Impact of ChatGPT on the quantitative acumen of postgraduate business management students in central India

Impacto do ChatGPT na perspicácia quantitativa de estudantes de pós-graduação em administração de empresas na Índia Central

Impacto de ChatGPT en la perspicacia cuantitativa de estudiantes de posgrado en administración de empresas en India central

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Nupur Gupta, Jaipuria Institute of Management, Indore Campus, India
https://orcid.org/0000-0003-1111-3572

Amit Shrivastava, Jaipuria Institute of Management, Indore Campus, India
https://orcid.org/0000-0003-0420-2008

Gaurav Mathur, Jaipuria Institute of Management, Indore Campus, India
https://orcid.org/0009-0005-7643-8978

J.K. Sachdeva, SNDT University, Mumbai, India.
https://orcid.org/0000-0002-7199-0529

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Abstract

Incorporating Artificial Intelligence (AI) advancements within the educational framework has significantly altered the methodologies and dynamics of learning experiences. ChatGPT, an AI platform centred on language processing, provides rapid responses and materials for learners addressing qualitative and quantitative academic challenges. This study explores a significant inquiry: "What is the effect of ChatGPT augmentation on the quantitative number crunching and data analysing abilities of students of Post Graduate Diploma in Management Studies at an AACSB alliance member business school in central India?" It explores essential courses requiring number crunching skills and acumen in numerical data interpretation and analyses how the AI tool alters students' approach. A self-designed online questionnaire featuring items on a 5-point Likert scale was utilised to gather data from 264 students pursuing PGDM. The investigation analysed student perceptions across five dimensions: ease of use and efficiency, application with confidence, challenges related to math and struggles with quantitative subjects, concerns regarding dependence and integrity, reliability, and ease of access. The findings indicate that ChatGPT significantly improves learners' efficiency, confidence, and ability to tackle complex numerical problems. It is also used for assignment preparation, mathematical problem-solving, and verification of the results generated by quantitative questions. The enhancement in comprehension and assignment efficiency is evidenced by a high Cronbach's Alpha score of 0.852, affirming the reliability of the survey constructs as detailed in the T-test analysis. This study also identified issues related to excessive dependence, with students expressing their apprehensions regarding the decline in academic performance attributed to reliance on the ChatGPT tool. Significant differences were noted in the views on readiness for independent learning and preparedness for assessments, raising issues about the learner's confidence in utilising AI tools. The recommendations advocate for integrating AI usage guidelines, ethical technology training, and proficiency in AI literacy within the management education curriculum.

Keywords: ChatGPT, Artificial Intelligence, Quantitative skills, higher education, dependence, integrity
JEL Codes: I23, C88, M53

Resumo

A incorporação de avanços da Inteligência Artificial (IA) na estrutura educacional alterou significativamente as metodologias e a dinâmica das experiências de aprendizagem. O ChatGPT, uma plataforma de IA centrada no processamento de linguagem, fornece respostas rápidas e materiais para alunos que abordam desafios acadêmicos qualitativos e quantitativos. Este estudo explora uma investigação significativa: "Qual é o efeito do aumento do ChatGPT nas habilidades quantitativas de processamento de números e análise de dados de alunos do Diploma de Pós-Graduação em Estudos de Administração em uma escola de negócios membro da aliança AACSB na Índia central?" Ele explora cursos essenciais que exigem habilidades de processamento de números e perspicácia na interpretação de dados numéricos e analisa como a ferramenta de IA altera a abordagem dos

alunos. Um questionário on-line autodesenhado com itens em uma escala Likert de 5 pontos foi utilizado para coletar dados de 264 alunos que buscam o PGDM. A investigação analisou as percepções dos alunos em cinco dimensões: facilidade de uso e eficiência, aplicação com confiança, desafios relacionados à matemática e dificuldades com assuntos quantitativos, preocupações com dependência e integridade, confiabilidade e facilidade de acesso. As descobertas indicam que o ChatGPT melhora significativamente a eficiência, a confiança e a capacidade dos alunos de lidar com problemas numéricos complexos. Ele também é usado para preparação de tarefas, resolução de problemas matemáticos e verificação dos resultados gerados por questões quantitativas. O aprimoramento na compreensão e eficiência das tarefas é evidenciado por uma alta pontuação Alpha de Cronbach de 0,852, afirmando a confiabilidade dos construtos da pesquisa, conforme detalhado na análise do teste T. Este estudo também identificou problemas relacionados à dependência excessiva, com os alunos expressando suas apreensões em relação ao declínio no desempenho acadêmico atribuído à dependência da ferramenta ChatGPT. Diferenças significativas foram observadas nas visões sobre prontidão para aprendizagem independente e preparação para avaliações, levantando questões sobre a confiança do aluno na utilização de ferramentas de IA. As recomendações defendem a integração de diretrizes de uso de IA, treinamento em tecnologia ética e proficiência em alfabetização em IA dentro do currículo de educação em gestão.

Palavras-chave: ChatGPT, Inteligência Artificial, Habilidades quantitativas, ensino superior, dependência, integridade

Resumen

La incorporación de avances en Inteligencia Artificial (IA) en el marco educativo ha transformado significativamente las metodologías y la dinámica de las experiencias de aprendizaje. ChatGPT, una plataforma de IA centrada en el procesamiento del lenguaje, ofrece respuestas rápidas y materiales a estudiantes que abordan desafíos académicos cualitativos y cuantitativos. Este estudio explora una pregunta clave: "¿Cuál es el efecto de la mejora de ChatGPT en las habilidades de análisis cuantitativo de datos y procesamiento numérico de los estudiantes del Posgrado en Estudios de Administración en una escuela de negocios miembro de la alianza AACSB en la India central?". El estudio explora cursos esenciales que requieren habilidades de procesamiento numérico y perspicacia en la interpretación de datos numéricos, y analiza cómo la herramienta de IA altera el enfoque de los estudiantes. Se utilizó un cuestionario en línea de diseño propio con ítems en una escala Likert de 5 puntos para recopilar datos de 264 estudiantes del Posgrado en Administración de Empresas (PGDM). La investigación analizó las percepciones de los estudiantes en cinco dimensiones: facilidad de uso y eficiencia, aplicación con confianza, desafíos relacionados con las matemáticas y dificultades con las asignaturas cuantitativas, preocupaciones sobre la dependencia y la integridad, fiabilidad y facilidad de acceso. Los hallazgos indican que ChatGPT mejora significativamente la eficiencia, la confianza y la capacidad de los estudiantes para abordar problemas numéricos complejos. También se utiliza para la preparación de tareas, la resolución de problemas matemáticos y la verificación de los resultados generados por preguntas cuantitativas. La mejora en la comprensión y la

eficiencia de las tareas se evidencia en una alta puntuación Alfa de Cronbach de 0,852, lo que confirma la fiabilidad de los constructos de la encuesta, como se detalla en el análisis de la prueba T. Este estudio también identificó problemas relacionados con la dependencia excesiva, ya que los estudiantes expresaron su preocupación por el deterioro del rendimiento académico atribuido a la dependencia de la herramienta ChatGPT. Se observaron diferencias significativas en las opiniones sobre la preparación para el aprendizaje independiente y la preparación para las evaluaciones, lo que plantea dudas sobre la confianza de los estudiantes en el uso de herramientas de IA. Las recomendaciones abogan por la integración de directrices de uso de IA, formación en tecnología ética y competencia en alfabetización en IA en el currículo de formación en gestión.

Palabras clave: ChatGPT, Inteligencia Artificial, Habilidades Cuantitativas, educación superior, dependencia, integridad

1. Introduction

The integration of artificial intelligence within educational settings has significantly influenced pedagogical approaches and learning methodologies across various fields. ChatGPT represents a significant advancement in artificial intelligence technologies, particularly within business management education, where quantitative methods play a crucial role. This research investigates the efficacy of the ChatGPT tool among postgraduate business management students in Central India, focusing on aspects such as cognitive development, learning methodologies, and academic performance.

ChatGPT, due to its multifaceted applications in education and remarkable capabilities, has generated a wealth of study and analysis in its brief existence. Some might assert that following democracy, artificial intelligence serves as the most significant equaliser because of its extensive reach and user-friendly prompts. AI is deemed Socratic as it answers inquiries thoroughly, encourages additional questions, and enhances interactive learning (Rospigliosi, 2023). Artificial intelligence arrived like a Black Swan event in education, but its outcomes were like those of the Horn of Plenty. It can improve the quality of education by optimising access to knowledge (OpenAI, 2023). ChatGPT can have a far-reaching impact on education through the practical usage of web mining and natural language processing (Rejeb et al., 2024). AI has the potential to fulfil the ultimate objective of good education by creating future business leaders who possess techno-savvy

skills and have a key sense of responsibility (Greenland et al., 2022). ChatGPT's tryst with Management education has led to an additional rubric in the already heady mixture of data, concepts, frameworks, and interconnections in contemporary Management education. The chief stakeholders in this journey are students, educators, and institutions, who are all interested in the interaction between ChatGPT and knowledge impartation and how the resultant output is shaped.

The significance of quantitative aptitude within a business curriculum is paramount, as various components such as financial accounting, statistics, investment banking, and corporate finance necessitate a strong foundation in numerical skills. ChatGPT, an artificial intelligence application, facilitates immediate interaction with users, addresses inquiries, resolves issues, performs calculations, and assists in decision-making processes. The integration of ChatGPT within educational frameworks prompts critical examination of its implications, influencing learning methodologies, academic honesty, and autonomy in the learning environment.

The implication of integrating ChatGPT within educational frameworks, tracking its influence on methodologies, and studying its impact on academic honesty and the larger educational environment needs a thorough critical appraisal. Existing research has mainly focused on tracing the impact on the educational framework. However, the impact on students' quantitative skills, especially postgraduate business management students, is a sub-domain that needs greater empirical research. Increased precision and enhanced mathematical acumen are the most significant advantages, and academic dishonesty and allied ethical considerations are the most significant setbacks. Overall, an in-depth examination of the tool for business management students is vital before any policy consideration can gain shape.

This research aims to examine performance effectiveness, learning dynamics, confidence and problem-solving ability as possible virtues and increased dependence, diminished analytical ability and compromised academic integrity as possible setbacks in evaluating quantitative skills of postgraduate business management students when they use ChatGPT. The research's primary objective is holistically integrating ChatGPT in management education curriculums. This research examines the frequency of the usage of

ChatGPT in assignments, examinations and self-directed learning, its perceived advantages and disadvantages in the perusal of quantitative subject domains, its impact on the skill set of students, their ethical conundrums, all in the domain of study of quantitative subjects.

The study was conducted in an AACSB-affiliated business school in Indore, a city in the central Indian state of Madhya Pradesh. It can impact academic policymaking and contribute to intellectual growth, learning outcome attainment, and popular perceptions regarding the integration of AI in learning environments while being of immense use to both learners and educators.

This research aims to contribute to ongoing discussions regarding artificial intelligence in educational contexts by providing empirical evidence derived from a developing nation. It will also contribute to developing curriculum design concepts, instructional strategies, and policies aimed at enhancing the educational outcomes of ChatGPT while minimising adverse effects.

2. Literature Review

ChatGPT has inspired individual thinkers, academic groups, and institutions. Forty-three researchers brainstormed on the pros and cons emerging from the use of AI in education. They were divided in their opinions on whether the innovation should be restricted or legislated but uniformly sought legislation and international frameworks to ensure uniformity in policymaking (Dwivedi et al., 2023).

From the perspective of educators grappling with this new tool, many seminal studies have been undertaken. Ratten and Jones (2023) opine that "to train students to use these technologies, educators need to focus on creativity and futuristic thinking and create assignments which integrate technology with critical thinking." AI will benefit educators by freeing them from mundane tasks and allowing them to take up more challenging assignments (Stokel-Walker, 2022). Nevertheless, the biggest challenge for educators is assessment and its fairness, and the most effective manner of combating ChatGPT-prompted answers is shunning theoretical assessments and moulding them to bring out

critical thinking and creativity while simultaneously getting the assessments checked on anti-plagiarism software (AlAfnan et al., 2023).

Studies have engaged with the nuances of how generative AI has acquired centre stage in educational impartation and assessment from the institutional perspective. Tlili et al. (2023), through a three-tier study, studied the initial warm reception of ChatGPT in the domain of education, its ability to herald education transformation, and, through case studies, brought to the forefront the gross academic misconduct it can perpetuate. Before heedless implementation of large language models (LLMs) of ChatGPT, "it is crucial to approach the use of these models with caution and to evaluate their limitations and potential biases critically" (Kasneci et al., 2023). There is also recognition of the challenges posed to institutional norms in evaluating AI-generated research by human evaluators and tools, which questions the overall credibility of the research ecosystem (Hu, 2023). Researchers have also written on speculative future narratives to identify the emerging themes related to the usage of ChatGPT in education in the 21st century (Bozkurt et al., 2023). Existing research data shows that institutions can use ChatGPT to develop comprehensive and practical feedback ecosystems, enhance learning outcomes, and foster a culture that rewards continuous improvement (Saini et al., 2024). Overall, educational management, teaching, and learning are the three steadfast pillars of every successful educational institution, and they can be optimised with ChatGPT (Stepanenko & Stupak, 2023).

From the students' viewpoint, the ramifications of ChatGPT usage have been researched for both benefits and drawbacks. On the one hand, research validates that ChatGPT can enhance learning in already established cognitive learning domains but severely curtail critical thinking and logical reasoning, leading to potential deskilling due to students' overreliance on ChatGPT for basic tasks (Valcea et al., 2024). There is also evidence that AI diminishes problem-solving in students, and written and verbal communication skills also lag, which has a far-reaching impact on their employability (Segbenya et al., 2023). The study of Adiguzel 2023 et al. emphasises ChatGPT's revolutionary impact on education by augmenting individualised learning, promoting academic performance, and cultivating critical thinking in students, especially in intricate disciplines such as finance. Caution must be exercised in using ChatGPT owing to its

fallouts like excessive dependence, diminished manual problem solving, and ethical dilemmas that emerge from its unbridled usage.

At the other end of the spectrum is the rainbow-hued panorama of the potential advantages of using ChatGPT, which includes heightened success in innovation and entrepreneurship education along with razor-sharp critical thinking ability (Abaddi, 2024; Su & Lui, 2023). Researchers have pointed out that bridging tools like ChatGPT-assisted Learning Aids (GCLA) can lessen over-reliance on generative AI, enhance self-paced and self-regulated learning and promote higher-order thinking Skills (HOTS) (Lee et al., 2024). Another facet pointed out is that if holistically integrated into curriculums, ChatGPT has shown encouraging learning outcomes in technology studies (Hakiki, 2023). A monumental role in content creation, differentiation, lesson planning, personalised instruction, feedback and assessment, and professional development has been done in a relatively short time by ChatGPT (Kasneci et al., 2023). Being a tightrope of advantages and fallouts, challenges and opportunities, risks and rewards, most scholars recommend using ChatGPT with vigilant attention (Cotton et al., 2024).

Another remarkable outcome of research on the subject is that the younger the age, the more avid and active the usage of generative AI (Lubis & Siregar, 2023). ChatGPT has also played a phenomenal role in giving impetus to the expectations of prospective employers, who now desire that prospective employees have considerable AI skills. It shall be a rubric for determining employability in the future (Prohorovs et al., 2024). The ubiquitous presence of ChatGPT in the realm of assessments cannot be ignored; this represents the greatest enigma for the student fraternity. Anti-plagiarism software like Turnitin attempts to throw a girdle around AI by romping up its technology. However, with newer versions of GPT emerging, it seems a perennial game of cat and mouse chase, which can only end with building mutually trustful relationships (Rudolph et al., 2023a).

Domain-specific studies in academia have shown that ChatGPT has a varied impact on context-specific scenarios. Research highlights the positive perceptions of ChatGPT for Teaching English to Speakers of Other Languages (TESOL) learners, which include convenience, accessibility, prompt feedback, provision for creation of templates, idea

generation and vocabulary improvement. However, fallouts include a lack of reliable references, occasional inaccuracies, and plagiarism concerns (Gervacio, 2023). Research spearheaded by Lo in 2023 found that ChatGPT usage resulted in outstanding outcomes in Economics, satisfactory results in Programming and unsatisfactory outcomes in Mathematics. Research on the impact of ChatGPT usage on students' computing and related skills, programming self-motivation and desire for learning programming yielded positive outcomes (Yilmaz, 2023). ChatGPT can be a virtual teaching assistant in medical education, providing students with specific and detailed information and sometimes providing interactive simulations (Lee, 2024).

ChatGPT in business communication education offers strengths like enhanced interactivity but poses challenges regarding originality and security (Sharma & Pandey, 2024). For enhancing general financial literacy and subsequent outcomes in the form of better investment decision-making, ChatGPT has shown positive outcomes that can translate into greater societal good. (Bansal et al. 2025). Rudolph et al. 2023b advocate that ChatGPT can be used as a writing partner rather than a ghostwriter whose text you copy and paste.

Data collection through questionnaires has sometimes yielded ambivalent outcomes, with students supporting certain features of ChatGPT but also voicing concerns about misuse, mistakes and moral vacuity (Fabella, 2023). One of the biggest concerns expressed by researchers zeroes in on the possibility of frequent hallucinations and the lack of a stochastic measure to provide sensitive and sincere communication (Gill et al., 2024).

Research has also pointed out that the engaging platform of ChatGPT has acted as a motivation for students owing to its easy user interface, but constraining critical thinking and problem-solving have been considered its limitations (Alnaim, 2024). At this nascent stage, it is difficult to conclusively state whether AI shall be a boon or a bane and comprehensive longitudinal studies to understand further the prolonged effects of AI on educational practices and outcomes are needed (Mohapatra & Yella, 2024).

The impact of using ChatGPT to assess progression in students' quantitative skills is a new domain that previous researchers have not touched on. They have mainly focused on critical thinking, communication skills, and language learning and how they are impacted

(either negatively or positively by ChatGPT). A more nuanced and evidence-based study needs to be conducted rather than widespread generalisations.

3. Formulation of Hypotheses and Research Inquiries

3.1 Statement of the Problem

Given the growing dependence on AI technologies, especially ChatGPT, there are possible obstacles to the conventional cultivation of financial and quantitative analytical skills in MBA students. These competencies, essential for business management professionals, are frequently developed through intensive training and autonomous study. This study examines the effects of ChatGPT utilisation on students' capacity for independent quantitative analysis and its wider influence on their academic and professional skills.

3.2 Objectives of the Research

1. To investigate the impact of ChatGPT on enhancing fundamental financial and quantitative competencies in PGDM students;
2. To assess the influence of ChatGPT usage on students' confidence in quantitative assessments where AI tools are disallowed;
3. To evaluate the influence of moderating variables (e.g., gender, study habits, academic achievement) on the correlation between ChatGPT utilisation and students' numeric proficiency;
4. To examine whether ChatGPT effectively balances its role in improving learning outcomes and fostering critical thinking in quantitative subjects.

3.3 Development of Hypotheses

H1: Beneficial Impacts of ChatGPT Utilization

H1a: ChatGPT markedly improves students' understanding of quantitative concepts

H1b: ChatGPT enhances students' confidence in resolving quantitative issues

H2: Adverse Consequences of ChatGPT Utilization

H2a: The utilisation of ChatGPT adversely affects students' capacity to resolve mathematical problems independently

H2b: Students who predominantly depend on ChatGPT exhibit reduced confidence and performance in assessments when AI tools are prohibited.

H3: Moderating Variables

H3a: Gender differences do not significantly moderate the link between ChatGPT usage and mathematical skill development

H3b: Study habits (e.g., hours dedicated to self-study) do not significantly modify the correlation between ChatGPT utilisation and the enhancement of quantitative skills

H4: Involvement and Education

H4a: ChatGPT markedly enhances student engagement in quantitative disciplines

H4b: Using ChatGPT enhances the perceived simplicity and effectiveness of studying quantitative disciplines

The current study's paradigm incorporates the beneficial and detrimental effects of ChatGPT utilisation on students' numeric skills, considering moderating factors such as gender, study habits, and academic achievement. It also assesses engagement and learning as intermediary elements in the correlation between ChatGPT utilisation and skill enhancement.

4. Data & Research Methodology

4.1 Data

This study used a survey design to collect data from postgraduate business management students from an AACSB alliance member business school based in the Central Indian city of Indore. We explored the student's use and perception of Chat GPT in quantitative subjects. The business school has a flagship course in business management, and students are awarded a postgraduate diploma in business management at the end of two years upon completing the requisite mandates in each subject. In the first year, the quantitative subjects included financial accounting, statistics for management, corporate finance, cost accounting, and advanced corporate finance. In the second year, the quantitative subjects include – equity analysis and portfolio management, investment banking, financial modelling and analysis, fixed-income securities, entrepreneurial finance,

financial economics, wealth management, fintech, and project finance. The total number of students in the business school for the academic year 2024-25 (when the study was conducted) is 348, which comprises 171 first-year students and 177 second-year students. The valid responses were collected from 264 students who wanted to participate in the survey using purposive and convenience sampling techniques. The survey was administered via an online questionnaire on Google Forms, consisting of three demographic questions of age, gender and marks cumulative grade points average and 24 close-ended questions on a Likert scale of 1-5, with one being strongly disagree / negation and five being strongly agree and affirmation. The initial questionnaire was developed by seeking tutelage from similar studies and existing questionnaires on teachers' and students' perceptions of educational technologies in higher education. Pilot studies were conducted before formal data collection to ensure the relevance and clarity of the questionnaire items and to weed out any anomalies.

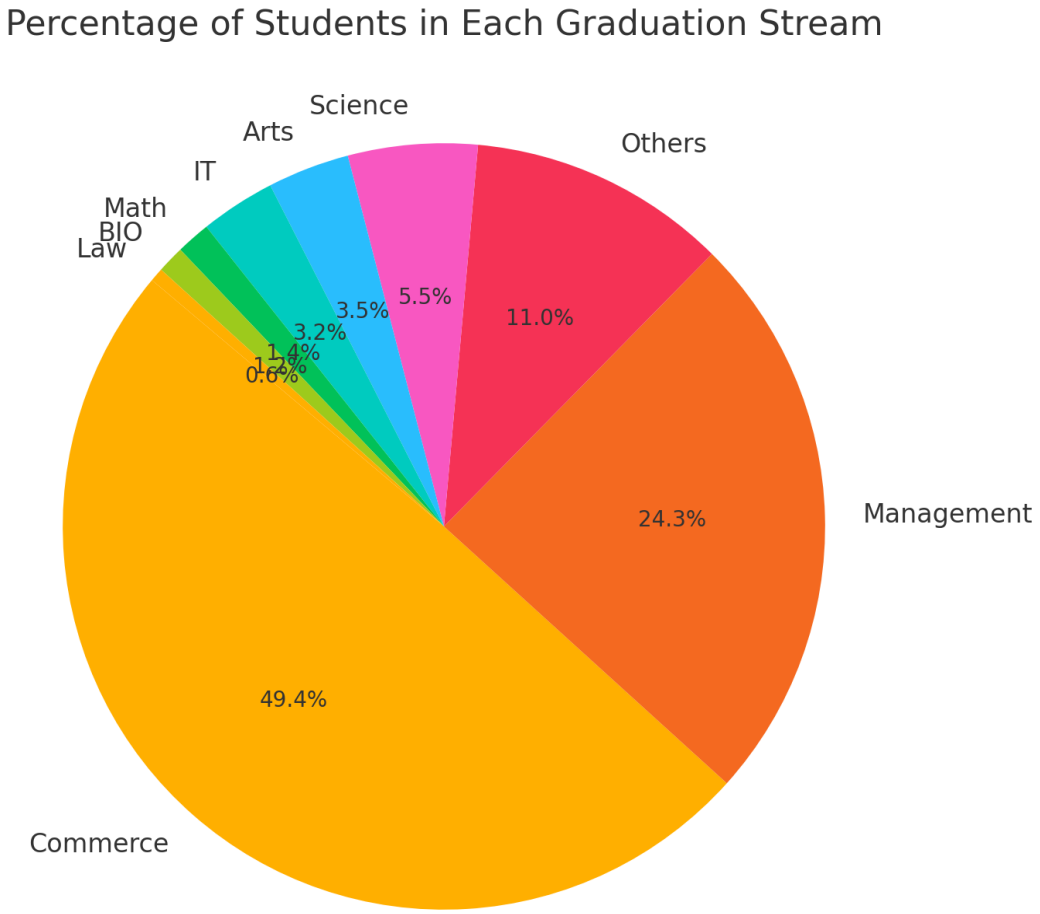
The questionnaire was customised based on the feedback from the pilot study. The final version of the instrument comprises a pool of 27 items, employing a 5-point Likert scale ranging from "Strongly agree" to "Strongly disagree,". The participants were sensitised first on the purpose of the project. They were assured of the anonymity of their identity and that the responses would not have any bearing on their future grades. Hence, participants were encouraged to respond honestly to the administered questionnaire. The topics covered in the survey were within the comfort of students using GenAI technologies like ChatGPT, the incorporation of chat GPT in understanding complex quantitative topics, assignment submission in higher education, etc. The participants were also quizzed on potential challenges to their independent thinking due to overuse related to AI technologies and the influence of AI on teaching and learning. Data was collected through an online survey targeting all 348 institute students to ensure that the results showed parity and represented the needs and values of all participants. Participation in the questionnaire was entirely voluntary, and the responses were anonymous. Descriptive analysis was utilised to analyse the survey data.

4.2 Nature of data and descriptives

The participants' age groups were 20-25, with 93% of the respondents in this age group and 7 % in the age group of 25-30. The respondents' gender was almost equally split between males and females, with males being 54% and females 46%. Around 74% of students studied management and commerce at their graduation level. Figure 1 portrays the field of study at the graduation level of the participants in the study.

Figure 1

Field of Study studies during Bachelor's graduation



Source: Based on data collected by authors

About 44% of respondents (n = 116) were comfortable not using Generative AI technology for learning. Only 13% of respondents (n =35) were either very uncomfortable

or uncomfortable in their learning purposes without using Generative AI technology. A sizeable portion of the respondents, 30% (n =83), were neutral in their response to the comfort of using generative AI for their learning purposes. A further chi-square test revealed no association between the comfort of the students not using generative AI in their learning purposes and gender (Chi-square value = 3.359, p >0.05)

63% of the respondents (n=166) spent less than 5 hours per week studying quantitative subjects as a part of self-study beyond classroom learning. These subjects primarily involved finance-related and statistics-related subjects in the first year of PGDM and finance elective subjects in the second year of PGDM. 32% (n =184) of the students spent 5-10 hours per week beyond the classroom in self-study mode in quantitative subjects, and only 5 % (n = 14) spent more than 10 hours per week studying quantitative subjects on their own beyond classroom learning. However, a test of association using a chi-square test revealed that there is an association between gender and hours used in studying per week in quantitative subjects. (Chi-square value = 16.647, p <0.05). It was found that female students spent less than 5 hours per week studying quantitative subjects, whereas male students spent an average of 5-10 hours per week studying quantitative subjects.

The cumulative grade points average (CGPA) is used in higher education to assess students' performance in their 2-year PGDM performance. It is based on the relative academic performance of the student vis-a-vis the entire batch of students. It is calculated as the average of the total grade points (10 being the highest and one being the lowest) in every course divided by the number of subjects. 80% (n = 214) of the student's academic performance fell in CGPA 5.29- 7.85. 9% (n=24) of the respondents reported higher GPAs of more than 7.85, and 10% (n=26) reported lower GPAs of less than 5.28 and below. However, a chi-square test to check the association between CGPA scores and the number of hours spent did not have any association. (Chi-square value = 7.793, p >0.05)

4.3 Sample characteristics

The reliability of the survey instrument was checked and found to be high, with a Cronbach Alpha of 0.852. This meant that the questionnaire was reliable and robust for

processing for further empirical investigations. Joppe (2000), as quoted in Golafshani (2003), defines reliability as:

"The extent to which results are consistent over time and an accurate representation of the total population under study is referred to as reliability, and if the results of a study can be reproduced under a similar methodology, then the research instrument is considered reliable."

Cronbach's Alpha estimates the reliability of the test without splitting the test's items (Cooper, 2003). Upon applying this to the questionnaire, the score comes to 0.852 for all n=27 questions used. This is considered almost acceptable in social science research (Cooper, 2003).

Factor analysis (discussed later under the Results and Discussions section) has identified five constructs in the questionnaire and has been tabulated in Table 1. The Cronbach Alpha for the first three constructs – ease of use and efficiency, application with confidence, and Math challenges and struggle had a Cronbach alpha in the range of 0.8. Two constructs – Concerns about dependence and integrity had fewer questions and had a Cronbach Alpha in the region of 0.53 to 0.688. Since this is social science research, a Cronbach alpha of 0.5-0.6 is acceptable (Cooper, 2003).

Table 1
Reliability of the five constructs

Construct name	No. of Questions	Cronbach Alpha
Ease of Use & Efficiency	7	0.831
Application with confidence	5	0.832
Math Challenges & Struggle	4	0.779
Concerns about Dependence & and Integrity	3	0.688
Reliability & Ease of Access	2	0.530

Source: As per constructs identified by factor analysis used by the authors

5.Results

5.1 Results of one sample t-test

The one-sample t-test was used to assess whether students' assessments of ChatGPT's influence on their quantitative skills significantly differed from a neutral test value of 3. This investigation offers insights into the advantages and possible disadvantages of using ChatGPT among postgraduate business management students in Central India. The one-sample t-test method compares the mean score of each statement against the test value of the average score of the neutral statement, which is 3 in this case, as the Likert scale used a 5-point scale. If the significance level is 0.05, this indicates a significant difference between the statements from the mean score of 3.

The results of the one-sample t-test were decomposed into positive effects, adverse effects, and no effects of ChatGPT on the quantitative acumen of postgraduate students pursuing business management studies.

5.1.1. Substantial Beneficial Effects

Multiple comments underscored statistically significant positive mean differences, suggesting that students regard ChatGPT as a valuable resource in their mathematical learning experience. Students depend heavily on ChatGPT to enhance their comprehension of intricate mathematical topics, evidenced by a t-value of 2.575 and a mean difference of 0.174 ($p = 0.011$). ChatGPT is often employed for validating manually derived solutions ($t = 4.504$, $p < 0.001$, Mean Difference = 0.337), aiding in quantitative problem-solving ($t = 3.462$, $p = 0.001$, Mean Difference = 0.235), and facilitating exam and assignment preparation ($t = 7.801$, $p < 0.001$, Mean Difference = 0.545). The ease of interaction with ChatGPT was identified as a notable strength ($t = 11.759$, $p < 0.001$, Mean Difference = 0.784), as well as its effectiveness in alleviating challenges associated with learning quantitative subjects ($t = 5.016$, $p < 0.001$, Mean Difference = 0.333). Moreover, students indicated that ChatGPT improves their efficiency in assignment completion ($t = 3.066$, $p = 0.002$, Mean Difference = 0.205) and aids in the clarity of comprehending quantitative data ($t = 6.107$, $p < 0.001$, Mean Difference = 0.367). ChatGPT significantly enhances students' confidence in resolving quantitative issues ($t = 2.648$, $p = 0.009$, Mean

Difference = 0.182). Additionally, students assert that ChatGPT enhances their proficiency using quantitative procedures (t = 2.305, p = 0.022, Mean Difference = 0.152).

5.1.2 Apprehensions Regarding Detrimental Effects

Although ChatGPT is beneficial in some respects, considerable apprehensions have been observed over its excessive utilisation and effects on academic integrity. Students express significant concern regarding excessive dependence on ChatGPT for resolving mathematical issues (t = 13.678, p < 0.001, Mean Difference = 0.928) and its possible detrimental effect on independent thought (t = 12.358, p < 0.001, Mean Difference = 0.826). Concerns about academic integrity in using ChatGPT for scholarly work were significant (t = 13.468, p < 0.001, Mean Difference = 0.822). A significant issue regarding performance in quantitative examinations without ChatGPT support was noted, shown by a negative mean difference (t = -3.755, p < 0.001, Mean Difference = -0.288).

5.1.3. Indifferent Outcomes

Certain statements exhibited minimal variations from the test value, indicating a neutral position. Students regarded ChatGPT's correctness and relevance as neither markedly positive nor negative (t = 1.064, p = 0.288, Mean Difference = 0.072). Likewise, its impact on classroom engagement (t = 1.763, p = 0.079, Mean Difference = 0.125) and enhancement of autonomous problem-solving skills (t = 0.166, p = 0.869, Mean Difference = 0.011) was equally neutral. The excessive use of ChatGPT did not substantially impair students' capacity to independently answer quantitative problems (t = 1.279, p = 0.202, Mean Difference = 0.095).

5.2. Factor Analysis

To ascertain the fundamental dimensions of this multi-item measuring scale, factor analysis was conducted on the 22 statements (with five control factors about gender, age, GPA, study hours, and technology comfort) to evaluate the influence of Chat GPT on the Students' quantitative proficiency. According to Nargundkar (2009), factor analysis is advantageous for diminishing data complexity by decreasing the number of analysed variables (2009). Factor analysis is frequently employed in psychology and education (Hogarty et al., 2005) and is suitable for evaluating self-report surveys (Bryant et al., 1999).

Factor analysis is also fundamental to the assessment of psychological constructs. Factor analysis was conducted on the Chat GPT usage questionnaire scale items utilising principal components analysis with Varimax rotation. An eigenvalue threshold of 1.0 assists in identifying the number of elements or dimensions for each scale (Hair et al., 2010). Factor loadings ranging from 0.30 to 0.40 are deemed acceptable, although loadings over 0.50 are typically required for practical significance (Hair et al., 2010). Consequently, items for a factor were preserved solely when the absolute magnitude of their factor loading exceeded 0.550.

Table 2 presents the Kaiser-Meyer-Olkin (KMO) results and explains Bartlett's sphericity and total variance test. Kaiser-Meyer-Olkin (KMO) is a measure of sampling adequacy used to examine the appropriateness of factor analysis (Hair et al., 2010). A range of 0.5 – 1.0 in KMO indicates that factor analysis is appropriate. Here, the KMO value of 0.867 signified that factor analysis was appropriate for analysing the dimensions of the questionnaire. Barlett's test of sphericity is the mode of determining the appropriateness of factor analysis. This test finds the statistical significance of correlations among variables (Hair et al., 2006). Here, the significance of this test is lesser than the α value at a 99% confidence level. Hence, this confirms the use of factor analysis for data reduction and aids in construct identification.

Table 2
KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.867
Bartlett's Test of Sphericity	Approx. Chi-Square	2291.987
	df	231
	Sig.	.000

Source: Based on primary data

The principal components analysis uses the varimax method with Kaiser normalisation rotation. This helped extract five factors with Eigenvalues that were more

significant than 1.0. These factors (F1 to F5) represent 22 items and account for 60.05% of the total variance (tabulated in Table 3). It is expected to consider a solution of about 60% satisfactory in social sciences research (Hair et al., 2010).

Table 3
Total Variance Explained

Factor	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
Ease of Use & Efficiency	6.856	31.163	31.163	3.744	17.017	17.017
Application with confidence	2.214	10.06	41.228	3.153	4.330	31.348
Math Challenges & Struggles	1.793	8.149	49.377	2.736	12.436	43.784
Concerns about Dependence & Integrity	1.254	5.701	55.078	2.056	9.345	53.129
Reliability & ease of access	1.094	4.975	60.053	1.523	6.925	60.053

Extraction Method: Principal Component Analysis
Source: Author's calculation based on 264 responses

Five Distinct Factors and Implications: The analysis identifies five key themes: (1) Ease of Use and Efficiency, (2) Skill Enhancement and Application, (3) Math Challenges and Struggles, (4) Concerns About Dependence and Integrity, and (5) Reliability and Ease of Access. The results suggest that while ChatGPT is valued for its ease of use and the confidence it provides, there are significant concerns about over-reliance and its impact on independent problem-solving. Additionally, the tool's role in enhancing skills is evident but struggles with mathematical concepts still need to be solved. This analysis helps to understand users' diverse perceptions and concerns regarding ChatGPT in the context of quantitative problem-solving.

5.3 Regression Analysis

The regression analysis examined the correlation between parameters influencing ChatGPT usage and CGPA scores among postgraduate Business Management students. The principal findings are tabulated in Table 4.

Table 4
Regression Results

Model	Unstandardised Coefficients		Standardised Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	6.458	.061		106.138	.000
Ease of Use and Efficiency	-.123	.061	-.119	-2.012	.045
Skill Enhancement and Application	.020	.061	.020	.331	.741
Math Challenges and Struggles	-.233	.061	-.226	-3.817	.000
Concerns About Dependence and Integrity	.010	.061	.010	.169	.866
Reliability and Ease of Access	-.189	.061	-.183	-3.099	.002

Source: Authors' calculations

5.3.1 Overview of the Model

The model's R^2 is 9.9%, signifying that the chosen components elucidate a minimal proportion of the variance in CGPA. This outcome is anticipated, given that the regressors are intended to be uncorrelated and additional factors affecting CGPA are excluded from this model. The model demonstrates statistical significance at the 1% level (p-value = 0.000), affirming the importance of the included variables in elucidating CGPA variation.

5.3.2 Distinct Variables and Coefficients

Ease of Use and Efficiency: The coefficient is negative and statistically significant at the 5% level ($\beta = -0.119$, $p = 0.045$), indicating ease of use and efficiency. This indicates that increased dependence on ChatGPT for convenience and efficiency adversely affects CGPA. Excessive reliance may result in less effort and superficial cognitive involvement, impacting academic achievement.

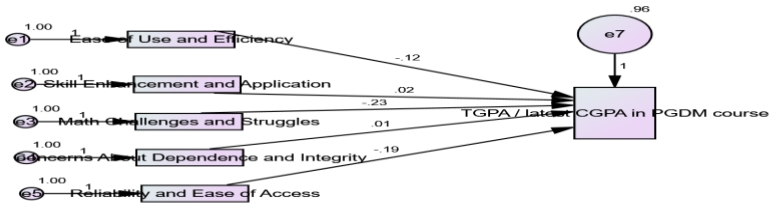
Mathematical Challenges and Difficulties: This variable exhibits a substantial adverse effect at the 1% significance level (β = -0.226, p = 0.000). Students who encounter difficulties in mathematics and extensively utilise ChatGPT may suffer a deterioration in their capacity to develop mathematical skills autonomously, negatively impacting their CGPA. The correlation between reliability and ease of access is negative and statistically significant at the 1% level (β = -0.183, p = 0.002). Facilitated access to ChatGPT may diminish problem-solving motivation, resulting in decreased academic achievement. The influence of skill enhancement and application on CGPA is negligible and statistically insignificant (β = 0.020, p = 0.741). This suggests that although ChatGPT may facilitate skill development, its influence on CGPA is neither direct nor quantifiable within this context. Concerns Regarding Dependence and Integrity variable's influence is neutral and negligible (β = 0.010, p = 0.866). This corresponds with the observation that apprehensions over ChatGPT's impact on academic integrity do not substantially affect CGPA.

5.4 Path Analysis

Figure 2 shows the results of the path analysis. The results are the same as those shown in regression. Table 5 shows the coefficients and their significance. Model parameters are suitable, as per Hair et al. (2010). CMIN/DF (1.829), PGFI (0.691), and RMSEA (0.056) are good with this analysis. The Coefficients of Ease of Use and Efficiency (5%), Math Challenges and struggles (1%), and Reliability and Ease of Access (1%) are negative and statistically at 5% and 1% levels.

Figure 2

Path Analysis Depiction



Source: Authors' Depiction

Table 5

Regression Weights (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
CGPAScore	<---	Ease of Use and Efficiency	-.123	.060	-2.032	.042	
CGPAScore	<---	Skill Enhancement and Application	.020	.060	.334	.738	
CGPAScore	<---	Math Challenges and Struggles	-.233	.060	-3.854	***	
CGPAScore	<---	Concerns About Dependence and Integrity	.010	.060	.171	.864	
CGPAScore	<---	Reliability and Ease of Access	-.189	.060	-3.129	.002	

Source: Author's calculations

5.4.1 Model Adequacy

CMIN/DF (1.829): Signifies a satisfactory match (acceptable threshold < 3)

PGFI (0.691): Indicates an adequate parsimony in the model architecture.

RMSEA (0.056): Signifies a favourable fit (acceptable threshold < 0.08).

5.4.2 Path Coefficients

Ease of Use and Efficiency, Math Challenges and Struggles, and Reliability and Ease of Access exhibit substantial negative correlations with CGPA at 5% and 1%

significance levels, affirming their detrimental effects. Skill enhancement, application, and concerns regarding dependence and integrity exhibit neutrality, showing no substantial impact on CGPA. The findings confirm that although ChatGPT provides significant efficiency and accessibility, overdependence adversely affects CGPA. Promoting a balance between AI technologies and conventional learning methods can safeguard students' academic integrity and quantitative skills.

6. Discussions

The research findings present a thorough account of the dual impacts of ChatGPT on the quantitative skills of postgraduate Business Management students. Conversely, ChatGPT has shown to be an invaluable resource that markedly improves students' understanding of intricate mathematical subjects. Students deemed it especially beneficial for corroborating manually obtained solutions, addressing quantitative challenges, and preparing for examinations and assignments. ChatGPT has emerged as a primary resource for students with mathematical learning difficulties. Through enhanced efficiency, elucidation of intricate facts, and increased confidence, its user-friendly interface and capacity to overcome educational obstacles render it an effective assistance system, particularly for students grappling with complex mathematical ideas.

Nevertheless, the study underscores considerable apprehensions regarding the possible drawbacks of using ChatGPT excessively. Many students articulated concerns regarding its influence on their capacity for autonomous problem-solving, voicing issues of less critical thinking and excessive reliance on the instrument. Ethical issues regarding academic integrity were significant, as students acknowledged using ChatGPT in manners that could jeopardise originality and fairness. Moreover, assessments conducted without ChatGPT presented a distinct problem, as students indicated diminished confidence and readiness without AI assistance. This dependence highlights the necessity for equitable utilisation that upholds fundamental academic abilities.

Notably, not all effects of ChatGPT utilisation were significant. Students maintained impartial perspectives regarding its precision, classroom involvement, and contribution to promoting independent problem-solving. The extensive use of ChatGPT did not diminish

students' capacities to solve quantitative issues independently markedly, nor did it inevitably improve these skills. Gender dynamics exhibited a notable trend in study habits, with female students dedicating less time to quantitative topics than their male peers; nevertheless, these discrepancies did not result in inequalities in academic performance.

7. Conclusion:

This study has demonstrated how ChatGPT can increase quantitative knowledge in postgraduate business management students in Central India. The results highlight ChatGPT's dual impact. Although an effective instrument facilitates learning and bolsters confidence, overreliance on it jeopardises fundamental academic skills and prompts legitimate ethical dilemmas. Institutions must formulate explicit regulations for their judicious utilisation and offer training programs that promote autonomous problem-solving abilities. With appropriate guidelines and a balanced methodology, ChatGPT can enhance traditional learning techniques, ensuring it enriches students' educational experiences without supplanting essential core abilities.

In the descriptive analysis and t-tests, even using factor analysis, the study discovered that improvements include understanding time and performance in mathematics exams, including finance, statistics, and corporate finance. However, the study also reveals that there could be adverse effects, such as students largely dependent on AI tools and issues with cheating. There is, therefore, a need to 'tread carefully' when incorporating AI tools into learning systems, such as placing equal emphasis on the various potential benefits, a feat that ChatGPT is passing on, given its dual-beneficial impacts on learning. By providing an empirical analysis of the conclusions of ChatGPT and comparing them along the lines of convenience, trust, quantitative difficulty, and reliability, this study enriches the understanding of AI as a tool in education and spotlights its strengths and weaknesses. These outcomes can be used as a reference point for educational practitioners, policymakers, or institutions who need to enhance the use of AI to improve learning outcomes while at the same time preserving the underlying principles of any given academic discipline.

8. Limitations and Future Research

The students of Central India are traditional learners belonging to a traditional fraternity, and they have different perceptions regarding the use of technology, particularly in the academic teaching-learning process. This research was not isolated from the region's cultural and educational experiences. In future research, one will focus on observing and understanding how culture impacts the use of artificial intelligence in learning by observing the learning behaviours and changes resulting from these activities.

Worse still, the outcome of this study might not be transferable to other learning institutions or subjects. AI may enter and be accepted at different levels in society's daily life; different industries, as well as different working sectors, may have different AI statuses, different ways of educating people and learning may be used for AI, and different ethical issues may be realised in various ways. In the creative field of the humanities, for example, the consequences that emanate from using a large amount of ChatGPT will be different from the ramifications of quantitative learning. Such differences may be examined in quantitative studies in the future, while longitudinal studies would be instrumental in describing what artificial intelligence does in various contexts of education.

As the idea is to develop two models that allow for achieving the most significant advantages and minimising possible risks, the topics of the research issues which should be discussed in these following studies should focus on how AI-based methods can be combined with traditional learning environments. Such studies may help educators, institutions, and legislators understand and integrate chatbots and other artificial intelligence features like ChatGPT in the educational systems rather than thinking these might be a threat that they will reduce skills proficiency aptitudes.

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