AI for Learning: Helping Foundation Year Students in Physical Sciences use ChatGPT Effectively

Contents

Executive summary

This project involved students, tutors and the course leadership team from the Astrophoria Foundation Year science course at the University of Oxford, to investigate the possibilities for constructive use of AI within the physical science foundation year, which could be expanded to use with undergraduate degree course material.

The key aim was to provide a guide (AI CEMS Playbook) for use with students being encouraged to explore active learning and revision using AI to enhance rather than suppress skills.

During the project methods were developed to brief and induct students (and tutors) into constructive AI use.

Contact sessions were held with tutors and students to carry out briefings, develop tools, and collect feedback.

There was initially a mix of scepticism and over-reliance on AI on the part of the students at the start of the project. By the end the cautious students had

gained confidence in using it constructively to improve their knowledge and skills, and the over-reliant ones had become more aware of the pitfalls of letting AI block their own skills development, and all students were more aware of the practical issues involved with using AI for learning.

Key project outcomes

- A form of training/induction was developed for use with science undergraduate students.
- Three ChatGPT-based methods were developed for students in the physical sciences to help them use AI for active learning and self-testing.
- A written guide to how to use AI to aid learning and skills development (the CEMS AI Playbook) was produced and used with five Astrophoria Foundation Year science students, being published to them on Canvas after an introductory workshop.
- Feedback was gathered from the students during two workshops held with them, at different stages in the Astrophoria year.
- A hackathon was held to engage with tutors on the course and determine how AI use by them or for their students could improve FY-level education.
- Custom GPTs were developed to use for active learning and self-testing. These appear to work with all subjects, not just with physical sciences.
- The Astrophoria Foundation Year science course team and a group of their tutors increased their understanding of AI use.

Key learning for the team around using AI for developing teaching and learning

- Everyone, whether students or tutors, can benefit from expert help understanding how AI works and how best to use it, as well as the potential pitfalls from uncritical AI use.
- AI use by undergraduates has increased dramatically during the last 18 months and is now widespread before students arrive at university, so early guidance is important, particularly for less mature and less self-aware students.
- The busy nature of OU degrees and high number of pressurised deadlines means that there is considerable temptation to use AI to shortcut work they should be undertaking on their own, including for submitted and non-invigilated assessments.
- Successful ChatGPT tools for undergraduates are best created in custom GPTs which can contain clear guardrails to avoid the AI providing too much information and short-circuiting the active learning process.
- The spectrum of student views on AI go all the way from a high degree of scepticism and aversion, through to deep, possibly inappropriate reliance on it during their academic courses.

- Both students and tutors came up with inventive ways to use ChatGPT which, though not part of the intended outcomes of the project, may be useful to university students and to tutors engaged in teaching.
- It is not always easy to detect when and how students are using AI during their courses, but it is patently better to have an ongoing conversation with them about it than to ignore the problem.

Project introduction

Background and context

The science section of the Astrophoria Foundation Year (AFY) involves three subjects — chemistry, engineering and materials science (CEMS) — and a small number of students (5 in each of the first two cohorts). They are taught chemistry, physics and maths by a team of tutors experienced in undergraduate teaching in those subjects. The AFY intention is to help students from highly disadvantaged backgrounds to develop university (HEF level 4) skills and repair deficits in factual knowledge, before they move on to degree education.

The Astrophoria Foundation Year (AFY) AI project was devised to investigate the possibility of creating positive tools for active learning and revision which would aid students on the CEMS (physical sciences) course in improving their own academic skills, instead of using AI as a crutch. Students were briefed and inducted on positive AI use, and warned about the dangers of passive reliance on AI which can suppress the acquisition of higher-level academic skills.

The project fortuitously coincided with a significant rise in concern within some areas of the undergraduate teaching side of the university, about students replacing work and effort within study with AI use. This was particularly used to address that within science subjects, an under-researched area.

Objectives

1. To develop our own understanding of AI use within science and by students as course and subject lead team, to be able to identify exactly which parts of the CEMS course could benefit from having students use AI tools to generate their own practice materials.
2. To produce a practical how-to guide for students walking them through the process of using an AI tool like ChatGPT to generate their own practice materials.
3. To carry out a comparison of the performance of different AI tools to generate practice materials. The comparison would use free-to-use versus paid-for models and the associated implications from an equality perspective, with the aim of informing wider policy regarding how our students may need to be given support to access such tools.

Scope

5 students, 6 tutors, 4 subject/course leads and 2 members of the OU AI Exploratory Group exploring AI use within physical sciences teaching at university.

Tools and technologies

ChatGPT (all public versions), ChatGPT Edu within Oxford University, and Canvas. It was not possible within the limitations of the project to use any AI types other than OpenAI's ChatGPT.

Collaboration

The AFY physical sciences team and six of their tutors collaborated with the AI Exploratory Fund team on the project.

Project outcomes and findings

Evaluation results

Students found the tools useful, though some were frustrated by the tendency for AI to over-help when they were attempting to learn for themselves. Student confidence in using AI increased over time in the project, and student appreciation towards the helpfulness of AI increased, but so did their understanding of potential pitfalls. Tutor confidence in and breadth of AI use, and their understanding of student use of AI, increased during the project.

Tools were developed along the planned lines, to help students develop their own self-teaching and self-testing resources.

Quantitative data

The average student perceived helpfulness of using AI increased from below 7/10 to just below 8/10 over the two workshops held with them, then decreased slightly after the final workshop while they were carrying out revision for exams.

The average student confidence in AI use increased from below 7/10 to above 8/10 over the two workshops, then decreased to 8/10 during the revision period.

One student reported feeling as if they were not learning when using AI, the other four were more positive.

Students scored AI as a range of 3/5-5/5 for helpfulness as a Socratic tutor, and 3/5-4/5 for quiz generation. The error finding tool, which was only used by one student, scored 2/5.

Qualitative insights

Students reported much more understanding of how AI works and how to use it, which for most was seen as a good change. Some students reported other uses for the AI access, such as revision schedule creation, creating cribs for sample papers, surveying ideas for a possible project essay topic, and emotional support. However they also criticised AI as they started to understand it more.
Selected quotes:

"It gaslights me into thinking the wrong answer is correct."
"ChatGPT is oddly persistent in giving me things [answers] like a slave when I don't want it to."
"Sometimes it can give wrong answers and back itself up using false reasoning in different chat boxes."
"If you give your answer first for a problem, it can be biased and give you the "correct" answer based on what you've given it, and can often give incorrect answers as a result. It doesn't always do this but it's good to be cautious".
"Learning is when I have to go thru pain to understand a concept. ChatGPT acts as the painkiller and very often bypasses the learning process. It's unfortunate because it's so accessible and popular, it's the most logical shortcut to take. Pre-ChatGPT me had a functional brain".

Lessons learned

Challenges

- Students did use AI passively, but improved to active learning slowly.
- ChatGPT kept insisting on giving answers when they weren't desired.
- Science on ChatGPT has limitations (especially where diagrammatic explanations are key).

Key takeaways

- Students are mostly using AI already, some are sceptical/cautious.
- Some students appear hooked on using AI to shortcut their work.
- It is essential to *demonstrate* to students (not just tell them) the pitfalls of AI.
- The intended outcomes were largely met.
- It was not possible to compare different AI brands.
- The hackathon held with tutors demonstrated the benefit of collaboration and brainstorming when using new technology for teaching.

Overall, ChatGPT can be used to help students create their own active learning materials for the physical sciences, and we have produced a guide to doing so. Some tools were more popular than others, though they all worked.

Advice for teams

- Be flexible: your trajectory may not go as expected.
- Discover the extent and type of AI use students have before the project starts.
- Collaborate with AI experts in a two-way process: they will suggest uses you didn't know exist, but they sometimes need detailed information on how education is affected by AI use in your own area.
- Seek frequent feedback, and let students see how their views have changed during the project.
- Engage in strong training for undergraduate students, who have not yet themselves acquired many of the skills that AI appears to be able to replace (summarising text, linking concepts, and providing explanations). The fact that they must be able to demonstrate in assessments that they, not the AI, have those skills, needs to be a loud clear message throughout any AI project.

Appendices

A. Pre-workshop 1 (students) survey questionnaire
B. Pre-workshop 1 (students) survey results

C. Post-workshop 1 (students) survey questionnaire
D. Post-workshop 1 (students survey results

E. Post-workshop 2 (students) survey results

F. Student Survey (feedback session TT) results

G. Post-hackathon (tutor) survey results

H. CEMS AI Playbook produced as a guide for students using AI for active learning and self-testing

A.

AFY - Workshop 1 - Pre-Survey

* Required

1. Do you currently use any AI tools to help with your learning? *

- ◯ Yes
- ◯ No

2. If you answered yes to the question above, which tools do you use? (Eg. ChatGPT, Claude, Grammarly, Gamma...)

3. How often do you use AI tools to help with your learning? 1=Never - 10=Every day *

1	2	3	4	5	6	7	8	9	10

4. How much do you think AI tools help you learn? 1=Nothing - 10=Everything *

1	2	3	4	5	6	7	8	9	10

5. How confident are you using AI tools for learning? 1=Not at all - 10=Extremely *

1	2	3	4	5	6	7	8	9	10

6. What is one thing you hope to learn about in this workshop? *

B.

Do you currently use any AI tools to help with your learning?	If you answered yes to the question above, which tools do you use? (E.g. ChatGPT, Claude, Grammarly, Gamma...)
No	
Yes	ChatGPT
Yes	chatgpt
Yes	ChatGPT, NotebookLM
Yes	ChatGPT

How often do you use AI tools to help with your learning? 1=Never - 10=Every day	How much do you think AI tools help you learn? 1=Nothing - 10=Everything	How confident are you using AI tools for learning? 1=Not at all - 10=Extremely
1	3	3
6	3	5
4	8	7
7	10	9
5	10	10

What is one thing you hope to learn about in this workshop?
How to use AI to support learning
How AI can be useful for learning
How to not have AI just answer questions for me and rather to give hints or links to concepts
How I can learn even more from AI
Sensible AI usage

C.

AFY - Workshop 1 - Post-Survey

* Required

1. How much do you think AI tools help you learn? 1=Nothing - 10=Everything *

1	2	3	4	5	6	7	8	9	10

2. How confident are you using AI tools for learning? 1=Not at all - 10=Extremely *

1	2	3	4	5	6	7	8	9	10

3. What is one thing you learned in this workshop that you found the most valuable? *

4. What could be changed about the workshop to improve it? *

5. What would you like to learn in future workshops about using AI in learning? *

D.

How much do you think AI tools help you learn? 1=Nothing - 10=Everything	How confident are you using AI tools for learning? 1=Not at all - 10=Extremely
9	9
7	8
9	7
7	9
5	6

What is one thing you learned in this workshop that you found the most valuable?
ChatGPT needs context
How to prompt correctly
Follow CRIE
being able to ask chatgpt prompts in other ways such as explaining topics as a tutor or to make it ask you questions
Practical limitations and potential of ChatGPT; printout ideas for more effective use

What could be changed about the workshop to improve it?
More ChatGPT laptops to improve personal experience
How to implement a specific topic
Not sure
it was good! splitting us across the room was a great idea
Possibly have a similar workshop for how ChatGPT could be used for research

What would you like to learn in future workshops about using AI in learning?
How to talk to it usefully
Are you able to create questions based on specific pages of textbooks
Not sure yet
how can uploads be utilised
Answer above

E.

How confident are you using AI tools for learning? 1=Not at all - 10=Extremely	What is one thing you learned in this workshop that you found the most valuable?
7	AI is good as a tutor if you use it correctly
8	Context matters
10	being hyper specific and being straight forward about what you want. not asking “can you ..” and instead to just tell it to
9	Give guardrails
9	Unsure

What could be changed about the workshop to improve it?
N/A
How to know if it is making mistakes
nothing it was good hands on experience
Make it shorter
Unsure

What would you like to learn in future workshops about using AI in learning?
N/A
How to know if AI is making mistakes/ how to avoid it
when it comes to written assignments, is it ok to let AI to come up with ideas for you if you are struggling
How to use it efficiently
Maybe something about how to generate graph etc

F.

How much do you think AI tools help you learn?	How confident are you using AI tools for learning?	Have you used ChatGPT or other AI tools to help you prepare for your start-of-term exams?	If yes, briefly describe how you used them. If no, explain why not.
7	8	Yes	Socratic tutoring mainly
7	8	Yes	Usin the socratic tutor method uploading multiple notes etc and compiling quizzes.
8	8	Yes	Asked to go thru some questions (tutorial and sample paper) “like an Oxford tutor and interactively”
6	7	Yes	I gave ChatGPT the slides of content and told it to quiz me using them and answer any questions I had about the content.
6	8	Yes	I gave it notes and tutorial sheets for a subject in a project folder. Then if to learn content I would ask it to give me key points from the notes, so I would be looking at the full notes and the key summary to help me work more efficiently. Once I was done with that I asked it to ask me questions from the sheets or to generate new questions based off the style of the sheet - I’d do them, and ask it to answer questions using key concepts from the notes to ensure it wasn’t teaching me content that wasn’t on the notes.

Do you plan to use ChatGPT or AI tools to help with your future exams?	Briefly explain your answer to question 5.
Yes	I believe it was helpful for revising some parts of the course
Yes	Similar to my answer to question 4
Yes	It’s like an addiction and also I don’t feel confident in my answers at all and for some reason ChatGPT has gotten very advanced in its ability to help me.
Yes	I’m going to do the same thing I did for the previous exams. Ill try to give it our tutorial questions and see if it can write me mock questions in the same style and give me a mark scheme so I can practise exam style questions.
Yes	It was very good in helping me answer the practice papers that do not have a mark scheme necessarily. It is really easy to command it to make it easier to mark I.e it can generate a mark scheme and along side each answer it can have a greater explanation that help you understand the answer.

You were introduced to three ways of using ChatGPT to help with revision and problem-solving. Which of these have you used?
Socratic tutor (asking it to quiz or guide me with questions);Creating custom quizzes;Other (please describe);
Socratic tutor (asking it to quiz or guide me with questions);Creating custom quizzes;
Socratic tutor (asking it to quiz or guide me with questions);
Socratic tutor (asking it to quiz or guide me with questions);Creating custom quizzes;Other (please describe);
Creating custom quizzes;Socratic tutor (asking it to quiz or guide me with questions);

Socratic tutor	Error identification	Quiz generation
4	Didn’t use	3
5 = Very helpful	2	3
5 = Very helpful	Didn’t use	3
3	Didn’t use	4
3	Didn’t use	4

Have you used ChatGPT to help refine or explore ideas for your research project during the vacation?	If yes, what kind of help did you ask for? If no, why not?
Yes	I gave a list of topics that I was interested in and asked what further research could be done for a project
Yes	I usually ask for help with my structure
Yes	I wanted some help choosing my project choice so I gave it my background and my degree pathway and asked it to quiz me on what I wanted to do
Yes	I asked it to give me a few different options on the things I could write about but didn't end up choosing any of them.
No	I did not want to become reliant on ChatGPT for my topic idea - using it at the very beginning to come up with a idea which is the most basic thing of the entire project would very much encourage asking it to do the rest of it.

Have you used ChatGPT in any other way to support your learning that wasn’t mentioned above?
To create summary sheets for revision
I have used it to help me with new concepts and learning for my project essay so i know more about the subject.
Helped me emotionally
No
Organising time - telling it what I need to do in what span of time and it is capable of creating realistic schedules to follow

Have you run into any problems when using ChatGPT?	If you answered yes, describe the problems you encountered.
Yes	Can get things incorrect, especially maths, and even after ages of trying to correct and teach it the right way, it was still getting it wrong.
Yes	It is very bad with diagram analysis and Im yet to figure out a way around it.
Yes	It wouldn't load (maybe cookies problem) but also it gaslights me into thinking the wrong answer is correct. ChatGPT is oddly persistent in giving me things like a slave when I don't want it to. Sometimes it can generate wrong answers and back itself up using false reasoning in different chat boxes.
Yes	It is unable to correctly read diagrams and has trouble understanding a concept if given mostly visual prompts.
Yes	If you give your answer first for a problem, it can be biased and give you the "correct" answer based on what you've given it, and can often encourage incorrect answers as a result. It doesn't always do this but it is good to be cautious.

How did you deal with those problems you described in Question 13?
Try to correct it, often didn't work however.
Be authoritative. Being kind to AI gives it too much room for error.
I answered the questions myself.
Mentioned above

Do you feel like you're learning when you use ChatGPT?	Explain your answer to question 15 further.
Yes	It helped me understand a lot of concepts better, especially conditions for organic chemistry.
Yes	Sometimes it is very struggled to try and use. ESPECIALLY with diagrams.
No	Learning is when I have to go thru pain to understand a concept. ChatGPT acts as the painkiller and very often bypasses the learning process. It's unfortunate but because it's so accessible and popular, it's the most logical shortcut to take. Pre-ChatGPT me had a functional brain
Yes	It is able to further describe concepts I dont understand when using reading the slides
Yes	It's a good tool to use with revision

G.

How confident are you using AI tools in your teaching? 1=Not at all - 10=Extremely	How much do you think AI tools can help students learn? 1=Nothing - 10=Everything	Which of the following specific functions of ChatGPT Edu do you believe are most beneficial for CEMS students? Choose up to three.
7	7	Offering “Socratic” prompts to guide student thinking;Generating personalised practice questions;Supporting students with revision;
7	7	Generating personalised practice questions;Helping identify gaps in students’ reasoning during tutorials;Explaining complex concepts in simpler language;
10	10	Generating personalised practice questions;Supporting students with revision;Pointing out typical errors (e.g., unit conversions, problem-set reasoning);

Since the AFY tutor ChatGPT Edu workshop in February, how often have you incorporated AI tools into your teaching?	Since the initial AFY ChatGPT Edu tutor training workshop, which AI feature or technique have you used most frequently in your teaching? Please give a concrete example or two (e.g., “I had ChatGPT...
Hardly ever	I have been using it in ways that don't directly interface with the students but for background tasks instead, e.g. in coming up with practice problems for the students.
Some lessons	generating questions
Some lessons	I've used GPT to build question banks for myself, using the lecture notes and typical student issues to refine the questions for the things that they find the hardest to master.

How confident do you feel in giving advice to students on the use of AI after receiving the training?	Please describe at least one challenge you've encountered when trying to use ChatGPT Edu since the initial workshop. How did you address or work around it?
8	When I uploaded a pdf of the lecture notes, I then tried to test whether ChatGPT could actually "see" the diagrams - I think the answer is no. I then learnt I had to upload the diagrams as separate images (e.g. screenshots) which it could see.
6	chatgpt sometimes do simple maths wrong - I prefer to do it myself
10	I'm still not convinced it's entirely reliable when it comes to explaining things - I think there needs to be more work on my part (and from the team) to make sure its accuracy is high enough to be relied upon. For now, I tell students to be cautious about what they see from it and to double check with me or another tutor if there's anything that's incongruous with their understanding or something they've encountered in their teaching.

Have you observed any notable improvements in student learning or engagement when ChatGPT Edu was used? If yes, please provide a brief example. If not, what do you think is missing?
I think it's incredibly difficult to quantify this because we don't have a control group which is totally avoiding AI. My feeling is that it is a net positive impact but I can't quantify it.
students were more engaging when used ChatGPT to create more example questions for them to try
It's hard to say with such small cohorts, but I think there's elements of students doing some of the leg work getting the basics in place which has been useful - so we can spend more of our tutorial time on the really sharp stuff, and/or extending their understanding beyond what they can reasonably manage on their own.

Do you have any concerns about ChatGPT Edu usage for CEMS tutoring (e.g., academic integrity, reliance on AI, subject-specific limitations)?
I am most comfortable with it being used for non-student-facing tasks, particularly those which can be verified by me. I think we have given our students sufficient guidance that they will use it wisely, but I would not advocate other students using it if I didn't think they'd received appropriate training.
None - I think the uni is in general too cautious with it, there are lots of opportunities here - obviously it needs some care and some thought but I worry the powers that be are going to shy away from its use, to the detriment of our students and our course. I'm fighting it, but it's hard to know how that's going to work out!

What is one thing you learned in the hackathon that you found the most valuable?
The whole GPT thing is pretty new to me, but especially getting chatGPT to write its own instructions
how to create a bot for repeated tasks
Seeing examples from an expert user

What could be changed about the hackathon to improve it?
I think I would have preferred to work solo on the GPT.
n/a
Maybe more time? But that's tricky - it might be that there's some sort of follow-up within the team instead, to see how these projects work out when fleshed out.

What would you like to learn in future workshops about using AI?
Can't think of anything right now
how to use AI to help marking and provide feedback
I'm looking for some more advanced concepts - I still feel like I don't "know" very much, I'm just sorta guessing and building with experience, which is fine but I can do that myself easily enough

Is there anything else you'd like to share—whether it's examples of creative AI usage, resource requests, or general reflections on this hackathon?
Big fan of the idea - more of these, maybe between teams, would be very cool! And thanks for sorting it 😊

H.

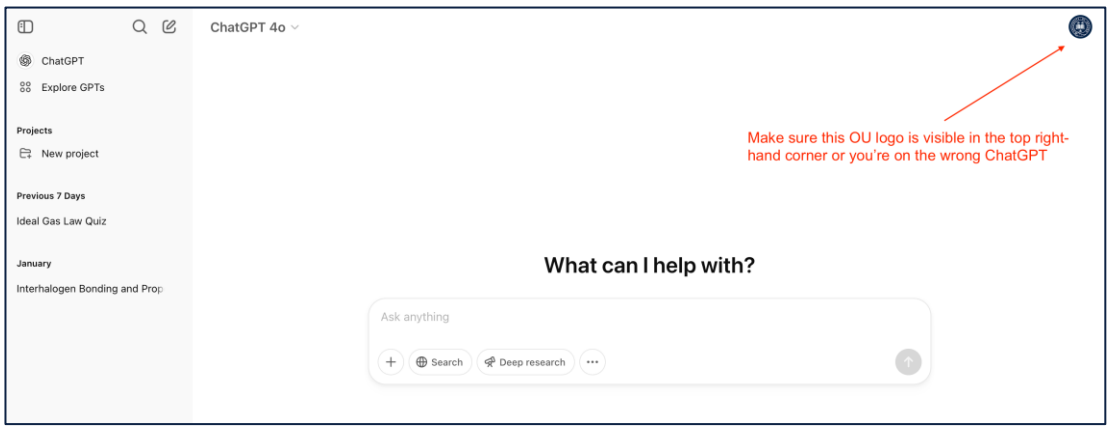
Guidance for CEMS students in using ChatGPT Edu

The CEMS AI Playbook

Logging on

1. Use the **"join workspace"** link in your invitation email to join ChatGPT Edu, the Oxford-specific area which comes with your licence.
2. Do not under any circumstances use publicly-available ChatGPT instead, that would breach copyright rules for AFY material and content, and will mean you cannot make use of the customised GPT which has been developed for you.
3. Click on Log in, and then enter your SSO into the top "Email address" box on the screen. This should have the format AAAAaaaa@ox.ac.uk where AAAAaaaa is your own Single-Sign-On name (eg trin0453@ox.ac.uk). Don't use any of the other options or it won't work.
4. Then click on "Oxford University SSO" (again the top option) as this will allow you to enter your own SSO password and multi-factor authentication code.

This is what it should now look like when you enter the Oxford Edu ChatGPT workspace:



The "Previous 7 Days" and earlier months will not show these GPTs in the left-hand menu, they will show only GPTs you personally have access to. (Initially nothing, then over time a list will build up).

Understanding the workspace

- To start a new chat on your start screen, begin typing into the box.
- After your first log in, you can simply go to the link https://chatgpt.com/gpts and it will automatically log you into your Oxford account GPT with a dashboard front page. That has a **My GPTs** button at the top right corner and a list of earlier chats down the left hand side.
- If you are in one chat and want to change to a new empty one, just click on the "ChatGPT" option at the top left of the menu to start again. Your old chat will then move to the list.
- You don't need to save chats, the system will do that.
- When you are in a chat, anything you add in will be taken into account, so you can improve your prompt step by step until the AI is doing exactly what you want it to do.
- You can ask it to summarise the chat so far, and can also ask it to summarise the prompts you have given it into one single prompt, then you can save and use that in future sessions.

Using it with others

- When you have started a chat the system will add a "Share" button at the top right beside the OU logo, which allows you to create a link which you can send to someone else if you want them to see the chat you're working with. Eg share quizzes and prompts with others.
- The AI expert helping CEMS has devised a specific version of ChatGPT Edu with CEMS 'guard rails' in it, to help you make the AI behave in the way most helpful to you. This is a new GPT.

Read and think before starting

- Before typing in the chat box, read the rest of this guidance and think carefully about your prompt. If you give an AI bad instructions, it will not do what you need it to do, and then you may find yourself using it in a way which harms your own academic development.

The aim of the CEMS AI project is to find out if ChatGPT can be used effectively to help students to revise factual knowledge and to learn Level 4 skills. It is not to aid them to avoid studying properly themselves.

WARNING – misuse of AI may cost you your degree.

If you breach the University's rules on plagiarism there are serious penalties.

If you use AI to do your work for you that counts as plagiarism.

Do not use AI to create references: they may be hallucinated and fake, or (even more likely) irrelevant to your point. Instead make sure that any sources inspired by an AI search you can also find yourself through accessing the relevant website directly, and that you find the URL you will use in the citation via direct access.

The biggest risk is that you will get into the habit of letting AI do the work for you, and therefore stop learning and understanding yourself. This can easily be avoided but it takes persistence and an honest determination not to cut corners. Keep making sure the AI does not give you too much help: that it does not give you answers. This needs to be a clear instruction and you may have to repeat it.

The AFY team and the University are both working on methods of detecting illicit AI use. If you cannot explain your answers and reasoning yourself to the right level then illicit AI use will be assumed. In submitted assessments, any sign of illicit AI use to write the essay will lead to a plagiarism case being taken to the Proctors, who are in charge of University discipline.

You cannot take AI into your exams.

The exams determine whether or not you will continue on course at Oxford and if you become reliant on AI you will fail your exams or project essay assessment.

Best practices for productive ChatGPT sessions

1. **Plan your prompt**. Before typing in a chat, think about exactly what you need, or you may not get the AI working in the best way to support you.

2. **Be specific**. Specify the way you want the AI to work, the kind of feedback you want (if any) and whether you need it to interact with you step by step.

3. **Check accuracy**. Use your own knowledge or peer discussion to check its input. If you find an error, tell ChatGPT – it can revise its response.

4. **Beware of references**. If ChatGPT suggests a source, ***always*** confirm it independently.

5. **Avoid 'walls of text'**. You can interrupt it and ask for shorter, more targeted help.

6. **Limit usage**. Over-reliance on ChatGPT for solutions can short-circuit your own learning. Use it as a supplement, not a crutch.

Using ChatGPT effectively to enhance (not replace) your learning

Choosing a model

ChatGPT Edu offers different versions (called *models*).

- 4o - Good at wording and natural-sounding discussions, plus decent at general tasks. The right one to try first time for most uses.
- o1 or o3 – Slower in responses, but often better at step-by-step logical reasoning and structured tasks.

In science you may wish to try out more than one model, with the same prompts, and see what difference it makes. The o1 and o3 models are intended for mathematical and logical constructions but they can't always accept uploaded images, while 4o has proved to be a good all-rounder.

There are three main types of use your tutors have identified as worth trying, to help you improve your own skills.

1. Generating quizzes and practice problems

- You can tune it to set questions to a certain level, though this varies in effectiveness. The AI can flip from very easy to very hard so use clarifying words (eg "a little more difficult") and bear in mind that uploading course content first will help it define the boundaries of what to ask.
- For the best effect ask it to ask you questions one at a time, and not to give you any help. You will see examples of successful prompts for this kind of usage in the Good Prompts file, and you can always add more information as you go.
- You can ask it to include calculations in some questions: tell it how many. These can be simplistic but are useful if you need practice at getting them right, or including the right units, or converting units before using them.
- You can ask it to make you write the answers, or to get you to choose between multiple choice answers. Bear in mind that Oxford exams are NOT multiple choice and so this version is only good at testing your factual knowledge. To test your Level 4 ability to explain, tell the AI to require you to give reasoning for your answers.
- ChatGPT is very good at creating maths quizzes and telling you whether or not your answers are right.
- For non-maths quizzes you need to include quite a lot of detail in the prompt to get a useful quiz of the right level.

CAUTION: sometimes ChatGPT gets the answers to a quiz wrong. If you think this has happened, tell it you think so and then it will revise its answer. Doing this helps it to develop more accuracy.

- If you tell the ChatGPT to use 'critical questioning' that can make it stop giving too many hints.

2. Finding errors

- The 4o model is good at creating a block of text about a science or maths concept but with errors in, and then making you find the errors.
- Make sure the prompt tells it not to give you any hints, and not to tell you how many errors there are until you have found all of them.
- In this type of usage, it doesn't matter if ChatGPT gets something wrong: you can point out errors it didn't plan, and it will usually manage to correct them (and will then congratulate you on being clever at finding the mistake).

3. Socratic questioning

- This is when you ask the AI to act like a good tutor and to make you explain yourself clearly, without giving you hints.
- You can say "I'd appreciate a gentle nudge in the right direction if I get stuck, without revealing the full answer, so I can work through the problem on my own."
- As with quizzes, you need to set the prompt up carefully to test you without providing answers itself. The AI is like a keen dog chasing a ball, it wants to be over-helpful. The AI is set up to constantly explain and summarise, even if you want to do all the work.
- Some students in the first session tried to ask it to act as a Socratic tutor, but the AI kept telling them the answer. This leads to lazy minds and failed exams, so stop it whenever it helps too much, don't let it fall back into its default 'explanation mode'. Be firm with the AI: it can be quite fun arguing with it!

General points

- You can hand-write a question or an answer (in black on white paper) and then upload that to the AI – most of the time it's able to interpret this quite well, including chemical molecules and sketched physics diagrams. It can interpret even quite bad handwriting.
- However, ChatGPT is not very good at creating its own images, since it is based on a large language model.

- It is not our tutors' job to teach ChatGPT so please don't use up their time asking them to correct AI errors.

Good ways to prompt ChatGPT – useful phrases are in bold.
The sections below are labelled by letters

Quizzes:	[A]	[C]	[F]	[I]	[J]
Find the errors:	[B]	[D]			
Socratic questioning:	[E]	[G]	[H]	[J]	

[A] I am a foundation year student in chemistry. **Create a ten-question quiz** to test my understanding of the ideal gas laws, **based on real-world scenarios**. **Five of the questions should make me do numerical calculations**. **Give me the questions one at a time** and **give me feedback on my answers** including how good my reasoning is. Don't give me any hints, and do **make sure I include the correct units for any calculations** along with **full reasoning for all answers**.

[B] Generate **250 words** describing the types of intermolecular bonding, **with examples**, but **deliberately make some errors in it**. **Don't tell me how many errors or mistakes there are**, let me find them. **Give me feedback** on whether or not I am right but **do not give me any hints even if I am wrong**. Use **critical questioning** to help me find all the errors without giving me the answer.

[C] Generate a 10-question multiple-choice physics quiz covering **Transformers, Capacitors, Inductance, and RL Circuits**. The questions should range from **easy to hard**. Provide **four answer choices** (a, b, c, d) for each question, and make the **correct option bold**. Save the quiz in **MS Word format** with the following structure:

- **Title:** "Physics Quiz: Transformers, Capacitors, and Inductance in RL Circuits"
- **Question format:** "Q1. What is the primary function of a transformer?"
- **Answer format:**
  - a) To convert AC to DC
  - **b) To step up or step down voltage**
  - c) To store energy
  - d) To create a magnetic field

Ensure proper formatting with **no bullet points**. Provide a **downloadable MS Word file**.
If you want to have it without the answer, take out the "make it bold" line.

[D] Can you **generate a short engineering question** about SHM and waves, **using content** from Oxford Astrophoria Foundation Year **documents I'm going to upload**, and **put an error in the question**. Leave the error embedded for me to find, and **do not give me any hints**, **make me explain** my thinking in full. Make it a **vivid and engaging example**.

[E] I am a foundation year student studying materials science. I have taken a maths course in matrices. **Use the socratic approach** to test my understanding of this topic. I have **uploaded the lecture notes**. **Ask one question at a time** and **do not give me hints** unless I ask for them. **Tell me how to write a matrix so that you can understand it. Do not go beyond** the content in the lecture notes.

[F] Generate a quiz from a physics topic covering Transformers, Capacitors and Inductance and RL circuits. **Generate 10 questions** and **give 4 options** for each question. **Use LaTeX format**. Generate **mixed questions from easy to hard level**. **Save the file** in MS word format.

[G] I am a foundation year student studying chemistry at the university of Oxford. I have recently studied complex numbers (**lecture notes are attached**). Please could you **help me check I understand them and can do similar examples** to those given and **act as a Socratic teacher** to help me learn? I must reach all the **intended learning outcomes**. **Please take me through each section at a time** and let me respond to each individual section at a time. Please also **highlight where I need to add more** explanation.

[H] Help me revise **De Moivres theorem** acting as a **Socratic tutor**. Make it very **interactive** and make me give you **detailed answers before moving on**. I'd appreciate a **gentle nudge in the right direction** if I am stuck, without revealing the full answer directly, **so that I can work through the problem on my own**.

[I] I am a foundation year student studying chemistry. I am taking a maths exam in a few weeks. I am uploading the sample paper and some of the lecture notes. **Make me another sample paper**. It should be the **same length and ask questions on similar topics**, but **not too similar** to the

original sample paper. **Do not go beyond the content of the uploaded notes**.

(If it still includes things not in your syllabus, tell it to replace that question).

[J] Be a friendly, supportive tutor. Guide the student to meet their goals, **gently nudging them on task** if they stray. **Ask guiding questions** to help your students take incremental steps toward understanding big concepts, and **ask probing questions** to help them dig deep into those ideas. **Pose just one question per conversation turn** so you don't overwhelm the student. Wrap up this conversation once the student has shown **strong evidence of understanding**.

If you create a good prompt after some trial and error within a chat, then you can tell the AI to summarise the prompts you used, and save it as an MS Word file so that you can use it again.

You can always ask the AI how to prompt it so that it gives you what you want. Some of these improved prompts were generated by asking the AI how to tell it that.

Telling it you are a foundation year student without uploading notes/slides may not help much.

Moving forward

- ChatGPT Edu can be beneficial for:
  Asking you to explain yourself, like a Socratic tutor.
- Creating quizzes and tests tailored to your current curriculum.
- Engaging in 'find-the-errors" exercises to test deeper conceptual learning.

However, #YOU CANNOT TAKE AI INTO YOUR EXAMS AND MUST NOT USE IT IN YOUR ESSAY#.

Quick reference checklist:
i) **Log in** with your Oxford SSO, not Microsoft

ii) **Verify** you're in the Oxford University ChatGPT workspace.

iii) **Prompt carefully**: be explicit about what you need, especially how much assistance.

iv) **Encourage reasoning**: ask ChatGPT to challenge incomplete answers or highlight gaps in your reasoning.

v) **Try out** different models for different uses.

vi) **Never** rely on AI for entire solutions or references: do your own work yourself.

vii) **Always** maintain academic integrity and honesty.

Don't let ChatGPT do calculations, problem-solving steps, writing or reference-finding for you: that undermines your learning and can lead to assessment failures. ChatGPT is a tool to ***support***, not replace, your own thinking and learning. Always strive to improve your own understanding and knowledge, especially as you progress towards Oxford University exams.

NEW STUFF
Voice options, but it can then go into a different language for no reason, sometimes.

If it isn't doing something, like creating a quiz, tell it "do it".

It can have problems with making an MS Word document which is downloadable.

It can't deal with things which don't exist on the internet, eg a wine glass full to the brim, or wine with the glass missing.

The "context window" can be a problem – after a while it starts to forget things you have said at the start, so change chats occasionally. In Edu it should be quite big but if you see errors, change chats and start again. A 'token' is a word, and the limit is 128,000 tokens in a chat. Anything you've uploaded counts as tokens too, so bear that in mind.

You do need to keep reminding it not to give you lots of information when asking it to help tutor you, ie keep repeating that it shouldn't help too much.

Quizzes – it is a good idea for you to take questions it has asked and write the answers out on paper, then upload that. This gets you away from it helping too much, and means you engage your brain and think more deeply.

Mostly the information in chats isn't shared between them, but sometimes it appears to have put something into memory eg using emojis.

ChatGPT mistakes

The top six of the following errors were made within a single two-hour workshop held by several AFY tutors and the subject leads. These are significant errors which act as a reminder that LLM AI models are very far from being authoritative. This was a higher error rate than we might have expected.

Always challenge an AI on any errors it makes.

1. It was surprisingly poor at matrices, calculating the wrong determinant when setting a quiz.

2. It misstated some points about nodes and antinodes in wave theory.

3. It suggested that the minimum angle in an octahedral molecule was 180°, not 90°.

4. It suggested that hydrogen bonding would occur between ammonia and bromide ion.

5. It said that hydrogen bonds don't break when a liquid is boiled to create a gas.

6. It describes dative bonding as part of a complex molecule, although that is now an outmoded way of describing some covalent bonds, and not used in our course.

7. It said that a tertiary carbocation would rearrange to a secondary carbocation (which is less stable), which it wouldn't.

8. It said that two positional isomers of a substituted aromatic ring were tautomers and would change into one another in aqueous acid. But that isn't true, they would need lots of complex synthesis steps to be interconverted.

9. It called a chloroketone an acid chloride and misnamed its reaction with an enolate, getting the order of steps completely wrong. Only someone who knew and understood the topic very well would spot this error, but it is a major one and would have led to completely the wrong answer in an examination.

10. It said that a molecular ion formed in mass spectrometry from propane would be the same mass as the propane, but that's impossible since at least one atom would have to break off.

However, it is very good at setting paragraphs which have errors in. This is because even if it has not intended a flaw to be an error, it will be prompted by the user finding the error, to identify it properly. This is therefore a very effective way to check your own knowledge.

Every time the AI offers *you* an explanation, read it very carefully and make sure everything fits with what you have learned. Do not assume it will be correct without checking.