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Relationship between AI Tutoring Tool Usage and Academic Self-Efficacy among University Students

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ABSTRACT
The swift expansion of artificial intelligence (AI) tutoring tools, encompassing conversational AI platforms and adaptive learning systems, has significantly altered the manner in which graduate students interact with academic content. This quantitative, survey-based research investigates the correlation between the frequency and nature of AI tutoring tool utilization and academic self-efficacy among postgraduate university students. A balanced sample of 200 M.Phil and PhD scholars (comprising 100 males and 100 females, with 50 participants from each of four academic disciplines) was selected from public sector universities through simple random sampling. Data collection was conducted using a structured questionnaire that included an AI Tool Usage Scale and Bandura's Academic Self-Efficacy Scale. Results demonstrate that most postgraduate students frequently employ AI tutoring tools, with a significant positive correlation between usage frequency and academic self-efficacy. Regression analysis identified task-specific AI usage, such as for literature synthesis and conceptual clarification, as the most robust predictor of self-efficacy scores. These findings imply that AI tutoring tools, when utilized with intent, can function as an effective academic support mechanism for graduate-level researchers. The implications for responsible AI integration in postgraduate education are examined.

Keywords: *Artificial Intelligence, AI Tutoring Tools, Academic Self-Efficacy, Postgraduate Students, M.Phil, Phd, Public University, Quantitative Research, Survey Study*

Introduction

The advent of generative and conversational artificial intelligence has introduced a fundamentally novel aspect to higher education, especially at the postgraduate level. Tools such as ChatGPT, Claude, and specialized AI tutoring platforms are increasingly integrated into the daily academic activities of M.Phil and PhD scholars. These scholars utilize these tools for various tasks, including literature synthesis, statistical interpretation, language refinement, and conceptual clarification. In contrast to undergraduate students, who frequently employ AI tools for routine coursework tasks, postgraduate researchers engage with these tools within the context of complex, self-directed, and often isolating research processes. This makes the psychological dimensions of such engagement particularly significant.

Existing research on AI in education has primarily concentrated on undergraduate populations, focusing on outcomes such as grades, plagiarism risk, and academic integrity. Consequently, the postgraduate experience, particularly its connection to academic self-efficacy, remains relatively

underexplored. This research gap is notably evident in the public university sector of South Asia, where institutional guidance on AI tool usage is largely lacking. As a result, graduate students often develop their own, frequently unstructured, engagement patterns with these technologies. This study seeks to address this gap by quantitatively analyzing the relationship between the frequency and nature of AI tutoring tool usage and academic self-efficacy among M.Phil and PhD students at public sector universities. By providing empirical, survey-based evidence on this relationship, the study aims to inform institutional policy regarding the responsible integration of AI tools into postgraduate research training and supervision practices.

Research Objective

The main objective of this study is to examine the relationship between AI tutoring tool usage and academic self-efficacy among M.Phil and PhD students at public sector universities, with particular attention to how this relationship varies across gender and academic discipline.

Research Question

What is the relationship between the frequency and nature of AI tutoring tool usage and the level of academic self-efficacy among postgraduate (M.Phil and PhD) university students?

Literature Review

The Rise of AI Tutoring Tools in Higher Education

Since the public release of large language model-based tools in late 2022, the integration of artificial intelligence into higher education has dramatically accelerated. Before this shift, Zawacki-Richter et al. (2019) identified four main use-cases in a systematic review of AI applications in higher education: adaptive systems and personalization, assessment and evaluation, intelligent tutoring systems, and profiling and prediction. More recent work has extended this typology to include generative AI tools that can generate novel text, code, and analysis in response to natural language prompts (Kasneci et al., 2023). Kasneci et al. (2023) point to the significant potential of the large language models for personalized learning support, especially in cases where human tutoring or supervisory feedback is limited – a scenario that very much characterizes the postgraduate research environment in many resource-constrained higher education systems. However, the same authors caution that uncritical or passive reliance on such tools can threaten to undermine the development of independent critical thinking and research skills, a concern that is especially relevant to doctoral training, since it is essentially oriented towards the development of independent scholarly competence.

Empirical evidence on actual usage patterns among graduate populations remains limited but growing. Chan and Hu (2023) surveyed postgraduate students across several disciplines and found that the majority used generative AI tools primarily for three purposes: summarizing and synthesizing academic literature, improving the clarity and grammar of academic writing, and generating preliminary code or statistical syntax for data analysis. Notably, students who reported using AI tools for higher-order tasks such as critically evaluating arguments or refining research questions also reported greater satisfaction with their overall research progress compared to those using the tools solely for low-order tasks such as basic information retrieval.

Academic Self-Efficacy in Postgraduate Education

Academic self-efficacy is rooted in the more general theory of self-efficacy (Bandura, 1986). Academic self-efficacy is the belief in one's ability to organize and execute the courses of action required to attain designated academic attainments. In postgraduate education, this construct has been closely linked with research output, persistence through the often lengthy and isolating process of thesis or dissertation work, and overall degree completion rates (Lent et al., 2018). Low research self-efficacy is associated with a significantly greater likelihood of extended time to completion, withdrawal, or attrition from doctoral and M.Phil students (Litalien & Guay, 2015).

Numerous studies have looked at peer networks, supervisory support, and previous research training as determinants of postgraduate self-efficacy. According to Litalien and Guay (2015), one of the best indicators of doctorate students' research self-efficacy and, consequently, their decision to continue in their programs was their supervisors' perceived competence and autonomy support. In more recent times, researchers have started to wonder if technological solutions, such as AI-based academic support systems, could promote students' confidence in their research abilities in a manner similar to that of human mentorship, especially in situations where supervisory availability is limited.

AI Tool Usage and Self-Efficacy: Emerging Evidence

Direct empirical data linking AI tutoring tool usage directly to academic self-efficacy remains rare, however several related strands of research offer indirect support for a favorable association. Prior educational technology research on intelligent tutoring systems consistently found that self-regulated learning behavior and increased learner confidence were linked to instantaneous, personalized feedback, which is a characteristic of both modern generative AI tools and traditional intelligent tutoring systems (VanLehn, 2011). Yilmaz and Yilmaz (2023) extended this line of thinking to generative AI and discovered that undergraduate students who utilized AI chatbots for programming support reported significantly higher computer programming self-efficacy than students who did not use such tools, indicating that a similar mechanism may function in other academic domains.

The literature does, however, also highlight a counterargument: an over-reliance or passive use of AI technologies could encourage a type of cognitive offloading that eventually undermines rather than increases true academic ability and confidence (Kasneci et al., 2023). By distinguishing between task-specific usage patterns (such as conceptual clarification versus passive content generation) rather than treating AI usage as a single undifferentiated construct, this study aims to empirically test the hypothesis that the relationship between AI usage and self-efficacy may not be consistently positive but rather dependent on the nature and purpose of usage.

The Postgraduate Context in Public Sector Universities

Public sector institutions in South Asia, particularly Pakistan, house the majority of the region's M.Phil and PhD scholars, however often operate with restrictive research infrastructure, high supervisor-to-student ratios, and minimal formal training in digital research tools (Hayat & Khan, 2022). Within this environment, AI tutoring tools may represent an especially consequential resource potentially compensating for limited supervisory bandwidth but their adoption has so far proceeded without institutional guidance, formal training, or empirical evaluation of their psychological and academic effects on graduate researchers. This work is positioned to address that specific empirical gap.

Research Methodology

Research Design

The research design used in this study is quantitative and survey-based. A quantitative technique was used to enable statistical measurement of the strength and direction of the link between AI tutoring tool usage and academic self-efficacy across a specific group of postgraduate students.

Population and Sample

The target population comprises M.Phil and PhD academics enrolled at public sector universities. A total sample of 200 postgraduate students was recruited using simple random sampling, 100 male and 100 female scholars, with 50 students drawn from each of four academic areas (Natural Sciences, Social Sciences, Humanities, and Engineering & Technology). In order to provide

sufficient statistical analysis for gender and discipline comparisons, this balanced approach was chosen.

Research Instrument

Data were acquired using a standardized, two-part questionnaire. Using a five-point Likert scale (1 = Never to 5 = Very Frequently), the first section, the AI Tool Usage Scale, was a 10-item tool created by researchers to measure the frequency and type of AI tutoring tool usage across various task types (e.g., literature synthesis, conceptual clarification, statistical assistance, and academic writing support). The second section featured Bandura's (1986) Academic Self-Efficacy Scale, tailored for postgraduate research situations, with 12 items assessed on a five-point Likert scale.

Data Analysis

IBM SPSS Statistics (Version 28.0) was used to examine the data. For every variable, descriptive statistics such as means, standard deviations, and frequency distributions were calculated. The bivariate association between overall AI tool utilization and academic self-efficacy was examined using Pearson correlation. Multiple linear regression analysis was used to establish which specific features of AI tool usage (literature synthesis, conceptual clarification, statistical aid, and writing support) most strongly predicted academic self-efficacy scores. Independent samples t-tests were used to compare self-efficacy scores between M.Phil and PhD researchers, and between male and female respondents. Statistical significance was determined at $p < .05$ throughout.

Results

Results are presented in three tables. Table 1 reports the demographic characteristics of the sample. Table 2 presents descriptive statistics for AI tool usage and academic self-efficacy. Table 3 presents inferential statistics, including correlation, regression, and group comparison results. All analyses are based on the complete sample of N = 200 postgraduate scholars.

Table 1: *Demographic Characteristics of the Study Sample (N = 200)*

Variable	Category	N	%
Degree Program	M.Phil	100	**50.0**
	PhD	100	**50.0**
Gender	Male	100	**50.0**
	Female	100	**50.0**
Discipline	Natural Sciences	50	**25.0**
	Social Sciences	50	**25.0**
	Humanities	50	**25.0**
	Engineering & Tech	50	**25.0**
Research Stage	Coursework/Proposal	68	**34.0**
	Data Collection	60	**30.0**
	Writing/Analysis	**72**	**36.0**

Gender and discipline were balanced by design (100 male / 100 female; 50 per discipline) using simple random sampling.

Table 2: *Descriptive Statistics: AI Tool Usage and Academic Self-Efficacy (N = 200)*

Variable	M	SD	Min	Max	C. Alpha
Overall AI Tool Usage	3.42	0.81	1.10	5.00	**.86**
Literature Synthesis	3.71	0.94	1.00	5.00	—
Conceptual Clarification	3.58	0.97	1.00	5.00	—
Statistical Assistance	3.21	1.05	1.00	5.00	—
Academic Writing Support	3.18	1.02	1.00	5.00	—

Academic Self-Efficacy (Total)	**3.64**	**0.68**	**1.50**	**5.00**	**.89**

Both scales used a 5-point Likert format (1 = Never/Strongly Disagree, 5 = Very Frequently/Strongly Agree). M = Mean; SD = Standard Deviation; alpha = Cronbach's alpha. Sub-dimensions of AI usage are listed beneath the overall composite score.

Table 3: *Inferential Statistics: Correlation, Regression, and Group Comparisons (N = 200)*

Analysis / Variable	**Statistic**	**Value**	**p**	**Effect Size**
Section A: Correlation with Self-Efficacy				
Overall AI Usage × Self-Efficacy	R	.47	<.001	**Moderate**
Section B: Multiple Regression (Predictors of Self-Efficacy)				
Literature Synthesis (beta)	beta = .28	t = 4.18	<.001	—
Conceptual Clarification (beta)	beta = .30	t = 4.46	<.001	—
Statistical Assistance (beta)	beta = .10	t = 1.49	.137	—
Academic Writing Support (beta)	beta = .07	t = 1.03	.305	—
Model Fit	**R^2 = .29 Adj. R^2 = .28 F(4, 195) = 20.05 p < .001**			
Section C: Group Comparisons (t-test) S				
Self-Efficacy: M.Phil vs PhD	t(198) = 2.21	M: 3.54 vs 3.76	.028	**d = 0.31**
Self-Efficacy: Male vs Female	t(198) = 0.79	M: 3.66 vs 3.61	.431	**d = 0.11**
Section D: Discipline Comparison (One-Way ANOVA)				
Self-Efficacy across 4 Disciplines	**F(3,196) = 2.94**	—	**.035**	**eta-sq = .04**

Theoretical Explanation (beta = .30) and Literature Synthesis (beta = .28) emerged as the strongest significant predictors of academic self-efficacy; Statistical Assistance and Academic Writing Support were not statistically significant predictors once the other variables were controlled. PhD scholars reported significantly higher self-efficacy than M.Phil scholars; no significant gender difference was found. A significant difference in self-efficacy was found across the four academic disciplines (p = .035); post-hoc Tukey tests indicated Engineering & Technology scholars reported the highest mean self-efficacy. Cohen's d: small = 0.20, medium = 0.50, large = 0.80; eta-squared: small = .01, medium = .0

Discussion

One main research question was the focus of this study: How do postgraduate university students' levels of academic self-efficacy relate to the frequency and type of AI tutoring tool usage? Drawing from a balanced sample of 200 M.Phil and PhD scholars, the results offer a clear, empirically supported, and largely affirmative answer: overall AI tutoring tool usage was significantly and positively correlated with academic self-efficacy (r =.47, p <.001), suggesting that postgraduate students who use AI tutoring tools more frequently tend to report higher confidence in their academic and research abilities. This finding directly supports the theoretical proposition, derived from Bandura's (1986) Social Cognitive Theory that AI tools may function as a novel source of vicarious experience and affirming feedback that contributes meaningfully to self-efficacy beliefs.

Crucially, the regression results clarify this response by showing that the link varies depending on how AI is used. Conceptual clarification (beta = .31, p < .001) and literature synthesis (beta = .29, p < .001) emerged as the strongest significant predictors of self-efficacy, while statistical assistance and academic writing support did not reach statistical significance once the other

usage dimensions were controlled. This pattern shows that the self-efficacy benefits of AI teaching tools are focused in higher-order cognitive tasks helping students think through and synthesize difficult ideas rather than in more mechanical or output-generating tasks such as grammar correction or code development. This distinction, which echoes the distinction Chan and Hu (2023) made between higher-order and lower-order AI usage patterns, directly addresses a tension found in the literature review: rather than consistently fostering dependency, AI tool usage appears to build self-efficacy specifically when deployed for substantive intellectual engagement (Kasneci et al., 2023).According to the larger postgraduate self-efficacy literature (Litalien & Guay, 2015), self-efficacy develops cumulatively through research experience and mastery over time; PhD scholars, being further along in their research training, may have both greater baseline self-efficacy and more developed skills in deploying AI tools purposefully rather than passively. The finding that PhD scholars reported significantly higher self-efficacy than M.Phil scholars ($t(198) = 2.21$, $p = .028$, $d = 0.31$).

The study's balanced 100 male/100 female design and the lack of a significant gender difference ($t(198) = 0.79$, $p = .431$) indicate that the self-efficacy benefits linked to AI tool usage are widely accessible across gender within this postgraduate population, which is an encouraging finding from an equity standpoint. The four academic disciplines also showed a significant difference ($F(3,196) = 2.94$, $p = .035$, eta-squared $= .04$), with engineering and technology scholars reporting the highest mean self-efficacy, which is likely due to their greater familiarity and comfort with AI-based digital tools within technical disciplines compared to the humanities and social sciences. When combined, these findings provide a nuanced response to the research question: Postgraduate students' use of AI tutoring tools is positively correlated with their academic self-efficacy, but this correlation is primarily driven by intentional, higher-order engagement, particularly conceptual clarification and literature synthesis, rather than by usage frequency alone. This subtlety has significant ramifications for how public universities should mentor graduate students to engage with AI tools in more productive and psychologically advantageous ways.

Conclusion

The purpose of this study was to investigate the relationship between academic self-efficacy and the use of AI tutoring tools among 200 M.Phil. & PhD students at public universities who were equally divided by gender (100 male, 100 female) and academic discipline (50 each from the Natural Sciences, Social Sciences, Humanities, and Engineering & Technology). The results show that the use of AI tools for conceptual clarification and literature synthesis, rather than for statistical or writing support, is the main driver of the statistically significant, positive association between overall AI tool usage and self-efficacy. There was no significant difference between male and female respondents, but there was a substantial variation across academic disciplines, with engineering and technology scholars reporting the greatest levels of self-efficacy. PhD scholars reported significantly greater levels of self-efficacy than M.Phil. Scholars. These findings imply that AI tutoring tools can be a valuable addition to traditional supervisory support in boosting postgraduate students' confidence in their research capabilities when used intentionally for substantive intellectual engagement. This benefit seems to be widely distributed across gender but somewhat uneven across academic disciplines.

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