarios such as a structuring aid or for proofreading.
- Create assignments in the exam where students are asked to figure out what is a good prompt for a specific question and have students explain how they went about it.
- Have students generate multiple answers from ChatGPT for the same question and rate them on their quality. Which answer is better and why? What distinguishes a good answer from a very good one? Here, students should again refer to concepts and theories from the course.
- Basically, we recommend as soon as you allow ChatGPT as a tool: Advise your students that they must later cite the use of ChatGPT and the prompts they used as a source.




## Examples of uses of ChatGPT

### Chat-Conversation with ChatGPT

We talked to ChatGPT to give us ideas about what the program means by itself, how it can support lecturers in university teaching.

 Act like an expert in higher education didactics. You have all the information about lecture design, didactic methods, knowledge of teaching and learning psychology, and formative assessment. Give me ten ideas on how ChatGPT could be used in higher education teaching.

- 
1. Interactive quizzes: Utilize ChatGPT's natural language processing to create interactive quizzes for students, helping them assess their understanding of course material.
  2. Personalized learning: Have ChatGPT adapt the pace and content of a lesson based on student feedback, creating a personalized learning experience.
  3. Knowledge verification: Use ChatGPT to assess student's understanding of course content, providing real-time feedback on their progress.
  4. Study material: Provide students with concise, personalized study materials based on their individual learning needs, generated by ChatGPT.
  5. Essay grading: Train ChatGPT on specific essay topics to grade student essays and provide formative feedback.
  6. Question answering: Allow students to ask ChatGPT questions about course material, receiving a prompt and accurate response.
  7. Group discussions: Facilitate group discussions by having ChatGPT facilitate conversations and keep track of key points.
  8. Class simulations: Use ChatGPT to create realistic simulations and scenarios for students to apply their knowledge and understanding.
  9. Gamification: Incorporate game-based elements in learning activities, using ChatGPT to generate challenges and rewards for student engagement.
  10. Virtual tutoring: Offer virtual tutoring sessions using ChatGPT to provide students with real-time support and feedback.

*Figure 4: Excerpt from chat session with ChatGPT on "10 uses of ChatGPT in teaching."*

With such an answer it is of course obvious that it would not yet be concrete enough to really implement it. We want to show you an example how a conversation with ChatGPT can look like to get a very concrete implementation idea at the end. However, you will quickly notice that it is definitely associated with work, especially if you are dealing with the matter for the first time.

We take as an example the point "8. ChatGPT can be used as a tool to support multimedia content, such as videos or audios, to make university teaching content more vivid and interactive."

At this point, we too are curious to see what something like this might look like in concrete terms. You can use our questions as inspiration for yourself.

DS What information do you need to create incorporate game-based elements in learning activities? Sketch me in detail how this could look like at a freely chosen university didactic example.

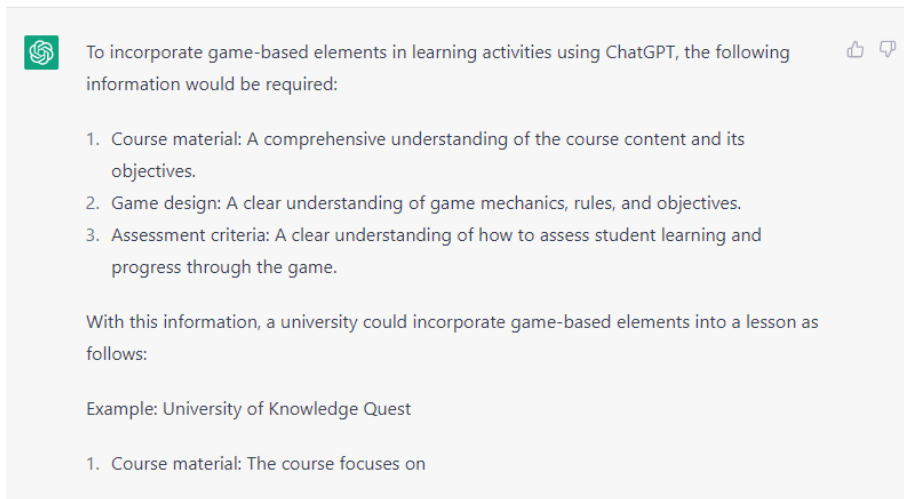


Figure 5: Excerpt from chat session with ChatGPT when asked what information it needs to create game-based elements in learning activities.

The bot terminates at this point. This happens quite regularly, especially when OpenAI's server capacities are overloaded. However, this is not a problem. We could simply continue the conversation as follows:

DS You were interrupted, can you complete your answer?

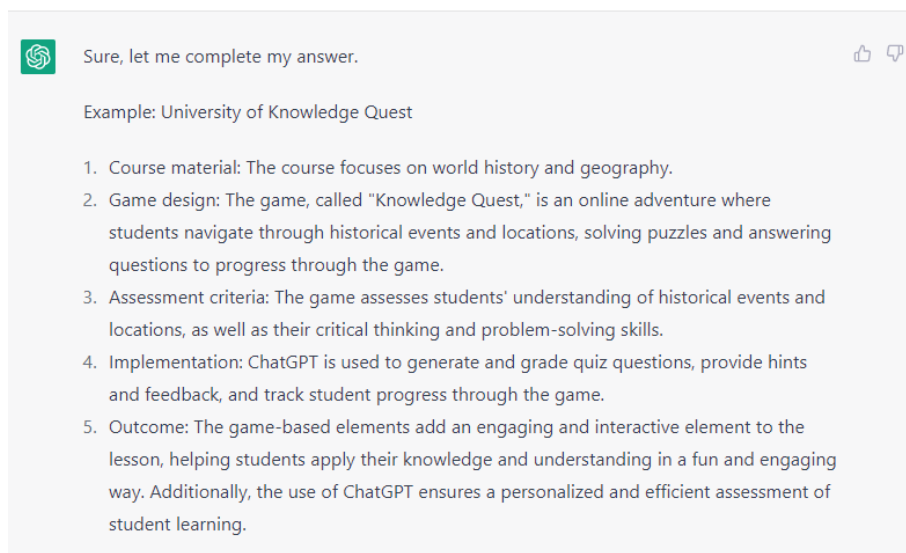


Figure 6: Excerpt from chat session with ChatGPT with request to complete the answer.

The answer was still not concrete enough for us. How should it be possible to load your own script of the lecture into ChatGPT? So we asked again (grammatical errors in the question are usually not a problem, see error in the next entry):

DS How ChatGPT can get a comprehensive understanding of my course content and its objectives.

ChatGPT can get a comprehensive understanding of course content and objectives by being trained on relevant text data, such as course materials, syllabi, lecture notes, and scholarly articles. This training process can be conducted by a teacher or instructional designer using data specifically curated for the course. The more relevant data ChatGPT is trained on, the more comprehensive its understanding of the course content and objectives will be.

Additionally, the teacher or instructional designer can provide specific instructions and guidelines to ChatGPT, such as what content to prioritize and how to present it, to further refine its understanding of the course and its objectives. This process can be iterative, with ChatGPT being fine-tuned as it's used in the course and feedback is gathered from students and the instructor.

DS How can I best provide ChatGPT with a script of my lecture?

To provide ChatGPT with a script of a lecture, it is best to format the script in a clear and organized manner, with a clear structure and well-defined sections. The following steps can help ensure the script is optimized for use with ChatGPT:

1. Outline the lecture: Start by creating an outline of the lecture, including the main topics and subtopics, and the flow of information. This will help ensure that the script is well-structured and easy for ChatGPT to understand.
2. Break down the lecture into sections: Divide the outline into clear sections, with each section containing a specific topic or subtopic. This will help ChatGPT understand the relationships between different pieces of information and how they fit together.
3. Write clear and concise sentences: Write each section of the script using clear and concise sentences, avoiding complex or technical language. ChatGPT is trained to generate concise responses, so using concise language in the script will help it respond in a similar manner.
4. Use headings and bullet points: Use headings and bullet points to highlight key points and make the information easier to understand. This will help ChatGPT identify and prioritize the most important information in the lecture.
5. Include examples and visuals: Including examples and visuals in the script, such as images, diagrams, or tables, can help reinforce the information and make it easier for ChatGPT to understand.

By following these steps, you can create a script that is optimized for use with ChatGPT, making it easier for the model to understand and generate responses based on the lecture content.

Figure 7: Excerpt from chat session with ChatGPT. We asked how you can upload your lecture transcript to ChatGPT.

As you can see, things are already getting more concrete here. For the next step, we would need to refactor our script or convert it to a suitable format and then give it to ChatGPT to process. Similarly, we would proceed with each of these described steps to ensure that we could use ChatGPT for our teaching as well. ChatGPT can only handle not too long text, so you will probably have to split your script into several parts.

Of course, ChatGPT can't create video, since it is text based. However, what ChatGPT can do is give you a "script" that you could then use to shoot a video.

## Concrete examples for use in university teaching

In this chapter, we've taken the ideas from the chapter "How could ChatGPT be used in teaching?" and made them more concrete with the help of ChatGPT. These examples are meant to serve as inspiration to show you what's possible with ChatGPT and how to craft the prompts for the best results.

### 1. Use as a learning guide

**Prompt:** How can ChatGPT plan and monitor students' self-learning activity? Outline this for me using any science topic as an example.

**Answer:**

A possible scenario could look as follows:

1. ChatGPT is used by instructors to create a list of learning objectives and content for a science topic, such as biochemistry.
2. Students are then asked to use ChatGPT to talk about their individual learning needs and styles. ChatGPT analyzes this information and then creates personalized learning plans for students.
3. Students are given access to a variety of learning materials, resources, and exercises that ChatGPT selects and delivers based on their learning plan.
4. At any time during the learning process, students can consult ChatGPT to ask questions, clear doubts, or get feedback on their progress. ChatGPT can even conduct periodic quizzes or tests to monitor students' progress.
5. At the end of the learning process, ChatGPT can ask students to complete a self-assessment to see how well they understood what they learned and what areas they may need to reinforce.
6. Instructors can then monitor the results of the self-assessments and students' progress, and provide targeted interventions when necessary.

By using ChatGPT, students' self-learning activity can be planned and monitored by allowing them to identify their individual learning needs and styles and provide learning materials and resources tailored to them.

### 2. Quiz on Maxwell's equations

**Prompt:** Act like a university professor from the field of electrical engineering. You have all the knowledge from the field of electrical engineering, physics as well as engineering didactics. In particular, you have knowledge of Bloom's learning objectives taxonomy. Create a quiz with a total of 3 questions in different taxonomy levels with four answer options each including solutions on the topic of Maxwell's equations for first semester physics students.

**Answer:**

What type of equations describe the interactions of electric and magnetic fields?

A) Ohm's equations B) Kirchhoff's equations C) Maxwell's equations D) Laplace's equations Taxonomy: Remember

What does Maxwell's equation  $\nabla \times \mathbf{E} = -\partial \mathbf{B} / \partial t$  describe?

A) the relationship between electric and magnetic fields B) the relationship between current density and voltage C) the relationship between conductivity and resistance D) the relationship between induction and magnetic field Taxonomy: Understanding

How can you derive the wave equations for electromagnetic waves from Maxwell's equations?

A) by solving the differential equations B) by transforming the integral equations C) by applying Fourier transforms D) by using calculus of variations Taxonomy: Apply

### 3. Create interactive simulations

**Prompt:** How can ChatGPT create interactive learning games and exercises? Sketch an example of this on any science topic.

**Answer:**

A possible scenario could look as follows:

1. ChatGPT is used by instructors to create a list of learning objectives and content for a science topic, such as physics.
2. Students are asked to use ChatGPT to talk about their individual learning needs and styles. ChatGPT analyzes this information and then creates personalized learning plans for students.
3. ChatGPT creates interactive learning games and exercises that are tailored to students' individual learning needs and styles to support content delivery. These learning games may include quizzes, puzzles, simulations, or other interactive elements.
4. Students can complete the learning games and exercises at their own pace and receive immediate feedback from ChatGPT on their performance.
5. ChatGPT can also administer periodic quizzes or tests to monitor student progress and provide targeted learning recommendations.
6. At the end of the learning process, ChatGPT can ask students to complete a self-assessment to see how well they understood what they learned and what areas they may need to reinforce. This gives instructors a better understanding of where students are and where they need support, and allows them to take targeted intervention actions to improve the learning process.

### 4. Outline of a presentation on storytelling with data

**Prompt:** Act like Simon Sinek (note: Simon Sinek is a gifted speaker). Create an outline for me for a presentation for the topic Storytelling with Data.

**Answer:**

- I. Introduction
  - Why is storytelling with data important?
  - What is the difference between "telling data" and "presenting data"?
- II. Understand your target group

- Who is your target group?
- What are their needs, desires and challenges?
- III. Collect the right data
  - What data is relevant to your story?
  - How can you collect and analyze this data?
- IV. Find the right story
  - What message do you want to convey?
  - What metaphor or analogy best fits your data?
- V. Design your presentation
  - How can you present your data visually?
  - How can you make your presentation interactive?
- VI. Tell your story
  - How can you structure your presentation?
  - How can you get your message across clearly and memorably?
- VII. Conclusion
  - What did you learn?
  - What should the audience do or think after seeing your presentation?

## 5. Code in R for binomial distribution

**Prompt** (Assignment from statistics): Act like a software developer. Write an R function `bincoef` that calculates  $n$  over  $k$  without using the function `choose` ( $n, k$ ). Write down the function call of the above function so that it calculates the number of possibilities to draw 6 out of 49 numbers like in a simple number lottery.

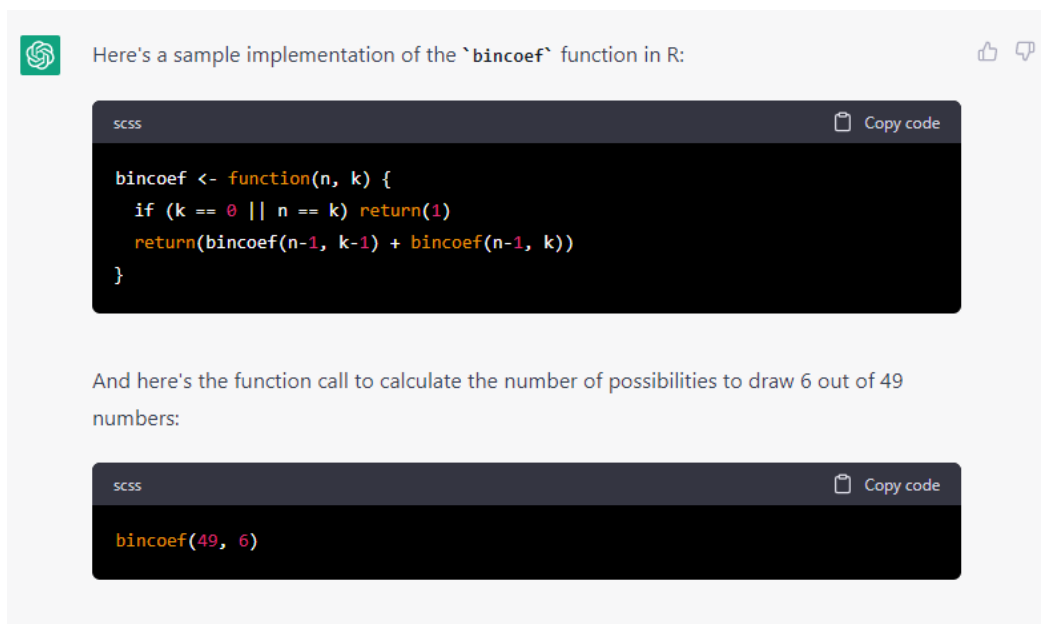


Figure 8: Excerpt from chat session with ChatGPT: Write an R function `bincoef`.

## Further materials and readings

Link to the [official page of OpenAI about ChatGPT](#)

Link to [an annotated link collection \(Hochschulforum Digitalisierung\)](#)

Video on the topic "[Teaching Philosophy in a World with ChatGPT](#)" (22:08 minutes)

Podcast on the topic "[How Artificial Intelligence is Impacting Higher Education](#)" (43:11 minutes)

If you've already had experience with ChatGPT or have any questions about this topic, please feel free to write to us at [info@prolehre.tum.de](mailto:info@prolehre.tum.de).