Original Research Article

THE ROLE OF CHATGPT IN MODERN EDUCATION: ASSESSING ITS INFLUENCE ON STUDENT ENGAGEMENT AND KNOWLEDGE ACQUISITION

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Abstract:

Nowadays, the majority of students are using ChatGPT. Our study focuses on the role of ChatGPT in modern education and the factors influencing student engagement and problems faced by them. By harnessing the power of large language models, ChatGPT redefines the dynamics of learning by providing personalized interactions tailored to individual student needs.

1. To analyse the relevancy of the generated content for the query asked on ChatGPT in the different areas of the study.
2. To identify factors influencing students' engagement with ChatGPT.
3. To identify the problems encountered by students while using ChatGPT.

The proposed study is descriptive in nature. A simple random sampling technique will be employed. The sample size considered for the study is 200.

This study will analyse the relevance of ChatGPT-generated content in different academic areas. Understanding student engagement factors and problems improves content accuracy and relevance, benefiting to the students and highlighting areas of excellence and improvement. Prioritizing accuracy enhances ChatGPT's role in knowledge acquisition.

Keywords: ChatGPT, Education, Student Engagement

Introduction:

ChatGPT is an artificial intelligence (AI) chatbot based on OpenAI's basic large language models (LLMs). This chatbot has pushed the boundaries of artificial intelligence, demonstrating that machines can "learn" the complexities of human language and interaction (Marr, 2023). ChatGPT, depending on how it is implemented in classrooms, might have a wide range of consequences on students and teachers. In education, instructors can employ ChatGPT in their courses to personalize the learning experience for their students. Given the increasing demand for updated teaching materials, ChatGPT can help the state develop and implement an impartial and fair curriculum. If properly

Concept:

1. GPT: Generative Pre-trained Transformer (GPT), a

implemented, this might serve as a bridge, relieving pressure on an overburdened educational system (Mohd Javaid, 2023).

Sam Altman, Greg Brockman, Elon Musk, Ilya Sutskever, Wojciech Zaremba, and John Schulman co-founded OpenAI in December 2015 (Marr, 2023). ChatGPT is an AI-powered tool for conducting engaging and honest conversations with others ChatGPT generates natural language interactions between humans and machines using deep learning techniques. Most of the students are using ChatGPT without analysing its authenticity. This study will help to understand how and where ChatGPT should be used and in which areas.

form of artificial intelligence language model, powers ChatGPT, a chatbot created by OpenAI,

leveraging the technology of Generative Pre-trained Transformer (Wikipedia, 2024).

2. Large Language Models (LLM): A generative AI is an artificial intelligence that can generate content like text or graphics. Within generative AIs, foundation models are recent developments often described as the fundamental building blocks behind such applications as DALL-E or Midjourney. In the case of text- generating AI, these are referred to as Large Language Models (LLMs) (Grégoire Martinon, 2024).

3. NLP: Natural language processing (NLP) refers to the branch of computer science—and more specifically, the branch of artificial intelligence, or AI—concerned with giving computers the ability to understand text and spoken words in much the same way human beings can (IBM, n.d.).

4. Deep learning: Deep learning is one of the most rapidly growing disciplines of data science. Deep learning refers to a class of algorithms that are based on artificial neural networks optimized to work with unstructured data such as images, voice, videos, and text (Deshpande, 2019).

Evolution of ChatGPT:

1. GPT-1: This model, released in June 2018, was the first iteration of the GPT series and contained 117 million parameters. GPT-1 demonstrated the power of unsupervised learning in language comprehension problems by utilizing books as training data to anticipate the next word in a sentence.

2. GPT-2: It was introduced in February 2019 and marked a big improvement, with 1.5 billion parameters. It demonstrated a significant advance in text creation capabilities, producing coherent, multi-paragraph writing. Fearing misuse, OpenAI held back GPT-2, releasing it in Nov 2019 after cautious deployment.

3.

4. GPT-3: GPT-3's June 2020 release (175 billion parameters) sparked widespread use in tasks like email writing, poetry, coding, translation, and even factual responses. It marked a pivotal moment, offering direct interaction and highlighting its potential impact.

5. GPT-3.5: ChatGPT 3.5 was released on March 15, 2022. It offers enhanced language understanding, improved context retention, broader knowledge integration, nuanced responses, reduced biases, finer control over generated content, and adaptable behaviour across diverse conversational contexts.

6. GPT-4: GPT 4 was released on March 14, 2023. It offers improved alignment with user intentions, reduced offensive output, increased factual accuracy, better steerability, and real-time internet connectivity. These advancements bring us closer to seamless AI integration, enhancing productivity, creativity, and communication. It has a word limit of 25000.

How does ChatGPT works?

ChatGPT operates by attempting to interpret a prompt (text input) and producing dynamic text in response. It can accomplish this because it is a large language model (LLM). It's simply a massive program that can read and generate natural language. The creators of ChatGPT achieved this through a deep learning training technique. In other words, they provided this machine the tools it needs to interpret data in the same way that a human brain would. The algorithm eventually learned to recognize word patterns and follow examples. Then it generates its own in response.

Prompt engineering and its techniques:

1. **Prompt engineering:**

   Prompt engineering is the process of creating prompts, asking, or instructions that guide the output of a language model like ChatGPT. It gives users control over the model's output and generates text tailored to their individual needs (Ma, 2023).

2. Techniques of prompt engineering:

1. Instruction prompting technique: The instructions prompt technique directs ChatGPT's output by supplying specific tasks and guidelines. It ensures relevance and quality in responses. Users must offer clear tasks and detailed instructions to effectively employ this technique, enhancing interaction with the model for desired outcomes.

2. Role prompting technique: The role prompting technique directs ChatGPT's output by assigning it a specific role. It tailors text to a given context or audience, such as customer service responses. To utilize this technique effectively, users must define a clear role for the model, ensuring relevant and targeted outputs.

3. Standard prompt technique: Standard prompts are a straightforward approach to directing the output of ChatGPT by giving the model a specific task to fulfil.

4. The self-consistency prompt: It is a mechanism for ensuring that ChatGPT's output corresponds to the input provided. This technique is beneficial for jobs like fact-checking, data validation, and text consistency testing. The formula for the self-consistency prompt is the input text followed by the command "Please ensure that the following content is self-consistent."

Prompt formula for ChatGPT:

Understanding the basic components of prompts - task, context, examples, persona, format, and tone—and their hierarchy is critical for producing quality results. Balancing the correct amount of context with your objective can make an effective prompt, and examples can significantly improve output quality. Personality, format, and tone can help ChatGPT and Bard grasp the 'who', 'how', and 'in what style' of your requirements.

Statement of problem:

1. Students use ChatGPT without analysing the relevancy of the generated content. Most of the students are not fully aware of the capabilities of ChatGPT.

2. Understanding the motivations and perceived benefits influencing students' decisions to interact with ChatGPT could allow educators to better anticipate how to integrate and regulate AI appropriately in academic contexts. Additionally, gaining insight into variables impacting engagement could help developers craft more student-friendly versions of ChatGPT and similar AI systems.

3. It is crucial for industry experts to address the problems faced by students' while using ChatGPT, as it can result in inaccurate knowledge acquisition. The various problems faced by students are inaccurate information, misleading information, lack of real time information, ethical and moral reasoning, biased opinions, poor quality, lack of emotional intelligence, privacy and security, unable to perform complex tasks, overuse of certain phrases, difficulty with multiple languages and irrelevant result.

Research Methodology:

Research questions:

1. How do students find the relevancy of the content for the query asked on ChatGPT related to mathematics or accounts?

2. How do students find the relevancy of the content for the query asked on ChatGPT related to grammar, e-mails or sentence rephrasing?

3. How do students find the relevancy of the content for the query asked on ChatGPT related to programming languages or coding?

4. How do students find the relevancy of the content for the query asked on ChatGPT related to research?

5. Which factors influence students' engagement with ChatGPT?

6. Which problems students have faced while using ChatGPT?

Objectives:

- To analyse the relevancy of the generated content for the query asked on ChatGPT in the different areas of the study.

- To identify factors influencing students' engagement with ChatGPT.

- To identify the problems encountered by students while using ChatGPT.

Hypothesis:

Hypothesis 1:

H_{01}- The generated content for the query asked on ChatGPT in different areas of the study is not relevant.

$H_{1.1}$- The generated content for the query asked on ChatGPT related to mathematics or accounts is relevant.

$H_{1.2}$- The generated content for the query asked on ChatGPT related to grammar, e-mails or sentencerephrasing is relevant.

$H_{1.3}$- The generated content for the query asked on ChatGPT related to programming languages or coding isrelevant.

$H_{1.4}$- The generated content for the query asked on ChatGPT related to research is relevant.

Hypothesis 2:

H_{02} –There are no factors influencing students' engagement with ChatGPT.H_2 -There exist factors influencing students' engagement with ChatGPT. **Hypothesis 3:**

H_{03} - Students are not facing any problems regarding ChatGPT.

H_3 - There exist problems which are encountered by the students while using ChatGPT.

Significance:

This study will help to analyse the relevancy of the generated content for the query asked on ChatGPT in the different areas of the study, such as mathematics or accounts, grammar, e-mails or sentence rephrasing, programming languages or coding and research. Identifying the factors influencing students' engagement with ChatGPT is crucial for improving the relevance of the generated content, especially in areas where it may lack accuracy or depth. It provides valuable insights for both industry experts and students, highlighting in which areas ChatGPT excels at generating highly relevant content and where improvements are needed.

Understanding the factors that affect students' engagement and the challenges they encounter is essential for enhancing the user experience and ensuring the accuracy and relevance of ChatGPT across various academic domains. Given its role in facilitating knowledge acquisition, ChatGPT must prioritize the accuracy of the information students learn through the platform.

Methodology:

For the study, a descriptive research methodology was used. A survey was done for this study. To evaluate the instrument's validity, split-half, spearman, and Cronbach alpha Brown's tests were computed to assess the instrument's dependability and internal consistency. The instrument was deemed dependable for the investigation since the Cronbach alpha was 0.721. The split-half dependability was determined using a scale of 0.696, which is sufficient, indicating that the questionnaire is dependable and internally consistent. Given that the Spearman-Brown correlation value was 0.82, the questionnaire is regarded as internally correlated and trustworthy. Questionnaires were used to gather primary data. Research papers, websites, reference books, journals,

and other sources are used to gather secondary data. Vassarstats software was used for data analysis. Research articles were gathered for the review of the literature by searching Google, Science Direct, Research Gate, etc.

For the research, a simple random sampling technique was performed. 200 responses collected from the students in the Maharashtra. Research papers from year 2019 to year 2024 were considered for the study.

Limitations:

The questionnaire provides primary data, which may not precisely reflect actual behaviour or attitudes. We may have gained additional insights by combining multiple data collection approaches. This may limit the advanced concepts related to ChatGPT. Despite of our collective efforts we were unable to reach every regionof Maharashtra. This study focuses on the role of ChatGPT in modern education and its influence on student engagement and knowledge acquisition.

In the above image, we asked the query 'which is the latest version of ChatGPT?' on ChatGPT itself. It repliedthat the GPT-3 is the latest version.
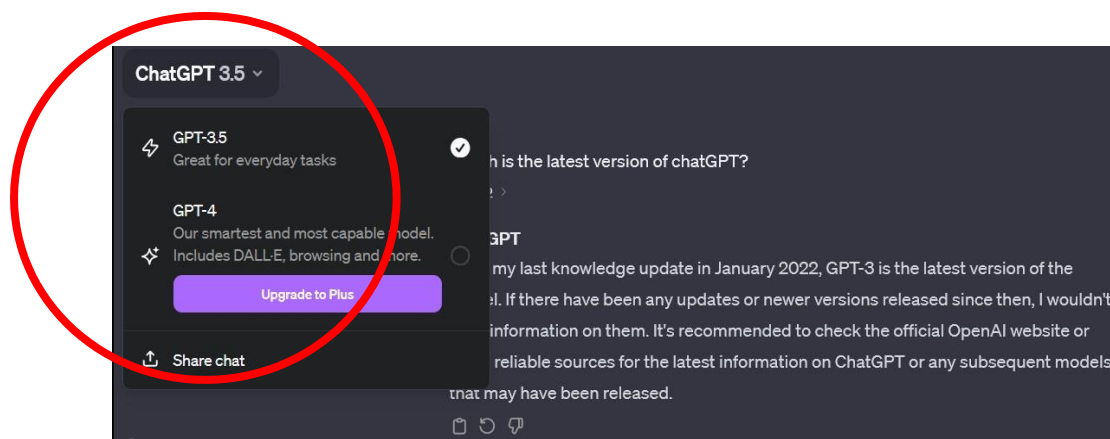
But as we can see in the above image, the query itself is asked on the ChatGPT-3.5 version, and at that time, ChatGPT-4 was also available. It shows that ChatGPT-3 is not capable of giving correct information about itself and lacks real-time data. In our research, we found that many students are not aware of this. Even though ChatGPT-4 is capable of providing real-time data, its subscription is not affordable for students.

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Review of Literature:

ChatGPT is a highly efficient tool for generating human-like text responses to inquiries. Developed online content, ChatGPT excels in paraphrasing and generating contextually appropriate responses for student. (Mohd Javaid, Abid Haleem, Ravi Pratap Singh, 2023). Its natural language processing capabilities empower it to generate responses akin to human communication, while its scalability, adaptability, and effectiveness render it suitable for diverse applications. Despite some limitations such as potential biases, lack of emotional understanding, and restricted knowledge bases (Dinesh Kalla,Nathan Smith,Dr. Sivaraju Kuraku,Fnu Samaah, 2023). The integration of AI-powered ChatGPT technology in higher education libraries presents both advantages and drawbacks. On one hand, ChatGPT offers swift and accurate responses to student inquiries, enhancing accessibility and freeing up staff for more complex tasks. (Shubhrajyotsna Aithal & P. S. Aithal, 2023).

In education, ChatGPT can revolutionize tutoring and personalized learning by offering on-demand live tutoring, serving as a virtual teaching assistant, and aiding in content creation for teachers. It enables rapid generation of grammatically correct and conversational text for chatbot interactions (Mohd Javaid a, Abid Haleem,Ravi Pratap Singh,Shahbaz Khan,Ibrahim Haleem Khan, 2023).An increase in the rate of assignment completion corresponds to a significant rise in ChatGPT usage, highlighting the role of artificial intelligence in enhancing the teaching and learning process. This study indicates that ChatGPT has notably impacted digitalized learning, as students find it convenient and cost-free for assignment submissions. (Alejandro Guadalupe Rincón Castillo's,Giovanna Jackeline Serna Silva'sJavier Pedro Flores Arocutipa's,Haydeé Quispe Berrios's, 2023). Behavioral Intention (BI) is the primary factor influencing students' acceptance and use behavior. BI is primarily influenced by Effort Expectancy, followed by Performance Expectancy. Social Influence was determined to have a minimal impact on BI, while Facilitating Conditions showed no significant effect (Haglund, 2023).

Data Analysis and Discussions:

1. **To analyse the relevancy of the generated content for the query asked on ChatGPT related to mathematics or accounts, we performed Kolmogorov-Smirnov Test.**

Kolmogorov-Smirnov Test using Vassarstats for mathematics or account contents

Output of Kolmogorov-Smirnov Test

Cumulative Proportions

	Observed	Expected	$\mid$ O—E $\mid$
A	0.24	0.1	0.14
B	0.385	0.2	0.185
C	0.815	0.3	0.515
D	0.955	0.4	0.555
E	1.0	1.0	0
F			
G			
H			

D_{max}

0.555

Critical Values of D_{max} for n = 200

Level of Significance (non-directional)	
.05	.01
0.0962	0.1153

Inference:

Vassarstats was used to do a Kolmogorov-Smirnov Test. In the above tables, A stands for highly not relevant, B for not relevant, and C for somewhat relevant, D for relevant and E for highly relevant. The P value is 0.0962, which is greater than 0.05. Hence, we accept the null hypothesis, i.e., that the generated content for the query asked on ChatGPT related to mathematics or accounts is irrelevant.

2. **To analyse the relevancy of the generated content for the query asked on ChatGPT related to grammar, e-mails or sentence rephrasing, we performed Kruskal-Wallis Test.**

Mean Ranks for Sample				
A	B	C	H =	140.88
10	45	135.5	df =	2
			P =	<0.0001

Kruskal-Wallis Test for content related to grammar, e-mails or sentence rephrasing

Inference:

Kruskal-Wallis Test was performed on Vassarstats. In the table 4.1.2, A stands for not relevant, B stands for somewhat relevant and C stands for relevant. The value of P is less than 0.0001 which is less than 0.05. Hence,

we accept alternate hypothesis, i.e., that the generated content for the query asked on ChatGPT related togrammar, e-mails or sentence rephrasing is relevant.

3. **To analyse the relevancy of the generated content for the query asked on ChatGPT related toprogramming languages or coding, we performed Kruskal-Wallis Test.**

Mean Ranks for Sample				
A	B	C	H =	119.91
12.5	47.5	109	df =	2
			P =	<0.0001

Kruskal-Wallis Test content related to programming languages or coding

Inference:

Kruskal-Wallis Test was performed on Vassarstats. In the table 4.1.3, A stands for not relevant, B stands for somewhat relevant and C stands for relevant. The value of P is less than 0.0001 which is less than 0.05. Hence,we accept alternate hypothesis, i.e., that the generated content for the query asked on ChatGPT related to programming languages or coding is relevant.

4. **To analyse the relevancy of the generated content for the query asked on ChatGPT related to research,we performed Kolmogorov-Smirnov Test.**

Data Entry

Category	Observed Frequency	Expected Frequency	Expected Proportion	
A	36	34.4	0.19999999	
B	17	34.4	0.19999999	Sums:
C	58	34.4	0.19999999	
D	50	34.4	0.19999999	Observed Frequencies:
E	11	34.4	0.19999999	172
F				
G				Expected Frequencies:
H				344
	Reset Calculate			Expected Proportions:
				1.0

Kolmogorov-Smirnov Test using Vassarstats for research content

Cumulative Proportions

	Observed	Expected	| O—E |	
A	0.209	0.1	0.109	
B	0.308	0.2	0.108	
C	0.645	0.3	0.345	
D	0.936	0.4	0.536	
E	1.0	1.0	0	
F				D_{max}
G				
H				0.536

Critical Values of D_{max} for n = 172

Level of Significance (non-directional)	
.05	.01
0.1037	0.1243

Output of Kolmogorov-Smirnov Test

Inference:

Vassarstats was used to do a Kolmogorov-Smirnov Test. In the above tables, A stands for highly not relevant, B for not relevant, and C for somewhat relevant, D for relevant and E for highly relevant. The P value is 0.1037, which is greater than 0.05. Hence, we accept the null hypothesis, i.e., that the generated content for the query asked on ChatGPT related to research is irrelevant.

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5. To identify factors influencing students' engagement with ChatGPT, factor analysis was done.

Factor analysis :

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.463	34.634	34.634	3.463	34.634	34.634
2	2.583	25.829	60.463	2.583	25.829	60.463
3	1.679	16.788	77.251	1.679	16.788	**77.251**
4	.865	8.645	85.896			
5	.672	6.724	92.620			
6	.318	3.178	95.798			
7	.200	1.997	97.795			
8	.143	1.429	99.224			
9	.078	.776	100.000			
10	- 1.388E-16	-1.388E-15	100.000			
Extraction Method: Principal Component Analysis.						

Communalities
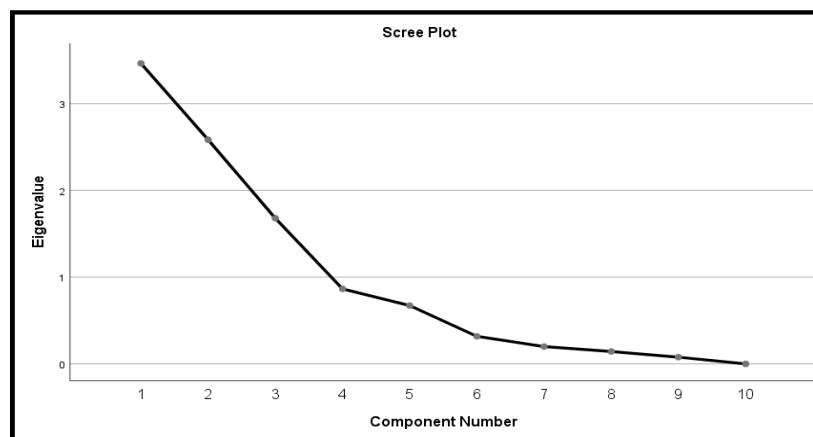
Scree plot

Component Matrixᵃ			
	Component		
	1	2	3
Ease of use	.204	-.500	-.743
Cost effective	.734	-.383	**.410**
Saves time	.220	**.604**	**.519**
Efficiency	.646	-.352	.407
Makes learning fun	**.808**	.207	-.333
Institutional support	**.755**	-.403	.369
Easy to understand	.397	**.829**	-.151
Curiosity and interest	-.562	.299	**.414**
To stay up to date	.397	**.829**	-.151
Influence of friends	**.751**	.168	-.244
Extraction Method: Principal Component Analysis.			
a. 3 components extracted.			

Inference:

As evident from Table 4.2.1, we find that three factors extracted together account for 77.251% of totalvariances. Hence, we have reduced the number of variables from 10 to three underlying factors.

Sr. No.	Factors	Factor loading
Factor 1	**Engaging Learning Experiences**	0.808, 0.755, 0.751
Factor 2	**Technological Efficiency Systematization**	0.604, 0.829, 0.829
Factor 3	**Economic Motivation Optimization**	0.410, 0.519, 0.414

**Factors considered for influencing students' engagement**

Factors for influencing students' engagement with ChatGPT considered are **Engaging Learning Experiences, Technological Efficiency Systematization and Economic Motivation Optimization.**

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6. To identify the problems encountered by students while using ChatGPT, factor analysis was done.

Factor analysis:

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.494	20.781	20.781	2.494	20.781	20.781
2	1.858	15.484	36.265	1.858	15.484	36.265
3	1.806	15.052	51.317	1.806	15.052	51.317
4	1.138	10.980	62.297	1.318	10.980	62.297
5	1.174	9.781	72.077	1.174	9.781	**72.077**
6	.874	7.280	79.358			
7	.785	6.539	85.897			
8	.587	4.893	90.790			
9	.527	4.389	95.179			
10	.258	2.179	97.328			
11	.190	1.585	98.913			
12	.130	1.087	100.000			
Extraction Method: Principal Component Analysis.						

Communalities
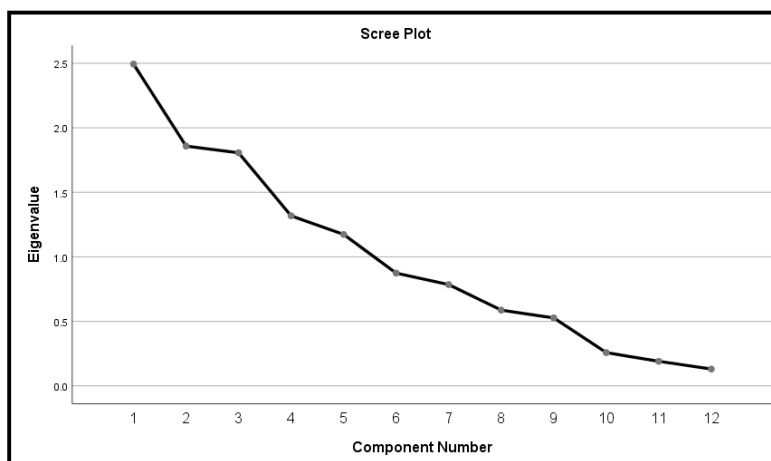
Scree Plot

Component Matrix[a]					
	Component				
	1	2	3	4	5
Inaccurate information	.048	**.762**	.036	-.137	-.337
Misleading information	.365	**.511**	**.482**	.115	.239
Lack of real time information	.121	**.356**	**.344**	**.565**	**.294**
Ethical reasoning	.452	-.421	**.482**	-.082	.194
Biased opinions	**.676**	-.080	.074	-.577	.064
Poor quality	**.727**	.154	-.038	-.395	.162
Lack of EQ	-.036	-.044	-.545	.205	**.684**
Privacy and security	.046	-.560	**.545**	.217	.101
Unable to perform complex task	.475	-.413	.142	**.343**	-.484
Over use of phrases	.216	-.392	-.619	.026	-.080
Difficulty with multiple languages	**.624**	.197	-.303	**.470**	-.322
Irrelevant results	**.699**	.069	-.357	.209	.161
Extraction Method: Principal Component Analysis.					
a. 5 components extracted.					

Component Matrix[a]

Inference:

As evident from Table 4.3.1, we find that three factors extracted together account for 72.077 % of total variances. Hence, we have reduced the number of variables from 12 to five underlying factors.

Sr. No.	Factors	Factor loading
Factor 1	**Content Objectivity Optimization**	0.676, 0.727, 0.624, 0.699
Factor 2	**Information Process Optimization**	0.762, 0.511, 0.356
Factor 3	**Ethical Information Optimization**	0.482, 0.344, 0.482, 0.545
Factor 4	**Language Task Optimization**	0.565, 0.343, 0.470
Factor 5	**Real Time EQ Functioning**	0.294, 0.684

Factors considered for problems encountered by students

Factors considered for problems encountered by students using ChatGPT considered are **Content Objectivity Optimization, Information Process Optimization, Ethical Information Optimization, Language Task Optimization and Real Time EQ Functioning.**

Summary of Findings:

90% of students are using ChatGPT due to various influencing factors such as ease of use, cost effective, savestime, efficiency, easy to understand, makes learning fun, curiosity and interest, influence of friends, to stay upto date with latest technology, institutional support. The generated content for the query asked on ChatGPT related to mathematics

or accounts and research is not relevant. Because students are facing various problemssuch as inaccurate or misleading information, lack of real time information, poor quality, unable to perform complex task, difficulty with multiple languages and irrelevant results. More than 50% of respondents think that generated content for the query asked on ChatGPT related to grammar, e-mails or sentence rephrasing andprogramming languages or coding is relevant.

Conceptual model :
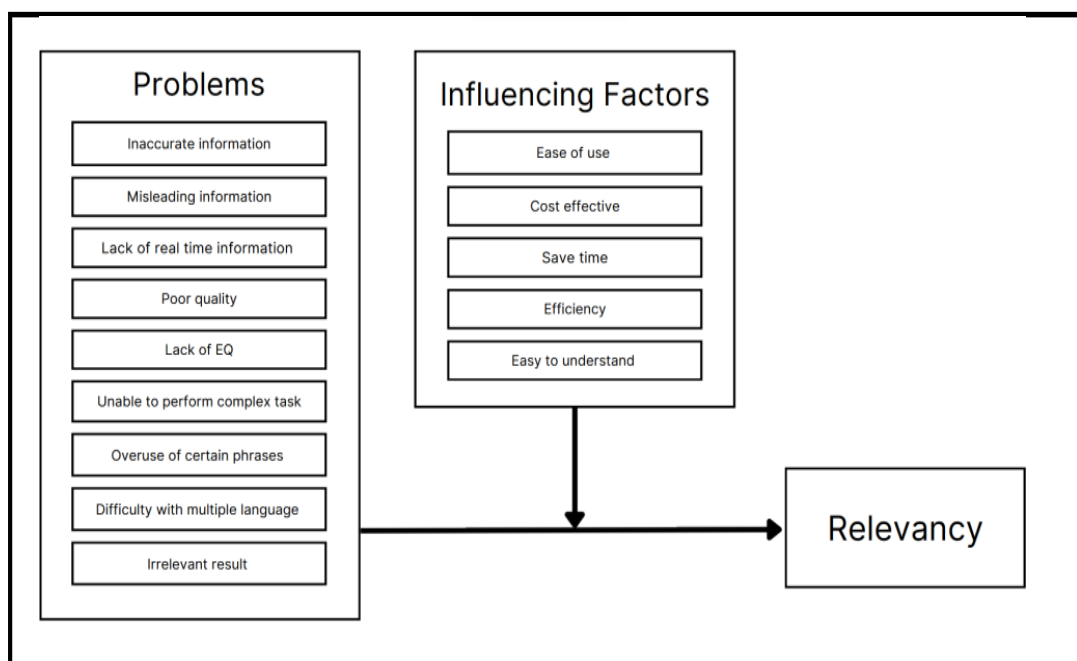
Suggestions:

1. To improve the relevance of the content, institutions should teach students how to use ChatGPT, employprompt engineering techniques, and conduct training programs for AI tools.

2. ChatGPT needs to address the influencing factors for students by enhancing the accuracy, quality, cost, and efficiency of the content. ChatGPT could solicit feedback from students to improve its database wherenecessary. Data validation and machine learning tools should be integrated to verify the reliability and accuracy of the content.

3. Generally, students cannot afford a $20/month subscription. ChatGPT should provide free access to real-time data for students. To achieve this, they could request document verification from students and implement differential pricing strategies based on various regions.

Conclusions:

The ChatGPT has a significant influence on students' engagement and knowledge acquisition. Students are using ChatGPT without considering crucial factors such as accuracy, reliability and relevancy. ChatGPT has limitations such as limited database, lack of real time data, inaccurate or misleading information, poor quality. While ChatGPT may appear to be an ideal teaching tool, it cannot replace the necessity for students to developcritical thinking and interpersonal skills. Our study reveals that current ChatGPT version is not capable of providing relevant content for mathematics or accounts and research. While in to grammar, e-mails or sentencerephrasing and programming languages or coding it provide relevant data. As ChatGPT evolves and improves,we can expect even more amazing results

in the years ahead.

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