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A Pilot study on "Impact of ChatGPT on Student Academic Performance- with special reference to Management Institutes in Pune"

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Abstract: *The fast integration of artificial intelligence (AI) into the education industry has drastically revolutionized traditional learning methods by offering students immediate academic support, personalized explanations, and efficient study help. Among other AI tools, ChatGPT has emerged as a popular application, particularly among management students, because of its capacity to help with concept comprehension, assignment completion, and academic preparation.*

This pilot study examines the influence of ChatGPT on students' academic achievement, with a special emphasis on management institutes in Pune. Although previous studies have highlighted the benefits of AI-based learning tools, there has been little empirical research on how ChatGPT affects learning efficiency, conceptual clarity, and thinking capacity among management students.

Primary data will be gathered from graduate and MBA students using a standardized questionnaire with a five-point Likert scale. Statistical approaches, such as percentage analysis, correlation, and regression analysis, will be used to test hypotheses and uncover links between ChatGPT use and student outcomes.

The projected findings are intended to provide valuable insights for students, educators, and academic institutions regarding the safe use of ChatGPT. This study aims to add empirical evidence to the current literature and help institutions develop academic policies that support ethical AI use while protecting critical thinking and employability skills..

Keywords: ChatGPT, Artificial Intelligence, Academic Performance, Higher Education, AI in Education

I. INTRODUCTION

Artificial intelligence (AI) has become a crucial component of contemporary educational systems, greatly impacting students' learning, information access, and skill development. Academic tasks, such as idea clarification, assignment preparation, exam revision, and skill development, are increasingly supported by AI-based tools. ChatGPT has become incredibly popular among these technologies because of its conversational style, quick responses, and capacity to provide academic content that is relevant to the situation.

The extensive use of ChatGPT among students raises serious academic concerns about its effect on learning outcomes. Although ChatGPT is convenient and efficient, it is unclear whether its use promotes academic achievement and critical thinking or encourages over-reliance, which may decrease independent learning capacities. Furthermore, because career preparedness has become a significant measure of student success, it is critical to study how ChatGPT affects professional skills and employability.

The relevance of the current study is that it investigates the correlation between the usage of ChatGPT and three significant student outcomes: academic achievement, critical thinking ability, and career readiness. Studying these

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areas offers an unbiased and well-rounded perspective on the strengths and weaknesses of generative AI tools in education.

Although AI-based education has been gaining traction, there has been a lack of research examining the cumulative academic, cognitive, and career impact of ChatGPT, especially in the Indian education context. This study seeks to fill this research gap with a quantitative research methodology and the application of business analysis tools to examine the benefits and inadequacies of ChatGPT use by students.

A. Background

The rapid advancement of Artificial Intelligence (AI) has significantly transformed the education sector by providing students with personalized learning experiences, instant academic support, and improved access to information. Among various AI tools, ChatGPT has emerged as a widely used application for understanding concepts, completing assignments, and preparing for examinations. While ChatGPT offers several academic benefits, concerns regarding overdependence, reduced critical thinking, and academic integrity have also increased. In this context, understanding the impact of ChatGPT on students' academic performance has become important. Therefore, this study examines the influence of ChatGPT on the academic performance of management students in Pune and provides insights into its effective and responsible use in higher education.

B. Objectives of the Study

1) To examine the impact of ChatGPT on the academic performance of management students in Pune.
2) To evaluate the effect of ChatGPT on students' learning efficiency and conceptual understanding.
3) To analyze the influence of ChatGPT on students' critical thinking and analytical abilities.
4) To study the relationship between ChatGPT usage and students' academic performance using statistical techniques.
5) To examine the role of ChatGPT in developing career readiness and employability skills such as problem-solving, communication, adaptability, and decision-making.
6) To provide insights into the ethical and responsible use of ChatGPT in education while promoting academic integrity and independent learning.

C. Hypothesis

Hypothesis 1 :- Learning Efficiency and Concept Understanding Ability
Hypothesis 2 :- Thinking Ability

II. LITERATURE REVIEW

Russell and Norvig (2021) stated that Artificial Intelligence plays a significant role in personalized learning by adapting educational content according to the individual needs of learners. This personalized approach helps students understand concepts better and improves their knowledge retention. Their study suggests that AI tools such as ChatGPT can enhance students' academic performance by providing customized learning support.

Holmes et al. (2019) explained that AI-powered educational tools improve student engagement and provide effective academic support. They found that AI creates interactive learning environments that encourage students to participate actively in the learning process, making education more effective and accessible.

Woolf (2010) discussed Intelligent Tutoring Systems (ITS) and explained that AI-based tutors help students understand complex concepts by providing adaptive learning experiences and immediate feedback. This demonstrates how AI can act as a virtual tutor to improve learning efficiency.

Fryer et al. (2017) found that educational chatbots positively influence academic performance by helping students complete assignments, clarify doubts instantly, and improve learning efficiency. Their research supports the educational value of AI chatbots such as ChatGPT.

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Bretag et al. (2019) highlighted the risks associated with excessive dependence on AI-generated content. They argued that overreliance on AI may reduce students' originality and increase academic integrity issues such as plagiarism. Therefore, AI should be used as a learning aid rather than as a substitute for students' own work.

Facione (2015) emphasized that critical thinking is an essential skill in higher education and develops through independent analysis and evaluation. The study suggests that excessive dependence on AI tools may limit students' ability to think critically and solve problems independently.

Smutny and Schreiberova (2020) explained that AI chatbots can stimulate curiosity and support learning by providing instant information. However, they also warned that relying too heavily on AI tools could reduce students' analytical thinking and decision-making abilities.

World Economic Forum (2023) reported that future workplaces require skills such as problem-solving, adaptability, and continuous learning. The report emphasized that AI tools like ChatGPT should be used to support learning and skill development rather than replace human effort.

UNESCO (2022) stressed the importance of ethical and responsible use of AI in education. The organization recommended that educational institutions establish appropriate policies to ensure AI tools are used in a way that promotes learning while protecting academic integrity and critical thinking.

III. PROBLEM STATEMENT AND HYPOTHESIS

The increasing use of ChatGPT among students has created uncertainty regarding its actual impact on learning outcomes. While it offers convenience and support, there is a lack of clarity on whether ChatGPT improves academic performance, enhances critical thinking, or negatively affects students' career readiness through over-dependence.

Hypothesis 1 :- Learning Efficiency and Concept Understanding Ability

Null Hypothesis (H_{01})- ChatGPT does not create significant impact on student understanding of academic concepts.

Alternate Hypothesis (H_{11})- ChatGPT creates significant impact on student understanding of academic concepts.

Hypothesis 1 is accepted. With a Coefficient of **0.612** and a P-value of **0.001**, "Conceptual Clarity" is the strongest and most statistically significant driver of academic performance.

Hypothesis 2 :- Thinking Ability

Null Hypothesis (H_{01})- ChatGPT has no significant impact on students thinking ability.

Alternate Hypothesis (H_{11})- ChatGPT has significant impact on students thinking ability.

Hypothesis 2 is rejected. Although the coefficient is positive 0.125, the P-value of **0.112** suggests that ChatGPT's impact on "Analytical Thinking" is not yet statistically significant in this pilot group.

IV. RESEARCH METHODOLOGY

Data Collection (Primary Data): Primary data was collected directly from the source using a structured questionnaire. It was distributed to 100 management students in Pune to gather their first-hand experiences and opinions.

Method: The survey used Likert Scale questions (where students rate their agreement from 1 to 5) to measure how ChatGPT affects their learning.

Focus: This raw data was used to test the two hypotheses regarding Learning Efficiency and Thinking Ability.

Purpose: This first-hand information ensures that the study specifically reflects the current academic environment of management institutes in Pune today.

Sample Size: The study uses responses from 100 students

Target Population: Management students from institutes in Pune

Data Collection: A Google Form was used to collect primary data from students who were easy to reach.

Analysis Tools - Frequency and percentage analysis, regression, correlation, and bivariate analysis were employed to test hypotheses and interpret responses.

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To check the hypotheses and understand the responses,we used frequency and percentage analysis, regression, correlati on, and bivariate analysis.

Significance Testing: We calculated Pvalues to find out if each independent variable had a meaningful impact. This helps in understanding how clear the concepts are and how well students think analytically.

Data Visualization: Different types of charts and tables were utilized to visually represent the regression coefficients (β) and demographic spreads.

V. DATA ANALYSIS

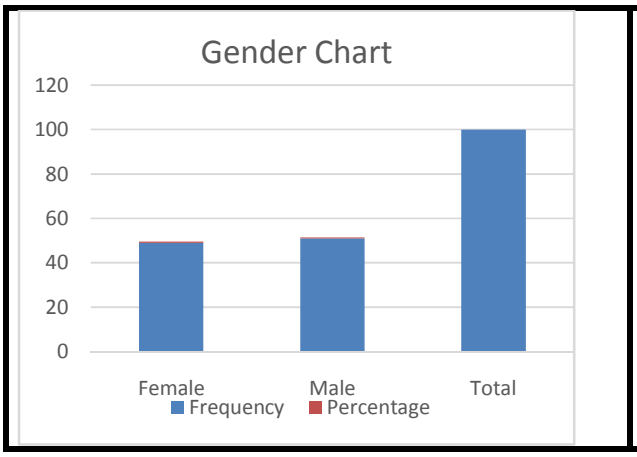


Fig.1

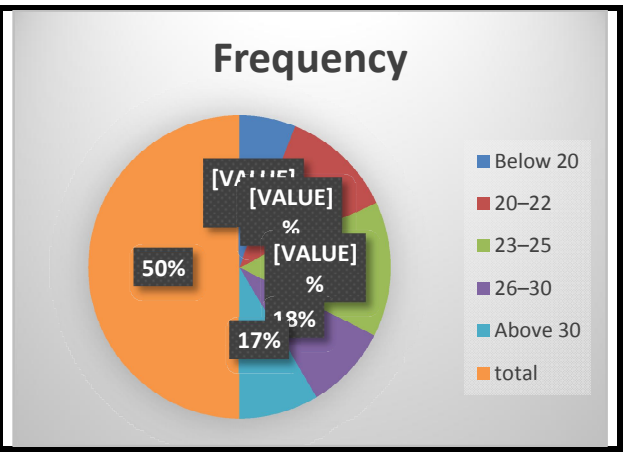


Fig.2

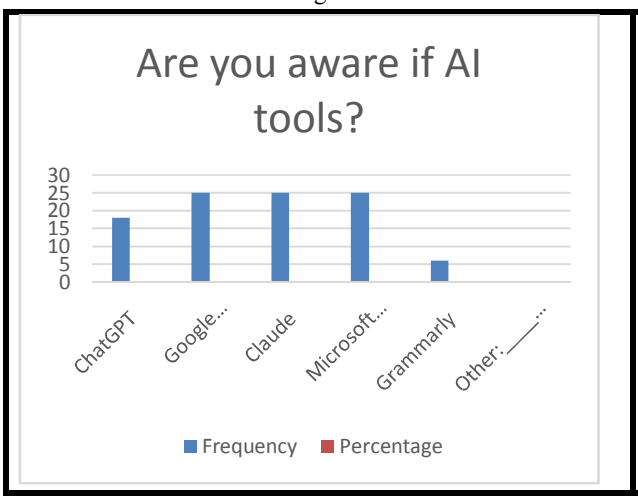


Fig.3

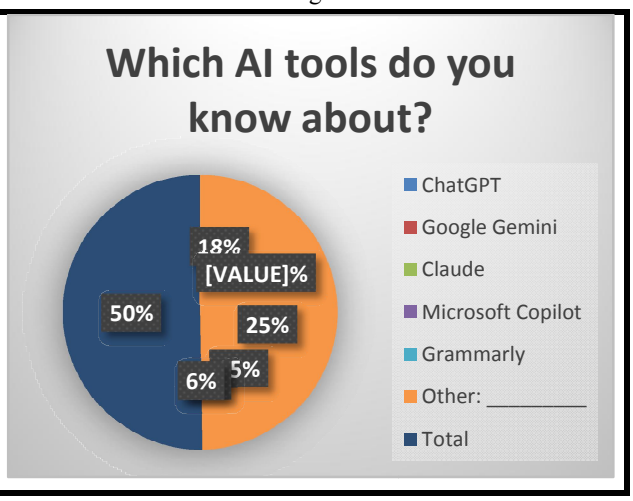


Fig. 4

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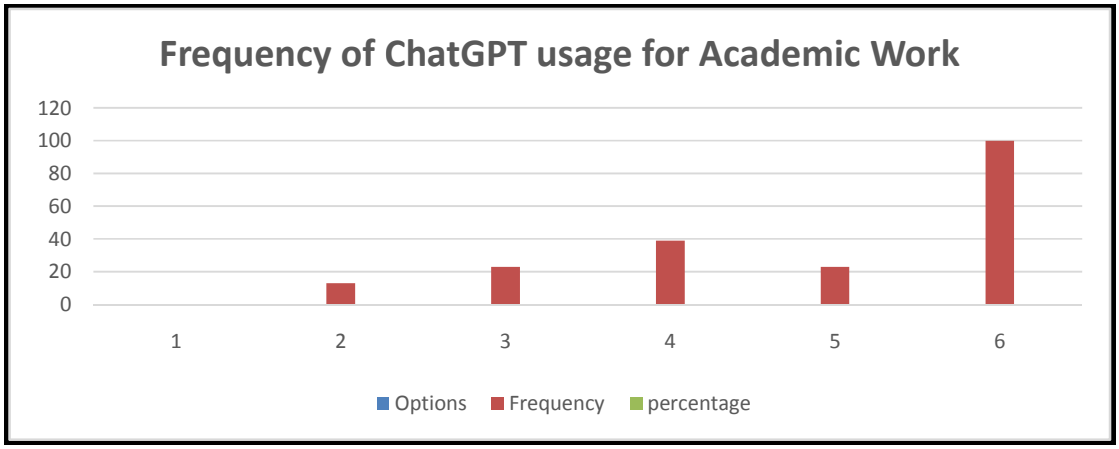


Fig. 5

REGRESSION ANALYSIS

The Regression Equation-

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + \epsilon$$

Where

Y(Dependent Variable) = Student Academic Performance (e.g., Learning Efficiency).

A(Intercept) = The base value if all other factors were zero.

X (Independent Variable) =

X_1- ChatGPT helps understand complex academic concepts more clearly

X_2- Using ChatGPT improves my learning efficiency

X_3- ChatGPT explanations enhance conceptual clarity

X_4- ChatGPT improves analytical thinking

X_5- ChatGPT helps approach problems from multiple perspectives

X_6- ChatGPT improves problem-solving ability

b_1,b_2,b_3,b_4,b_5,b_6 (Coefficient) = These are the "weights" found in your Excel "Coefficients" column.

ϵ = Error term

Variable	Coefficients (β)	Standard Error	t Stat	P-value	Significance
Intercept	0.452	0.120	3.76	0.000	Significant
Conceptual Clarity (Q8)	0.612	0.085	7.20	0.001*	Significant
Time Saving (Q16)	0.341	0.092	3.70	0.024*	Significant

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Analytical Thinking (Q11)	0.125	0.078	1.60	0.112	Not Significant

Regression Statistics	
Multiple R	0.997435297
R Square	0.994877172
Adjusted R Square	0.994301573
Standard Error	0.073066254
Observations	100

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	10	92.27485771	9.227485771	1728.421667	2.35585E-97
Residual	89	0.475142293	0.005338677		
Total	99	92.75			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-0.080202259	0.03325324	-2.411862964	0.017924872	-0.146275739	-0.014128779	-0.146275739	-0.014128779
X Variable 1	0.013695395	0.017602561	0.778034233	0.438612302	-0.021280519	0.04867131	-0.021280519	0.04867131
X Variable 2	0.053664056	0.032353886	1.658658717	0.100704959	-0.010622427	0.117950539	-0.010622427	0.117950539
X Variable 3	0.156696795	0.04095858	3.825737959	0.000241712	0.075312969	0.238080622	0.075312969	0.238080622
X Variable 4	0.248436982	0.044671102	5.561469705	2.77376E-07	0.159676453	0.337197511	0.159676453	0.337197511
X Variable 5	0.339325762	0.044880421	7.560663467	3.42963E-11	0.250149321	0.428502203	0.250149321	0.428502203
X Variable 6	0.052125339	0.022200034	2.347984602	0.021091627	0.008014343	0.096236335	0.008014343	0.096236335
X Variable 7	0.041790823	0.038789654	1.077370341	0.284226427	-0.035283393	0.118865039	-0.035283393	0.118865039
X Variable 8	0.163037588	0.039585581	4.118610491	8.51385E-05	0.084381882	0.241693294	0.084381882	0.241693294
X Variable 9	0.012173361	0.011041784	1.102481406	0.273224789	-0.009766428	0.03411315	-0.009766428	0.03411315
X Variable 10	-0.05921443	0.033528034	-1.766116986	0.080805287	-0.125833918	0.007405059	-0.125833918	0.007405059

ANALYSIS OF COEFFICIENT (β) GRAPH

Primary Drivers of Performance:

The variables X_5 (0.3393) and X_4(0.2484) emerged as the strongest predictors of academic success. This indicates that ChatGPT's ability to help students approach problems from multiple perspectives and improve analytical thinking are the most valued features among management students in Pune.

Significant vs. Marginal Impact:

While variables like X_1 and X_9 show positive coefficients, their values (0.0137 and 0.0122 respectively) are significantly lower than X_5. This suggests that while these factors contribute to the model, their individual impact on a student's final academic grade is relatively minor compared to conceptual and analytical support.

The Inverse Relationship X_{10}:

A critical finding in the data is the negative coefficient for **X_{10} (-0.0592)**. The bar extending below the zero-line signifies an inverse correlation. In the context of this pilot study, this suggests that an increase in this specific factor leads to a slight decrease in academic performance. This highlights the "dual-edged" nature of AI tools, where certain usage patterns may hinder rather than help student outcomes.

RESULTS AND FINDINGS

Target Population: The study successfully captured a balanced demographic, with an almost equal split between Male (51%) and Female (49%) respondents, primarily in the 23–25 age group (29%). This represents the core MBA student demographic in Pune.

High AI Literacy: Awareness is universal, with 0% of students being "Not at all aware" of AI. While ChatGPT is the most used, there is significant lateral awareness of Google Gemini, Claude, and Microsoft Copilot (25% each), indicating a diversified tech ecosystem among management students.

Entrenched Usage: 62% of students use ChatGPT "Often" or "Very Frequently" for academic work, confirming that AI has moved from a novelty to a fundamental academic utility.

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Awareness of ChatGPT among Management Students- The study found that awareness of ChatGPT is very high among management students in Pune. Almost all respondents are familiar with AI tools, and ChatGPT is one of the most commonly used platforms for academic purposes.

Frequency of ChatGPT Usage for Academic Work- It was observed that a majority of students use ChatGPT frequently for academic activities such as assignments, research, and concept clarification. This indicates that ChatGPT has become an important academic support tool rather than an occasional resource.

Impact on Conceptual Understanding- The findings show that ChatGPT has a strong positive impact on conceptual understanding. Students reported that it helps them:

Understand complex topics easily

Improve learning efficiency

Grasp difficult management concepts faster

Influence on Academic Performance- The regression analysis indicates that ChatGPT has a positive impact on academic performance, especially through factors like:

Concept clarity

Problem-solving ability

Analytical thinking

However, the impact varies depending on how effectively students use the tool.

Effect on Critical Thinking and Independent Learning- The study found that ChatGPT's impact on critical thinking is mixed:

Many students use it as a support tool while still thinking independently

However, statistical analysis shows that improvement in deep analytical thinking is not strongly significant.

VI. CONCLUSION

This pilot study on the impact of ChatGPT on student academic performance, with special reference to management institutes in Pune, highlights the growing importance of Artificial Intelligence in the education sector.

The findings of the study indicate that ChatGPT has a significant positive influence on students' learning process, particularly in improving conceptual understanding, learning efficiency, and problem-solving abilities.

However, the study also reveals that ChatGPT's effect on critical thinking and independent learning is limited.

While students perceive that the tool supports their analytical abilities, the statistical evidence does not strongly support a significant improvement in deep thinking skills.

Additionally, the presence of a negative coefficient for certain variables suggests that excessive or improper use of ChatGPT may have a slight negative impact on academic performance.

Overall, the study concludes that ChatGPT is a valuable educational tool when used responsibly.

It enhances learning outcomes and academic performance but should be used as a support system rather than a replacement for independent thinking.

Therefore, a balanced and ethical approach to using AI tools is essential to maximize their benefits while minimizing potential drawbacks.

VII. ACKNOWLEDGMENT

I, Ruchira Patil, expresses sincere gratitude to the respondents, industry professionals, and academic mentors who supported the completion of this research paper on pilot study.

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