Prompt Engineering with ChatGPT - A Paradigm Shift in Education: A Guide for School teachers

Narendra D Deshmukh[1] & Vinita A Shrouty[2]

[1]Homi Bhabha Centre for Science Education, TIFR, Mumbai

Email- ndd@hbcse.tifr.res.in

[2]SNDT Women's University, Mumbai

Abstract

Advancements in the area of Artificial Intelligence (AI) significantly impacted education in the era of the fourth industrial revolution. ChatGPT is an AI-powered application designed to generate chat responses in a conversational style, paving the way for flexible and responsive education to become mainstream. Various research on ChatGPT has sparked debates about its potential implications to support education for providing adaptive and personalized environments. This ongoing descriptive study analysed the use of ChatGPT by 24 school teachers who participated in a course in the first step of study. It aimed to evaluate teachers' initial knowledge regarding ChatGPT, particularly its educational applications and potential advantages, before their course. Based on connectivism learning theory the present study sought to pinpoint effective prompts that teachers could incorporate into their teaching methods. Furthermore, it aimed to gauge the impact of the course on enhancing teachers' awareness and understanding about ChatGPT, basically prompt engineering with its possible applications. The data was collected from base survey, feedback form, discussion forum and assignments and analysed using the descriptive method. The first step of the study revealed that teachers have minimal baseline knowledge of ChatGPT but after the course they found ChatGPT as their virtual teacher assistant. It emphasises the importance of preparing teachers for a paradigm shift in education.

The study found a direct correlation between cognitive engagement and interaction levels of connectivism theory. However, as interaction levels increase, participant involvement tends to decline.

Keywords: ChatGPT, Connectivism theory, Prompt engineering, School Teachers, Paradigm shift in education

Introduction

Effective classroom management is essential for creating a conducive learning environment, where a teacher uses a blend of strategies to create an ideal learning environment. Engaging lesson plans, suitable teaching methodologies, appropriate teaching aids, and diverse assessment strategies compose a toolbox that collectively foster an optimal learning atmosphere.

Whereas, the learning outcomes of the class depends upon the satisfactory completion of learning needs of the student. Nevertheless, personalised lesson plans in a heterogeneous classroom is a quiet challenge.

Prompt Engineering as an Important Emerging Skill

Prompt engineering is the process of designing, refining, and optimising input

prompts to effectively communicate the user's intent to a language model like ChatGPT. It can be called as the art of crafting effective prompts which can guide ChatGPT to generate desired responses (Ekin, 2023). It also plays a significant role in enhancing the user experience and ensuring effective communication when interacting with AI models like ChatGPT (Ray, 2023). According to Ekin (2023), the quality of the prompts directly affects the quality of the generated responses, understanding the nuances of prompt engineering is vital for creating effective and meaningful interactions with ChatGPT.

ChatGPT 3.5 has the potential to revolutionise education systems providing personalised learning experiences (Dempere et al., 2023). Teachers can incorporate ChatGPT by leveraging the AI's capabilities to help create, organise, and structure course content in a coherent and effective manner (Dilmegani, 2024). Nevertheless, ChatGPT will not replace teachers (Atlas, 2023), instead teachers can use it to enhance their practice (Lo, 2023). However, Dilmegani (2024) reveals educators' concerns about chatbots amplifying plagiarism while recognizing their transformative potential in education, emphasising the importance of ethical guidelines and proactive integration into teaching approaches. Winkler and Söllner (2018) emphasised the need to explore the potential of Chatbots for mentoring students. Teachers should adapt to this upcoming AI technologies like ChatGPT to keep education relevant and effective. They should learn how it works, how to access information, and create engaging and interactive lessons. They should have expertise in prompt engineering (Ding et al., 2023 & Farrokhnia, et al., 2023). Because of naiveness in using ChatGPT, Barrett and Pack (2023) stressed the essentialness of teacher training. Hence, in this study we conducted the first step of our course in September 2023 for the school teachers on the skill of prompting questions. As the usage of the tool is at infancy, we provided the teachers with a variety of prompts to assist in effectively utilising ChatGPT.

ChatGPT: Opportunities and Challenges in Education

ChatGPT presents numerous opportunities in education. It enables personalised learning, 24/7 virtual guidance, and grants access to material. It provides a simulated experience of having assistance from a more knowledgeable person. It gives a wide range of potential applications including assistance in writing, serving as research assistant, offering individualised feedback and developing writing and communication skills, creating lesson plans, presentations, grading student work, designing syllabus, quizzes, and evaluating student progress (Atlas, 2023). Furthermore, ChatGPT facilitates adaptive learning, and aids in developing innovative assessments (Koos and Wachsmann, 2023).

Along with opportunities ChatGPT poses several challenges, and potential issues and concerns (Panagopoulou et al., 2023) like generation of incorrect information, undermining students' critical thinking skills (Woodland, 2023) and lack of emotional intelligence. It gives inaccurate, fabricated, or biased information (Mohammad et al., 2023) also there is a risk of plagiarism, loss of critical thinking skills, and difficulty in evaluating information generated by ChatGPT (Rahman and Watanobe, 2023). Currie and Barry (2023) highlighted concern for cheating on exams and assignments. Hence, the use of ChatGPT requires careful consideration of ethical principles to ensure its responsible and ethical integration in various domains (Ali and Djalilian, 2023).

Rationale of the Study

While numerous studies have explored the application and significance of ChatGPT in medical science (Lee, 2023), its utilisation in teacher and school education has not been extensively explored, leaving a gap in harnessing its potential. Well-crafted prompts enable teachers to craft input instructions to guide ChatGPT to generate educational content. Considering this, it's crucial for teachers to know how to formulate prompts that align with their teaching objectives. Following this rationale the objective of this ongoing study is to assess the impact of a ChatGPT course on teachers' knowledge, highlighting the need for teachers to not only be proficient in ChatGPT usage but also skilled in formulating prompts. Along these lines, the present research was examined the following research questions:

RQ 1: - What is the baseline level of knowledge that school teachers currently possess regarding ChatGPT, particularly its applications and potential benefits in education, before receiving training?

RQ 2: - What are the various prompts that school teachers can effectively utilize in their instructional practices?

RQ 3: - To what extent has the course improved school teachers' awareness and knowledge about ChatGPT and its potential applications in the field of education?

To answer the above research questions, we conducted a course on ChatGPT in online asynchronous mode using Google Classroom.

Theoretical framework

Theory of Connectivism

George Siemens and Stephen Downes developed a theory for the digital age, called connectivism (Duke, et al., 2013). This theory provides a framework for understanding the role of humans and appliances in the learning process and how they interact with each other to create new knowledge (Omodan, 2023). Siemens (2005) suggested implication of the connectivism theory as designing learning environments which facilitates learning by incorporating internet technologies into the educational process.

ChatGPT views learning as a networked phenomenon influenced by technology and socialisation, where learners develop mental connections between pieces of information through interaction with various sources (Liet al. 2022).

Voskoglou (2022) described Connectivism as a new theory for understanding learning in our digital era. According to Kop (2011), ICTs has led to the concept of connectivism, emphasising learning through networks and digital resources. Connectivism serves as both a learning and instructional theory in the 21st century (Kropf, 2013). It provides a conceptual framework for understanding how learning occurs in a digital environment (Dziubaniuk et al. 2023). The theory explains how internet technologies help people learn and it creates new learning opportunities by using the latest digital technologies e.g. twitter, wikis, blogs, open educational resources etc.

Methodology

The below section discusses the research methodology used in the study.

Method

Considering the nature of the present study we employed a descriptive method. Data was collected using a survey. As described by Mathiyazhagan

and Nandan (2010), survey research is a descriptive research method used for the collection of data from the representative sample of the target population.

Participants and Data Collection

A purposive sampling technique was employed to select 24 participants (see Table-1) out of the 56 practicing teachers who had enrolled in the Google Classroom. These 24 individuals successfully completed the baseline test and the feedback form. A purposive sampling which can be used for both qualitative and quantitative research (Tongco, 2007) was used as a sampling technique. The study collected data using base survey, feedback form, discussion forum and assignments which validated from five experts.

Data before the training program was gathered through a Google Form that included 17 closed-ended questions (see Table 1), and one open-ended question. Post course teachers' feedback and knowledge assessment was collected using a gamification tool Quizizz.com. It included 14 closed-ended questions.

Planning and Implementation

The section below discusses in detail about the planning of the course and implementation guided by Connectivist Levels of Interaction.

Planning

A Google Classroom was created for the purpose of uploading learning material, assignments, base survey questionnaires, and feedback form. Discussion forums were used for sharing the ideas among the participants. Within this platform, a course was designed and for its implementation four sessions were planned. In each session a presentation was shared on Google Classroom. Course design is shown in Appendix 1.

The first session was focused on the objective of the course, information related assignment submission and the outline of the session and as they were novice to ChatGPT this session also familiarise them with it. The objective of the next session was to give understanding about prompt engineering. The following two sessions were planned to help them to know how prompts should be designed.

A WhatsApp group was formed to facilitate communication and to provide a platform for easy interaction and resolving doubts. Participants were guided to join the Google Classroom and log in to ChatGPT. At the outset, an initial base survey was administered, and upon conclusion, participants were provided with a feedback form.

Implementation guided by Connectivist Levels of Interaction

To facilitate effective and meaningful learning experiences we used the conceptual framework from connectivism theory having four levels of interaction as- i) operation interaction, ii) wayfinding interaction, iii) sensemaking interaction, and iv) innovation interaction designed by Wang, et al. (2014). This framework is inspired by the hierarchical model for instructional interaction (HMII) proposed by Chen (2004) in distance learning. Connectivism theory was also used in the study on ChatGPT in Advanced Programming Courses by Gottipat et al. (2023).

The following Figure 1 shows the interconnectedness between four interaction levels and increase in cognitive engagement and learner's interaction (Wang, et al., 2014).

Figure-1: The four interaction levels, cognitive engagement and learner'sinteraction (Wang, et al., 2014)
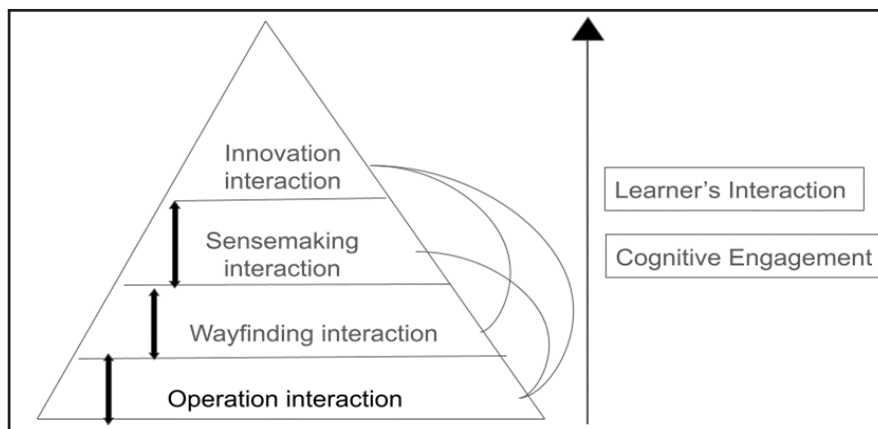
The following paragraph gives the details about four interaction levels as suggested by Wang, et al. (2014) and the incorporation of it in our course.

(i) Operation interaction is the first level that provides the possibility to connect with different groups of people and information, and to change their sensemaking behaviours.

(ii) Wayfinding interaction is the second level in which learners actively connect with technologies and people in groups having similar learning goals, to share and exchange knowledge.

(iii) Sensemaking interaction is the third level of connectivism framework. It emphasizes learner-learner, learner-teacher and learner-content interaction. It is a collaborative process that includes information sharing, discussion, negotiation, reflection, and decision-making. In this level the learner shows more interaction as compared to previous interaction level.

(iv) Innovation interaction is the deepest, highest and most challenging form of interaction in which the learner is involved in artifact creation. The learner creates something new or a modified version. This level requires the deepest cognitive engagement compared to all four interactions. To reach the highest level, the learner should have deepest cognitive engagement, self-directedness, and creativity.

Based on four interaction levels as suggested by Wang, et al. (2014) the researchers designed a Framework for Interaction and Cognitive Engagement in Connectivist Learning (see Figure 1).

Course design and implementation

During the implementation of the present study, a WhatsApp group was formed to give the instructions, guidance and for solving the doubts of the participants. They were asked to join the Google classroom using the shared link. Novice participants were guided to using Google Classroom.

The paragraph below discusses the course design of four sessions and its implementation in detail.

Session 1

During the session, the participants were guided to install ChatGPT. Links for installing ChatGPT on mobile and

laptop were provided (https://chat.openai.com). The session incorporated knowledge about how ChatGPT generates data, benefits and challenges of using it. Also introduced the use of ChatGPT for various interactive activities like generating questions answers, lesson plan, rubrics, blueprint, planning of virtual tours, generating debate topics, creative writing etc. The Session-1 concluded by creating a discussion forum where participants were encouraged to share their perspectives on the advantages of utilising ChatGPT.

Session 2

Operation interaction along with Wayfinding interaction was continued as emphasis was given on building social networks and informational networks. During session 2, the participants were given an understanding about prompt engineering and its importance as it is essential for controlling the model's behaviour and generating accurate and useful responses. Initially, they were introduced with various features and buttons of ChatGPT like +New Chat, Regenerating button etc. They were given clear understanding about cross checking and editing the responses for accuracy and relevance. And also instructed about providing a source material and a clear, context-rich prompt for obtaining accurate and relevant results. Next, they were given steps for giving the prompts to ChatGPT as - 1) Select and highlight the shared prompt; 2) Copy the prompt; 3) Go to the ChatGPT platform; 4) Click in the chat box where you will talk to GPT, and 5) Paste the prompt and press enter. At the end of session - 2 the first assignment was shared.

In the first assignment participants were given a paragraph and asked to paste it into ChatGPT's workspace.

Subsequently, they were directed to use the given prompt to create a lesson plan based on the STEAM approach and submit their response. A discussion was also initiated about the variations in outcomes when using the same prompts. Getting different responses for the same prompt shows sensemaking interaction. On discussion forums we noticed learner-learner, learner-content and learner-teacher interaction in a deeper sense.

Session 3

As this session provided participants with subject specific prompts (Appendix-1), group interaction among particular subject teachers was observed.

Session 4

This session provided prompts on creative aspects, designing rubrics, method of teaching etc. At the end of session 4 second assignments were shared. However, following the session, only a few of the participants shared their creative prompts.

In the second assignment focusing on innovative applications of ChatGPT in teaching, the emphasis was on fostering innovative interactions. Among the 24 participants only four participated in this aspect of the assignment. Among them, a science teacher devised an assignment involving ChatGPT, where students were instructed to bring a short paragraph using Chat GPT on deforestation using a provided prompt. The plan was for students to generate responses from ChatGPT, which they would subsequently share in class. This would lead to a discussion on environmental conservation. Similarly, a mathematics teacher crafted a prompt for her students aimed at generating a variety of mathematical problems based on concept in proportion.

In the present study, researchers observed that initial stages, wayfinding and sensemaking showed participants' involvement, while fewer participants reached the innovation level. This pattern of teacher participation aligns with findings from Wang et al. (2014) study, which states that as the interaction levels become more innovative, the number of participants tends to decrease.

Data analysis and Discussion

Our research primarily focuses on empowering teachers with the knowledge about the ChatGPT and guiding them for its practical use in their instructional process. Though 56 participants joined the Google Classroom only 24 participants filled the base survey and feedback form. Also, among them a few took part in a discussion forum and submitted the assignment. Here, one of the reasons can be their limited competency in basic digital literacy and learning literacy as these are essential to engage in connectivist learning (Wang, et al. 2014).

During the program implementation before and after the course participants' responses were collected and analysed. The section below discusses the responses collected on closed and open-ended questions in base surveys, participants' feedback and Submission of Assignment based on levels of Connectivist learning.

The following paragraphs analyses and discusses the data of the base survey, feedback form, discussion forum and assignments.

Data analysis and discussion of the base survey

Below is the data analysis and discussion of the Base survey. It is divided into two parts—Data analysis and discussion of closed ended questions of base survey and data analysis and discussion of open-ended questions of base survey.

Data analysis of closed ended questions of base survey

The base survey included 17 closed-ended questions (see Table 1, Table 2, Table 3), and the following sections provide an analysis of these questions.

The analysis of teacher backgrounds indicates a diverse distribution of subjects they specialise in. Approximately 37.5 per cent were focused on mathematics and science, closely followed by 33.8 per cent specialising in language arts. Moreover, 20.8 per cent of participants were involved in teaching social studies, while 4.2 per cent were responsible for art and music instruction. A quarter of the participants, precisely 25 per cent, were engaged in teaching other subjects, reflecting the varied expertise within the educator group.

The participants from various grade levels and teaching various subjects were enrolled for the course. Regarding technology integration in classroom practices, 50 per cent of participants reported moderate familiarity. And 45.8 per cent expressed interest in using AI-driven tools or chatbots but reported they haven't used them; rather 54.2 per cent of participants expressed willingness for integrating ChatGPT-generated content into their lesson plans (see Table-1).

Table-1: Geographical Distribution, Experiences and Future perspectives of using Technology and AI Tools

#	Question	Responses (N=24)	%
1. Teaching subjects	Which subject(s) do you primarily teach? (You can choose multiple options)	Science	37.5%
		Mathematics	37.5%
		Language Arts	33.3%
		Social Studies	20.8%
		Arts and Music	4.2%
		Physical Education	0%
		Other	25%
2. Grade	For which grade level(s) do you primarily teach? (You can choose multiple options)	Elementary (Pre-K to Grade 5)	37.5%
		Middle School (Grade 6 to 8)	45.8%
		High School (Grade 9 to 12)	33.3%
		College/University	29.2%
3. Familiarity with technology	How familiar are you with integrating technology into your teaching practices?	Very familiar	20.8%
		Somewhat familiar	50%
		Neutral	16.7%
		Not very familiar	12.5%
		Not familiar at all	0%
4.	Have you previously used AI-driven tools or chatbots in your teaching?	Yes, frequently	0%
		Yes, occasionally	29.2%
		No, but I'm interested	45.8%
		No, never	25%
5. Future Perspectives	How likely are you to incorporate ChatGPT-generated content in your lesson plans?	Very likely	12.5%
		Likely	54.2%
		Neutral	25%
		Unlikely	8.3%

Prior understanding for application of ChatGPT among participants shows: 75 per cent recognised it as a language model for interactive lessons and student queries, 79.2 per cent recognised ChatGPT as an AI-based text generation tool. 66.7 per cent correctly understood ChatGPT's support for critical thinking and providing additional resources, 75 per cent know that it can be used to assist in lesson planning and content generation. The study found misunderstandings of participants that ChatGPT couldn't provide personalised learning (29.2 per cent), enhance creativity (41.7 per cent), minimise

teacher workload (41.7 per cent), or improve accessibility for diverse learners (29.2 per cent). But on the other hand, 79.2 per cent of participants correctly identified its versatility across subjects like science and literature and another 79.2 per cent of participants correctly identified it for natural language understanding but some of them also misunderstood its use for stock trading, video game development and weather forecasting (see Table 2).

Table-2: Teachers Prior understanding about application of ChatGPT

#	Question	Responses (N=24)	%
1.	What is Chat GPT, and how can it be applied in an educational context? (You can choose multiple options)	ChatGPT is a gaming platform for students. It can be used for creating educational games.	20.8%
		ChatGPT is a language model AI. It can generate interactive lesson plans and answer student questions.	75%
		ChatGPT is a video conferencing tool for online classes.	8.3%
2.	Which of the following best describes ChatGPT's function? (choose as many options)	A video conferencing tool	8.3%
		A language translation service	16.7%
		An AI-based text generation tool	79.2%
		A social media platform	12.5%
		I don't know	4.2%
3.	How can ChatGPT be used to enhance classroom engagement? (choose as many options)	By replacing all teacher-student interactions	25%
		By automating all aspects of teaching	25%
		By fostering critical thinking and providing additional resources	66.7%
		By eliminating the need for teacher involvement	12.5%
		I don't know	8.3%
4.	In education, how can Chat GPT be utilised? (choose as many options)	As a substitute for teachers	20.8%
		To automate grading without review	4.2%
		To assist in lesson planning and content generation	75%
		I don't know	8.3%
5.	Which of the following is/are NOT potential benefits of using ChatGPT in education? (choose as many options)	Personalised learning experiences	29.2%
		Enhanced creativity in students	41.7%
		Increased teacher workload	41.7%
		Improved accessibility for diverse learners	29.2%
		I don't know	12.5%
6.	ChatGPT can assist in generating content for which of the following subjects? (choose as many options)	Only mathematics	0%
		Only history	4.2%
		A wide range of subjects, from science to literature	79.2%
		None, it is limited to language translation	8.3%
		I don't know	8.3%

#	Question	Responses (N=24)	%
7.	ChatGPT is designed for which of the following applications? choose as many options)	Stock trading	12.5%
		Video game development	16.7%
		Natural language understanding	79.2%
		Weather forecasting	12.5%
		I don't know	12.5%

While taking prior knowledge 50 per cent of participants correctly identified ChatGPT as "Generative Pre-trained Transformer. 66.7 per cent of participants knew ChatGPT's limitation in providing incorrect or biased information. Though 66.7 per cent of participants understood ChatGPT generates text from statistical patterns, 33.3 per cent think it accesses real-time internet data. Additionally, 20.8 per cent misunderstood it as generating text randomly. Whereas, the majority of participants (58.3 per cent) correctly identified the internet text dataset as ChatGPT's primary training source. Also, 20.8 per cent indicated they didn't know its training method. 41.7 per cent of participants correctly recognised GPTZero's ability to distinguish between human and AI-written content however, 33.3 per cent misunderstood its capability for complex calculations, and 25 per cent were uncertain about its features (see Table-3).

Table-3: Teachers Prior Knowledge about ChatGPT

Sr. No	Question	Responses (N=24)	%
1.	What is/are the main limitation/s of ChatGPT when it comes to generating text? (choose as many options)	General Predictive Transformer	8.3%
		Generative Pre-trained Transformer	50%
		Global Prediction Toolkit	16.7%
		General Purpose Text	0%
		I don't know	25%
2.	What is/are the main limitation/s of ChatGPT when it comes to generating text? (choose as many options)	It generates text that is too short.	20.8%
		It cannot generate coherent text.	8.3%
		It may sometimes produce incorrect or biased information.	66.7%
		It is too slow in generating responses.	4.2%
		I don't know	12.5%
3.	ChatGPT uses patterns and information from a large dataset to generate text. Which of the following statements are true? (choose as many options)	It generates text randomly without any patterns.	20.8%
		It relies on personal experiences and emotions.	4.2%
		It generates text based on statistical patterns in the training data.	66.7%
		It accesses real-time information from the internet.	33.3%
		I don't know	4.2%

Sr. No	Question	Responses (N=24)	%
4.	What is/are the primary source/s of training data for ChatGPT? (choose as many options)	Real-time user conversations	37.5%
		A massive dataset of internet text	58.3%
		Encyclopedias and textbooks	20.8%
		Private research documents	12.5%
		I don't know	20.8%
5.	What is/are the primary distinguishing feature of GPT Zero? (choose as many options)	It generates highly creative and imaginative content.	37.5%
		It has the ability to perform complex calculations.	33.3%
		It accurately distinguishes between human and AI-written content.	41.7%
		It can predict future events with high accuracy.	8.3%
		I don't know	25%

Discussion on Closed Ended questions of Base survey

Before the commencement of the course responses on base surveys were collected using Google form and were analysed. The responses revealed various misconceptions about ChatGPT among the participants prior to the course. Notably about 50 per cent of participants showed a moderate understanding of the subject. Some participants displayed no prior knowledge of ChatGPT, while others had misperceptions considering it as a gaming tool, a video conferencing platform, or even a social media tool. They showed their misconceptions about its applications ranging from associating it with weather forecasting to stock trading. Only a few recognised the potential of ChatGPT in enhancing classroom engagement, personalizing learning experiences, nurturing student creativity, and improving accessibility for diverse learners. Even some participants have a notion that ChatGPT could replace teachers. Participants also showed misconceptions regarding the subject-specific utility of ChatGPT, with some participants in a delusion that use of ChatGPT is limited to English classes.

They assume limitations of ChatGPT as it generates incoherent and brief responses and the speed of providing responses is slow.

In addition, there were misconceptions about the operation of ChatGPT including the belief that it generates text randomly without any patterns or that it accesses real-time internet information. Their misconceptions about the sources of ChatGPT's training data included real-time user conversations, encyclopedias, textbooks, and private research documents. Lastly, they showed their misunderstanding about GPTZero as it can generate highly creative and imaginative content, perform complex calculations, or even predict future events with remarkable accuracy. These different views and misconceptions emphasise the importance of providing the course regarding what ChatGPT can and cannot do within an educational setting. A noteworthy observation was that a significant number of participants expressed a keen interest in incorporating ChatGPT generated content into their teaching practices.

Data analysis and discussion of open-ended questions of base survey

Including the closed ended questions, the base survey also asked one open ended question to get deeper understanding about the participants' vision regarding ChatGPT in impacting the future of education. The following paragraph analyses and discusses the open-ended responses provided by participants in response to "How do you foresee AI-powered tools such as ChatGPT influencing the future of education?"

Data analysis of open-ended questions of base survey

75 per cent participants expressed positive views on the impact of AI tools, mentioning benefits like making teaching more interesting and easier, enhancing the teaching-learning process, and assisting with various aspects of education. 16.66 per cent participants were unsure about or had no specific idea regarding the impact. Very few (8.33 per cent) participants explicitly stated their intention to use ChatGPT for teaching (Ding et al., 2023). Overall, a majority of the participants (75 per cent) held positive views about the potential impact of AI tools in education, while the remaining participants had either uncertain or no opinions.

Discussion open ended questions of base survey

Many participants recognised the potential benefits of integrating AI tools into the educational context. They foresee ChatGPT as a virtual assistant that can help teachers to invest their extra time on creative and complex activities. They shared that it can enhance the teaching learning process by incorporating various techniques and strategies as per the classroom's needs, making learning engaging and effective. Two of them recognised the benefit of using it for students as it will provide students with quick access to information. It can assist students in understanding topics, providing detailed explanations, and preparing projects and assignments. However, one of the participants shared that though AI-powered chatbots can assist in the learning process, it will never replace human teachers, as machines can never provide emotional support to students.

A few participants shared challenges and concerns of using AI-powered tools like ChatGPT. They find the need to focus on potential consequences of using such tools. Secondly, one of the participants showed concern about their impact on students' exploration ability and connection with books.

Many participants find ChatGPT as a new technology to learn, they do not have any idea about it, some of them inquired about—How can teachers use ChatGPT for enhancing teaching learning experience? And how to accurately provide a prompt to have suitable output from GPT. This emphasises the need for the implemented course.

Data analysis and Discussion on Feedback form

The feedback form comprised 13 questions aimed at assessing the knowledge acquired by the participants concerning ChatGPT after completing the course. The subsequent paragraph delves into an analysis and discussion of the data collected from these feedback forms.

Data analysis of Feedback form

Following the course, a substantial 88 per cent of participants now hold the belief that ChatGPT cannot serve as a replacement for human educators. 91.67

per cent of participants are now aware that ChatGPT primarily comprehends and interacts with spoken language. And 87.5 per cent correctly identified ChatGPT's primary training purpose as generating human-like text responses. After attaining the course 62.5 per cent of participants understood that ChatGPT is a natural language processing tool and they correctly understood that ChatGPT generates responses from its training data patterns. Now 75 per cent of participants correctly identified that a prompt refers to an input or instruction given to ChatGPT. However, 17 per cent mistakenly believe it means a user's response to ChatGPT's question. 83 per cent of participants are now aware that ChatGPT can understand and respond to prompts in various languages.

83.33 per cent know OpenAI created the ChatGPT model. 87.5 per cent correctly recognise that ChatGPT can facilitate personalized learning, assist students with disabilities, and provide instant feedback. Now 83.33 per cent of participants believe that educators can ensure the quality of ChatGPT-generated content through careful review. 79.17 per cent understood the importance of prompt engineering as they think providing context and specifying desired outputs increases the effectiveness of prompt; also 75 per cent of participants recognise that overly complex prompts can be a common challenge. 75 per cent find ChatGPT capable of generating random and unique prompts for creative exercises (see Table-4).

Table-4: Effectiveness of implementation program

#	Question	Responses (N=24)	%
1.	Can ChatGPT replace human teachers entirely?	Yes	8.33%
		No	87.5%
		Unattempted	4.17%
2.	What type of input does ChatGPT primarily understand and respond to?	Spoken language	8.33%
		Text-based input	91.67%
3.	What is ChatGPT?	A natural language processing tool	62.5%
		A speech recognition software	37.5%
4.	What is a prompt in the context of ChatGPT?	An input or instruction given to ChatGPT	75%
		A user's response to ChatGPT's question	17%
		ChatGPT's response	8.33%
5.	Can ChatGPT understand and respond to prompts in different languages?	No, it only understands English	16.66%
		Yes, it can work with multiple languages	83.33%
6.	How does ChatGPT generate responses?	By using a set of predefined responses	8.33%
		By generating new responses based on patterns in its training data	63%
		By searching a database of previously seen responses	21%
		By randomly selecting words and phrases from a large vocabulary	8.33%

#	Question	Responses (N=24)	%
7.	Which company developed ChatGPT?	Microsoft	4.17%
		Google	8.33%
		Amazon	4.17%
		OpenAI	81.33%
8.	What is the potential impact of ChatGPT on education?	It can facilitate personalised learning	4.33%
		It can help students with disabilities or special needs	8.33%
		All of the above	87.5%
9.	What is the primary purpose of ChatGPT's training?	To generate human-like text responses	87.5%
		To translate between different languages	4.33%
		To perform complex mathematical calculations	8.33%
10.	How can educators ensure the quality of content generated by ChatGPT for educational purposes?	By not reviewing the content at all	83.33%
		By trusting it completely	17%
11.	When using ChatGPT for teaching, what can educators do to ensure effective prompts?	Provide context and specify the desired output	79.17%
		Never use prompts, only free-form conversation	12.5%
		Use complex jargon and terminology	8.33%
12.	Can ChatGPT generate random prompts for creative exercises?	No, it can only generate responses to pro mpts	12.5%
		No, it can only generate responses based on its training data	8.33%
		Yes, it can generate random and unique prompts for creative exercises	75%
		No, it only follows a fixed pattern	4.33%
13.	Which of the following is a common challenge when using ChatGPT for prompts in teaching?	Overly complex prompts	75%
		ChatGPT can't generate human-like text	8.33%
		ChatGPT can't understand human language	4.33%
		ChatGPT can't be used for teaching	8.33%

Discussion on Feedback form

The feedback after the completion of the course unveils valuable insights into the knowledge enhancement among participants about ChatGPT. The responses show that the course made a positive impact on their understanding of ChatGPT. When students have positive attitudes toward online courses, they are more likely to be satisfied with them (Alshammari et al., 2023). A significant proportion of participants now acknowledge that ChatGPT cannot replace human teachers. This indicates that participants have a more realistic understanding of the capabilities and limitations of ChatGPT.

In terms of ChatGPT's functionality it's apparent that the course has effectively communicated ChatGPT primarily understands and responds to spoken language. Also, ChatGPT is a natural language processing tool distinguishing it from the misconception that it's a speech recognition software. Participants have recognised the meaning of what a "prompt" means in the context of ChatGPT. In terms of multilingual capabilities, a substantial portion of participants now understand that ChatGPT can respond to prompts in different languages, dispelling the misconception that it's limited to English only. There found no significant shift in participants' comprehension about "How does ChatGPT generate responses?" They may have found it challenging to fully comprehend the meaning of "patterns in its training data". For further clarification, qualitative insights from the teachers' will be required.

The majority of participants now correctly attribute the development of ChatGPT to OpenAI. They now showcase their awareness for recognising the ChatGPT's potential for personalised learning, support for students with disabilities, instant feedback and assistance. Participants now have the clear understanding that generating human-like text responses is the primary purpose of ChatGPT's training. After getting the experience of using prompts, participants acknowledge the importance of carefully reviewing and verifying the content. Overall, the feedback shows the knowledge improvement in participants about the ChatGPT.

Data Analysis and Discussion on Participants interaction on Google Discussion Forum

The following paragraph analyses and discusses the interaction of participants on Google Discussion Forum.

Data Analysis of Participants interaction on Google Discussion Forum

Though all the participants joined the discussion forum a limited number of participants (16.66 per cent) were active. All participants found ChatGPT as their virtual personal assistant. A few (16.66 per cent) showed their concern about ethical use of ChatGPT in teaching. Most of the participants (75 per cent) agreed that students' assignments should be designed in a creative way and students should also get the opportunity to use AI tools like ChatGPT which will serve to enhance 21st century skills. Very few participants (12.5 per cent) discussed the variations in outcomes when using the same prompts.

Discussion on Participants' interaction on Google Discussion Forum

Discussion Forum shows very few participants reached sensemaking interaction level. Participants shared their experiences about novices in using ChatGPT. They shared their thoughts on the essentialness of using technology like AI in an ethical way. As there is a strong possibility of getting the assignment done from ChatGPT they unanimously come to the point that participants should design the assignment in a creative manner so that students will make use of ChatGPT and its results will get discussed in the classroom. Thus, students will also get the opportunity to use AI tools like ChatGPT. Hence, there will be enhancement in questioning, and 4C's skills.

Most of the participants experimented on the provided prompts from the course. They uploaded their assignments. Thereby they noticed that for the same prompt the ChatGPT has given different responses. Among a few of them discussed and understood the importance of clear and specific prompts and noticed ChatGPT may provide various responses for the same prompt.

Discussion on response variability led to the conclusion that for consistent results, users should provide clear and specific prompts and they should be prepared for some level of variation in response as suggested by ChatGPT 3.5. In line with this finding, Stojanov (2023) also identified textual inconsistencies in their auto ethnographic study.

Data Analysis and Discussion on Submission of Assignments

During the course the participants were assigned two assignments to assess their proficiency in utilizing suitable prompts. The subsequent paragraph analyses and discusses the submission of assignments.

Data Analysis on Submission of Assignments

First assignment was uploaded by most of the participants (80 per cent). While the second assignment was uploaded by a few participants (16.66 per cent).

Discussion on Submission of Assignments

The following section discusses submission of Assignment 1 and Assignment 2.

Discussion on Submission of Assignment 1

The first assignment instructed participants to utilise the provided prompt to design a lesson plan following the STEAM approach and submit their response, along with the outcomes generated by ChatGPT.

The study shows an increase in the number of submissions of the first assignment; it can be attributed to several factors. Participants may have found the first assignment relatively easy; they didn't need to spend much time designing prompts. Another reason could be their convenience in using the prompt as the prompt was already provided in the Session 2.

## Discussion on Submission of Assignment 2

The second assignment instructed participants to share innovative applications of ChatGPT in teaching.

Thus, the second assignment focused on the innovation interaction level, which involved creating an artifact. Only a few participants submitted this assignment. Several factors could contribute to this low submission rate. It's possible that they found the assignment challenging, or the course design may have failed to sufficiently engage them. Additionally, it's plausible that the designers of the course did not provide adequate guidance, support (Wang et al., 2014). Or it may be due to some participants not inherently self-directed learners or may lack confidence in their creative skills. While ChatGPT can generate a wealth of ideas and information, effective presentation also relies on strong Pedagogical Content Knowledge (PCK) (Schroeven et al., 2023). Thus, a deficiency in PCK might be another contributing factor that cannot be overlooked.

Discussion on implementation of four interaction levels of connectivism theory

The following Figure 2 gives the idea about the implemented course in the study and the framework for Interaction and cognitive engagement in connectivist learning, based on Wang et al. (2014).

Figure-2: Framework for Interaction and Cognitive Engagement in Connectivist Learning, based on Wang et al. (2014)
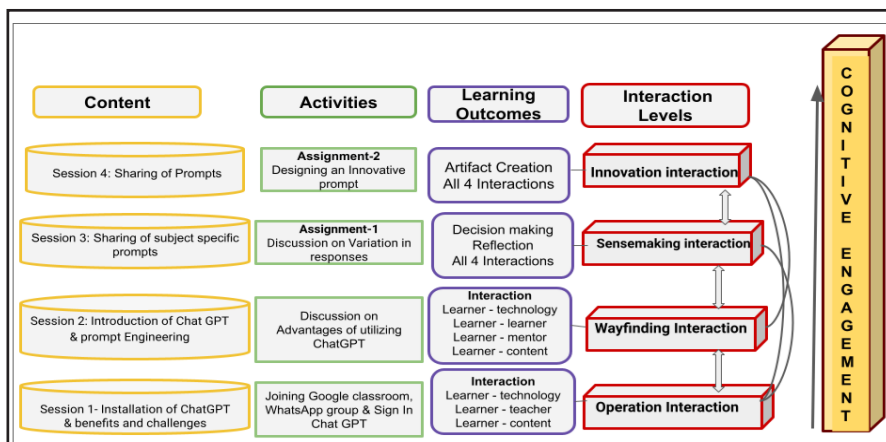
The present study shows lower levels of interaction of connectivism theory serve as the foundation of higher levels of interaction. And all the interaction levels are interlinked with each other. The theory demands digital literacy for deeper involvement with the four interactions. Increased interaction occurs among learners, technology, teachers, and content, fostering deeper engagement with both social and informational networks.

The level of cognitive engagement increases as the learners cross each interaction level. In the Operational interaction, the participants showed interaction with technology, researcher as a mentor, and the content. In the beginning, the participants joined WhatsApp group, Google Classroom, Sign in ChatGPT, took initiative in discussion and uploaded assignments that showed participants connected with technology. It is in line with the study by Wang et al. (2014) which suggests, operational interaction deals with engagement of the learners with technology as this level serves as a basis for their further learning.

In the Wayfinding interaction, the participants showed interaction with technology, learner, mentor, and the content. Thus, it helps to expand the level of interaction and involvement in sensemaking interaction. In the present study, it was observed as participants submitted assignments and they participated actively in discussion on variability in responses of ChatGPT. Here it formed the basis of sensemaking interaction. The learner-learner, learner-content, learner-technology and learner-teacher interaction was observed at a deeper sense in sensemaking interaction which helped them to reflect and make decisions.

In the present study, the second assignment was based on creativity which is the Innovation Interaction stage. A low submission rate for creating an artifact was noted which may be due to the various aspects as discussed in the above paragraph (Discussion on Submission of Assignment 2).

Limitations of the study

The study has many limitations, data on a small sample comprising 24 participants, is too less to generalise the findings. Furthermore, while the study did incorporate qualitative data in the form of responses for having the understanding of ChatGPT before and after the course, it might have

been constrained. A more thorough qualitative examination, using methods like thematic coding and focus group interviews, will serve a deeper into the experiences of the teachers. Immediate collection of data on the post-course knowledge assessment may not capture the long-term impact of the course on teachers' practices and understanding. Lastly, the limited participation in submitting assignments and engaging in the discussion forum restricted the holistic understanding of the integration of ChatGPT in teaching practices and comprehension. These recognised limitations highlight the potential for future research to explore these areas and to address these gaps.

Conclusion and Implications

This ongoing qualitative study sheds light on the significance of training school teachers on ChatGPT in an online asynchronous mode based on connectivism theory (Barnett et al., 2013). The study is underpinned by the theoretical framework of connectivism, which offers valuable insights into the essential learning skills and tasks required for learners to thrive in the digital age (Siemens, 2005). The study observed a knowledge gap and misconceptions about ChatGPT in teachers before the course. However, after the implementation of the course a noticeable change was observed in their understanding. They recognised potential benefits of using ChatGPT in their teaching and they found it as a virtual teacher assistant. They recognised the potential of ChatGPT in enhancing the teaching-learning process and reducing their workload (Subramaniam, Apr 1, 2023). However, they also expressed concerns about the ethical implications and the need for human support and guidance in education.

All the prompts in the course on ChatGPT served as a guide for upgrading the skill of prompt engineering. Teachers recognised the significance of prompt engineering in their teaching practices. They acknowledged that for consistent results, it is crucial for users to offer clear and specific prompts, and noticed the quality of the prompts significantly affects the quality of the generated content. Additionally, they understood the need to be prepared for some level of variation in responses, as advised by ChatGPT. The study found a direct correlation between cognitive engagement and interaction levels. However, as interaction levels increase, participant involvement tends to decline. The study contributes to the growing body of knowledge on ChatGPT in education. It emphasises the importance of preparing teachers for a paradigm shift in education.

Declarations

Availability of data and materials

The anonymous datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

References

Ali., M.. A. & Djalilian, A. (2023). Readership awareness series - Paper 4: Chatbots and ChatGPT - Ethical considerations in scientific publications. Ocular Surface. doi:

10.1016/j.jtos.2023.04.001

https://www.researchgate.net/publication/369438152_Readership_Awareness_Series_-Paper_4_Chatbots_and_ChatGPT_-Ethical_Considerations_in_Scientific_Publications

Alshammari, S.H., Almankory, A.Z., & Alshammari, M.H. (2023). The Effect of self-efficacy and course design quality on students' satisfaction with online courses: A structural equation modeling approach. *International Journal of Technology in Education (IJTE)*, 6(3), 475-487. https://doi.org/10.46328/ijte.549

Atlas, S. (2023). ChatGPT for Higher Education and Professional Development: A Guide to Conversational AI. https://digitalcommons.uri.edu/cba_facpubs/548

Baeesa, S. (2023). Editorial – Spine surgeon's virtual assistant ChatGPT incorporation into spine surgery patients' care. *Journal of spine practice*, doi: 10.18502/jsp.v2i2.13532

Barrett, A., Pack, A. Not quite eye to A.I.: student and teacher perspectives on the use of generative artificial intelligence in the writing process. *International Journal of Educational Technology in Higher Education,* 20, 59 (2023). https://doi.org/10.1186/s41239-023-00427-0

Barnett, J., McPherson, V. & Sandieson, R. M. (2013). Connected teaching and learning: The uses and implications of connectivism in an online class. *Australasian Journal of Educational Technology,* 2013, 29(5). https://ajet.org.au/index.php/AJET/article/view/243/757

Chen, L. (2004). A hierarchical model for student and teacher interaction in distance learning. *Distance Education in China*, (05), 24-28.

Chokshi, A. (April 4, 2023). Planning Professional Development on ChatGPT. https://www.ascd.org/blogs/planning-professional-development-on-chatgpt

Connectivism. (2023, September 24). Connectivism. https://en.wikipedia.org/w/index.php?title=Connectivism&oldid=1146112564

Connectivism: A model of learning for the digital age. (n.d.). Connectivism: A model of learning for the digital age. http://risingkashmir.com/connectivism-a-model-of-learning-for-the-digital-age

Currie G, Barry K. (2023). ChatGPT in Nuclear Medicine Education. Journal of Nuclear Medicine Technology. 2023 Sep;51(3):247-254. doi: 10.2967/jnmt.123.265844. Epub 2023 July 11. PMID: 37433676. https://pubmed.ncbi.nlm.nih.gov/37433676/

Dempere J, Modugu K, Hesham A and Ramasamy LK (2023). The impact of ChatGPT on higher education. *Frontier in Education*. Vol. 8, 01-13. doi: 10.3389/feduc.2023.1206936

Ding, L., Li, T., Jiang, S. Gapud, A. (2023). Students' perceptions of using ChatGPT in a physics class as a virtual tutor. *International Journal of Educational Technology in Higher Education*. https://doi.org/10.1186/s41239-023-00434-1

Duke, B., Harper, G., & Johnston, M. (2013). Connectivism as a Digital Age Learning

Theory. *The International HETL Review,* Special Issue, 2013. https://www.hetl.org/wp-content/uploads/2013/09/HETLReview2013SpecialIssueArticle1.pdf

Dilmegani, C. (2024). ChatGPT Education Use Cases, Benefits & Challenges in 2023. https://research.aimultiple.com/chatgpt-education/

Dziubaniuk, O., Ivanova-Gongne, M. & Nyholm, M. (2023). Learning and teaching sustainable business in the digital era: a connectivism theory approach. *International Journal of Educational Technology in Higher Education*, doi: 10.1186/s41239-023-00390-w.

Ekin, S. (2023). Prompt Engineering For ChatGPT: A Quick Guide To Techniques, Tips, And Best Practice. TechRxiv. DOI:10.36227/techrxiv.22683919.v2

https://www.researchgate.net/publication/370531844_Prompt_Engineering_For_ChatGPT_A_Quick_Guide_To_Techniques_Tips_And_Best_Practices

Farrokhnia, M., Banihashem, S. K., Noroozi, O. & Wals, A. (2023). A SWOT analysis of ChatGPT: Implications for educational practice and research, *Innovations in Education and Teaching International,* https://www.tandfonline.com/doi/full/10.1080/14703297.2023.2195846

Gottipati, Swapna; Shim, Kyong Jin; and Shankararaman, Venky, "AI for Connectivism Learning - Undergraduate Students' Experiences of ChatGPT in Advanced Programming Courses" (2023). AMCIS 2023 Proceedings. 16. https://aisel.aisnet.org/amcis2023/sig_ed/sig_ed/16

Koos, S. & Sebastian, Wachsmann, S.. (2023). Navigating the Impact of ChatGPT/GPT4 on Legal Academic Examinations: Challenges, Opportunities and Recommendations. https://e-journal.unair.ac.id/MI/article/view/45270

Kop, R. (2011) The Challenges to Connectivist Learning on Open Online Networks: Learning Experiences during a Massive Open Online Course International Review of Research into Open and Distance Learning, Vol. 12, No. 3 https://www.irrodl.org/index.php/irrodl/article/view/882/1823

Kropf, D. C. (2013) Connectivism: 21st Century's New Learning Theory. *European Journal of Open, Distance and e-Learning,* Vol. 16 / No. 2. https://files.eric.ed.gov/fulltext/EJ1017519.pdf

Lee H. (2023). The rise of ChatGPT: Exploring its potential in medical education. Anat Sci Educ. Mar 14. doi: 10.1002/ase.2270. Epub ahead of print. PMID: 36916887.https://pubmed.ncbi.nlm.nih.gov/36916887/

Li, Chen., Yaqian, Xu. (2022). Theoretical Development of Connectivism through Innovative Application in China. *Canadian Journal of Learning and Technology*, doi: 10.21432/cjlt28255

Lo, C.K. (2023). What Is the Impact of ChatGPT on Education? A Rapid Review of Literature. Education Sciences. 13(4), 410; https://doi.org/10.3390/educsci13040410.

Mathiyazhagan, T. & Nandan, D. (2010). Survey research method. https://www.krishanpandey.com/rpapersd/Surver-Content.pdf

Mohammad B, Supti T, Alzubaidi M, Shah H, Alam T, Shah Z, Househ M. (2023). The Pros and Cons of Using ChatGPT in Medical Education: A Scoping Review. *Studies in Health Technology and Informatics.* 2023 Jun 29;305:644-647. doi: 10.3233/SHTI230580. PMID: 37387114. https://pubmed.ncbi.nlm.nih.gov/37387114/

OpenAI Platform. (2023, September 24). OpenAI Platform. https://platform.openai.com

Omodan, B. (2023). Analysis of connectivism as a tool for posthuman university classrooms. *Journal of Curriculum Studies Research*, 5(1), 1-12. https://doi.org/10.46303/jcsr.2023.2

Panagopoulou, F., Parpoula, .C. & Karpouzis, K. (2023). Legal and ethical considerations regarding the use of ChatGPT in education. arXiv.org, doi: 10.48550/arXiv.2306.10037 https://arxiv.org/abs/2306.10037

Ray. P.P. (2023). ChatGPT: A comprehensive review on background, applications, key challenges, bias, ethics, limitations and future scope. https://www.sciencedirect.com/science/article/pii/S266734522300024X

Rahman, M. Watanobe.Y. (2023). ChatGPT for Education and Research: Opportunities, Threats, and Strategies. Applied Sciences, https://typeset.io/papers/chatgpt-for-education-and-research-opportunities-threats-and-3hotu7mu

Schroeven, M., Buelens, W. & Kirschner, P. A. (January 31, 2023). Chatgpt – What Teachers Need To Know. https://3starlearningexperiences.wordpress.com/2023/01/31/chatgpt-what-teachers-need-to-know/

Siemens, G. (2005) Connectivism: A Learning Theory for the Digital Age https://jotamac.typepad.com/jotamacs_weblog/files/connectivism.pdf

Stojanov, A. (2023). Learning with ChatGPT 3.5 as a more knowledgeable other: an autoethnographic study. *International Journal of Educational Technology in Higher Education* 20, 35 (2023). https://doi.org/10.1186/s41239-023-00404-7

Subramaniam, R. (April 1, 2023). How can ChatGPT help teachers manage their workload, provide feedback to students. https://www.financialexpress.com/jobs-career/education-how-can-chatgpt-help-teachers-manage-their-workload-provide-feedback-to-students-3026863/

Tongco, M. D. C. (2007) Purposive sampling as a tool for informant selection. Ethnobotany Research & Applications 5:147-158. https://scholarspace.manoa.hawaii.edu/bitstream/10125/227/4/I1547-3465-05-147.pdf

Voskoglou, M. G. (2022). Connectivism vs Traditional Theories of Learning. *American Journal of Educational Research,* 10(4), 257-261. https://pubs.sciepub.com/education/10/4/15/

Wang, Z., Chen, L., & Anderson, T. (2014). A Framework for Interaction and Cognitive Engagement in Connectivist Learning Contexts. https://files.eric.ed.gov/fulltext/EJ1030140.pdf

Wilichowski, T. & Cobo, C., (May 02, 2023). How to use ChatGPT to support teachers: The good, the bad, and the ugly. https://blogs.worldbank.org/education/how-use-chatgpt-support-teachers-good-bad-and-ugly

Winkler, R. & Söllner, M. (2018). Unleashing the Potential of Chatbots in Education: A State-Of-The-Art Analysis. https://journals.aom.org/doi/10.5465/AMBPP.2018.15903abstract

Woodland, T. (2023). ChatGPT for Improving Medical Education: Proceed With Caution. https://www.mcpdigitalhealth.org/article/S2949-7612(23)00033-0/fulltext

Day 04 | ChatGPT and AI tools for Educators | Online FDP Carmel College Mala. (2023, September 24). Day 04 | ChatGPT and AI tools for Educators | Online FDP Carmel College Mala. https://www.youtube.com/watch?v=jRKMpvA-CTI

Session #	Course Content
1.	(i) How to install chatGPT? (ii) How does ChatGPT generate data? (iii) What are the benefits and challenges of using it in the classroom? (iv) How does chat GPT help various subject teachers to design their instructional strategies? (v) Various Interactive activities for classroom teaching using ChatGPT.
2.	(i) What is Prompt engineering? (ii) What is the importance of prompt engineering? (iii) Prompts for- Designing Lesson plans, Getting previous knowledge/ discussion on topic, Creating questions, Creating Study Guides, Creating Cornell Notes, Creating flashcards an Designing 'Think-Pair-Share activity
3.	(i) Prompts for- Designing graphic organisers, Designing role play, Designing projects as an group activity (ii) Subject specific prompts
4.	Prompts for - Creating creativity - (ex. writing stories), Tailoring Rubrics, Using teaching aid, Method, Diagram and Summative assessment.

Assignments

1.	Use the given prompt of designing a lesson plan on STEAM approach. Submit the response along with the results generated by ChatGPT.
2.	Sharing innovative applications of ChatGPT in teaching,

Discussion forum

1.	Discuss the advantages of utilising ChatGPT
2.	Discuss the variability in responses of ChatGPT