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ARTIFICIAL INTELLIGENCE AND DIGITALIZATION IN HIGHER EDUCATION: ENHANCING DOCTORAL RESEARCH PRODUCTIVITY IN INDIAN UNIVERSITIES

Abstract. The growing integration of Artificial Intelligence (AI) in the modern education system is transforming traditional academic work, particularly for research scholars. The doctoral students have been utilizing AI tools in their academic writing with some potential challenges within Indian Universities. This study aims to understand and explore the impact of Artificial Intelligence on their research productivity among Indian Universities. This involves a quantitative approach, with the dataset of 106 doctoral students across various disciplines to explore their experiences, perceptions and challenges faced by the doctoral students regarding AI Tools in their research productivity, improving writing skills, doing literature reviews, analyzing datasets, interpretations of research results, generating references, citation and improving visual representations in facilitating a more efficient and seamless research workflow. Research findings reveal that there are many benefits that are derived from AI adoption in their doctoral program, identification of specific AI tools that are most suitable for them, as most of them have answered ChatGPT, Google Bard, Research Rabbit, Quillbot. The students demonstrate a strong awareness of these tools and actively use them for drafting outlines, organizing literature, managing references, and generating citations. However, the study also outlines the potential negative impacts of AI tools that bring ethical concerns, data privacy issues, trust issues, and errors in search results. The study concludes with recommendations for the effective integration of AI tools in doctoral programs, aimed at enhancing research productivity and ensuring ethical utilization. Training programs, workshops, FDPs related to effective use of AI should be planned and provided to guide the doctoral researchers effectively.

Keywords: Artificial Intelligence; Research Productivity; Academic Research; Higher Education; Doctoral Students.

1. INTRODUCTION

The digital revolution and its rapid growth in the higher education sector have profoundly transformed the way academic research is conducted in doctoral programs in India. Artificial Intelligence (AI) tools have been reshaping the way for the researchers to make it more time-saving, convenient, and informative, while also reducing the burden in many ways because of its capability to automate the complex tasks, processing large amount of data, providing analysis. These are enhancing the efficiency and effectiveness of AI Tools and getting more popular among scholars, especially doctoral students, who have the pressure of extensive literature reviews, analyzing the vast data sets, generating new knowledge and the challenges related to academic research writing. Teachers as well as professionals have been facing the significant imbalance in the use of AI in

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research and its potential, which could address ethical challenges and consider scholars learning perspectives [1]. AI tools have been influencing the academic performance of students in open and distance learning (ODL) environments, specifically highlighting the gap across gender and region [2]. In India, there are 56 central universities, 460 state universities, 128 deemed to be universities, 23 IITs, 31NITs, 482 Private universities but only 1072 universities offer PhD programs to scholars [3]. AI in education has been expanding its arms and capturing all levels of students, whether UG students, PG students, or doctoral students. Understanding the functions and effects of AI tools in assisting researchers especially in India is very important, as the country has a developing academic system and an increasing number of doctoral programs. The use of AI in education has become increasingly popular worldwide, but there is still a significant lack of empirical research focusing on the opinions, expertise, and productivity of doctoral students in Indian universities.

Formulation of the problem.

In India, doctoral students face various kinds of difficulties, such as handling data, overloaded information, vast available resources, time limits, and increasing academic demands. Artificial Intelligence (AI) Tools have emerged as transformative tools; little is known about how they affect doctoral research empirically. By examining the use of AI tools among doctoral students and concentrating on their perceived value, impact on various research stages, and difficulties, this study seeks to address this. The study intends to offer evidence-based methods for incorporating AI into doctoral programs as well as practical insights for improving research outcomes in the Indian academic context.

Analysis of recent studies and publications.

In India, a nation with an expanding research academic ecosystem and a growing number of doctoral fellows, understanding the role and impact of AI in supporting research is particularly crucial. The study concluded, AI tools help in academic and research writing, idea generation, supporting literature review, editing, reviewing, and communicating. ChatGPT has higher potential, but it also presents some challenges related to academic integrity and the balance of AI use with human supervision [4]. Artificial intelligence has become a powerful tool in scientific research. Information science, mathematics, life science, and other disciplines of science have various challenges. AI can help in mitigating these challenges [5]. AI technology is facilitating the education system with personalized learning experiences, but there are high concerns for human connection, algorithmic bias, ethical issues, and data privacy that need to be addressed accordingly. A balanced approach can safely guard the usage of AI with proper monitoring of humans [6]. AI has the potential to benefit education. Its innovative and applicable approach better serves both the AI education technologies and educators and provide the future research directions [7]. There is a pressing need for Artificial Intelligence literacy in education and technology that can prepare students for future work-oriented roles with the use of AI tools [8]. As there is a rise in the usage of AI tools, there are ethical concerns that also need to be handled carefully. Open and distance learning programs, which enroll students, have many concerns regarding ethical issues as they use third-party services, even for data collection and storage [9]. In education, due to the differences in their program, the students are aware of AI and use it in their daily study requirements [10]. An Australian study found a lack of agreement on the impact of Artificial Intelligence on Higher education. This suggested that universities should stay informed about the developments related to the field of AI and commit to ongoing research and discussions [11]. The generative Artificial

Intelligence (GAI) has the potential to provide assistance to higher education institutions, as they have adopted it, but there is a need to define clear roles and responsibilities in collaboration with the institutions [12]. U.S. universities have also adopted Generative Artificial Intelligence, but are also concerned with ethical issues, data privacy, etc. The universities are also providing workshops and resources to address these issues [13]. The systematic reviews and case studies related to implementing generative AI in higher education have shown the actual impacts and challenges of AI in enhancing current knowledge and critical thinking, but they also encounter bias and reliability issues related to AI [14]. There is a positive impact of Generative Artificial Intelligence on students' experiences in higher education, revealing six themes that harness AI for enhanced academic performance, ethics, trust, and impact on learning. Generative AI works as a supplement to human work, Integration and Versatility of AI tools, but also balances the limitations of AI to navigate the journey of AI adoption [15]. Swedish university students have a positive attitude towards AI, but are also concerned about its future use. Students are well aware of the AI chatbot – ChatGPT, but they are not that much aware of other chatbots [16].

The aim of this study: The primary aim of the study is to empirically investigate the impact of Artificial Intelligence (AI) tools on the research productivity of doctoral students in Indian universities. The secondary aims are to identify their perceptions, explore the challenges they face, and provide recommendations for the effective integration of AI in their research process.

2. RESEARCH METHODOLOGY

This study was designed as a preliminary exploratory investigation to understand the role of Artificial Intelligence (AI) tools in supporting doctoral studies in India, an area with limited prior research. Using a descriptive approach for data collection, the study gathered primary data to explore the experiences, perceptions, and challenges associated with the utilization of AI tools among doctoral scholars. For the purpose of this study, research productivity was operationally defined as the efficiency and effectiveness gained by doctoral students in completing key academic tasks such as literature review, data analysis, and manuscript writing. The questionnaire comprised 35 items, including items measuring awareness and usage of AI tools, the impact of AI on research productivity, perceptions and challenges related to AI in research, and future perspectives and recommendations. Demographic information was also collected, including age, gender, research area, year of doctoral study, university, city, and state. The questionnaire utilized a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree) for the majority of the items, along with open-ended questions to gather detailed qualitative feedback. The questionnaire was administered online using Google Forms, including Ph.D. scholars' telegram groups, WhatsApp PhD groups, emails, ResearchGate having doctoral scholars from various universities in India. The study utilized a non-probability, convenience-sampling method to recruit 106 doctoral scholars via online channels, including academic groups and forums. We acknowledge that the sample size and its regional concentration present limitations to generalizing the findings; however, this was a deliberate methodological choice to gain in-depth, foundational insights from a key academic ecosystem, thereby providing a basis for future, larger-scale research. The collected data were analyzed using IBM SPSS Statistics 23.

2.1. Theoretical Foundation of AI-Doctoral Research Productivity Framework (AI-DRPF)

The AI-Doctoral Research Productivity Framework (AI-DRPF), as shown in Figure 1, serves as the conceptual model guiding this study. The framework is not based on a single, pre-existing model but is a synthesis of key constructs from the Technology Acceptance Model (TAM) [17] and literature on AI adoption in education, awareness and usage of AI in education, perceptions and challenges related to AI, and academic productivity. Its structure is designed to systematically investigate the factors influencing AI tool utilization and its subsequent impact on research productivity.

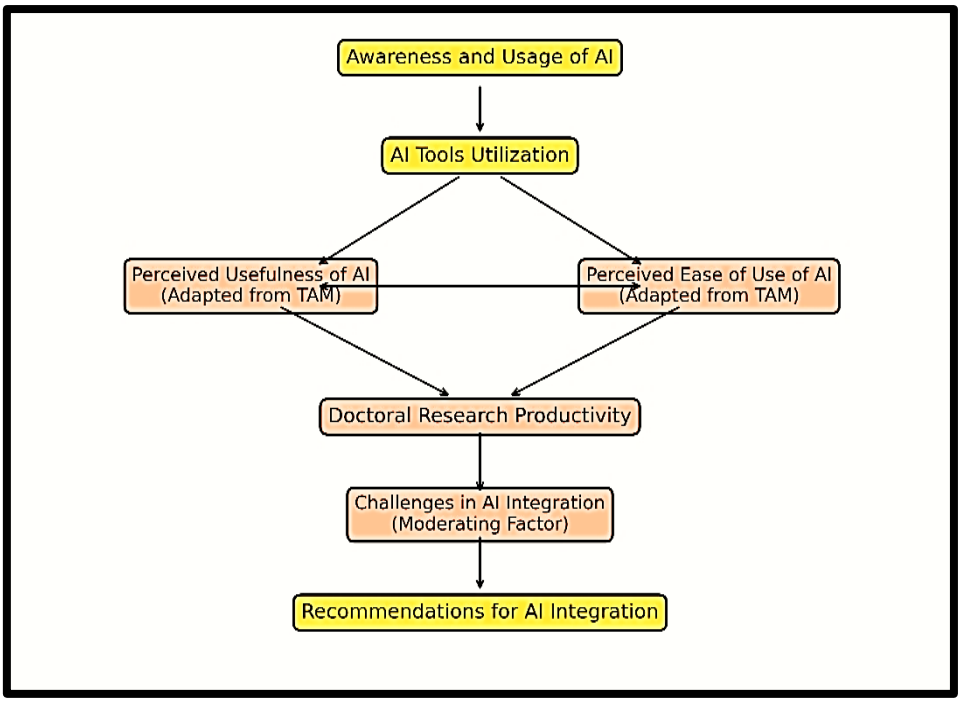

Figure 1. AI-DRPF Model

Technology Acceptance Model (TAM): Davis [17] proposed that Perceived Usefulness and Perceived Ease of Use are primary determinants of technology adoption. These constructs have been validated across diverse domains. In the AI-DRPF, these constructs explain doctoral students' intention and willingness to adopt AI tools. Awareness is the initial stage of technology adoption. Without exposure to AI tools, doctoral students are unlikely to integrate them into their workflow. According to the TAM model, actual interaction with technology shapes users' perceptions of its usefulness and ease of use. For doctoral students, hands-on experience with AI tools helps determine whether these tools genuinely reduce workload, enhance productivity, and align with their academic needs.

UTAUT (Unified Theory of Acceptance and Use of Technology): Venkatesh et al. [18] expanded TAM by integrating additional factors such as performance expectancy, effort expectancy, social influence, and facilitating conditions. While not all constructs are directly used, UTAUT highlights the role of contextual and moderating factors, which the AI-DRPF incorporates through *Perceptions and Challenges*. Drawing from UTAUT and higher education literature, factors such as lack of institutional support, ethical concerns, data privacy, or inadequate training may weaken or moderate the positive relationship between AI adoption and productivity. This reflects the real-world barriers doctoral students face in translating AI use into tangible benefits.

AI in Higher Education Literature: Recent studies [19]–[20] emphasize that AI adoption

in education is influenced by awareness, institutional support, ethical concerns, and anticipated future benefits. These perspectives inform the *Awareness and Usage*, *Perceptions and Challenges*, and *Future Perspectives* constructs of the framework.

The AI-Doctoral Research Productivity Framework (AI-DRPF) illustrates how doctoral students' awareness and usage of AI drive AI tool utilization, which in turn shapes their perceptions of usefulness and ease of use (adapted from TAM). These perceptions positively influence doctoral research productivity, while challenges in AI integration act as a moderating factor that may weaken this relationship. Finally, the framework leads to recommendations for effective AI integration in doctoral research contexts.

Thus, the AI-DRPF framework synthesizes validated theoretical constructs with emerging empirical insights. Its contribution lies in contextualizing AI adoption specifically for doctoral research productivity and integrating moderating and forward-looking dimensions, making it both theoretically sound and practically relevant.

2.2. Questionnaire Development and Validation

A structured questionnaire was developed to gather data on "The impact of AI on research productivity among doctoral students in Indian universities". The questionnaire comprised 25 items, including 4 items measuring "Awareness and usage of AI tools", 7 items measuring "The impact of AI on research productivity", 7 items assessing "Perceptions and challenges related to AI in research", and 7 items related to "Future perspectives and recommendations" in which 7 questions are close ended and 3 questions are open ended. Demographic information was also collected, including age, gender, research area, year of doctoral study, university, city, and state. The questionnaire utilized a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree) for the majority of the items, along with open-ended questions to gather detailed qualitative feedback." Content validity was ensured by aligning questionnaire items with research objectives and the conceptual framework.

Validity

First, after drafting the questionnaire, it was reviewed by the researcher's PhD supervisor, an expert in educational research and technology, to ensure face validity and content validity. The supervisor confirmed that the items were clear, relevant, and comprehensive, adequately covering the key aspects of the research topic. Subsequently, the questionnaire was pilot-tested with 30 doctoral scholars studying or have completed PhD from State Universities, Central Universities and IITs in India, who provided feedback on the clarity, comprehensiveness, and ease of completion. These scholars indicated that the questions were easily understandable and covered all the relevant areas of the research. Subsequently, construct validity was empirically assessed using Principal Component Analysis (PCA) with an Oblimin rotation. The data demonstrated excellent factorability, evidenced by a Kaiser-Meyer-Olkin (KMO) measure of .734 and a highly significant Bartlett's Test of Sphericity ($p<.001$). Although initial statistical indicators (eigenvalues > 1 and the scree plot) suggested six components, a more theoretically aligned and parsimonious four-component solution was extracted, accounting for a substantial 70.930% of the total variance. These four components were clearly interpretable, representing distinct dimensions of the construct.

Reliability

Internal consistency reliability was assessed using Cronbach's Alpha in IBM SPSS 23. The Cronbach's Alpha for the 25 items measuring the core constructs of the study was 0.938, exceeding the generally accepted threshold of 0.70 [22], indicating a high degree of internal consistency and that the items reliably measure the intended constructs. Based on the expert review, positive feedback from pilot participants, and the high Cronbach's Alpha value, the questionnaire was deemed a valid and reliable instrument for data collection.

Table 1 represents the case processing summary of total valid cases, N = 106, with 100% while excluding N = 0, with 0% in total of 106, considering all the variables in the procedure.

Table 1

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.828	.839	4
.927	.926	7
.851	.848	7

This Table 2 represents the results of the internal consistency reliability analysis conducted using Cronbach's Alpha for four distinct multi-item scales within questionnaire for 106 responses. The first scale consists of 4 items. The second, third, and fourth scales each consist of 7 items. The Cronbach's Alpha values for four scales are .828, .927, .851, and .908. This value is calculated after standardizing the items. The results indicated excellent internal consistency for all scales, with Cronbach's Alpha values ranging from .828 to .927, confirming the reliability of the measurement instrument.

Table 2

Case Processing Summary			
		N	%
Cases	Valid	106	100.0
	Excluded[a]	0	.0
	Total	106	100.0
a. List wise deletion based on all variables in the procedure.			

3. RESULTS

3.1. Demographic Details

In Table 3, the demographic characteristics of the 106 doctoral students who participated in this study are summarized in Table 3 given below. The Female respondents constituted 54.7% (n=58), and the Male respondents made up 45.3% (n=48) of the total participants. In terms of Age, the majority of the doctoral students were in the 27-35 age group (58.5%, n=62), followed by the

18-26 age group (20.8%, n=22) and the 36-44 age group (17.9%, n=19). A small proportion (2.8%, n=3) were aged 56 or above, indicating that the sample primarily consists of early to mid-career researchers. The Research Area/Subject of the respondents was notably diverse, reflecting a broad spectrum of academic disciplines. The most frequently represented fields were Business Management (16.0%, n=17) and Commerce (15.1%, n=16). Other significant contributions came from Finance (9.4%, n=10), Marketing (6.6%, n=7), Sociology (5.7%, n=6), and Music (5.7%, n=6). The presence of numerous fields with smaller frequencies (e.g., Indigenous Knowledge System, Yoga, AI and Social Media, etc.) underscores the wide applicability and interest in AI tools across various academic domains. The largest group of participants was in their 3rd year (35.8%, n=38), followed by those in their 4th year (20.8%, n=22) and 2nd year (19.8%, n=21). Students in their 1st year (13.2%, n=14), 5th year (5.7%, n=6), and those who had already completed their studies (4.7%, n=5) comprised smaller segments. This distribution suggests that a substantial portion of the respondents were actively engaged in the core phases of their doctoral research. The type of University/Institution revealed that State Universities accounted for the largest share of respondents (60.4%, n=64), followed by Central Universities (24.5%, n=26). Institutions such as IITs, IIMs, NITs, and Private Universities collectively represented a smaller percentage of the sample, highlighting a strong representation from state-funded institutions. Finally, the geographical distribution by State/Union Territory indicated a significant concentration of respondents from Uttar Pradesh (52.8%, n=56). Other states contributing to the sample included Delhi (7.5%, n=8), Rajasthan (6.6%, n=7), and Haryana (6.6%, n=7), while the remaining states had smaller, but still contributing, numbers of participants. This geographical distribution suggests a regional focus in the sample, primarily from North India. Demographics of participants in Table 3 is given below.

Table 3

Demographics of Participants (N = 106)

Variables	**Labels**	**Frequency**	**Percentage**
Gender	Male	48	45.3
	Female	58	54.7
Age	18-26	22	20.8
	27-35	62	58.5
	36-44	19	17.9
	56 or Above	03	2.8
Your Research Area/Subject	Commerce	16	15.1
	Business Management	17	16.0
	Indigenous knowledge system		0.9
	Yoga	01	
	Finance	01	0.9
	Marketing	10	9.4
	AI and Social Media	07	6.6
	Electronics	01	0.9
	Geography	01	0.9
	Music	05	4.7
	Sociology	06	5.7
	Economics	06	5.7
	Accounting	02	1.9

	Consumer Behaviour	01	0.9
	HRM	01	0.9
	Partial differential equations	03	2.8
	Education	01	0.9
	Sports Women		
	Law	03	2.8
	Computer Vision	01	0.9
	Bioinformatics	01	0.9
	Physics	01	0.9
	Hindi	01	0.9
	Microbiology	01	0.9
	Mass Communication	04	3.8
	History	02	1.9
	Mathematics	02	2.8
	Home Science	03	2.8
	Chemistry	03	0.9
	Computer Science	01	0.9
	Social Work	01	0.9
	English	01	0.9
		01	0.9
		01	0.9
Year of Doctoral Study	1st Year	14	13.2
	2nd Year	21	19.8
	3rd Year	38	35.8
	4th Year	22	20.8
	5th Year	06	5.7
	Completed	05	4.7
University/Institution	Central University	26	24.5
	State University	64	60.4
	IIT	03	2.8
	IIM	02	1.9
	NIT	03	2.8
	Private University	08	7.5
State/UN	Uttar Pradesh	56	52.8
	Madhya Pradesh	02	1.9
	Delhi	08	7.5
	Rajasthan	07	6.6
	Uttarakhand	03	2.8
	Assam	03	2.8
	West Begal	03	2.8
	Haryana	07	6.6
	Tamil Nadu	03	2.8
	Karnataka	02	1.9
	Gujarat	02	1.9
	Punjab	02	1.9

	Odisha Bihar Maharashtra	04 02 02	3.8 1.9 1.9

3.2. Descriptive Statistics Details

Table 4 represents the descriptive statistics for all variables included in this study, providing a complete overview of the central tendency, dispersion, and shape of the distribution of responses from the 106 doctoral students. For all listed variables, the sample size (N) is 106, indicating complete data for these items.

Table 4

Descriptive Statistics	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
1. Age	106	2.03	.710	.448	.235	.362	.465
2. Gender	106	1.55	.500	-.192	.235	-2.001	.465
3. Your Research Area/Subject	106	10.35	9.158	.806	.235	-.620	.465
4. Year of Doctoral Study	106	3.00	1.265	.345	.235	-.062	.465
5. University/Institution	106	2.21	1.336	1.906	.235	2.971	.465
6. City	106	9.57	9.731	1.020	.235	-.136	.465
7. State/Union Territory	106	4.24	4.533	1.236	.235	.212	.465
8. I am familiar with AI tools that can support research.	106	4.16	.967	-1.809	.235	3.704	.465
9. I have used AI tools in my doctoral research.	106	4.00	1.051	-1.304	.235	1.440	.465
10. My university/institution provides sufficient training on AI tools for research.	106	3.51	1.326	-.658	.235	-.738	.465
11. AI tools are readily available and accessible to me	106	3.93	1.017	-1.251	.235	1.540	.465
12. AI tools have significantly improved my literature review process.	106	4.08	.933	-1.228	.235	1.542	.465
13. AI tools have enhanced my data analysis capabilities	106	3.95	.989	-1.288	.235	1.643	.465
14. AI tools have helped me in writing and editing my research documents	106	4.02	.956	-1.238	.235	1.647	.465
15. AI tools have	106	4.00	1.051	-1.354	.235	1.539	.465

reduced the time spent on research tasks							
16. AI tools have increased the quality of my research output.	106	3.97	.990	-1.263	.235	1.617	.465
17. AI tools have helped me with language translation of research papers	106	4.25	.874	-1.835	.235	4.458	.465
18. AI tools have helped me to find research papers, and data sets.	106	4.12	.953	-1.393	.235	2.107	.465
19. I am confident in using AI tools for research.	106	3.98	.926	-.770	.235	.224	.465
20. I believe AI tools are reliable for research purposes.	106	3.93	.876	-.997	.235	1.449	.465
21. I have concerns about the ethical implications of using AI in research.	106	4.20	.844	-1.166	.235	1.647	.465
22. I am concerned about data privacy and security when using AI tools	106	4.19	1.015	-1.447	.235	1.947	.465
23. I face challenges in integrating AI tools into my research workflow	106	3.99	1.175	-1.130	.235	.433	.465
24. The cost of AI tools is a barrier to their use in my research.	106	4.13	1.147	-1.344	.235	.943	.465
25. I believe that AI tools will reduce the critical thinking skills required for research.	106	4.32	1.019	-1.782	.235	2.863	.465
26. My university should invest more in AI infrastructure for research.	106	4.09	1.083	-1.430	.235	1.552	.465
27. Researchers should receive mandatory training on AI tools.	106	4.30	.807	-1.605	.235	4.067	.465
28. AI tools will significantly change the future of doctoral research.	106	4.27	.889	-1.729	.235	3.845	.465
29. AI tools will create more research opportunities than it eliminates.	106	4.19	.957	-1.451	.235	2.223	.465
30. Ethical guidelines for AI use in doctoral	106	4.41	.790	-1.925	.235	5.454	.465

research are necessary.							
31. AI literacy is an essential skill for doctoral students.	106	4.42	.816	-2.004	.235	5.295	.465
32. AI tools should be integrated into the doctoral curriculum.	106	4.39	.811	-1.914	.235	5.089	.465

Figure 2 represents the data for all four variables (set of four components with their composite scores), approximately normally distributed as indicated by the symmetrical bell-shaped curves. This clearly suggests that the majority of the scores for each variable in the components are clustered around the mean value. Awareness of AI Score, Impact of AI on Research Productivity, perceptions and challenges regarding the use of AI and the future recommendations of AI all are revealing the clear attitude of the doctoral students that although they are aware of AI tools, using for their day to day research tasks but have challenges and concerns. They also have some recommendations, which can enhance their research productivity.

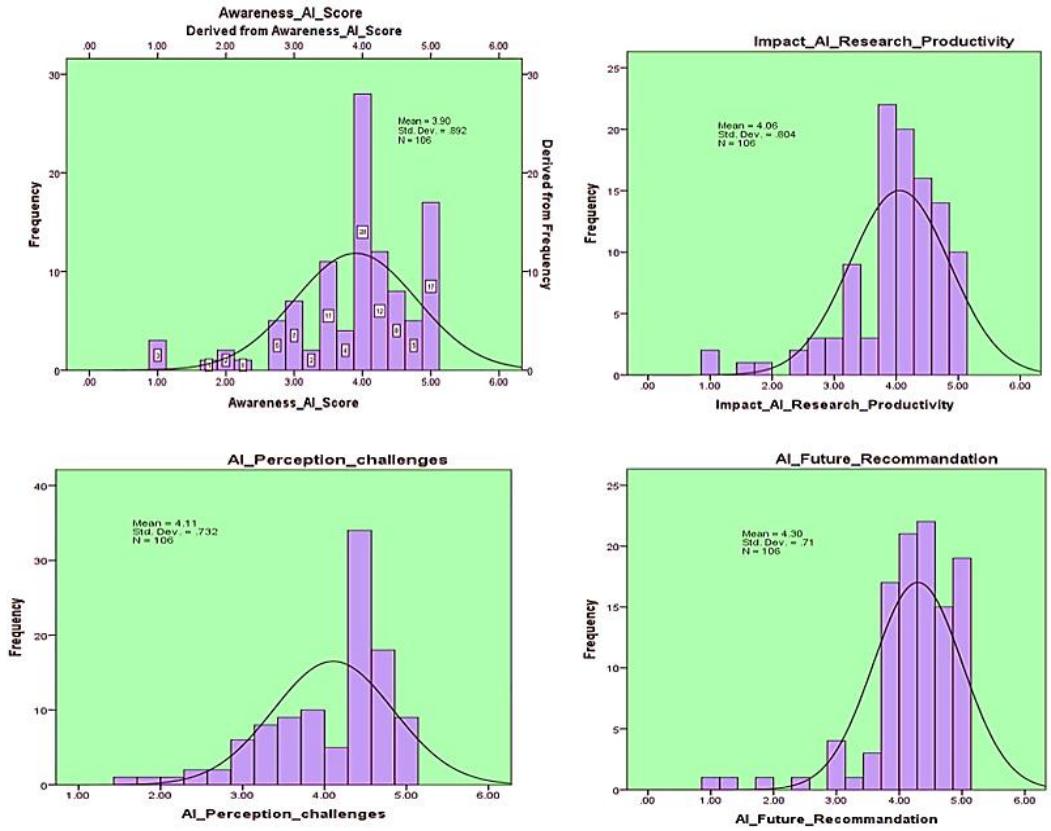

Figure 2.

Interpretation of Key Variables:

3.2.1. Demographic Variables (Q1-Q7):

For categorical variables like Age, Gender, Research Area/Subject, Year of Doctoral Study, University/Institution, City, and State/Union Territory, the Mean, Standard Deviation, Skewness,

and Kurtosis are less directly interpretable in a continuous sense. Their distributions are more meaningfully understood through frequency and percentage distributions, as detailed in the "Demographics of Participants" section (Table 3). The 'Minimum' and 'Maximum' values for these variables correspond to their coded categories.

3.2.2. Awareness and Usage of AI in Research (Q8-Q11):

In question 8, familiarity with AI tools where Mean = 4.24, SD = 0.967, Skewness = -1.809, Kurtosis = 3.704. The high mean indicates strong familiarity. The significant negative skewness and positive kurtosis show that responses are heavily concentrated at the "Agree" and "Strongly Agree" end, implying widespread awareness. In question 9, Usage of AI tools in doctoral research, where Mean = 4.16, SD = 1.051, Skewness = -1.304, Kurtosis = 1.440. A high mean suggests that most respondents have used AI tools. The negative skewness indicates a leaning towards agreement on usage. In question 9, the University/institution provides sufficient training, where Mean = 4.00, SD = 1.326, Skewness = -0.658, Kurtosis = -0.738. A mean of 4.00 indicates general agreement, but a slightly higher standard deviation and negative kurtosis suggest a more spread-out distribution compared to familiarity and usage, with some respondents potentially disagreeing. In question 11, AI tools are readily available and accessible, where Mean = 3.51, SD = 1.017, Skewness = -1.251, Kurtosis = 1.540. This mean is slightly lower than other awareness items, indicating moderate agreement on accessibility, suggesting some perceive barriers. The negative skewness still shows a tendency towards agreement.

3.2.3. Impact of AI on Research Productivity (Q12-Q18):

The mean value for Q12 is 3.93, Q13 is 4.08, Q14 is 3.95, Q15 is 4.00, Q16 is 3.97, Q17 is 4.25 and Q18 is 4.12. These mean value results highlight that students perceive AI as very important for their research.

3.2.4. Perceptions and Challenges (Q19-Q25):

For perception and challenges, there are 7 items in the scale. The doctoral students are highly confident in using the AI tools in research, with a mean value of Q19=3.98. They found AI tools generally reliable, with a mean value of Q20=3.98, but they are also strongly concerned about the ethical implications of AI in research, with a mean value of Q21=4.20. The doctoral students are also highly concerned about the data privacy and security, with a mean value of Q22=4.19. There are several challenges also integrated with the use of AI tools in research with a mean value of Q23=3.99 like high cost of AI tools as a barrier with a mean value of Q24=4.13. The students are concerned about the reduction in critical thinking skills after the use of AI, with a mean value of Q25=4.32.

3.2.5. Future Perspectives and Recommendations (Q26-Q32):

Future perspectives and recommendations for the use of AI in doctoral research are a very important aspect to understand about the students' viewpoint. As the participants believe their universities should invest more in AI infrastructure, with a mean value of Q26=4.09, the students are very strongly in favor of AI training, with a mean value of Q27=4.30. They strongly believe that AI tools will significantly change the future of doctoral research with a mean value of Q28=4.27, will create more research opportunities with mean value of Q29=4.19. They strongly agree on the necessity for the ethical guidelines for the use of AI in doctoral research, with a mean value of Q30=4.41. AI literacy is an essential skill for the effective use of AI, with a mean value of Q31 = 4.42. The scholars are strongly in support of the integration of AI in the curriculum, with

a mean value of Q32=4.39.

Table 5 represents the descriptive statistics of the 4 components covered in this study.

Table 5

Descriptive Statistics of Composite Score

Composite Scores	N	Minimum	Maximum	Mean	Std. Deviation
Awareness of AI Score	106	1.00	5.00	3.9009	.89221
Impact of AI in Research Productivity	106	1.00	5.00	4.0566	.80443
Perception and challenges of AI	106	1.57	5.00	4.1065	.73217
Future Recommendation of AI	106	1.00	5.00	4.2965	.71025
Valid N (listwise)	106				

The participants have a positive and impactful perspective of AI awareness (M=3.90). The average score of Impact of AI in research productivity (M=4.06) is also high indicates the AI tools are very increasing the research productivity among doctoral students. Perception and challenges of AI (M=4.10) which shows the hurdles are also present there with the use of AI tools. Future recommendation of AI (M=4.29) which is also high, presenting a strong belief that there are some potential which the doctoral students recommends to cover up by the Indian universities. The low standard deviation among all these variables indicating that the participants are largely agreed on their views related to the impact of AI in doctoral research with potential challenges that needs to be eliminated.

3.3. Most Helpful AI Tools in Research Analysis Q33

At present technology and innovation in AI has been expanding and reaching to everyone. Doctoral students are also aware of them and utilizing various kind of AI tools for their studies. Q33 was an open-ended question to know about what kind of AI tools are the most helpful tools for them. Table 6 represents the replies related to AI tools, the doctoral students use in their research.

Table 6

AI Tool/Category	Number of Mentions
ChatGPT	48
Research Rabbit	12
Elicit	10
QuillBot	10
Gemini (AI)	6

Bard (Google Bard)	5
PaperPal	5
Zotero	5
SciSpace	4
DeepSeek AI	3
Perplexity AI	3
Copilot	2
Grammarly	2
Jenni.ai	2
Julius AI	2
Mendeley	2
Bibliometrix	1
ChatPDF	1
Connected Papers	1
Deepchem	1
Lit review (general)	1
Open AI	1
Researchpal	1
Scriber	1
Vosviewer	1
Google Chrome/Social Media	1
None	1
NA	2
Provide free access	1

ChatGPT has emerged as the highest and most mentioned (n=48) AI tool. This shows its widespread adoption and utilization by them. Research Rabbit (n=12), Elicit (n=10), Quillbot (n=10) were also popular among doctoral students. Research Rabbit and Elicit are well-known for literature review and research papers' finding purpose. Quillbot is well-known for paraphrasing, grammar checking and other writing assistance. Gemini AI (n=6)and Google Bard (n=5) are the same AI used for various research support tasks. For academic writing and reference management the students are using PaperPal (n=5), Zotero (n=5), Scispace (n=4), Grammarly (n=2) and Mendeley (n=2). Some other popular AI tools like Deep seek (n=3), Perplexity AI (n=3), Copilot (n=2), JenniAI (n=2) and Julius AI (n=2) are also mentioned by students. While some have mentioned NA. They are not using any AI tools or are not aware of AI tools. Some students

mentioned broader categories and did not mention specific AI tool names. These findings suggest doctoral students are getting the benefits of AI tools in their studies, strongly supporting the conceptual framework.

3.4. Recommendations for Improving AI Integration (Q34 Frequency of Mentions)

Doctoral students are not only aware of AI Tools but also use them for their studies. This illustrates the positive impact of AI on doctoral studies. However, there are some recommendations also suggested by the doctoral students, as mentioned in Table 7 given below.

Table 7

Recommendation Theme	Number of Mentions
Training & Workshops / FDPs	26
Proper Guidance & Knowledge / Education	11
Ethical Guidelines & Usage	9
Integration into Curriculum / Coursework	8
Accessibility to AI Tools (Free/University-level)	8
Awareness (Training & General)	4
Regular Updates & Availability of AI Tools	2
Validation/Reliability of AI Output	1
Assessibility & Method Knowledge	1
High-level Training	1
Music and AI in research trainings	1
AI is good with limited & careful usage	1
Implement guidelines	1
Use of AI for writing purposes only	1
No/Not Sure/Nothing/NA	8

Table 7 represents the recommendations for improving AI in doctoral research. Most of the students have suggested that training and development programs are paramount. They have a clear demand for learning opportunities to effectively and ethically use AI tools. They need proper guidance and an ethical framework to gain a clear understanding of best practices, ethical considerations, and proper integration of AI in their research. The students suggest the need for free access to AI tools from the university. The integration of AI tools into their curriculum/coursework can enhance their capacity to utilize AI tools in the right direction. They need general awareness and regular updates on the availability of AI tools. These recommendations strongly suggest that Indian Universities should prioritize a well-structured training program, establish clear ethical guidelines for the use of AI, and ensure accessibility of AI tools to better

contribute to their doctoral studies.

3.5. Potential Negative Impacts of AI Analysis

The questionnaire consists of a question (Q35) to understand the potential negative impacts of AI in doctoral research. This was a multiple-choice question. Multiple response analysis was done by using IBM SPSS 23, shown in Table 8, given below.

Table 8

Potential Negative Impacts of AI Frequencies				
		Responses		Percent of Cases
		N	Percent	
Potential Negative Impacts of AI[a]	35.1. Over-reliance on AI, leading to reduced critical thinking and analytical skills	87	16.2%	82.1%
	35.2. Increased potential for plagiarism and academic dishonesty	62	11.5%	58.5%
	35.3. Bias in AI algorithms, leading to skewed research results and conclusions	50	9.3%	47.2%
	35.4 Data privacy and security risks, compromising sensitive research information	63	11.7%	59.4%
	35.5 Increased cost of research due to reliance on expensive AI tools and subscriptions	47	8.7%	44.3%
	35.6. Dependence on AI tools that may become obsolete or unsupported	51	9.5%	48.1%
	35.7. Loss of human intuition and creativity in the research process	64	11.9%	60.4%
	35.8. Potential for job displacement of research assistants and support staff	53	9.9%	50.0%
	35.9. Difficulty in validating and verifying AI-generated research findings	61	11.3%	57.5%
Total		538	100.0%	507.5%
a. Dichotomy group tabulated at value 1.				

Table 8 clearly visualizes that doctoral students are well aware of various potential negative impacts of AI associated with it in research. 82.1% of the students are concerned with Over-reliance on AI, leading to reduced critical thinking and analytical skills. 60.4% of them are concerned about the loss of human intuition and creativity in the research process. 59.4% students expressed their concern for data privacy and security risks, compromising sensitive research information. 58.5% of the students are worried about the increased potential for plagiarism and academic dishonesty.

57.5% were concerned about difficulty in validating and verifying AI-generated research findings. 50.00% are concerned about the potential for job displacement of research assistants and support staff, while 48.1% students believe that dependence on AI tools may become obsolete or unsupported. 42.2% doctoral students selected bias in AI algorithms, leading to skewed research results and conclusions. 44.3% of students find AI tools very expensive because of their subscription plans.

3.6. Interpretation of Spearman's Rho Correlation Analysis

Spearman's rho correlation coefficients measure the direction and strength of association between two ranked variables, which is specifically suitable for Likert scale data shown in Table 9. The study consists of four key variable scores, including Awareness of AI score, Impact of AI on research productivity score, Perception and challenges of AI scores, and future recommendations of AI score.

Table 9

Correlations

			Awareness of AI Score (Composite Score)	Impact of AI in Research Productivity (Composite Score)	Perception and challenges of AI (Composite Score)	Future Recommendation of AI (Composite Score)
Spearman's rho Correlation	Awareness of AI Score (Composite Score)	Correlation Coefficient	1.000	.674**	.590**	.328**
		Sig. (2-tailed)	.	.000	.000	.001
		N	106	106	106	106
	Impact of AI in ResearchProductivity (Composite Score)	Correlation Coefficient	.674**	1.000	.482**	.421**
		Sig. (2-tailed)	.000	.	.000	.000
		N	106	106	106	106
	Perception and challenges of AI (Composite Score)	Correlation Coefficient	.590**	.482**	1.000	.458**
		Sig. (2-tailed)	.000	.000	.	.000
		N	106	106	106	106
	Future Recommendation of AI	Correlation Coefficient	.328**	.421**	.458**	1.000

	(Composite Score)	Sig. (2-tailed)	.001	.000	.000	.
		N	106	106	106	106
**. Correlation is significant at the 0.01 level (2-tailed).						

Table 9 represents the correlation of Spearman's Rank-Order Matrix at a significance level of 0.01%, 2-tailed for n=106. The analysis indicates a statistically positive relationship among the study variables. There is a strong positive correlation between Awareness of AI score and Impact of AI on Research productivity with value of r=0.674, p<0.001. This means that doctoral students who are more aware of AI tools tend to perceive a greater positive impact of these tools on their research productivity. There is a moderate positive correlation between Awareness of AI score and AI Perception Challenges with value of r=0.590, p<0.001. This suggests that an increase in AI awareness also increases the perception of challenges and ethical considerations associated with AI. This is an interesting finding, suggesting that greater understanding of AI also brings a delicate awareness of its complexities and potential downsides. There is a weak to moderate positive correlation between the Awareness AI score and AI Future Recommendations, with a value of r=0.328, p<0.001. This suggests higher awareness is associated with higher future recommendations for AI in doctoral studies. There is a moderate positive correlation is seen between Impact of AI in Research Productivity and Perception and challenges of AI with value of r = 0.482, p < 0.001. This suggests that even as students perceive a positive impact of AI on their productivity, they also strongly acknowledge the associated challenges. There is a moderate positive correlation between Impact of AI in Research Productivity and Future Recommendation of AI with a value of r = 0.421, p < .001. This means that students who experience a greater positive impact from AI are more likely to support and suggest future recommendations for its integration in doctoral studies. There is a moderate positive correlation between Perception and challenges of AI and Future of Recommendation AI with value of r = 0.458, p < 0.001. This suggests that those who are more aware of the challenges and ethical concerns are also more motivated to propose recommendations for better governance and integration of AI in doctoral research. This highlights a positive attitude towards mitigating risks.

In summary, Spearman's Rho correlation analysis largely supports the interconnectedness of the constructs within the conceptual framework of this study. Higher awareness of AI is strongly linked to perceived positive impacts on productivity in research outputs, but also moderately to an increased recognition of challenges associated with AI Tools in research. Notably, both the perceived positive impact and awareness of challenges significantly correlate with the desire for future recommendations and the structured integration of AI in doctoral education.

4. CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH

This study shows that Artificial Intelligence (AI) tools are not merely supplementary aids but have a significant and transformative role in enhancing the research productivity of doctoral students in Indian universities. The findings reveal a high level of awareness and usage of these tools, which have a tangible positive impact on the efficiency and effectiveness of academic work. While students acknowledge these benefits, they also express notable concerns regarding potential pitfalls, including ethical issues, data privacy, and the financial cost of access. The results of this research underscore a critical need for structured AI integration and support within doctoral

programs. A clear desire for ethical guidelines and the incorporation of AI literacy into the curriculum was evident, suggesting that academic institutions must proactively address these challenges. Specifically, institutions should focus on developing training programs, ensuring robust infrastructure, and creating clear ethical frameworks to facilitate the responsible use of AI.

The contribution of this study lies in addressing an underexplored area of higher education in India and providing empirical evidence that bridges theory with practice. Its insights will support academic institutions and policymakers in leveraging AI to improve research productivity and foster a culture of innovation and responsibility in higher education. Future studies could expand this work by comparing AI adoption across various academic disciplines, conducting a more in-depth analysis of specific challenges, and exploring how different universities are designing and implementing AI policies.

REFERENCES (TRANSLATED AND TRANSLITERATED)

[1] X. Tan, G. Cheng, and M. H. Ling, "Artificial intelligence in teaching and teacher professional development: A systematic review," *Comput. Educ. Artif. Intell.*, p. 100355, Dec. 2024, doi: 10.1016/j.caeai.2024.100355. (in English)

[2] M. D. Adewale, A. Azeta, A. Abayomi-Alli, and A. Sambo-Magaji, "Impact of artificial intelligence adoption on students' academic performance in open and distance learning: A systematic literature review," *Heliyon*, vol. 10, no. 22, p. e40025, Nov. 2024, doi: 10.1016/j.heliyon.2024.e40025. (in English)

[3] "PhD Study in India – A Guide for 2025," *FindAPhD*. [Online]. Available: https://www.findaphd.com/guides/phd-study-in-india. Jan. 27, 2025. (accessed Jul. 30, 2025). (in English)

[4] M. Khalifa and M. Albadawy, "Using artificial intelligence in academic writing and research: An essential productivity tool," *Comput. Methods Programs Biomed. Update*, vol. 5, p. 100145, Jan. 2024, doi: 10.1016/j.cmpbup.2024.100145. (in English)

[5] Y. Xu et al., "Artificial intelligence: A powerful paradigm for scientific research," *Innov.*, vol. 2, no. 4, p. 100179, Oct. 2021, doi: 10.1016/j.xinn.2021.100179. (in English)

[6] A. M. Al-Zahrani, "Unveiling the shadows: Beyond the hype of AI in education," *Heliyon*, vol. 10, no. 9, p. e30696, May 2024, doi: 10.1016/j.heliyon.2024.e30696. (in English)

[7] K. Zhang and A. B. Aslan, "AI technologies for education: Recent research & future directions," *Comput. Educ. Artif. Intell.*, vol. 2, p. 100025, Jan. 2021, doi: 10.1016/j.caeai.2021.100025. (in English)

[8] K. Stolpe and J. Hallström, "Artificial intelligence literacy for technology education," *Comput. Educ. Open*, vol. 6, p. 100159, Jan. 2024, doi: 10.1016/j.caeo.2024.100159. (in English)

[9] M. R. M. Amin, I. Ismail, and V. M. Sivakumaran, "Revolutionizing education with artificial intelligence (AI): Challenges and implications for open and distance learning (ODL)," *Soc. Sci. Humanit. Open*, vol. 11, p. 101308, Jan. 2025, doi: 10.1016/j.ssaho.2025.101308. (in English)

[10] M. Staikova, V. Ivanova, and N. Chivarov, "Students' understanding for AI in different educational levels," *IFAC-PapersOnLine*, vol. 58, no. 3, pp. 182–186, Jan. 2024, doi: 10.1016/j.ifacol.2024.07.147. (in English)

[11] D. Lee et al., "The impact of generative AI on higher education learning and teaching: A study of educators' perspectives," *Comput. Educ. Artif. Intell.*, vol. 6, p. 100221, Apr. 2024, doi: 10.1016/j.caeai.2024.100221. (in English)

[12] Y. Jin, L. Yan, V. Echeverria, D. Gašević, and R. Martinez-Maldonado, "Generative AI in higher education: A global perspective of institutional adoption policies and guidelines," *Comput. Educ. Artif. Intell.*, p. 100348, Dec. 2024, doi: 10.1016/j.caeai.2024.100348. (in English)

[13] H. Wang, A. Dang, Z. Wu, and S. Mac, "Generative AI in higher education: Seeing ChatGPT through universities' policies, resources, and guidelines," *Comput. Educ. Artif. Intell.*, p. 100326, Oct. 2024, doi: 10.1016/j.caeai.2024.100326. (in English)

[14] M. Belkina et al., "Implementing generative AI (GeNAI) in higher education: A systematic review of case studies," *Comput. Educ. Artif. Intell.*, p. 100407, Apr. 2025, doi: 10.1016/j.caeai.2025.100407. (in English)

[15] H. Leite, "Artificial intelligence in higher education: Research notes from a longitudinal study," *Technol. Forecast. Soc. Change*, vol. 215, p. 124115, Apr. 2025, doi: 10.1016/j.techfore.2025.124115. (in English)

[16] C. Stöhr, A. W. Ou, and H. Malmström, "Perceptions and usage of AI chatbots among students in higher education across genders, academic levels and fields of study," *Comput. Educ. Artif. Intell.*, vol. 7, p. 100259,

Jun. 2024, doi: 10.1016/j.caeai.2024.100259. (in English)
[17] F. D. Davis, “Perceived usefulness, perceived ease of use, and user acceptance of information technology,” *MIS Q.*, vol. 13, no. 3, p. 319, Sep. 1989, doi: 10.2307/249008. (in English)
[18] N. Venkatesh, N. Morris, N. Davis, and N. Davis, “User acceptance of information technology: Toward a unified view,” *MIS Q.*, vol. 27, no. 3, p. 425, Jan. 2003, doi: 10.2307/30036540. (in English)
[19] O. Zawacki-Richter, V. I. Marín, M. Bond, and F. Gouverneur, “Systematic review of research on artificial intelligence applications in higher education – where are the educators?,” *Int. J. Educ. Technol. High. Educ.*, vol. 16, no. 1, Oct. 2019, doi: 10.1186/s41239-019-0171-0. (in English)
[20] R. Luckin, W. Holmes, M. Griffiths, and L. B. Forcier, *Intelligence Unleashed: An Argument for AI in Education*. Pearson, 2016. [Online]. Available: https://www.scirp.org/reference/referencespapers?referenceid=3391328. (in English)
[21] W. Holmes, M. Bialik, C. Fadel, and Center for Curriculum Redesign, *Artificial Intelligence in Education: Promises and Implications for Teaching and Learning*. Center for Curriculum Redesign, 2019. [Online]. Available: https://curriculumredesign.org/wp-content/uploads/AIED-Book-Excerpt-CCR.pdf. (in English)
[22] J. F. Hair, W. C. Black, B. J. Babin, and R. E. Anderson, *Multivariate Data Analysis*, 7th ed. Pearson, 2010. [Online]. Available: https://www.scirp.org/reference/ReferencesPapers?ReferenceID=1841396. (in English)

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ШТУЧНИЙ ІНТЕЛЕКТ І ЦИФРОВІЗАЦІЯ ДЛЯ ПІДВИЩЕННЯ ПРОДУКТИВНОСТІ НАУКОВИХ ДОСЛІДЖЕНЬ В УНІВЕРСИТЕТАХ ІНДІЇ

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Анотація. Зростаюча інтеграція штучного інтелекту (ШІ) в сучасну систему освіти трансформує традиційну академічну роботу, особливо для науковців-дослідників. Аспіранти використовують інструменти ШІ у своїх наукових працях, що створює певні потенційні виклики в індійських університетах. Це дослідження має на меті зрозуміти та дослідити вплив штучного інтелекту на продуктивність їхніх досліджень в індійських університетах. Це передбачає кількісний підхід із використанням набору даних про 106 докторантів різних дисциплін для дослідження їхнього досвіду, сприйняття та викликів, з якими стикаються докторанти щодо інструментів ШІ в їхній дослідницькій продуктивності, вдосконаленні навичок письма, проведенні оглядів літератури, аналізі наборів даних, інтерпретації результатів досліджень, створенні посилань, цитуванні та вдосконаленні візуальних представлень для сприяння більш ефективному та безперебійному дослідницькому робочому процесу. Результати дослідження показують, що впровадження ШІ в докторських програмах має багато переваг, а також дозволяє визначити конкретні інструменти ШІ, які є найбільш підходящими для них, більшість з яких належать до ChatGPT, Google Bard, Research Rabbit, Quillbot. Студенти демонструють глибоке розуміння цих інструментів і активно використовують їх для складання конспектів, систематизації літератури, управління посиланнями та створення цитат. Однак у дослідженні також окреслюються потенційні негативні наслідки використання інструментів ШІ, які викликають занепокоєння з точки зору етики, проблеми конфіденційності даних, питання довіри та помилки в результатах пошуку. Дослідження завершується рекомендаціями щодо ефективної інтеграції інструментів ШІ в

докторські програми, спрямованими на підвищення продуктивності досліджень та забезпечення їх етичного використання. Слід планувати та проводити навчальні програми, семінари, FDP, пов'язані з ефективним використанням ШІ у наукових дослідженнях здобувачів наукових ступенів.

Ключові слова: штучний інтелект; продуктивність досліджень; академічні дослідження; вища освіта; докторанти.

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