

UQ SchoolsNet - Engaging Minds in IT (Dec 2025)

Practical AI - Tools for Educators: Choose your Adventure

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A new human computer interface

OpenAI ChatGPT was released on 30 Nov 2022

A prompt is a piece of text that triggers a specific response or action

Come up with concepts
for a retro-style arcade game

Write a text message
asking a friend to be my plus-one at a wedding

Show me a code snippet
of a website's sticky header

Plan a trip
to explore the nightlife scene in Bangkok

 Send a message



Rarely has a technology possessed such profound potential to both revolutionize and challenge the boundaries of education

- Answer questions
- Feedback on writing
- Feedback on programming
- Brainstorm new ideas
- Personalised Chatbot tutors/mentors



- Provide direct answers across multiple domains
- Write essays for you
- Write programming code for you
- Perform data analysis

Initial Flaws Identified by Educators

3 years since the first initial release and already most are not valid ...

Can't take
feedback

Can't reflect

Can't do
math

I'll be able to
detect it

The text will
have false
facts

Can't
include
references

Can't
understand
images

Can't reason

Current LLM Prompts for Teachers

ChatGPT 5.2

Share Add people

Activity 1 Source

Categorise the top LLM prompts used by high and primary school teachers.

Could you please clarify a few things so I can categorize the top LLM prompts accurately:

1. Are you interested in prompts used globally or within a specific country or region?
2. Should the categories be based on subject area (e.g., math, history), task type (e.g., lesson planning, grading help), or something else?
3. Are you looking for actual example prompts, or just high-level categories with descriptions?
4. Would you like me to focus on prompts used by teachers with students, or also include behind-the-scenes uses like curriculum development?

Let me know so I can tailor the research appropriately!

1. globally
2. all
3. just high level categories with descriptions and a sample of the prompt
4. all

Great, I'll look into globally used LLM prompts by both primary and high school teachers, organizing them into high-level categories by subject, task type, and audience. I'll include descriptions and sample prompts for each category. I'll let you know when the research is ready—feel free to keep chatting with me in the meantime!

Checking content 1 source

Ask anything

Stop Update

ChatGPT can make mistakes. Check important info.

5 meta-categories of teacher LLM prompts (Primary + High School)

Meta-category	Includes (examples)	Audience	Description	Sample prompt
Plan & Design	lesson planning, unit sequencing, activity ideas, resource creation	Teacher (planning)	Uses LLMs to draft or refine lesson/unit structure and generate teaching resources quickly	"Design a 3-lesson sequence on this topic with learning goals, activities, and a simple exit ticket for each lesson."
Teach & Explain	concept simplification, worked examples, alternative explanations, model answers	Student-facing (often teacher-mediated)	Produces clear explanations and worked examples at an appropriate level and tone	"Explain this concept for a 10-year-old using a real-world analogy, then give two quick check-for-understanding questions."
Assess & Give Feedback	quizzes, rubrics, marking guides, formative comments, feedback suggestions	Teacher (planning)	Supports assessment construction and faster, more consistent feedback	"Create a rubric for this task with 4 criteria and 4 performance levels, then draft example feedback for a 'developing' response."
Differentiate & Support Learners	personalization, scaffolds, tutoring prompts, accessibility/EAL adaptations, metacognitive prompts	Mixed (teacher planning + student-facing)	Adapts materials for diverse needs and provides scaffolded tutoring-style support	"Rewrite this passage at two reading levels and add sentence starters for students who struggle to begin."
Communicate & Manage	parent emails, admin notes, behaviour strategies, classroom routines, meeting summaries	Teacher (planning)	Helps with professional communication and classroom management planning	"Draft a supportive email to parents about upcoming assessments, including practical ways they can help at home."

**My aim today is to
challenge
what you think is possible in
Education?**

Text instructions are all you need



Example 1: Maths Worksheet Creator

- Asks questions to get audience and topic
- Uses Python code to do the calculations
- Provides step by step teacher solutions
- Provides either a MS Word or Latex version
- Implemented as an Open AI Custom GPT
- <https://chat.openai.com/g/g-ZEXukr2ci-math-worksheet-creator>

Example 1: Maths Worksheet Creator

Math Worksheet Creator 5.2 ▾

Create a worksheet on Area for Year 10 students

Hi! 🤖 I'm **Math Worksheet Creator**, an expert maths teacher that creates **engaging maths worksheets** in **Microsoft Word format**, complete with **clear word problems** and **full step-by-step teacher solutions**.

Before I create your **Year 10 Area worksheet**, I just need a few details so I can tailor it perfectly for your students:

1. What specific area topics should be covered?

(e.g. triangles, trapeziums, circles, composite shapes, surface area, real-world applications)

2. Year level:

You mentioned **Year 10** — please confirm if this is **standard**, **advanced**, or **mixed-ability**.

3. How many questions would you like in total?

4. What difficulty structure would you like?

For example:

- 3 simple skills questions
- 2 medium questions
- 2 challenging real-world word problems

5. Preferred output format:

- Microsoft Word (.docx)
- LaTeX (.tex)
- PDF (with rendered equations)

Once you answer these, I'll generate the full worksheet with:

- Clearly written **word problems**
- **Equations used**
- **Step-by-step teacher solutions**
- **Python calculation code shown** for every answer
- **A download link** to your finished worksheet 📁✨

Example 1: Maths Worksheet Creator

Your worksheet is ready! 

I've created a **Year 10 mixed-ability Area worksheet** with:

- **5 questions** (3 simple, 2 difficult real-world problems)
- Clear worded questions
- Equations used for each problem
- Step-by-step teacher solutions
- All calculations performed using **Python** (shown during creation)
- Professionally formatted as a **PDF**

[👉 Download the Year 10 Area Worksheet \(PDF\)](#)

If you'd like, I can:

- Adjust difficulty or add **extension questions**
- Convert this to **Microsoft Word** or **LaTeX**
- Create a **student version (questions only)** and a **separate answer booklet**
- Align it to a specific **curriculum (e.g. Australian Curriculum, GCSE, NCEA)** 

Year 10 Mathematics Worksheet: Area

This worksheet contains 5 questions on Area. Questions 1–3 are simple, and Questions 4–5 are more challenging real-world problems. Full teacher solutions are included.

Question 1: Find the area of a rectangle with length 8 cm and width 5 cm.

Equation used: $\text{Area} = \text{length} \times \text{width}$

Solution:

$$\text{Area} = 8 \times 5$$

$$\text{Area} = 40 \text{ cm}^2$$

Question 2: Calculate the area of a triangle with base 10 cm and height 6 cm.

Equation used: $\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}$

Solution:

$$\text{Area} = \frac{1}{2} \times 10 \times 6$$

$$\text{Area} = 30.0 \text{ cm}^2$$

Question 3: Find the area of a circle with radius 7 cm. Give your answer to 2 decimal places.

Equation used: $\text{Area} = \pi r^2$

Solution:

$$\text{Area} = \pi \times 7^2$$

$$\text{Area} \approx 153.94 \text{ cm}^2$$

Question 4: A shape is made from a rectangle (12 m by 6 m) with a triangle on top that has base 6 m and height 4 m. Find the total area.

Equation used: $\text{Total area} = \text{area of rectangle} + \text{area of triangle}$

Solution:

$$\text{Rectangle area} = 12 \times 6 = 72 \text{ m}^2$$

$$\text{Triangle area} = \frac{1}{2} \times 6 \times 4 = 12.0 \text{ m}^2$$

$$\text{Total area} = 84.0 \text{ m}^2$$

Question 5: A circular garden has a radius of 5 m. Grass costs \$12 per square metre to lay. Calculate the total cost to cover the garden. Give your answer to the nearest dollar.

Equation used: $\text{Area} = \pi r^2$, $\text{Cost} = \text{area} \times \text{cost per m}^2$

Solution:

$$\text{Area} = \pi \times 5^2 \approx 78.54 \text{ m}^2$$

$$\text{Cost} = 78.54 \times 12 \approx \$942$$

Example 2: Pedagogical Moves Tutor

- Pedagogical moves described with few shot examples
- No finetuning and all done in a single prompt
- Tutor for any topic
- Does not directly give the answer
- Implemented as an Open AI Custom GPT
- Prompt can be re-used on other platforms
- <https://chat.openai.com/g/g-7DbChkwg7-guide-mind-every-subject-tutor>

Example 2: Pedagogical Moves Tutor



A

You

I need to calculate x .

The equation is $2x + 2 = 12$

I get $x = 7$



Guide Mind Every Subject Tutor

It seems like there might be a little confusion in how you've solved the equation. Let's go through the steps together to see where the mix-up might be. Can you start by telling me what the first step is to isolate x in the equation $2x + 2 = 12$? (Focus: Guiding Student Focus)



A

You

Move the 2 to the other side of the equation. So I add it to 12 to get 14.

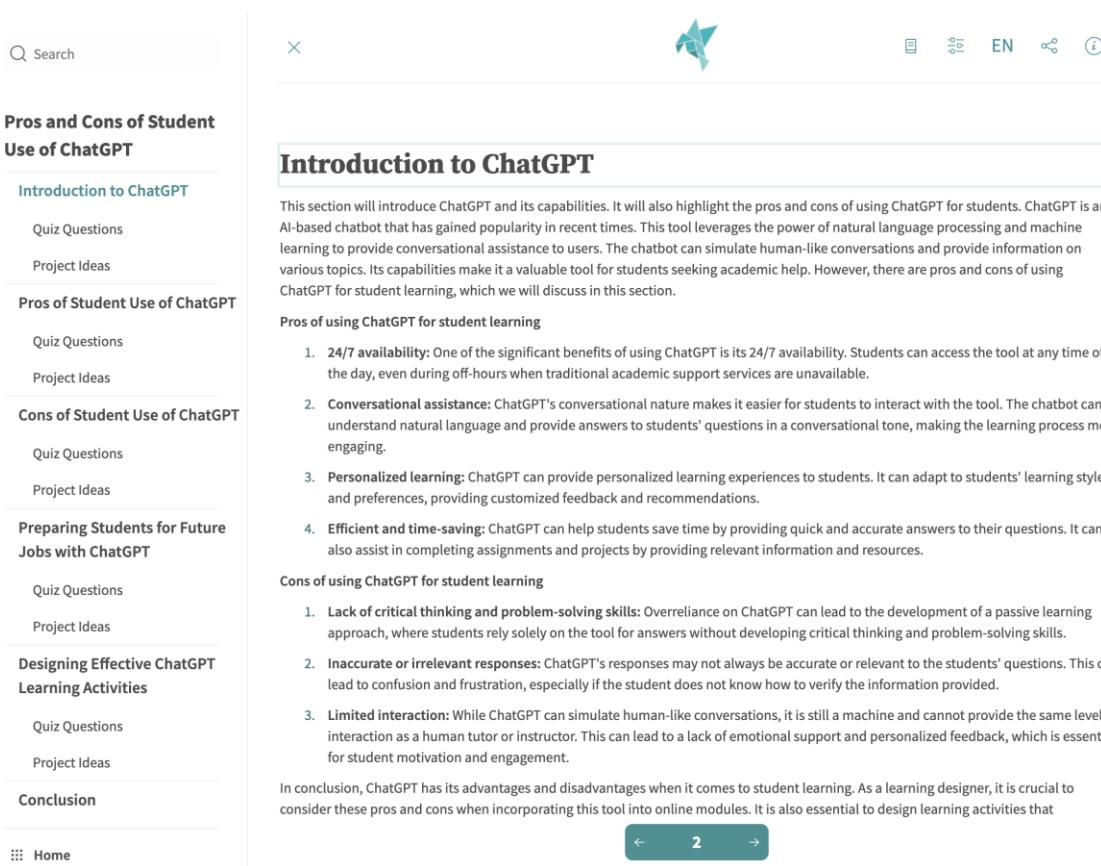


A

Guide Mind Every Subject Tutor

It's great that you're thinking about moving the 2 to the other side of the equation, but there seems to be a small misunderstanding in the operation used. When you have $2x + 2 = 12$, and you want to move the 2 to the other side, you actually do the opposite operation of what was done to x . Since 2 is being added to $2x$, what operation should you use to move it to the other side? (Probing: Seeking Self Correction)

Example 3: Automated Course Generation



Search

Pros and Cons of Student Use of ChatGPT

- [Introduction to ChatGPT](#)
- [Quiz Questions](#)
- [Project Ideas](#)

Pros of Student Use of ChatGPT

- [Quiz Questions](#)
- [Project Ideas](#)

Cons of Student Use of ChatGPT

- [Quiz Questions](#)
- [Project Ideas](#)

Preparing Students for Future Jobs with ChatGPT

- [Quiz Questions](#)
- [Project Ideas](#)

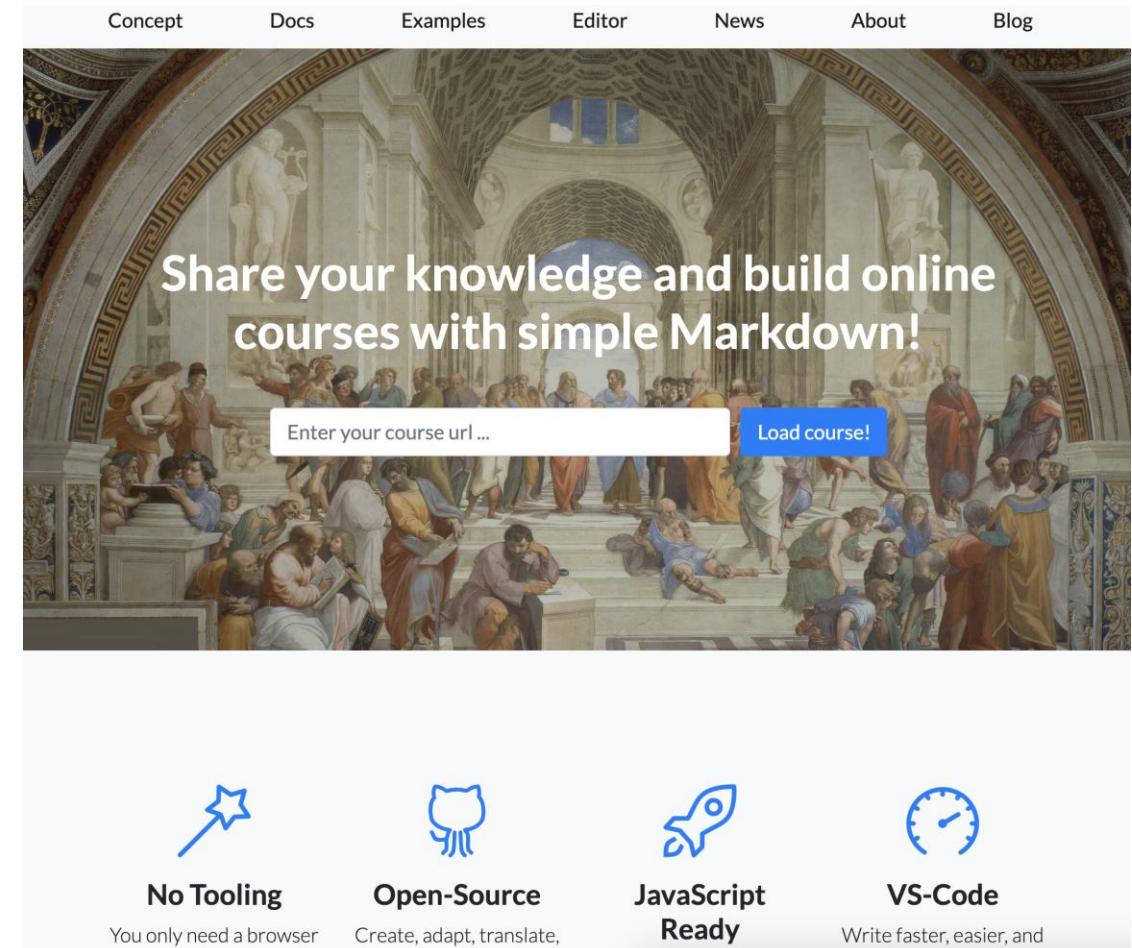
Designing Effective ChatGPT Learning Activities

- [Quiz Questions](#)
- [Project Ideas](#)

Conclusion

In conclusion, ChatGPT has its advantages and disadvantages when it comes to student learning. As a learning designer, it is crucial to consider these pros and cons when incorporating this tool into online modules. It is also essential to design learning activities that

2



Concept Docs Examples Editor News About Blog

Share your knowledge and build online courses with simple Markdown!

Enter your course url ...

Load course!

 **No Tooling**
You only need a browser

 **Open-Source**
Create, adapt, translate,

 **JavaScript Ready**

 **VS-Code**
Write faster, easier, and

<https://github.com/aneesha/eduweaver>

<https://liascript.github.io/>

Eduweaver Prompts

Prompt: Generate TOC

Please act as a subject matter expert on the topic of {topic} that also has learning designer skills and knowledge of markdown and json.

You know how to design online modules. You can break up the content into chunks, explain concepts so that can easily be understood, write quizzes to test knowledge and write creative learning activities for students.

Could you please come up with {no_sub_topics} sections for an online module on the topic of {topic} for {audience} in json format?

{sub_topics_to_include_text}

{sub_topics_to_not_include_text}

Here is an example of the format you need to return:

```
[{"section_name": "The name of the section 1",  
 "section_description": "The descriptions of the section 1"}]
```

Please don't return any intro text before or after the json.



Prompt: Generate Content

Could you please write the content for {section_name} that will be understood by {audience}?

The description of the topic that you must write is {section_description}.

{teaching_method_to_include_text}

{sub_topics_to_not_include_text}

Please don't output the section name but do include an introductory paragraph.



Prompt: Generate Quiz

Could you please write quiz questions for the content in {section_name} that will be appropriate for {audience}?

The description of the topic that you must write quiz questions for is {section_description}.

Please write {no_quiz_questions_in_sub_topic} questions in the json format that is given in the example below.

```
[{"question": "Question 1", "question_type": "single_option", "options":  
 [{"option_name": "Option 1", "correct": "false"},  
 {"option_name": "Option 2", "correct": "true"}]]
```

The incorrect answers should not be obvious or easy.

Example 4: Creating Learning Tools

Claude

AB Act as a frontend web developer and design a searchable glossary using only HTML and Javascript. Please don't link to external styles or javascript libraries. The glossary needs to:

- display a list of words with a definition using detail summary tags
- have a search form for users to enter words to search
- filter the list of words based on what the user entered into the search
- Include concepts with definitions on the topic of Probability for a First Year University students

Certainly! I'll create a searchable glossary using HTML and JavaScript, focusing on probability concepts for first-year university students. I'll use the `<details>` and `<summary>` tags for the glossary items, implement a search functionality, and include relevant probability terms.

[Searchable Probability Glossary](#)
Click to open website

I've created a searchable glossary using HTML and JavaScript, focusing on probability concepts for first-year university students. Here's a breakdown of the implementation:

1. HTML Structure:
 - The page has a title, a search input field, and a list of probability terms using `<details>` and `<summary>` tags.
 - Each term has a summary (the term itself) and a paragraph with its definition.
2. CSS Styling:
 - Basic styling is included to make the glossary visually appealing and easy to read.
 - The style is embedded in the HTML to avoid external dependencies.
3. JavaScript Functionality:
 - The search function filters the list of terms based on user input.

Reply to Claude...

Claude 3.5 Sonnet

Searchable Probability Glossary

← Searchable Probability Glossary

Preview Code X

Probability Glossary

Search for a term...

- ▶ Probability
- ▶ Sample Space
- ▶ Event
- ▶ Random Variable
- ▶ Expected Value
- ▶ Variance
- ▶ Standard Deviation
- ▶ Conditional Probability
- ▶ Bayes' Theorem
- ▶ Independence

Last edited just now

Published

<https://claude.site/artifacts/064cf03e-988f-4bf0-8244-f9c5d891ca86>

Example 5: Creating Smart Apps

Creative Project Kickoff ▾

AB Create a Multiperspective Elaboration Smart App

The UI should follow these steps:

1. Describe Multiperspective Elaboration
2. Ask the user for the topic. The user should also select from 2 templates eg Pros & Cons or SWOT.
3. Create either a 2 cell or 4 cell grid based on the user selection. Each cell should have a markdown editor that lets the user enter their ideas. Ask them to only use bullet points. There should be validation to mandate entry in all cells of at least 1 line of text (or bullet point). There should be a "Get Other Users Perspectives" button with a spinner when clicked.
4. Then send the text entered into each cell by the user along with info on the topic and that this is a multiperspective elaboration task to your API. Ask for perspectives that were missed (diverse perspectives are required) and feedback. Include the results below what the user entered with the heading Feedback. Display both what the user entered for each perspective and below that what the AI included and the AI's feedback.
5. Finally allow the user to copy a markdown version of everything.

Build with a clean UI. Perspective cells can have a light background but it must not interfere with reading text.

Get Claude to call itself

Example 5: Creating Smart Apps

The image displays two screenshots of the Claude AI interface. The left screenshot shows a 'Creative Project Kickoff' section with a card for 'Create a Multiperspective Elaboration Smart App'. It details the UI steps: 1. Describe Multiperspective Elaboration, 2. Ask the user for the topic, 3. Create a 2 or 4 cell grid, 4. Send text entered by the user along with info on the topic, 5. Finally allow the user to copy a markdown version of everything. Below this is an 'App Structure & Flow' section with 'Step 1: Introduction' and 'Step 2: Topic & Template Selection'. The right screenshot shows a 'Published' app titled 'Analyze: Blue economy' using the 'Pros & Cons' template. It lists 'Pros' (Preserves marine biodiversity, Enhances Food Security) and 'Cons' (High Initial Costs, Without strong regulation, it can lead to unsustainable fishing, mining, and tourism). A 'Get Other Perspectives' button is at the bottom right.

Creative Project Kickoff

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5. Finally allow the user to copy a markdown version of everything.

Build with a clean UI. Perspective cells can have a light background but it must not interfere with reading text.

Perfect! Here's the plan for your Multiperspective Elaboration Smart App:

App Structure & Flow

Step 1: Introduction

- Clean explanation of what Multiperspective Elaboration is and its benefits
- Simple, engaging description to help users understand the concept

Step 2: Topic & Template Selection

Reply to Claude...

AB

Analyze: Blue economy

Template: Pros & Cons

Use bullet points (-) to organize your thoughts in each perspective cell.

Pros

- Preserves marine biodiversity
- Enhances Food Security

Cons

- High Initial Costs
- Without strong regulation, it can lead to unsustainable fishing, mining, and tourism

Back

Get Other Perspectives

Example 5: Creating Smart Apps

The image shows a conversational AI interface with two main panels. The left panel, titled 'Creative Project Kickoff', contains a plan for a 'Multiperspective Elaboration Smart App'. The right panel, titled 'Analysis Complete: Blue economy', shows AI-generated pros, cons, and feedback.

Creative Project Kickoff

AB Create a Multiperspective Elaboration Smart App

The UI should follow these steps:

1. Describe Multiperspective Elaboration
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App Structure & Flow

Step 1: Introduction

- Clean explanation of what Multiperspective Elaboration is and its benefits
- Simple, engaging description to help users understand the concept

Step 2: Topic & Template Selection

Reply to Claude...

Claude Sonnet 4

Analysis Complete: Blue economy

Your perspectives + AI feedback

Pros

Your Perspective:

- Preserves marine biodiversity
- Enhances Food Security

Cons

Your Perspective:

- High Initial Costs
- Without strong regulation, it can lead to unsustainable fishing, mining, and tourism

AI Feedback & Additional Perspectives

Blue Economy: Multiperspective Analysis

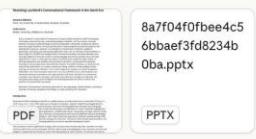
1. Important Perspectives/Viewpoints Missing

Economic Dimensions:

- **Developing vs. Developed Nation Perspectives**: The blue economy impacts differ significantly between nations with varying economic capacities and maritime dependencies
- **Traditional vs. Modern Livelihoods**: Coastal communities often face tension between traditional fishing/maritime practices and modern blue economy initiatives
- **Scale Considerations**: Small-scale artisanal operations versus large-scale industrial

Example 6: Slides, Posters and Infographics

Conference presentation slides from research paper



8a7f04f0f0bee4c5
6bbaef3fd8234b
0ba.pptx

AB I've attached a paper in pdf. I need to present it at a conference. I've uploaded the powerpoint template. Could you please make slides? I need about 6-7 slides.

Read the paper and then come up with the slides based on the paper. I have attached a template in powerpoint please use this, it will be a big help if you use this template.

I'll read the PPTX skill first to ensure I create high-quality slides, then examine the template you've provided.

Reading the PPTX skill for best practices

Now let me read the rest of the skill file and the template-specific instructions:

Reading the truncated section of the PPTX skill

Now let me examine the template you've provided:

Creating thumbnail grid of the template to understand its structure

Viewing the template thumbnail to understand the slide layouts

Show working file

Slidedeck made with a ppt template in Anthropic Claude



Karl McGuirk · 2nd · Senior Digital Learning Lead at ... 4d · + Follow

Day 1, afternoon at #ASCILITE25 - what I'm noticing is a shift from "how do we stop AI breaking education?" to the more interesting question: what could we build if AI is now part of the learning design material? The afternoon AI & Human Synergy stream leaned into that, while also naming what's already fractured.

Aneesha Bakharia & Linda Corrin (University of Queensland / Deakin University) "Revisiting Laurillard's Conversational Framework in the GenAI Era" reframed innovation as a move from programming to prompting. Tools like Claude Artifacts suggest everyday academics don't need to code, they can design learning conversations using natural language prompts. Laurillard's dialogue types ...more

You and 39 others 4 comments - 2 replies

Celebrate Comment Repost Send

Give your good wishes...

Most relevant

Danny Liu · 1st · Professor in Educational Technologies at U... 4d · + Follow

Thanks for the summary Karl McGuirk, wish I was there!

Like · 2 · Reply · 1 reply

Karl McGuirk · Author · Senior Digital Learning Lead at Ranga...

Infographic Made with Gemini – Nano Banana Pro

Scaling Qualitative Insight: An Agentic Workflow for Analysing Student Voices

Aneesha Bakharia¹, Antonette Shibani², Brayam Alexander Pineda Miranda², Lisa-Angelique Lim², Trish McCluskey³ & Simon Buckingham Shum²
¹The University of Queensland, ²University of Technology Sydney, ³Deakin University

THE CHALLENGE: SCALING QUALITATIVE ANALYSIS



An "AGENTIC WORKFLOW" uses LLMs to automate analysis while ensuring transparency, trustworthiness, and preventing AI hallucinations.

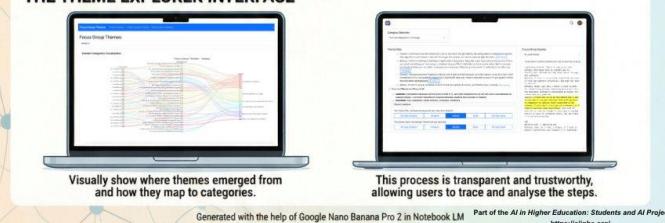
THE PROPOSED AGENTIC WORKFLOW

1. Theme Generation
2. Quote Verification
3. Refinement Loop
4. Categorization

EVALUATION

- Comparative Study Design
- Multi-Level Evaluation
- Human analysts rate quality and accuracy of Categories, Merged Themes, and Individual Themes.
- Multi-Rater Coherence Evaluation

THE THEME EXPLORER INTERFACE



Visually show where themes emerged from and how they map to categories.

This process is transparent and trustworthy, allowing users to trace and analyse the steps.

Generated with the help of Google Nano Banana Pro 2 in Notebook LM Part of the AI in Higher Education: Students and AI Project: <https://aiinhe.org/>

Poster – made with NotebookLM



THE UNIVERSITY
OF QUEENSLAND
AUSTRALIA

CREATE CHANGE

Challenges

Metacognitive Laziness

Beware of metacognitive laziness: Effects of generative artificial intelligence on learning motivation, processes, and performance

Yizhou Fan  Luzhen Tang, Huixiao Le, Kejie Shen, Shufang Tan, Yueying Zhao, Yuan Shen, Xinyu Li, Dragan Gašević

First published: 10 December 2024 | <https://doi.org/10.1111/bjet.13544> | 

Read the full text >

 PDF  TOOLS  SHARE

Abstract

With the continuous development of technological and educational innovation, learners nowadays can obtain a variety of supports from agents such as teachers, peers, education technologies, and recently, generative artificial intelligence such as ChatGPT. In particular, there has been a surge of academic interest in human-AI collaboration and hybrid intelligence in learning. The concept of hybrid intelligence is still at a nascent stage, and how learners can benefit from a symbiotic relationship with various agents such as AI, human experts and intelligent learning systems is still unknown. The emerging concept of hybrid intelligence also lacks deep insights and understanding of the mechanisms and consequences of hybrid human-AI learning based on strong empirical research. In order to address this gap, we conducted a randomised experimental study and compared learners' motivations, self-regulated learning processes and learning performances on a writing task among different groups who had support from different agents, that is, ChatGPT (also referred to as the AI group), chat with a human expert, writing analytics tools, and no extra tool. A total of 117 university students were recruited, and their multi-channel learning, performance and motivation data were collected and analysed. The results revealed that: (1) learners who received different learning support showed no difference in post-task intrinsic motivation; (2) there were significant differences in the frequency and sequences of the self-regulated learning processes among groups; (3) ChatGPT group outperformed in the essay score improvement but their knowledge gain and transfer were not significantly different. Our research found that in the absence of differences in motivation, learners with different supports still exhibited different self-regulated learning processes, ultimately leading to differentiated performance. What is particularly noteworthy is that AI technologies such as ChatGPT may promote learners' dependence on technology and potentially trigger "metacognitive laziness". In conclusion, understanding and leveraging the respective strengths and weaknesses of different agents in learning is critical in the field of future hybrid intelligence.

Practitioner notes

What is already known about this topic

- Hybrid intelligence, combining human and machine intelligence, aims to augment human capabilities rather than replace them, creating opportunities for more effective lifelong learning and collaboration.
- Generative AI, such as ChatGPT, has shown potential in enhancing learning by providing immediate feedback, overcoming language barriers and facilitating personalised educational experiences.
- The effectiveness of AI in educational contexts varies, with some studies highlighting its benefits in improving academic performance and motivation, while others note limitations in its ability to replace human teachers entirely.

What this paper adds

- We conducted a randomised experimental study in the lab setting and compared learners' motivations, self-regulated learning processes and learning performances among different agent groups (AI, human expert and checklist tools).
- We found that AI technologies such as ChatGPT may promote learners' dependence on technology and potentially trigger metacognitive "laziness", which can potentially hinder their ability to self-regulate and engage deeply in learning.
- We also found that ChatGPT can significantly improve short-term task performance, but it may not boost intrinsic motivation and knowledge gain and transfer.

Implications for practice and/or policy

- When using AI in learning, learners should focus on deepening their understanding of knowledge and actively engage in metacognitive processes such as evaluation, monitoring, and orientation, rather than blindly following ChatGPT's feedback solely to complete tasks efficiently.
- When using AI in teaching, teachers should think about which tasks are suitable for learners to complete with the assistance of AI, pay attention to stimulating learners' intrinsic motivations, and develop scaffolding to assist learners in active learning.
- Researcher should design multi-task and cross-context studies in the future to deepen our understanding of how learners could ethically and effectively learn, regulate, collaborate and evolve with AI.

Productive Failure – The missing element?

Towards the Pedagogical Steering of Large Language Models for Tutoring: A Case Study with Modeling Productive Failure

Romain Puech^{1,2}, Jakub Macina^{1,3}, Julia Chatain⁴, Mrinmaya Sachan¹, Manu Kapur⁴

¹ETH Zurich, ²École polytechnique, ³ETH AI Center,

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Abstract

One-to-one tutoring is one of the most efficient methods of teaching. With growing popularity of Large Language Models (LLMs), there have been efforts to create LLM-based conversational tutors which can expand the benefits of one-to-one tutoring to everyone. However, current LLMs are trained primarily to be helpful assistants and lack crucial pedagogical skills. For example, they often quickly reveal the solution to the student and fail to plan for a richer multi-turn pedagogical interaction. To use LLMs in pedagogical settings, they need to be steered to use effective teaching strategies: a problem we introduce as *Pedagogical Steering*. We develop StratL, an algorithm to optimize LLM prompts and steer it to follow a predefined multi-turn tutoring plan represented as a transition graph. As a case study, we create a prototype tutor for high school math following *Productive Failure* (PF), an advanced and effective learning design. To validate our approach in a real-world setting, we run a field study with 17 high school students in Singapore and show that StratL succeeds in steering the LLM to follow the PF tutoring strategy. Finally, we highlight challenges in Pedagogical Steering of LLMs and offer opportunities for further improvements by publishing a dataset of PF problems¹ and our code².

Models (LLMs), there has been a growing interest in using them to make tutoring affordable by building conversational tutoring systems (Jurenka et al., 2024; Khan, 2023). However, previous research has highlighted the lack of pedagogical properties of LLMs (Macina et al., 2023b; Tack and Piech, 2022). Most LLMs are instruction-tuned to optimize for a broad set of human preferences (Ouyang et al., 2022; Zhang et al., 2023), leading to assistant-like responses. However, a tutor’s goal is to maximize learning, not user satisfaction.

These two goals can be contradictory. For example, if a student asks for help, providing them directly with the solution would likely maximize their satisfaction and be the response preferred by LLMs (Macina et al., 2023a). Yet, it is more efficient from a learning standpoint to promote students’ active engagement and let them cognitively engage with the problem, for example, by providing an indirect hint or asking a guiding question (Freeman et al., 2014; Merrill et al., 1992). Moreover, existing LLM tutors are optimized and mostly evaluated for single-turn requests, while a tutoring dialog should be envisioned as a multi-turn teacher-student interaction where the teacher uses various pedagogical cues (Merrill et al., 1992). As LLMs are not natively made for tutoring, we introduce the shift from their user-serving goal to



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Choose Your Adventure

Choose Your Adventure Labs

Lab 1: Learning Resources	Lab 2: Chatbot Tutors	Lab 3: Building GenAI Systems
Create Worksheets with Teacher Step by Step Solutions	Create a Pedagogical Moves Tutor	Teaching Students to Build Apps that Make LLM API calls
Build an Interactive Glossary	Create a Design Thinking/Brainstorming Tutor	Build your own UI for a chatbot
Developing Student Evaluative Judgement	Create a Programming Tutor that helps build debugging and code reading skills	Explore LLMs and Machine Learning Models that run in the Browser

Go to: <https://prompting.uqcloud.net>

Considerations

Considerations

- Student Learning of Fundamentals?
- Learning to Learn (even with direct answers)
- Equal Access
- Guiderails (for both prompts and responses)
- Bias
- Ethical Use
- Privacy
- Hallucination



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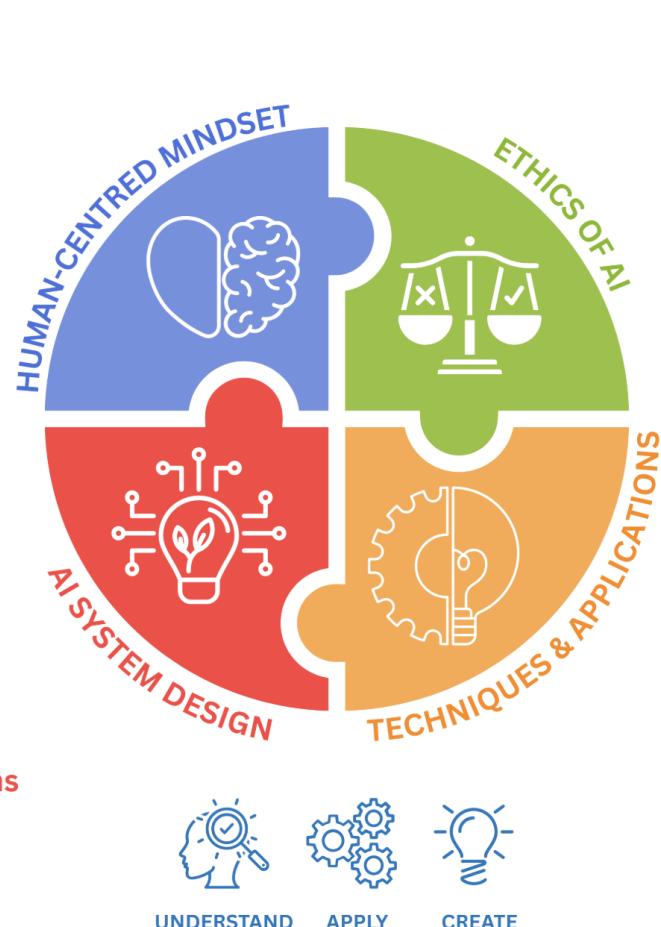
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AI Literacy

AI COMPETENCY FRAMEWORK FOR STUDENTS

PREPARING STUDENTS TO BE RESPONSIBLE AND CREATIVE CITIZENS IN THE ERA OF AI

-  I recognize AI is created by people and affects human lives.
-  I take responsibility for how I use AI and who it impacts.
-  I shape the future of AI with empathy, curiosity & social purpose.
-  I can define a problem for AI and know what it takes to build a useful system.
-  I can plan, design, and build simple AI systems that reflect ethical and technical thinking.
-  I improve and evaluate AI systems based on testing, feedback, and impact on people and society.



-  I know AI can raise issues of fairness, bias, and rights.
-  I make sure I use AI safely, ethically, and fairly.
-  I design or evaluate AI to be ethical from the start, including all voices.
-  I understand how AI uses data and algorithms.
-  I can build or use AI tools thoughtfully and critically.
-  I create or improve AI tools with real-world impact and ethical awareness.



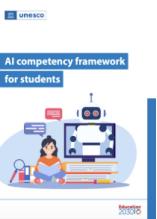
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Adapted from **UNESCO's AI COMPETENCY FRAMEWORK FOR STUDENTS (2024)**

Poster by Stephen Taylor (@sjtyle).

Source: <https://www.unesco.org/en/digital-education/ai-future-learning/guidance>





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Thank you