

# Evaluating the Perception and Experience of Engineering Faculty with ChatGPT - A Case from a Developing Country

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## Abstract

The increasing popularity of artificial intelligence (AI) chatbots has sparked immense interest in almost every industry. As in other areas, researchers and lecturers in engineering fields have started investigating the potential of ChatGPT, an AI chatbot launched in 2022. However, this popularity has also brought about a significant amount of controversy in terms of efficiency and reliability of the tool. Therefore, this study aims to discover the attitude of faculty members toward ChatGPT use in academia. The responses of 30 faculty members in engineering programs in Pakistan were analyzed using qualitative, descriptive statistics and explanatory factor analysis (EFA). The qualitative data analysis revealed that faculty members evaluated their self-perceived proficiency, with most placing themselves at moderate to high levels. The commitment to learning knowledge demonstrates a strong predisposition towards continuous improvement and adaptation, which is essential in today's rapidly changing AI influenced world. For EFA, fifteen factors were defined and classified to evaluate respondents' experience in higher education with AI chatbots. The results showed that the experience of academicians can be clustered under three categories: User Experience and Familiarity, Impact and Value of ChatGPT, and Trust and Concerns. The findings also indicated that researchers are satisfied with the ease of use of ChatGPT for research and educational purposes and are optimistic about ChatGPT's potential in the future. However, the results also revealed that the respondents have a high level of concern about potential biases or inaccuracies in the output material generated by ChatGPT.

## Keywords

Artificial Intelligence, ChatGPT, Engineering Academia, Faculty Attitudes, Explanatory Factor Analysis

## 1. Introduction

Artificial intelligence's (AI) rapid evolution has affected the entire world in the last few years. AI is a technology that imitates human behavior such as learning, reasoning, and predicting by utilizing a system or machine (Xu et al., 2021). The broad benefits of AI led industries to adopt AI technologies to improve their industrial applications. The AI market has a \$86.9 billion revenue in 2022 and it is expected to increase to \$407 billion by 2027 (Haan, 2023), which is predicted to cause an increase in the United States GDP by 21%. With the release of AI chatbots, people have started to utilize these tools in almost every area, including manufacturing, business, education, and even daily chores. A chatbot is a computerized program that simulates conversations as an intermediary between humans and virtual assistants (Gupta et al., 2020). These AI tools, such as ChatGPT, Bing Chat, Google's Bard, merge Large Language Models (LLMs) with user-friendly interfaces (Teubner et al., 2023). However, ChatGPT (Generative Pre-trained Transformer), released by OpenAI in November 2022, stood up among others with its ability to manage a diverse set of natural language processing tasks without the requirement of adjustments. Because it has been trained on a large amount of data, including books, articles, and web content, ChatGPT can generate reliable text (Hughes, 2023; Teubner et al., 2023).

Like other industries, AI has drawn more attention in academia with opportunities for research and teaching. ChatGPT can interpret human language to provide relevant responses on various subjects, translate languages, do

coding, and respond in the correct tone by doing sentiment analysis. Firat (2023) states, educators and researchers might utilize AI chatbots to optimize their learning and personal growth, enhancing their academic experience. Even though these opportunities seem helpful for researchers, they also created some concerns. For example, Haan, (2024, 2023) show that 54% of users believe that AI-driven chatbots improve the text quality and creativity of content. Therefore, this study aims to discover the experience of faculty members in engineering education and provide insight by presenting descriptive and factor analysis results.

## 2. Methods

This study aims to evaluate engineering faculty members' perception and experience with ChatGPT use in teaching and research. Therefore, a questionnaire for faculty members in engineering departments was designed to evaluate their perception and experience related to ChatGPT use. A 5-point Likert scale was utilized in the questionnaire (1- extremely low to 5- extremely high). The participants were asked to answer 15 questions related to their perception, familiarity, experience, and plans about ChatGPT. Table 1 shows the online survey questionnaire codes, questions and variables names.

**Table 1.** Online Survey Questionnaire Codes, Questions and Variables Names

Code	Question	Variable Name
Var1	How familiar are you with Chat GPT?	Familiarity Level
Var2	How confident are you in your ability to use ChatGPT for academic purposes?	Confidence in Usage Abilities
Var3	How concerned are you about the ethical implications of using AI language models like Chat GPT in academic or research settings?	Ethical Concerns in AI Language Model Usage
Var4	How useful do you think ChatGPT is for improving the quality of research outputs in your field?	Quality Improvement Potential
Var5	How much do you trust the accuracy and reliability of ChatGPT-generated content for academic or research purposes?	Trust in Content Accuracy
Var6	How concerned are you about potential biases or inaccuracies in ChatGPT-generated content?	Concerns about Bias and Inaccuracies
Var7	How interested are you in learning more about ChatGPT and its potential applications in your field?	Interest in ChatGPT's Potential
Var8	How frequently have you used ChatGPT in the past year?	Frequency of Usage
Var9	How satisfied are you with the quality of the content generated by ChatGPT?	Content Satisfaction
Var10	How relevant is the content generated by ChatGPT to your research interests?	Content Relevancy
Var11	How much has Chat GPT helped you in your research?	Help in Research
Var12	How easy was it for you to learn how to use ChatGPT?	Ease of Learning
Var13	How much do you think ChatGPT has improved your productivity in research?	Productivity Enhancement
Var14	How likely are you to continue using ChatGPT in your academic field?	Continued Usage
Var15	How likely are you willing to subscribe if ChatGPT becomes only paid service?	Subscription Likelihood

The online questionnaire was sent to approximately 100 faculty members working at engineering departments in Pakistan. A total of 30 responses were returned and the response rate is 30%. The majority of respondents have 5-10 years (33.3%) and 10-15 (26.7%) years of experience and most of the participants work as Lecturer (40%) and Assistant Professor (33.3%). The gender distribution was Female 10 responses (33%) VS Male 20 responses (67%).

To commence the data analysis, qualitative assessment was made to overlay gender-age-experience with characteristics of perception of usefulness versus likely recommendation to others (Fig.1); perception of usefulness versus institutional support expectation for learning support (Fig. 2); and perception learning time versus confidence to significantly impact teaching and research (Fig.3). Since, this study aimed to reveal the attitude, perception and experience of faculty members toward ChatGPT use in academia. Therefore, the study utilized descriptive statistics to reveal and order the importance of the factors. To evaluate the reliability of the questionnaire data, the Cronbach alpha was calculated. The Cronbach Alpha value is calculated as 0.839 which indicates high internal consistency (Cortina, 1993). The study also utilized explanatory factor analysis (EFA) to identify the primary factors and categories reflecting the ChatGPT experience of participants with academic purposes. EFA is a statistical approach

based on dimension reduction to make the data more manageable while preserving as much information (Field, 2013). Because there is no preliminary study on this topic, EFA allows authors to uncover the factors and categories to evaluate the experience of construction industry researchers' practice with AI chatbots. These categories would help researchers by defining the latent relationships between measured variables. Before extracting the factors in factor analysis (FA), two essential principles were examined i.e. multivariate normality and sampling adequacy (Chan, 2012). To assess the multivariate normality of the variables, Bartlett's test of sphericity was employed, while the Kaiser-Meyer-Olkin (KMO) test was utilized to determine if the distribution of values were suitable for conducting FA. The KMO value was found to be 0.655 (>0.5) and statistically significant at 0.001 level, which established the eligibility for factor analysis. Variables having less than 0.4 loading scores were excluded from the analysis.

### 3. Results and Discussion

The succeeding sections will elaborate on the qualitative assessments of Age-Years of Experience-Gender with the following characteristics of the assessment.

- Perception of Usefulness versus Likely Recommendation to Others
- Perception of Usefulness versus Institutional Support Expectation for Learning Support
- Perception Learning Time versus Confidence to Significantly Impact Teaching and Research

#### 3.1 Visualization of Perception and Experience of Engineering Faculty with ChatGPT

Fig.1 provides a thorough examination of a varied cohort of participants, primarily consisting of males, indicating a potential gender bias in interest or selection that warrants additional analysis. The study encompasses a wide age spectrum, ranging from individuals in their mid-twenties to seniors aged 65 and above. This allows for an investigation into how various life stages influence one's perceptions of the subject being examined. The variability in age may influence characteristics such as technological proficiency, requirements, and preferences, which in turn may influence participants' assessments of the utility of the subject and their likelihood of recommending it.

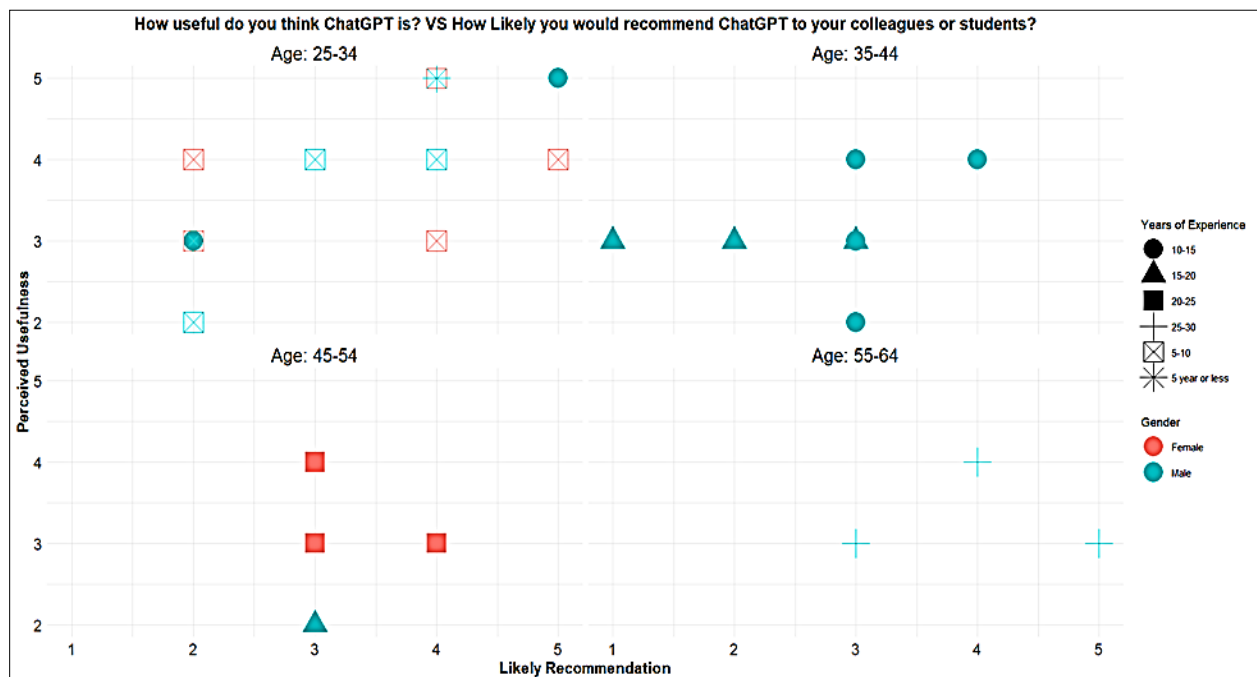


Fig.1. Perception of Usefulness VS Likely Recommendation to Others

Additionally, the dataset exhibits a significant range in experience levels, ranging from individuals with less than five years of experience to highly skilled professionals with over 30 years of expertise in the industry. The presence of diversity is essential because it enables an examination of how the extent of one's experience is related to the perceived usefulness and worthy of recommendation. Preliminary results indicate a moderate agreement regarding both the

perceived utility and the probability of recommendation, with average ratings centered around the middle of the utilized scales. Nevertheless, the existence of heterogeneity in individual responses, as indicated by the standard deviations, suggests the presence of underlying causes that may have a more profound impact on these views.

This heterogeneity prompts a need for a focused examination to identify the unique components or characteristics of the subject that could improve its attractiveness or usability, especially among individuals who are less inclined to recommend it. Gaining a thorough understanding of these subtle distinctions could play a crucial role in customizing improvements, communication tactics, or training initiatives that more effectively cater to the requirements of various user demographics.

This dataset not only captures current perceptions but also serves as a starting point for more in-depth qualitative and quantitative inquiries. By examining demographic disparities and disparities in levels of knowledge can help identify areas for improvement, this strategy can facilitate the integration of a comprehensive understanding of all user groups into future decision-making processes, perhaps resulting in higher rates of adoption and more efficient utilization of ChatGPT in teaching and research in an engineering institution.

As depicted in Fig. 2 the age range includes both young professionals and experienced specialists, providing a thorough understanding of the variance in age within the sample. The dataset includes participants with a diverse spectrum of professional experience, ranging from individuals who are just beginning their professions to those with more than thirty years of experience. The wide range of perspectives suggests that there is a wealth of valuable information to be gained about how varying levels of experience might influence an individual's opinions and interactions with ChatGPT's perceived usefulness and the expected assistance from institutions for learning.

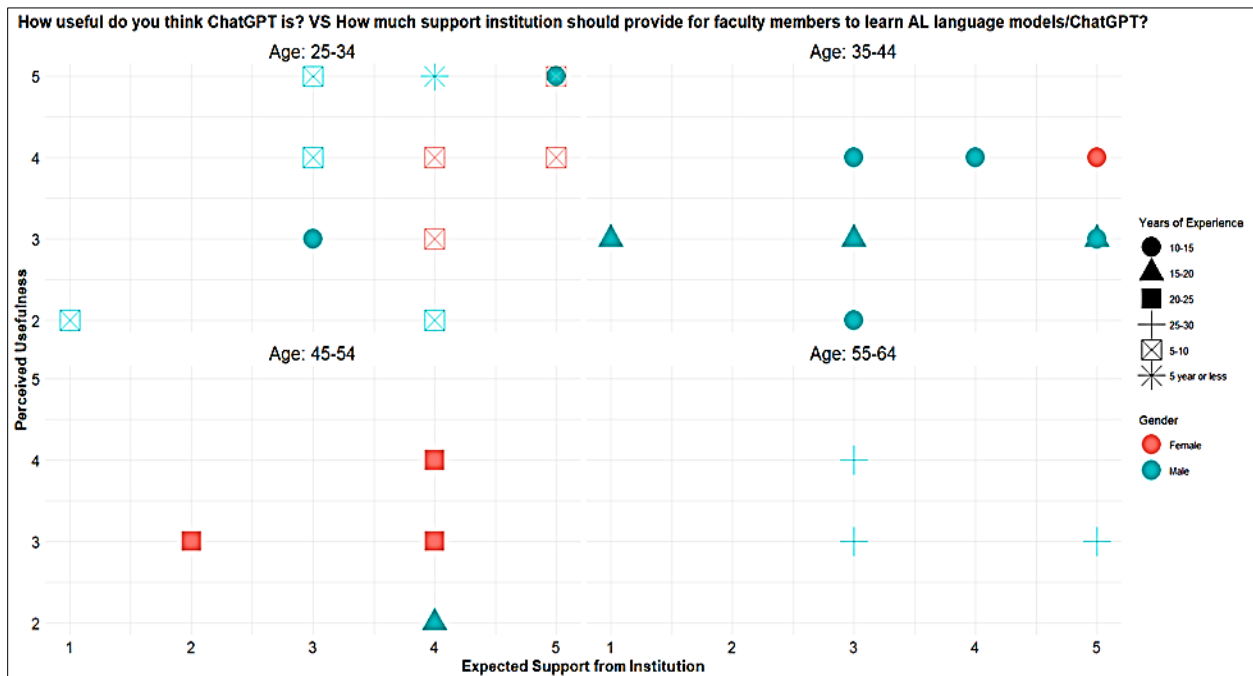


Fig.2. Perception of Usefulness VS Institutional Support Expectation for Learning Support

The research indicates that participants generally have a modest level of satisfaction in terms of perceived usefulness and expected support. Nevertheless, there are notable discrepancies in how individuals evaluate their experiences, indicating that personal or demographic traits may have a pivotal influence on molding these impressions. The range of responses highlights the necessity for a sophisticated method in comprehending the precise elements that lead to these contrasting perspectives. This may entail delving into more profound, qualitative research techniques to discern the reasons behind the varying expectations and levels of satisfaction among different age groups, genders, or experience levels.

In summary, this dataset not only captures current opinions but also acts as a crucial basis for focused investigations. By examining the factors that contribute to the differing viewpoints among various demographic groups, the higher administration can create more customized approaches that cater to the distinct requirements and anticipations of each segment.

As presented in Fig. 3 the participants assessed their perceived skill to learn AI LLM like ChatGPT, with the majority positioning themselves at moderate to high levels. This self-assessment is an important measure of professional confidence and is likely to be linked to their proactive efforts in professional growth, as seen by the amount of time they dedicate to learning activities. The dedication to acquiring knowledge, with the majority of individuals devoting a reasonable amount of time to this pursuit, highlights a firm inclination towards ongoing enhancement and adjustment, which is crucial in the current swiftly evolving professional environments such as teaching and research in higher education academia.

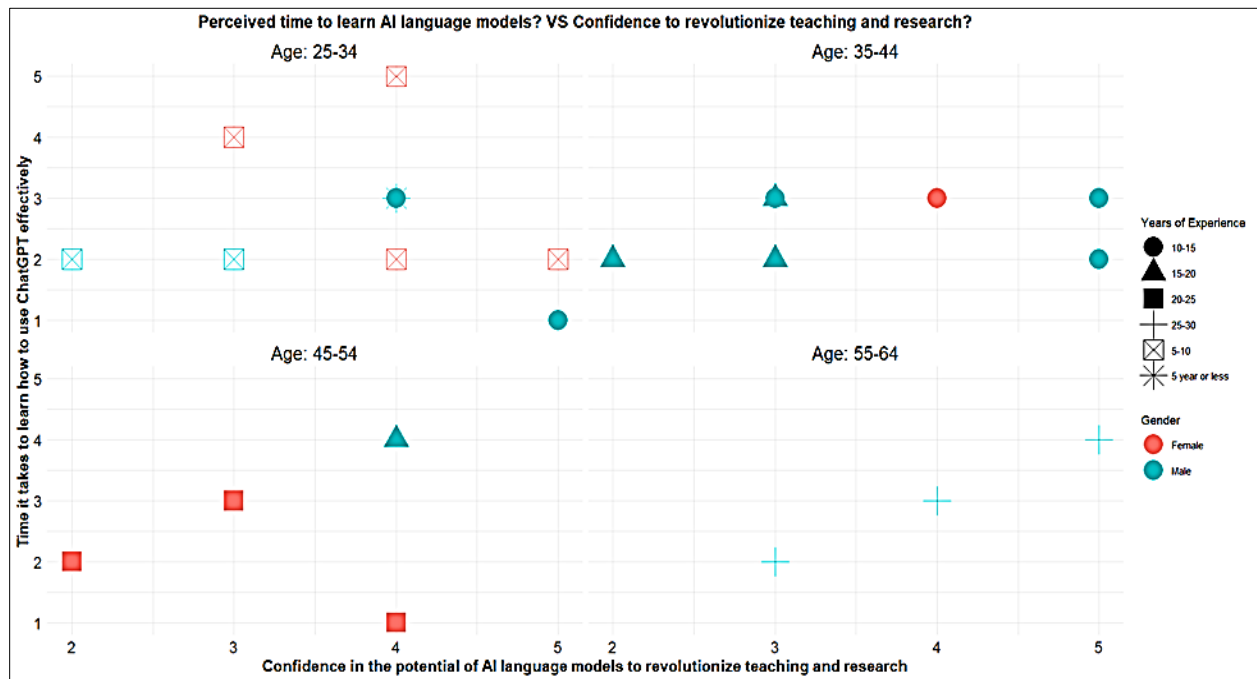


Fig.3. Perception Learning Time VS Confidence to Significantly Impact Teaching and Research

These findings offer useful insights into the patterns of professional growth in an engineering faculty from a developing country. Gaining insight into these patterns might assist in formulating specialized educational initiatives and seminars that address the specific requirements of faculty members at various points in their academic careers. Furthermore, the data indicates that the participants have a shared recognition of the significance of continuous learning in order to stay informed about industry innovations. This dedication helps them improve their skills and remain competitive at teaching and research in an AI LLM era.

### 3.2 Exploratory Factor Analysis (EFA)

The EFA was used to assess the grouping that might exist in the questionnaire factors, and the results revealed that the 15 factors can be grouped into three principal factors. Table 2 shows the factor loads of each variable. The three categories were named i) Impact and value of ChatGPT in academic research, ii) User experience and familiarity, and iii) Trust, concerns, and ethical considerations. In the "Impact and value of ChatGPT in academic research," factor included eight variables: Continued Usage, Help in Research, Productivity Enhancement, Content Satisfaction, Content Relevancy, Interest in ChatGPT's Potential, Quality Improvement Potential, and Subscription Likelihood. The "user experience and familiarity" factor consisted of four variables: Familiarity Level, Confidence in Usage Abilities, Frequency of Usage, and Ease of Learning. Finally, the "Trust, concerns, and ethical considerations" factor included three variables: Trust in Content Accuracy, Concerns about Bias and Inaccuracies, and Ethical Concerns in AI Language Model Usage. In the last factor group, variable 6 and 3 have negative loadings because they were negatively related to the factor due to the questions inquiring for their concerns while the other inquiring about trust.

**Table 2.** Factor Loadings of Each Variable

Code	Factor			Mean	SD
	1	2	3		
Var14	0.773			3.17	1.234
Var11	0.755			2.53	1.008
Var13	0.711			2.7	1.119
Var9	0.708			2.97	1.066
Var10	0.703			3.13	1.137
Var7	0.69			4.13	0.73
Var4	0.596			3.23	0.971
Var15	0.577			2.07	1.363
Var1		0.806		2.8	1.031
Var2		0.805		2.4	1.102
Var8		0.691		2.3	1.236
Var12		0.549		3.8	0.997
Var5			0.717	2.73	0.907
Var6			-0.65	3.5	1.042
Var3			-0.516	3.47	1.196

The mean and standard deviation values of the variables in the first-factor group called "Impact and value of ChatGPT in academic research" are presented in Table 3. As the table shows, Interest in ChatGPT's Potential has the highest mean value, with 4.13 out of 5 points. It shows that the faculty members are volunteering to learn more about ChatGPT and its potential applications in their engineering field. Quality Improvement Potential (3.23), Continued Usage (3.17), and Content Relevancy (3.13) followed the first factor with relatively higher mean scores. It shows that the users highly think that ChatGPT is for improving the quality of research outputs in their field. They are eager to continue using ChatGPT for academic purposes. Similarly, Sallam et al. (2023) showed that the main benefits of ChatGPT for healthcare education and research include improved scientific writing and enhanced research equity and versatility. Moreover, Opara et al. (2023) also stated that one of the leading prospects of ChatGPT is improving research. On the other hand, Subscription Likelihood has the lowest mean (2.07) value in this category. Even though the participants think that ChatGPT is for improving the research quality research quality; they volunteer to pay for it if the service becomes only paid service.

**Table 3.** Perceived Impact and value of ChatGPT in academic research

Code	Impact and Value of Chat GPT in Academic Research	Mean	Ranking
Var 7	Interest in ChatGPT's Potential	4.13	1
Var 4	Quality Improvement Potential	3.23	2
Var 14	Continued Usage	3.17	3
Var 10	Content Relevancy	3.13	4
Var 9	Content Satisfaction	2.97	5
Var 13	Productivity Enhancement	2.7	6
Var 11	Help in Research	2.53	7
Var 15	Subscription Likelihood	2.07	8

Table 4 shows the variables' mean and standard deviation values in the second-factor group called "User experience and familiarity". As the table shows, Ease of Learning has the highest mean value (3.8), and it is followed by Familiarity Level (2.8). It shows that even though participants think ChatGPT is an easy tool to learn, they are moderately familiar with it. Moreover, the mean values of the participants' confidence in usage abilities (2.4) and their frequency of usage (2.3) are relatively low.

**Table 4.** User experience and familiarity

Code	User Experience and Familiarity	Mean	Ranking
Var12	Ease of Learning	3.8	1
Var1	Familiarity Level	2.8	2

Var2	Confidence in Usage Abilities	2.4	3
Var8	Frequency of Usage	2.3	4

The mean values of variables in the "Trust, Concerns, and Ethical Considerations" factor group were listed in Table 5. The results show that the participants are highly concerned about biases or inaccuracies in ChatGPT-generated content (3.5) and ethical issues related to AI language model use (3.47). On the other hand, the participants moderately trust in content accuracy of ChatGPT. These results also show a similarity with the findings of Sallam (2023), presenting that the main concerns about ChatGPT use in education are ethical, copyright, transparency, and legal issues. Moreover, Rahimi and Abadi (2023) expect the plagiarism rate to increase in upcoming manuscripts and suggest researchers double check the content produced by ChatGPT.

**Table 5.** Trust, Concerns, and Ethical Considerations

Code	Trust, Concerns, and Ethical Considerations	Mean	Ranking
Var6	Concerns about Bias and Inaccuracies	3.5	1
Var3	Ethical Concerns in AI Language Model Usage	3.47	2
Var5	Trust in Content Accuracy	2.73	3

The result of this study shows that even though the participants think that ChatGPT improves the quality of research, they are also aware of the possible issues regarding bias, inaccuracy, and ethics. The results also represent the ease of learning of the tool. As a result, it can be concluded that AI tools are providing great opportunities and concerns for faculty members in engineering departments at the same time. Therefore, focusing on overcoming these concerns for benefiting AI tools with a better trust might provide researchers with a better experience.

#### 4. Conclusions and Recommendations

This study aimed to investigate faculty members' attitudes in engineering education in Pakistan towards using ChatGPT, an AI chatbot. The findings from the analysis of responses from 30 faculty members shed light on the various aspects of their experiences with AI chatbots in higher education. The results revealed that faculty members positively viewed ChatGPT, recognizing its potential as a valuable tool for research and educational purposes. They appreciated its ease of use and acknowledged its benefits to their academic endeavors. The optimistic attitude displayed by researchers indicates that AI chatbots like ChatGPT can significantly enhance academic productivity and efficiency in the future.

However, despite the overall positive sentiment, the study also exposed some notable concerns among the faculty members. A primary concern highlighted in the findings was related to potential biases or inaccuracies in the output generated by ChatGPT. This concern is well-founded, as AI models can sometimes reflect biases in the data, which is used to train them, leading to potentially unreliable results. Addressing this issue is crucial to ensure that ChatGPT and similar AI chatbots are used responsibly in academia. As AI chatbots continue to gain popularity and become integrated into various aspects of academic life, it becomes imperative for educational institutions to implement measures that address and mitigate concerns regarding bias and inaccuracies. Transparent and ethical guidelines should be developed and followed in developing and deploying AI chatbots to ensure their reliability and trustworthiness.

Future research can investigate deeper into strategies to minimize biases in AI chatbot outputs, along with investigating other potential concerns related to privacy, security, and the impact of AI on human learning experiences. Additionally, conducting similar studies with a more extensive, diverse sample can provide a more comprehensive understanding of faculty attitudes toward ChatGPT across various academic disciplines and geographical locations.

In conclusion, ChatGPT holds significant promise as a helpful tool in engineering academia, and its potential benefits should not be overlooked. However, continuous efforts are required to address the identified concerns and challenges to maximize its positive impact on education and research while ensuring its responsible and ethical use. By doing so,

we can harness the full potential of AI chatbots in academia and contribute to a more productive and innovative learning environment.

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