

Exploration of the use of conversational text-based AI tools for academic teachers: a use case and study

S Venkatraman
Dept. of Electronics
Dolcera ITES Pvt. Ltd.
Telangana, India
venkatraman.s@dolcera.com

Sumneet Kaur Bamrah
Information Systems
Nissan Motor India Pvt. Ltd.
Tamil Nadu, India
sumneetbamrah@gmail.com

G Auswin Joseph Arulraj
Dept. of Chemical Engineering
PSN Engineering College
Tamil Nadu, India
auswin_joseph@yahoo.com

Abstract—The article explores the scope of integrating conversational AI (Artificial Intelligence) tools into the daily activities of academic teachers. The article presents a use case of adopting AI tools for performing some of the day to day, or regular activities of academic teachers. Today, AI is leveraged for multitude of activities including training robots to perform or mimic some human activities, processing large datasets to derive quick and intelligent decisions, and automating, or semi-automating some routine and repeated human tasks. Since 2021, conversational AI tools have witnessed huge amounts of usage activities from people across different industries. ChatGPT and Claude AI were used for prompt engineering to automate the use cases considered in this work and the results are presented in good detail. The accuracy and relevancy of ChatGPT and Claude AI outputs are good and this stands as a testament to the suitability of utilizing AI tools for some of the day-to-day activities of teachers.

Keywords— AI, Artificial Intelligence, ChatGPT, Claude AI, conversational, Google Gemini, teachers.

I. INTRODUCTION

The widespread use of artificial intelligence (AI) has reached an impressive level, with applications extending across various fields within Science, Technology, Engineering, and Medicine (STEM). AI technologies have become an integral part of scientific research, data analysis, medical diagnostics, and advances in engineering. With such widespread proliferation across different verticals, it is sometimes intriguing to find out what AI isn't capable of!

Notably, recent developments in natural language processing (NLP) have paved the way for conversational AI tools like ChatGPT, Google Bard (now Gemini), and Claude AI. These tools harness the power of AI to engage in human-like conversations and automate a diverse range of tasks. Conversational AI tools can be harnessed by academic teachers and professors to perform several repetitive and routine tasks that are being performed manually. This article delves into the possibilities of incorporating these tools into the daily routines of teachers.

It is important to note that while this article demonstrates the use of conversational AI tools for performing some of the academic activities of teachers, a final manual inspection might be required to validate the end outcomes of the tools.

II. OVERVIEW OF GENERAL RESPONSIBILITIES OF TEACHERS

A. General responsibilities of academic teachers

Academic teachers bear multifaced responsibilities. These include classroom teaching, mentoring students, and engaging in academic auditing tasks. While the academic auditing processes have witnessed some digitalization in the

form of online mode audit document submissions, teachers are still left with engaging in the rigorous documentation and compliance requirements set forth by the auditing regulatory bodies. Teachers might find it difficult to balance their routine academic activities amid these accreditation and auditing works.

B. Time constraints and workload

The research work gathered feedback from over 100 academic teachers of different institutions across India. When asked how they balance the workload especially during academic auditing season, vast majority of the teachers stressed on the incorporation of some sort of tools that automate or at least partially automate some of the intensive tasks that are repetitive in nature, usually performed manually.

They justified their stance by further stating that automation of tasks can at least partially offload some of the works and they can concentrate more on academic auditing works and research activities – to name a few. The views expressed here based on the survey are to be treated as personal and not as a whole representation of the academic community.

In addition to teaching and academic auditing responsibilities, teachers are typically given a limited timeframe, ranging from three days to one week, to prepare examination/test question papers. The time constraint, amidst their already hectic schedules, is compounded by their participation in faculty development programs (FDPs) and online/offline certification courses. Furthermore, teachers must navigate the challenging task of completing the syllabus within the allocated time frame.

Considering the above aspects, the research work utilized ChatGPT and Claude AI to prepare prompts to automate or semi-automate the process of question paper preparation for student assignments and exams. The detailed process is explained in the upcoming sections.

III. SCOPE OF USING CONVERSATIONAL AI TOOLS FOR TEACHERS

AI tools are used in academia for varied applications. The following table (Table I) shows some of the literature works that focused on the integration of AI tools into academia for applications such as curation of question papers, creating answers for student assessments, writing research articles and the like. The work of this article is also included as the last entry in the table for a comparison purpose.

For the current work ChatGPT 3.5 and Claude v2.1 have been used. However, this is not a limiting factor. Other higher versions shall also be applied to carry out the use cases discussed in the research article.

TABLE I. AI USAGE IN ACADEMIA (SOME PREVIOUS WORKS)

Ref. No	Application(s)	Objective(s)	AI Tool(s) used
[1]	Utilizing ChatGPT to get answers for assessments on financial accounting.	To assess the suitability of using ChatGPT to automatically generate answer keys of student assessments by assessing the accuracy of its generated answers.	ChatGPT v3.5 and ChatGPT v4
[2]	Utilizing ChatGPT for student media assignments such as short film crafting, podcast production and the like.	To evaluate how Egyptian media students can utilize ChatGPT for their media projects/assignments.	ChatGPT v3.5
[3]	Utilizing ChatGPT to automate the preparation of MCQs.	To create student assessments (MCQ type) and evaluating GPT's knowledge of identifying Turkish translations of English words.	ChatGPT v4
[4]	Utilizing LLMs for academic writing/coding and the like	To evaluate the ethical adoption of AI in academia.	General LLMs with specific focus on ChatGPT v3.5
[5]	Utilizing ChatGPT for curating contents of various sections of a research article such as introduction, literature review and the like.	To evaluate the suitability of using ChatGPT for writing academic research articles	ChatGPT v3.5
[6]	Utilizing ChatGPT to get answers for online quizzes	To evaluate the accuracy of ChatGPT in answering student quizzes on the topic 'Quantitative Techniques'	ChatGPT v3.5 and ChatGPT v4
Our work	Utilizing ChatGPT & Claude for curating student assessments and generating short articles/summaries of events conducted.	To evaluate the suitability of using ChatGPT & Claude for generating student assignments by assessing the relevancy/accuracy of the questions being curated.	ChatGPT v3.5 and Claude AI v2.1

A. Automation of question paper preparation

Conversational AI tools like ChatGPT, Claude AI, and Google Bard (now Gemini) might potentially offer a viable solution for the teachers to address the time-sensitive task of question paper preparation amid various activities assigned to them. Through the process of prompt engineering, these tools

can assist teachers in automating or semi-automating the creation of questions for student assessments.

There are two approaches involved in automating the question paper preparation task:

- i.) The first approach is to visually inspect a question paper, already prepared by manual means. Next, using prompt engineering, similar questions can be asked to be generated by the AI tool by providing the subject topics as inputs/prompts.
- ii.) Instead of manually providing the subject topics as inputs, the manually prepared question paper document can be fed as input to the AI tool and ask the tool to analyze the contents and get familiarized with the topics from which questions are present. Then, the tool can be instructed to curate new or revised versions of the original questions without deviating from the overall scope of the subject topics.

The prompts and their responses for both the approaches are presented in the subsequent sections of this article.

B. Summary/Report generation for academic events

Conversational AI tools can be leveraged to swiftly generate articles, reports and short summaries of various academic events conducted by different departments of colleges and universities. The events include symposia, conferences, workshops, and guest lectures.

IV. READINESS OF INCORPORATION OF AI TOOLS – A SURVEY

In order to assess the readiness index of academic teachers in incorporating AI tools for performing some of their day-to-day activities, a survey was conducted and the feedback, of more than 100 academic teachers from different institutions/universities across India, was received and analyzed. The survey was conducted in October 2023. The respondents of the survey had different designations with varying experiences (41% were assistant professors, 49% were associate professors, 7% were professors, and 3% were lecturers).

Taking into consideration the process of automating the preparation of question paper, the following sub-sections shall discuss multi-faceted aspects related to question paper preparation process.

A. Time budget for preparation of question papers

When enquired about the time budget or time unit allocated by the college/university for preparing question papers, nearly 67% of the respondents replied that they were given up to one week's time for preparation of question papers while about 15% of the respondents replied that they were provided a timeframe of 3 days, and about 18% replied that they were provided 2 days of time for this task.

The respondents further added that even with one week time provided, in most cases, they had to finalize the question paper within three to four days.

B. Correlation between question paper quality and available time budget

Considering the limited time budget provided for preparation of question papers, 37% of the respondents said

that they took important questions from previous year question papers. Another 37% said that they prepare model questions based on the questions discussed during classroom lecture sessions. 11% of them said that they take repeated questions from question papers.

When enquired about referring to standard and reference textbook questions, 37% of them said they pick important questions from the prescribed standard and reference textbooks. A vast majority of the respondents (74%) said that they prefer to have some manually prepared new questions along with the mix of important questions, repetitive questions and questions from previous year papers.

The teachers further added that they themselves find it essential to include at least a few questions that: stimulate critical thinking, are out of the ordinary, or a combination thereof. They suggested that questions of the above-mentioned type shall also improve the critical thinking of students and help them face competitive exams for various recruitments. Further, a common viewpoint was the lack of time for preparing such type of questions.

In section V, a brief description of conversational AI tools of ChatGPT, Google Bard (now Gemini), and Claude AI is provided, and in section VI, the prompt-response testing, for question paper preparation, is described in detail.

V. PROMT ENGINEERING – AN OUTLINE

A. Brief introduction to ChatGPT, Claude AI, and Google Bard

ChatGPT, launched in November 2022, is a powerful AI chatbot powered by OpenAI's GPT-3.5 language model. ChatGPT can hold nuanced conversations, answer questions in informative ways, and even generate different creative text formats like poems, scripts, or musical pieces. GPT-4 entered the market in March 2023, marking a significant leap in large language models. ChatGPT can be accessed using the link: [ChatGPT (openai.com)]. One can choose the version required for the operation as per convenience (ChatGPT 3.5/Chat GPT 4). It is important to note that there are various sub-versions/models of GPT apart from 3.5 and 4.

Claude AI, a next-generation tool from Anthropic, excels at natural conversations and tackles various tasks through its powerful language model. Claude appears promising in summarizing information, crafting creative writing, answering tricky questions, and even coding. Claude 2 model, Anthropic's second generation AI based chat tool, was released in July 2023, and boasts improved performance, longer responses, and an API access option for businesses.

Google Bard (now Gemini), an AI conversation partner from Google AI, initially released in March 2023, (initially announced in February 2023) is a versatile language expert, trained on a massive dataset of text and code. It can answer questions in a comprehensive and informative way, even if they're open-ended, challenging, or strange. It can also generate poems, code, scripts, and even translate languages.

B. Prompts

Prompt engineering, at its very basic level, involves asking questions and getting answers based on the nature of questions. What is being asked, is conveyed, or expressed through prompts. The answers that are obtained, are called responses. It goes without saying that the accuracy of responses depends on the accuracy of prompts.

C. Qualities of a good prompt

When writing prompts for conversational AI tools, aiming for clarity, specificity, and context will yield the most accurate and satisfying results.

i.) Clarity: Use simple, concise language: avoid jargon, complex sentence structures, and unnecessary ambiguity. Point out the request/question in a straightforward manner: tell the AI what you want it to do, be it answering a question, completing a task, or generating creative content.

ii.) Specificity: Provide relevant details: the more information you give the AI, the better it can understand your intent and produce a more tailored, or customized response.

iii.) Context: With respect to context, keywords used are crucial. Use keywords best suited to the context so as to get more relevant results.

It should be noted that improving the prompt improves the accuracy of the results, and therefore, prompt engineering might involve multiple iterations. The prompts might require fine tuning in order to get the expected results.

VI. PREPARATION OF QUESTION PAPERS USING CONVERSATIONAL AI TOOLS

The details of the prompt-response testing are presented as follows in table.

TABLE II. DETAILS OF PROMPT RESPONSE TESTING

PARAMETER	REMARKS
Conversational AI tools	Used ChatGPT (Model: GPT 3.5) and Claude AI (Model: Claude 2.1)
Task	Automation of question paper preparation for the following subject(s): Digital Electronics (Undergraduate level)
Inputs	Already manually prepared sample question paper for each above-mentioned subject along with manual prompt instructions.
Outputs	Question papers prepared by the tools in the required format as per the prompts
Testing timeframe	September - November 2023

A. Working with ChatGPT

A question paper, on the subject 'Digital Electronics', previously prepared manually, was analyzed, and the syllabus along with the level of difficulty of questions of the paper was noted. Next, an attempt to prepare a revised version of the question paper, was made using ChatGPT, without deviating from the scope of the questions originally present in the question paper.

The revised version of the question paper is expected to contain questions that simulate critical thinking amongst students. The questions are not to be just rephrased versions of existing questions, and are not to be too straightforward as well.

First, questions present in the question paper considered for analysis (which we call 'reference question paper'), are presented here for reference. Next, the prompt used for preparing the question paper is presented. Finally, a comparison between the original questions, and the questions provided by ChatGPT, is presented. The process of

preparation of prompts is also explained in this section. Following this, additional processes can be performed with customized prompts which are also detailed in this section.

The question paper considered for analysis has questions categorized into 3 parts namely Part-A, B, and C. We attempt to use ChatGPT to follow the same template but with rephrased questions. Fig. 1, Fig. 2, and Fig. 3 show the questions from reference question paper.

PART-A (5 × 2 = 10 Marks)			
		K-Level	CO
1	Convert 125.34_8 to base 16	K1	CO1
2	Express the function $Y=AC+AB+BC$ in canonical SOP.	K2	CO1
3	Which gates are called as universal gates? Why they are called so?	K1	CO1
4	Difference between combinational and sequential circuit	K1	CO2
5	Define Multiplexer	K1	CO2

Fig. 1 Part-A of reference question paper

PART - B (2 × 13 = 26 Marks)					
			Mark Split up	K-Level	CO
6.	a)	Reduce the following switching function using K-map and realize using logic gate. $F(A,B,C,D)=\sum m(0,1,5,8,9,12,13,14,15)$.	13	K3	CO1
		OR			
	b)	Solve the following using Quine Mc Clusky method: $f(A, B, C, D) = \sum m(0, 1, 3, 7, 8, 9, 11, 15)$ List the prime implicants and essential prime implicants.	13	K3	CO1
7.	a	Explain Carry look ahead Adder with Circuit.	13	K1	CO2
		OR			
	b	Briefly explain about BCD adder with neat logic diagram	13	K1	CO2

Fig. 2 Part-B of reference question paper

PART - C (1 × 14 = 14 Marks)					
			Mark Split up	K-Level	CO
8.	a(i)	Simplify the three variable expression using Boolean algebra $Y(A, B, C) = \Pi M(1, 3, 5, 7)$	8	K2	CO1
	(ii)	Discuss a Half subtractor and full adder in detail	6	K1	CO2
		OR			
	b(i)	Convert the following expression in canonical POS form a. $Y = (A+B)(B+C)(A+C)$ b. $Y = A(A+B)(A+B+C)$	8	K2	CO1
	(ii)	Explain 4 bit Binary Parallel Adder with circuit.	6	K1	CO2

Fig. 3 Part-C of reference question paper

B. Preparing the prompt

The first step involves informing ChatGPT what its role is. This is a very critical step to ensure accuracy. Searching for information related to 'cell structure' in ChatGPT can possibly give results related to i.) the molecular cell structure, or ii.) architectural layouts of a cell with respect to a prison, or jail, or iii.) cell site construction structure with respect to telecommunication sector, or a combination thereof.

It is therefore important to clearly tell ChatGPT what its role exactly is, so that it would pull out only the relevant data and possibly eliminate any irrelevant ones. If you want to search specific information related to molecular cell theory, the prompt should possibly begin like 'You are an expert specialized in molecular cell biology', or any alternate related terms, so as to quickly and accurately get the required results.

The entire prompt for preparing the question paper is presented in Fig. 4.

You
You are a professor, teaching digital electronics at undergraduate level. You are required to prepare questions for a student assignment. The structure of questions should be strictly as follows:
1) The maximum marks for the test is 50.
2) Categorize your questions into "Part-A", "Part-B", and "Part-C" wherein a.) "Part-A" has 5 short answer type questions, each carrying 2 marks. b.) "Part-B" has 2 long answer type questions carrying 13 marks each (2×13=26 marks). c.) "Part-C" has 1 long answer type question carrying 14 marks (1×14=14 marks).
3) Provide 1 alternate question for each question from "Part-B" and "Part-C" (for questions under Part-B as well as Part-C, keep the numbering as questionnumber.a and questionnumber.b where "questionnumber" is the next sequence question number after the last Part-A question. Do not explicitly use or mention the term "alternate question").
4) The questions can be theoretical as well as problem solving (numerical) type questions.
5) The questions should strictly be within the scope of the following topics: a.) Combinational digital circuits (including multiplexer, demultiplexer, half adder, full adder, half subtractor, full subtractor, magnitude comparator and the like) b.) Boolean digital logic theory (can include simplification/expression of Boolean functions using Karnaugh Map)
6) Let the questions not be too much straightword, and let it be in the form that simulates critical thinking.
7) Do not repeat any questions. Do not keep questions that are more or less similar to each other.
8) The exam will be for 90 minutes and hence the curate the questions as accordingly.
9) Number the questions, starting from 1. The numbering should be continuous.
10) Create three separate sets of questions, following the above mentioned steps, and name them "Set-A", "Set-B", and "Set-C".
11) Importantly, mathematical symbols/special characters should be properly embedded/presented/formatted.

Fig. 4. Full prompt in ChatGPT for Digital Electronics

C. Walkthrough of the prompt

Step-1: At the very beginning, it can be observed that role of ChatGPT has been clearly and explicitly mentioned (Reference: pink box: the very first box).

Step-2: As per the reference question paper, there are three parts, Part-A, Part-B, and Part-C. This template is incorporated in the prompt (Reference: teal box: second and fourth boxes).

Step-3: The technical areas for the questions are mentioned (Reference: gold box: the third box).

D. Response of the prompt

The response provided by ChatGPT v3.5 is presented in Fig. 5, Fig. 6, and Fig. 7 present below. One can assess the relevancy of the response from these figures. Comparing Fig. 5 with Fig. 1, it can be observed that there have been similar questions curated by ChatGPT, and importantly, the questions were within the scope of the technical topics mentioned in the prompt.

Analogous questions in Fig. 5 and Fig. 1 are highlighted in yellow boxes. In Fig. 1, Fig. 2, and Fig. 3, the 'CO' and 'K-

level' correspond to Bloom's taxonomy levels. Using prompts, these metadata can also be included in prompt response.

Q.No.	Question
1	Convert the binary number (1110) ₂ to hexadecimal number system.
2	Write the simplified Boolean expression $Y=A'BC+AC$
3	What is a decoder?
4	Differentiate between combinational and sequential circuits.
5	Draw the logic diagram of a 4:1 multiplexer.

Fig. 5. Prompt response for 'Part-A' from ChatGPT

PART - B (2 × 13 = 26 Marks)	
Q.No	Question
6	a) Implement the following logic function using a 4-to-1 multiplexer: $F = \sum(0, 1, 4, 5, 7, 9, 14, 15)$ OR b) Design a combinational circuit to check if a given 4-bit binary number is even or odd using multiplexers.
7	a) Explain a 4-bit serial 2's complementer with block diagram, timing waveform and truth table. OR b) Explain the operation of a parallel binary subtractor circuit with logic diagram, truth table and timing waveforms.

Fig. 6. Prompt response for 'Part-B' from ChatGPT

PART - C (1 × 14 = 14 Marks)	
Q.No.	Question
8	a) Simplify the following Boolean expression using Karnaugh map: $Y(A,B,C,D) = \sum M(0,2,4,8,9,10,11,15)$ OR b) Design a 4-bit magnitude comparator using multiplexers and explain its operation with logic diagram and truth table.

Fig. 7. Prompt response for 'Part-B' from ChatGPT

From Fig. 5, Fig. 6, and Fig. 7, it can be observed that the questions have been categorized into Part-A, Part-B, and Part-C, following the prompt specified. Analogous questions, similar to what was mentioned previously, are highlighted in yellow boxes.

It can also be observed that the questions in Fig. 5, Fig. 6, and Fig. 7 have been presented in a table. An additional step mentioned in the prompt (not shown in Fig. 4) yielded ChatGPT's response in the form of a table. The difficulty level of questions can also be modified with clear instructions in the prompt.

E. Continuing with prompting – another similar exercise

The prompt in Fig. 4 can be extended to curate questions from other technical topics of the same subject. With all other steps of the prompt remaining the same, it is enough if point number 5 of the prompt in Fig. 4 is modified as required. Fig. 8 illustrates a prompt with a different set of technical topics of the same 'Digital Electronics' subject. It is to be noted that the same prompt template can be used to curate questions from different subjects as well, which is also displayed in this sub-section.

PROMPT #2	Default (GPT-3.5)
V	<p>You are a professor, teaching digital electronics at undergraduate level. You are required to prepare questions for a student assignment. The structure of questions should be strictly as follows:</p> <ol style="list-style-type: none"> The maximum marks for the test is 50. Categorize your questions into "Part-A", "Part-B", and "Part-C" wherein <ol style="list-style-type: none"> "Part-A" has 5 short answer type questions, each carrying 2 marks. "Part-B" has 2 long answer type questions carrying 13 marks each (2×13=26 marks). "Part-C" has 1 long answer type question carrying 14 marks (1×14=14 marks). Provide 1 alternate question for each question from "Part-B" and "Part-C" (for questions under Part-B as well as Part-C, keep the numbering as questionnumber.a and questionnumber.b where "questionnumber" is the next sequence question number after the last Part-A question. Do not explicitly use or mention the term "alternate question"). The questions can be theoretical as well as problem solving (numerical) type questions. The questions should strictly be within the scope of the following topics: <ol style="list-style-type: none"> Sequential circuits (flip flops, registers, counters) Meare and Mooly state machines Synchronous and Asynchronous sequential circuits Let the questions not be too much straightword, and let it be in the form that simulates critical thinking. Do not repeat any questions. Do not keep questions that are more or less similar to each other. The exam will be for 90 minutes and hence the curate the questions as accordingly. Number the questions, starting from 1. The numbering should be continuous. Create three separate sets of questions, following the above mentioned steps, and name them "Set-A", "Set-B", and "Set-C". Importantly, mathematical symbols/special characters should be properly embedded/presented/formatted.

Fig. 8. ChatGPT prompt response for different set of technical concepts from 'Digital Electronics'

As per prompt in Fig. 8, ChatGPT is asked to prepare three sets of question papers and this is an optional condition. The responses are not shown here for the sake of brevity, however, they can be accessed using the following link below: {<https://drive.google.com/drive/folders/1yuuW8JbUsehq1QgNzJ1UJRX3qDHU5FFK?usp=drive>} (under the Question responses folder).

F. Working with Claude AI

Instead of manually inspecting the questions in reference question paper, we can upload the reference question paper as input to the AI tool (here, Claude), and ask it to thoroughly analyze the document questions and prepare revised version of the question paper as per requirement. Claude AI supports uploading of documents as inputs. This feature might stand extremely useful when lengthy reports are required to be manually read and summarized.

With this document upload feature, considerable amount of time can be saved. The same approach is followed here for preparing questions based on analyzing the questions in the