Empowering Researchers: Role of Artificial Intelligence in Enhancing Research Self -Efficacy

Sreedevi. A. S

Junior Research Fellow
Dept. of Education,
University of Calicut
sreedevisanil.a.s@gmail.com
8157915424

Dr. Reesha Karally

Assistant Professor
Dept of Education,
University of Calicut
drreesha@uoc.ac.in
9496362993

Sreedevi. A. S
Dr. Reesha Karally

Abstract:

Artificial Intelligence is widely used in the educational field, especially by students, teachers and researchers. Research is systematic and the scientific process often creates challenging situations for investigators. Conducting research with self - efficacy is very important to maintain sound mental health. The aim of this paper is to study the role of AI to enhance research self-efficacy of researchers. The study was conducted among 104 research scholars using the self-developed Research Self- Efficacy scale. The researcher followed the Quantitative approach for data collection.

Keywords: Artificial Intelligence, Research self- efficacy,

1. Introduction:

Artificial Intelligence is creating tremendous impacts in every field of society in recent years .AI tools generate responses based on what prompts they receive from the user. Different kinds of AI chatbots produce content like text, images, videos, or audio based on input or learned patterns. AI systems have sophisticated algorithms and machine language to generate new materials and contents that often imitates human creativity. The traditional search tools focus on retrieving existing content from the web and do not create new content but the AI can generate new content, such as articles, code, summaries, and creative text, based on the input provided. AI-driven research tools like Elicit, sci space, Consensus, Iris.ai, Research Rabbit, and Inciteful are enhancing scholarly processes of research. It highlights their role in improving literature search, data collection, and analysis. It emphasizes the advantages and challenges of these tools in improving research processes (TSE, 2024). These AI tools are available to ease human work which also helps the researchers to avail resources and data in a short span of time. AI tools are available to do the review related literature and data analysis and data transcription of qualitative data.

"Self-efficacy is peoples judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. It is concerned not with the skills one has but with judgments of what one can do with whatever skills one possesses" (Bandura, 1986).

Artificial Intelligence Self-Efficacy (AISE) is an individual's confidence in their ability to utilize and engage with AI technologies and applications. This domain-specific construct evaluates one's belief in managing AI-related tasks effectively. Key components of AISE are the ability to use AI as an assistive tool, ease and comfort in interacting with AI systems that exhibit human-like characteristics, a general sense of comfort and reduced anxiety when using AI technologies (Wang & Chuang,2024). Research Self-Efficacy (RSE) refers to an individual's confidence in their ability to successfully carry out research-related tasks, serving as a key determinant of engagement in research activities. Several factors contribute to RSE, including a strong interest in research, which enhances confidence in research capabilities and a supportive research training environment. Which plays a significant role in fostering RSE. High levels of RSE are associated with increased research productivity and a well-defined research identity (Livinți et al., 2021). Factor Structures of Three Measures of Research Self-Efficacy examines the dimensions of research self-efficacy using three instruments. That are the Research Self-Efficacy Scale (RSES), the Self-Efficacy in Research Measure (SERM), and the Research Attitudes Measure (RAM) (Forester et al., 2004). Bieschke et al. (1996) identified four core dimensions of Research Self-Efficacy Scale (RSES) such as research conceptualization, research implementation, initial tasks, and result presentation.

Research self- efficacy is the ability to successfully perform challenging tasks associated with the research. Research self- efficacy is very essential for every phase of research from the identification of problems to dissemination of results. It is very important for the researchers and educators to perceive their own self-efficacy when using AI technologies for doing their research ethically. It is equally important to consider the other realm of AI technologies to affect human behaviour.

2. Literature Review:

In the early 2023 one of the prominent generative AI ChatGPT gained a massive user base and was widely accepted in the social media platforms. People admired its capabilities and creative content (Taecharungroj,2023). The emergence of ChatGPT and other AI models opens new dynamics in the relationship between AI and human skills. It is challenging to predict how technology will impact human cognition. ChatGPT trained on a variety of tasks including text generation, both open and closed ended question answering, brainstorming, rewriting, summarizing, classification, extraction and chat interactions (Ouyang et al.,2022). A variant of GPT-3 of ChatGPT is introduced in 2021 and it is designed to produce human-like text and has been applied in areas such as translation, content creation, and chat-based applications. It offers opportunities to improve student engagement, foster collaboration, support remote learning, and create personalized and interactive assessments, including game-based formats (Cotton et

al., 2024). AI has become an assistant for humans to handle large databases effectively and perform complex analysis that is often time consuming and difficult. Researchers encounter challenges like information overload, fragmented insights, and inefficiencies in organizing and synthesizing knowledge. The Artificial Intelligence-Powered Research Assistant (ARA) utilizes advanced AI technologies to improve information retrieval, analysis, and synthesis of data .ARA integrates large language models, semantic web technologies, and knowledge graphs to construct a dynamic, interconnected network of research information .ARA aims to optimize research workflows, uncover hidden insights, promote cross-disciplinary collaboration, and boost research productivity and communication (Chaudhari et al., 2024).

Ugwu et al. (2024) conducted a rapid review to address ethical challenges associated with the use of artificial intelligence (AI) in research writing. The findings of the study highlight that AI can assist in research writing. it is crucial to address ethical issues like plagiarism, transparency, and disclosure to preserve academic integrity. The study stresses the need for human oversight and proper recognition of AI's contributions. Cooperman and Brandao (2024) explores the potential, challenges, and ethical implications of using AI in scientific writing. It outlines how AI tools can improve efficiency, accuracy, and clarity. And also acknowledging the limitations and potential biases that may arise. It stresses the need for human oversight and ethical awareness when applying AI to scientific literature.

3.Research Gap:

Extensive literature highlights the widespread use of AI tools across various fields. Emphasizing their ability to reduce human workload and address professional challenges. These studies have explored the impact of AI on human cognition and ethical considerations associated with its use. The use of AI in research assistance has been well-documented. The investigator found there is a notable gap in how AI influences the research self-efficacy of researchers particularly within the Indian context. Therefore, this study holds significant relevance in the current scenario.

4. Objectives of The Study:

i)   To study whether there exists any significant difference in mean score of AI-assisted research self-efficacy among Research scholars based on the sub-samples of gender, subject discipline, and age group.
ii)   To find out the level of Research Scholars AI Influenced Research Self- Efficacy based on dimensions.

5. Methodology:

i)   **Methods:** Survey method adopted in the present study.

ii) **Sample and Sampling:** The study was conducted among 104 research Scholars. The stratified random sampling method used to collect data.

iii) **Tool Used for The Study:** AI Based research Self - Efficacy scale used for the present study. The scale has following dimensions such as Research Interest Ability at Entry Time, Research Interest and Ability during Research Period, Research Interest with Use of AI, Research Productivity with Use of AI, Research Outcome Expectation with Use of AI, Intention or Goal for a Career in Research with AI, and Research Identity with AI.

iv) **Statistical Techniques:** Statistical technique used for the data analysis is Test of significance difference between mean score (Independent sample t-test). Dimension wise percentage analysis.

6. Study Conducted and Data Collection:

The study was conducted among 104 research scholars of the University of Calicut, Kerala. Data collected from both science and non-science streams. The selection of participants was done randomly and data collection done through both Google Forms and hard copies of the AI-Based Research Self-Efficacy Scale. The sample included 58 female and 46 male research scholars, representing diverse academic streams. Of the total participants 58 were from non-science disciplines and 46 were from science disciplines. The sample included scholars from different age groups with 48 participants aged above 30 years and 56 participants aged below 30 years.

The AI-Based Research Self-Efficacy Scale employed in the study consisted of seven dimensions and 24 items constructed to measure the self-efficacy of scholars in conducting research using AI. The scale was three-point Likert-type scale with response options of "Agree," "Neutral," and "Disagree." Positive items on the scale were scored from 3 to 1 while negative items were reverse-scored ranging from 1 to 3.

7. Analysis of Data and Interpretation of Result:

Table- 1. Results of the test of significance of difference between mean score Role of AI in enhancing Research Self-Efficacy Among Research scholars.

	Categorical Subgroup	N	Mean	SD	t-value	Level of significance
Gender	Male	46	55.3	9.51	.344	.05% NS
	Female	58	55.3	9.51		
Subject	Non-Science	58	55.5	10.74	.626	.05% NS
	Science	46	54.21	9.88		
Age	Up to 30	56	52.82	10.42	2.293	.05% S
	Above 30	48	57.39	9.79		

As shown in the table the t-value obtained between male and female is .344 which is less than the table value 1.96 required for significance at 0.05 level. Hence there is no significant difference in the mean scores of male and female research scholars. In the subject group between science and non-science the t-value is .626 which is not significant at 0.05 level. There is a significant difference in the mean scores between the age group of up to 30 years and above the 30 years of the research scholar. The obtained t-value is 2.293 which is above the table value 1.96 required for the 0.05 level. Their mean score indicates that above 30 years of age shows the higher influence of AI in the Research Self-efficacy among the research Scholars. This may be the influence of the years of experiences in this area and their interest in the field of research.

Table 2 Result of Dimension Wise Percentage of Role of AI in Enhancing Research Self-Efficacy Among Research scholars

Dimensions	High Level		Moderate Level		Low Level	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Total	16	15.4%	71	68.2%	17	16.4%
Research Interest and Ability at Entry Time	19	18.3%	67	64.4%	18	17.3%
Research Interest and Ability during Research Period	14	13.5%%	68	65.4%	22	21.1%
Research Interest with Use of AI	32	30.7%	54	52%	18	17.3%
Research Productivity with Use of AI	0	0	90	86.5%	14	13.5%
Research Outcome Expectation with Use of AI	32	30.8%	51	49%	21	20.2%
Intention or Goal for a Career in Research with AI	32	30.8%	56	53.8%	16	15.4%
Research Identity with AI	21	20.2%	68	65.4%	15	14.4%

Table 2 reveals the level Role of AI in enhancing Research Self-Efficacy Among Research scholars based on their total sample. The 15.4 percent of research scholars exhibit high level of research self-efficacy when using AI tools based on the total sample. A majority of research scholars have an average level of research self-efficacy influenced by the use of AI during their research period that is 68.2 percent. On the other hand,16.4 percent of scholars show a low level of research self-efficacy. The research interest and ability at the entry stage reveals that 18.3 percent of scholars demonstrate a high level of research self-efficacy. Meanwhile, 64.4 percent of scholars exhibit an average level of research self-efficacy and 17.3 percent have a low level of research self-efficacy at the entry point of research.

During the research period the research interest and ability of research scholars indicates that 13.5 percent of research scholars have a high level of research self-efficacy. The majority of

scholars show an average level of self-efficacy that is 65.4 percent. Whereas 21.1% display a low level of research self-efficacy during the research time period.

Research Interest with the Use of AI appears to positively influence research interest. The result shows that 30.7 percent of research scholars have high levels of Research self-efficacy using AI tools. The 52 percent of research scholars have moderate levels of interest with use of AI. While the 17.3percent exhibit low levels of interest in AI use in Research. These findings highlight the potential of AI tools to enhance research engagement.

Research Productivity with the Use of AI reveals a significant reliance on moderate levels of productivity that 86.5 percent of scholars. None of the research scholars showed high levels of productivity with use of AI in the Research. The 13.5 percent shows a low level of AI based research self-efficacy.

Research Outcome Expectation with the Use of AI reveals that 30.8 of scholars have high self-efficacy. That indicates many scholars have positive expectations about AI-enhanced research outcomes. The 49 percent of research scholars have moderate levels. The 20.2 percent exhibit low levels. Intention or Goal for a Career in Research with AI the 30.8 percent of scholars exhibit high self-efficacy that reflects strong aspirations to pursue research careers with the aid of AI. The majority of the scholars maintain moderate levels of self-efficacy 53.8 percent. Remaining 15.4 percent shows the low levels.

Research Identity with AI shows 20.2 percent of scholars strongly identifying as competent researchers using AI. The majority 65.4 percent of research scholars have a moderate sense of identity. While 14.4 percent report low levels of self-efficacy in this dimension.

8. Findings:

The findings of the study were

- No significant difference in AI-based research self-efficacy was found between male and female research scholars (t = 0.344, p > 0.05).
- No significant difference was observed in AI-based research self-efficacy between science and non-science research scholars (t = 0.626, p > 0.05).
- Scholars above 30 years demonstrated significantly higher AI-based research self-efficacy compared to those aged up to 30 years (t = 2.293, p < 0.05), likely due to greater experience and interest in research
- AI based Research Self-Efficacy of the total sample was (68.2%) exhibited average self-efficacy, with 15.4% showing high and 16.4% showing low levels.
- At Entry Research Interest and Ability among scholars were average (64.4%) was predominant with high (18.3%) and low (17.3%) levels.

- During Research Interest and Ability among scholars were average remained dominant (65.4%), low self-efficacy increased (21.1%), and high levels decreased (13.5%).

- Research Interest with AI were positively influenced interest 30.7% showing high levels and though the majority (52%) remained average.

- Research Productivity was predominantly average (86.5%), with no high levels reported and 13.5% showing low levels.

- Research Outcome Expectation with AI were reported by 30.8%, but the majority (49%) were average, and 20.2% had low expectations.

- Intention for a Research Career with AI Strong aspirations were seen in 30.8%, with the majority (53.8%) at average levels and 15.4% low.

- Research Identity with AI showed most scholars (65.4%) had a moderate sense of research identity, while 20.2% reported high and 14.4% low levels.

AI tools enhance research interest, outcome expectations, and career aspirations and about one-third of scholars demonstrating high self-efficacy in these dimensions. Overall research productivity remains moderate and no scholars reporting high productivity levels.

The integration of AI tools has played a significant role in shaping the research self-efficacy of scholars during their research journey. These findings stress that AI tools significantly enhance certain aspects of research self-efficacy such as research interest, outcome expectation, and career intentions. The majority of scholars consistently fall into the moderate level across dimensions.

Artificial Intelligence (AI) has significantly transformed the research landscape by providing tools to support researchers in handling complex tasks.AI empowers researchers with advanced capabilities and also poses questions about its impact on human cognition. Particularly in areas such as critical thinking, problem-solving, and creativity. Over-reliance on AI tools may reduce opportunities for cognitive engagement and skill development in some areas and emphasizing the need for a balanced approach.

Reference:

Bandura, A. (1986). Social Foundations of Thought and Action: A social Cognitive Theory. Englewood Cliffs, NJ: Prentice-Hall.

Bieschke, K. J., Bishop, R. M., & Garcia, V. L. (1996). *The utility of the research self-efficacy scale*. Journal of Career Assessment, 4.

Chaudhari, D., Parapalli, D. S., Warade, K., Thool, Y., & Deshmukh, A. (2024). ARA: Artificial Intelligence-Powered Research Assistant. Government College of Engineering Nagpur. https://doi.org/10.13140/RG.2.2.28162.90567/1

Cooperman, S. R., & Brandão, R. A. (2024). AI assistance with scientific writing: Possibilities, pitfalls, and ethical considerations. *Foot & Ankle Surgery: Techniques, Reports & Cases, 4*, 100350. https://doi.org/10.1016/j.fastrc.2023.100350

Cotton, D. R. E., Cotton, P. A., & Shipway, J. R. (2023). Chatting and cheating: Ensuring academic integrity in the era of ChatGPT. Innovations in Education and Teaching International, 61(2), 228–239. https://doi.org/10.1080/14703297.2023.2190148

Forester, M., Kahn, J. H., & Hesson-McInnis, M. S. (2004). *Factor structures of three measures of research self-efficacy*. Journal of Career Assessment, 12(1), 3–16. https://doi.org/10.1177/1069072703257719

Ouyang, L., Wu, J., Jiang, X., Almeida, D., Wainwright, C.L., Mishkin, P., Lowe, R., 2022. Training Language Models to Follow Instructions with Human Feedback. arXiv preprint arXiv:2203.02155. https://doi.org/10.48550/arXiv.2203.02155

Raluca Livinţi, George Gunnesch-Luca & Dragoș Iliescu (2021) Research self-efficacy: A meta-analysis, Educational Psychologist, 56:3, 215-242, DOI: 10.1080/00461520.2021.1886103

Taecharungroj, V., 2023. "What can ChatGPT do?" Analyzing early reactions to the innovative AI Chatbot on Twitter. Big Data Cogn. Comput. 7 (1), 35. https://doi.org/10.3390/bdcc7010035

Tse, Y. L. (2024). Evaluation of AI-based research assistance tools: Case study research (Master's thesis). University of Graz.

Ugwu, N. F., Igbinlade, A. S., Ochiaka, R. E., Ezeani, U. D., Okorie, N. C., Opele, J. K., Onayinka, T. S., Iroegbu, O., Onyekwere, O. K., Adams, A. B., Aigbona, P., & Ojobola, F. B. (2024). Clarifying ethical dilemmas of using artificial intelligence in research writing: A rapid review. *Higher Learning Research Communications, 14*(2), 29–47. https://doi.org/10.18870/hlrc.v142.1549

Wang, Y.-Y., & Chuang, Y.-W. (2023). *Artificial intelligence self-efficacy: Scale development and validation*. Education and Information Technologies, 29, 4785–4808. https://doi.org/10.1007/s10639-023-12015-w