Bridging the Mediating Role of Artificial Intelligence Challenges between Nursing Students' Artificial Intelligence Attitude and Self-Efficacy

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Abstract

Background: Artificial intelligence (AI) has emerged as a transformative force in nursing education, offering benefits such as adaptive learning, simulations, and intelligent assessment. However, challenges related to ethics, privacy, and technical limitations may influence students' ability to engage confidently with AI. **Aim:** To examine the mediating role of AI challenges in the relationship between nursing students' attitudes toward AI and their self-efficacy. **Methods:** A cross-sectional study was conducted with a convenience sample of 342 undergraduate nursing students across all four academic levels at Sohag University. Data were collected using three validated instruments: the AI Challenges Assessment Questionnaire, the AI Attitude Scale, and the General Self-Efficacy Scale. Statistical analyses included descriptive statistics and path analysis to assess direct, indirect, and total effects. **Results:** Most participants were female (50.3%), from rural areas (63.5%), and had not received formal AI training (89.5%). However, 91.2% reported using AI applications, with ChatGPT being the most common (77%). High levels of AI challenges (80.4%), AI attitude (67.5%), and self-efficacy (76.6%) were observed. Path analysis revealed a significant direct effect of AI attitude on self-efficacy ($\beta = 0.343$, $p < 0.001$), an indirect effect through AI challenges ($\beta = 0.266$, $p < 0.001$), and a total effect of $\beta = 0.609$ ($p < 0.001$). **Conclusion:** AI challenges partially mediate the relationship between students' attitudes toward AI and their self-efficacy. Positive attitudes enhance self-efficacy, but overcoming AI-related barriers is essential to maximize this impact. **Recommendation:** Provide supportive guidance from faculty members how model effective AI use, address student concerns, and foster a positive learning environment.

Keywords: Artificial intelligence, nursing education, nursing students, AI challenges, AI attitude, self-efficacy, mediation analysis

Introduction

Artificial intelligence (AI) has become an increasingly influential tool in nursing education, offering opportunities to transform learning through adaptive technologies, virtual simulations, and intelligent feedback **systems (Hwang, 2023; Yaseen et al., 2025).** While AI holds significant promise for enhancing students' professional knowledge, critical thinking, and access to affordable education **(Galindez et al., 2025; Santos & Junior,**

2024), its integration is not without challenges. Concerns such as techno-stress, data privacy, plagiarism, over-reliance on AI tools, and limited trust in technology complicate its effective use in educational settings **(Wu, 2023; Ge, 2024; Huang, 2023; Kim & Lee, 2023).**

Students' attitudes toward AI and their self-efficacy in using these technologies play a critical role in shaping their willingness and ability to integrate AI into their learning **(Omari, 2024; Jia & Tu, 2024; Liang et al., 2023).** However, the presence of AI-related challenges may influence this relationship, either by strengthening or weakening the impact of positive attitudes on self-efficacy **(Guipitacio et al., 2025; Gerlich, 2023).** Despite the growing body of literature on AI in education, limited research has examined how challenges mediate the relationship between nursing students' AI attitudes and their self-efficacy. Therefore, this study seeks to fill this gap by exploring the mediating role of AI challenges in the link between nursing students' attitudes toward AI and their self-efficacy, offering insights for improving AI adoption in nursing education **(Alenazi, 2025; Ali et al., 2025).**

Nursing education aims at improving patient care by providing patients and their relatives with basic nursing knowledge about illness prevention and health promotion **(Donkor et al., 2023).** Hence, it is essential to enhance nursing students' professional knowledge and abilities in health education. Nursing education is greatly impacted by artificial intelligence (AI), which presents both opportunities and challenges for students' academic growth **(Kucukkaya, et al., 2024).** An analytical study by **Wang, et al (2024)** on the use of AI technologies like ChatGPT in nursing found that AI has been widely researched within the field of nursing education, highlighting the significant incorporation of such technologies into nursing education and practice.

AI offers various advantages that can significantly improve students' educational experiences; tailored learning, improved evaluation and feedback, virtual reality, simulations, and intelligent content creation are some of the primary benefits of AI in education **(Hwang, 2023).** Additionally, AI can provide adaptive learning, which improves learning outcomes by dynamically modifying the degree of difficulty of the course materials according to a student's achievements **(Yaseen et al., 2025).** Furthermore, it fosters critical thinking abilities by involving students in participatory discussions that entail creating innovative ideas, analyzing data, and providing logical conclusions **(Galindez et al., 2025).** Above all, AI technology can be utilized to advance low-cost, accessible education as mobile learning applications and massive open online courses, which provide learners in remote locations the chance to learn constantly **(Santos & Junior, 2024).**

Although AI presents many educational opportunities, there are several challenges that need to be resolved to guarantee the successful incorporation of these technologies into educational settings **(Wang & Wang, 2024).** One of these issues is the possibility that AI systems may be employed to monitor and control students in educational settings, thereby compromising their autonomy. Students' motivation to learn may be impacted by the usage of AI-powered technologies, resulting in excessive dependence on external assistance, reducing the sense of autonomy and internal drive to learn **(Zhai, et al., 2024).**

Another challenge of AI is the quick information processing of AI tools, which test traditional learning approaches, raising concerns about replacing human input. Moreover, over-reliance on AI for evaluation and feedback could limit chances for meaningful discussion and reflection, which are fundamental for the growth of critical thinking abilities **(Wu, 2023).** Besides the inaccurate, misleading, and other detrimental data, the growing use of AI

raises a serious concern about plagiarism as students misuse AI to create academic work, which questions the novelty and objectivity of their academic accomplishments **(Ge, 2024).** An additional crucial issue is data privacy; the possibility of data breaches, illegal access, and improper use of student information can negatively impact students' privacy and well-being **(Huang, 2023). Kim & Lee (2023)** highlighted the lack of students' understanding of such technologies and their benefits as another significant challenge of AI, which was supported by a study done by **Douali et al. (2022),** revealing that the majority of participants do not trust AI due to their misunderstanding. In addition, students get confused and unsatisfied when presented with AI tools. Thus, students' attitudes toward AI are central in accepting AI and serve as a foundation for academic success **Cengiz and Peker, 2025).** Further, **Omari (2024)** found that students who had a positive attitude toward AI were more likely to use it and have greater self-efficacy.

Jia and Tu (2024) considered self-efficacy as the degree of students' confidence in their capability to interact with AI-driven technologies. Self-efficacy has been proven to influence students' effort and performance in learning activities **(Liang, et al 2023).** According to **Guipitacio et al. (2025),** attitudes about AI and self-efficacy have a foremost part in the successful application and utilization of AI in education. Therefore, it is critical to recognize how the students' belief in their own technology can impact their attitude about AI **(Gerlich, 2023).** Going with this context, it is valuable to assess the mediating role of AI challenges between nursing students' AI attitude and their self-efficacy.

Nursing students play a significant role in integrating, applying, and utilizing technology in education and clinical practices **(Radwan, et al 2024).** However, AI technologies present challenges to nursing education, which adversely affect the ability of nursing students to access and use AI tools, particularly in developing countries, due to the lack of basic knowledge with inadequate infrastructure, lack of internet connectivity, and digital devices **(Ali et al., 2025).** Hence, assessing the mediating role of AI challenges is crucial as these challenges would impact students' ability to use applications of AI tools.

Alenazi (2025) highlighted that AI has the potential to revolutionize nursing education in academic and clinical contexts. However, studies on nursing students as AI users and their attitude toward utilizing AI are scarce. Consequently, it is vital to evaluate nursing students' attitudes toward using AI. Kim and Lee (2023) discovered that students with more positive attitudes toward AI possessed greater self-efficacy to learn. Nevertheless, research studies incorporating attitude and self-efficacy towards AI in education are still lacking. Accordingly, it is essential to evaluate nursing students' self-efficacy. Furthermore, by investigating the challenges related to utilizing AI in educational settings, this research aims to add to the expanding corpus of research on AI in education and offer insightful information to those who are interested in using AI to enhance learning outcomes.

Aim Of The Study

The current study aims to evaluate the mediating role of AI challenges between attitude toward AI utilization and self-efficacy among nursing students, A correlational study.

Methods

Research design:

A correlational descriptive design was employed in this research. The questionnaire was selected to gather information on students' attitudes regarding using AI, their degrees of self-efficacy, and the challenges of AI.

Participants and setting

A convenience sample was drawn from nursing students enrolled in the Bachelor of Nursing Science program at Sohag University, representing all four academic levels. The faculty comprises approximately 2,800 students in total. To determine the appropriate sample size, the Raosoft Sample Size Calculator was utilized. Assuming a 50% response distribution, a 95% confidence level, and a 5% margin of error, the recommended minimum sample size was calculated to be 342 students. Accordingly, this number of participants was recruited for the study. Participation was entirely voluntary, and only students who expressed willingness and provided informed consent were included. Both male and female students were eligible to participate. Exclusion criteria were applied to individuals who either declined to provide consent or were unable to complete the survey questionnaire. This approach ensured that the sample reflected the diversity of the student population across different academic years while maintaining ethical considerations for voluntary participation.

Tools of data collection:

The following instruments were used to gather data. In addition to students' demographic factors, gender, age, academic level, and whether they participated in AI training were included. The following three tools were used to acquire essential data regarding the study variables.

Tool I: Artificial intelligence's challenges assessment questionnaire: it was developed by researchers after reviewing a literature study (**Shan, 2024; Dimitriadou & Lanitis, 2023; Ali et al., 2024; Khan, 2023)** and has 13 items. Five grade alternatives were used to determine the proficiency levels of the items. The options were categorized as "strongly disagree," "disagree," "undecided," "agree," and "very. The scale has a maximum score of 65 and a minimum value of 13.

Tool (II): Artificial Intelligence Attitude Scale was modified from **Gök et al. (2024).** It was discovered that the scale has a three-factor structure with 13 components. The scale is divided into three sub-dimensions: "Benefits of artificial intelligence", "Risks of artificial intelligence", and "Use of artificial intelligence." Five grade alternatives were used to determine the proficiency levels of the items. The options were categorized as "strongly disagree," "disagree," "undecided," "agree," and "very. The scale has a maximum score of 65 and a minimum value of 13. A high scale score indicates a high level of attitude toward artificial intelligence.

Tool (III): The General Self-efficacy Scale was adapted from **Schwarzer et al. 1995**) and has become a common instrument for measuring general self-efficacy. The General Sciences Examination (GSE) evaluates "a vast and steady sense of personal ability to deal efficiently with various kinds of stressful situations." It consists of ten items graded from 1 ("not at all true") to 4 ("exactly true").

Scoring system: The scoring system for the three tools, 70% and more considered high and less than this percentage considered low.

Procedure

The instruments were subjected to a rigorous process to ensure validity and reliability before data collection. Since the original scales were developed in English, a standard translation and back-translation procedure was employed to produce the Arabic version. Two bilingual experts independently translated the tools into Arabic, and another two experts back-translated them into English. The versions were then compared to ensure semantic, conceptual, and cultural equivalence. Content validity was established by a panel of five experts in nursing education, who reviewed the instruments for clarity, relevance, and appropriateness. Based on their recommendations, minor wording modifications were made. Face validity was

also assessed by distributing the preliminary version to 15 nursing students, who confirmed that the items were clear and understandable. A pilot study was then conducted on 34 students (not included in the main sample) to test feasibility and comprehension; the results confirmed that the tools were acceptable and did not require major modification. Construct validity was examined using confirmatory factor analysis (CFA), which supported the three-factor structure of the Artificial Intelligence Attitude Scale and confirmed the unidimensionality of both the AI challenges scale and the General Self-Efficacy Scale. Reliability testing was performed using Cronbach's alpha coefficients, which demonstrated high internal consistency: 0.823 for the AI challenges scale, 0.852 for the AI attitude scale, and 0.888 for the General Self-Efficacy Scale. Test–retest reliability was assessed with a two-week interval on a subsample of 25 students, yielding correlation coefficients above 0.80 for all tools, indicating strong temporal stability. Following validation, data were collected using a structured self-administered questionnaire. The researchers approached students across different academic levels at Sohag University's Faculty of Nursing, explained the study objectives, and obtained informed consent. Participants completed the questionnaire anonymously in a classroom setting under the supervision of the researchers, ensuring both standardization of administration and confidentiality of responses.

Results:

Table 1 shows that the highest percentages of the study sample are (50.3%) females, (63.5%) rural residence, (43.9%) second level education, (89.5%) have not received AI training, and (91.2%) are using AI applications.

Figure 1 shows that the highest percentage of the study sample is 77% using the ChatGPT AI application.

Ethical Considerations:

The research proposal was approved by the Sohag University Nursing Faculty ethics committee on March 18, 2025, with number 225. There was no risk to the research participants. The study complied with ethical standards for clinical research. Students gave their verbal agreement to take part in the study after outlining the purpose and character of the study. Anonymity and confidentiality were promised. Students were free to decline or leave the study at any moment without providing a reason. During data collection, study participants' privacy was given top priority.

Statistical item:

The collected data were organized, tabulated, and the computer software Jeffrey's Amazing Statistics Program (JASP) version 0.19.3, released in 2024 by the JASP Team, was used for analysis of data results using frequencies. Lavaan version 0.6-19 was used to calculate the mediation results and draw the mediation model through path analysis for the study variables: artificial intelligence's challenges (the mediator, M), attitude toward artificial intelligence utilization (independent variable X), and general self-efficacy (outcome, Y). Correlation is significant at *P value < 0.05, moderately significant **P value < 0.01, and highly significant *** P value < 0.001.

Table 2 depicts that the highest percentages of the study sample (80.4%, 67.5%, and 76.6%) have high levels of AI challenges, AI attitude, and self-efficacy, respectively.

Table 3 and Figure 2 prove the path analysis of the mediation results of AI challenges between the relationship of AI attitude and self-efficacy. These findings of standardized path coefficients declare the positive direct effect between AI attitude and self-efficacy ($\beta = 0.343$, $P < 0.001$) and the positive total effect between AI attitude and self-efficacy ($\beta = 0.609$, $P < 0.001$). Moreover, there is a positive indirect effect

path of AI challenges between the relationship of AI attitude and self-efficacy (β = 0.266, P < 0.001). The path model demonstrated acceptable fit to the data, with an RMSEA of 0.074 and an SRMR of 0.097, while a CFI of 0.725 is slightly less than the acceptable value, and there was a significant chi-square. There are partial mediation of AI challenges between the relationship of AI attitude and self-efficacy.

Table 1: Personal characteristics of the studied nurses' students

Personal characteristics	No.	%
Sex		
Male	170	49.7
Female	172	50.3
Residence		
Rural	217	63.5
Urban	125	36.5
Education Level		
First level	116	33.9
Second level	150	43.9
Third level	12	3.5
Fourth level	64	18.7
Received AI training		
No	306	89.5
Yes	36	10.5
Using AI		
No	30	8.8
Yes	312	91.2

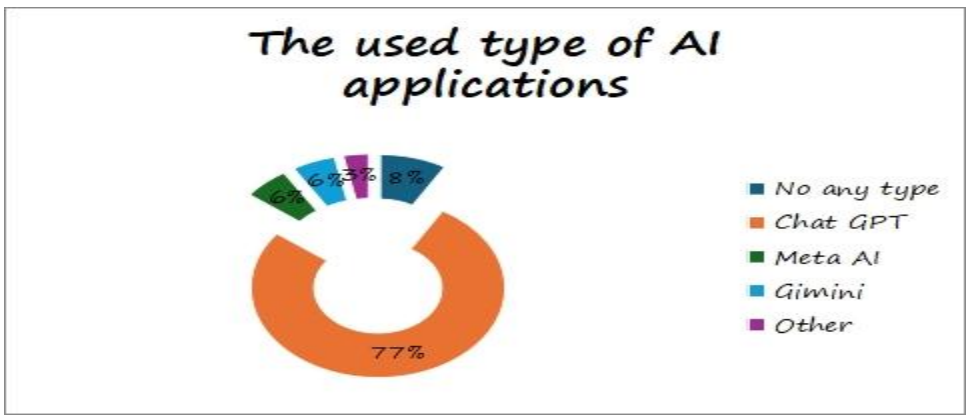

Figure 1: Percentage distribution of the types of AI applications used

Table 2 Percentages of study sample AI challenges, AI attitude, and self-efficacy levels (n. = 342)

Variable	Low		High	
	n.	%	n.	%
AI Challenges	67	19.6	275	**80.4**
Accuracy and Reliability	58	17.0	284	**83.0**
Ethical Concerns	62	18.1	280	**81.9**
Security and Privacy	86	25.1	256	**74.9**
Technical Limitations	82	24.0	260	**76.0**
AI Attitude	111	32.5	231	**67.5**
Benefits of AI	61	17.8	281	**82.2**
Risks of AI	104	30.4	238	**69.6**
Use of AI	141	41.2	201	**58.8**
Self-Efficacy	80	23.4	262	**76.6**
Belief in one's competence	99	28.9	243	**71.1**
Problem-solving ability	58	17.0	284	**83.0**

Table 3 Path analysis for study sample AI challenges, AI attitude, and self-efficacy (n. = 342)

Effects	Path					*β*	Std. error	z-value	p	95% Confidence Interval	
										Lower	Upper
Direct	AI Attitude	→	Self-Efficacy			0.343	0.050	6.825	< .001	0.245	0.442
Indirect	AI Attitude	→	AI Challenges	→	Self-Efficacy	0.266	0.036	7.439	< .001	0.196	0.336
Total	AI Attitude	→	Self-Efficacy			0.609	0.051	11.822	< .001	0.508	0.710

β = Standardized coefficient

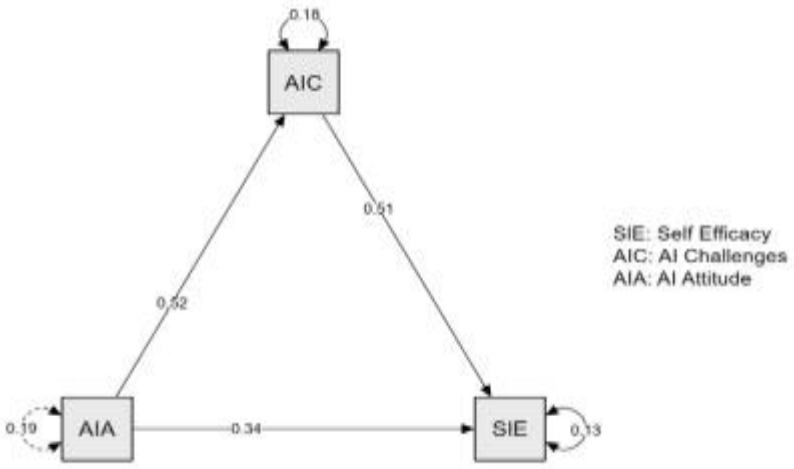

Figure 2 Path plot model for the mediation analyses of AI challenges between the relationship of AI attitude and self-efficacy

Discussion

Artificial intelligence (AI) is a crucial tool in various fields, enhancing efficiency, accuracy, and decision-making. Its applications include natural language processing, image recognition, predictive analytics, and autonomous systems. AI supports early diagnosis, personalized treatment, and large dataset management in healthcare, education, finance, transportation, and communication. However, its integration raises ethical concerns about privacy, accountability, and workforce displacement. AI is a transformative force reshaping society **(Lameras & Arnab, 2021).**

Regarding personal characteristics of the studied nurses, the current study shows that more than half of the studied sample were female, about two-thirds of them were from rural residences, more than one-third of them had second-level education, the majority of them had not received AI training, and most of them were using AI applications. From the researcher's point of view, this may be due to Nursing is still a female-dominated profession globally, including in Egypt, which explains the slightly higher female proportion. Mid-level nursing qualifications are the most common in Egypt, reflecting the structure of nursing education. AI training programmes are still new and not integrated widely into nursing curricula, leading to a large training gap.

The current study agrees with **Bansal et al. (2023),** who studied "Artificial intelligence use among rural healthcare workers: Challenges and opportunities" and found that a high percentage of the study sample were female from rural areas. In contrast, a study by **Alsubaie et al. (2023)** disagreed, showing that a lack of formal AI training significantly reduces adoption and practical use among nurses.

Regarding the percentage distribution of the used type of AI applications, the current study shows that the majority of the studied sample uses the ChatGPT AI application. From the researcher's perspective, this may be due to ChatGPT being free, accessible on smartphones, requiring no technical background, and supporting Arabic and English, making it appealing to nurses.

This aligns with recent studies by **Sallam (2023),** who found ChatGPT to be the most widely adopted AI tool in healthcare and nursing education due to its accessibility and conversational abilities. However, evidence from **Mohammed et al. (2023)** indicated that image-based diagnostic AI systems were more prevalent than text-based platforms among healthcare workers.

Regarding percentages of study sample attitude toward AI utilization, AI challenges, and self-efficacy levels, depicted that the highest percentages of the study sample have moderate levels of attitude toward AI utilization, AI challenges, and self-efficacy levels, respectively.

From the researcher's opinion, nurses recognise AI's benefits but also feel cautious due to ethical concerns and fear of replacement. Nurses may feel confident in basic AI use (like chatbots) but lack confidence in advanced or clinical AI systems.

The current study was Similar to **Atalla et al. (2025),** who found that moderate self-efficacy is common among nurses transitioning to AI use. A comparable result was reported by **Mesko and Topol (2023)**, who showed moderate but improving attitudes toward AI in clinical practice.

Conversely, **Saleh et al. (2023)** disagreed, noting that nurses often

exhibited low confidence and negative attitudes toward AI due to fears of job displacement. Regarding Spearman's correlations for the study sample's attitude toward AI utilisation, AI challenges, and self-efficacy levels, the current study revealed that there were significant and positive correlations between attitude toward AI utilisation, AI challenges, and self-efficacy.

According to the researcher, nurses who believe in their abilities are more likely to adopt and view AI positively. Facing challenges may increase awareness, discussions, and motivation to adapt, which paradoxically fosters a more positive outlook in some cases. Nurses with higher self-efficacy are better at overcoming challenges and seeing them as manageable rather than barriers.

The current study agrees with findings by Tschannen-Moran and Hoy (2020), who emphasised the strong association between self-efficacy and openness to innovation. However, differing evidence comes from **Elfar et al. (2025),** who suggested that perceived challenges weaken the relationship between self-efficacy and AI utilisation.

Regarding path analysis for the study sample's attitude toward AI utilisation, AI challenges, and self-efficacy levels, the current study proves the path analysis of the mediation results of AI challenges between the relationship of self-efficacy and attitude toward AI utilisation. These findings declare the positive direct effect between self-efficacy and attitude toward AI utilisation and the positive total effect between self-efficacy and attitude toward AI utilisation. Moreover, the positive indirect effect path of AI challenges on the relationship between self-efficacy and attitude toward AI utilisation.

From the researcher's point of view, nurses with higher confidence directly develop positive attitudes toward AI use. Challenges do not completely block the effect of self-efficacy; instead, both factors together shape attitudes. This reflects real-world complexity where personal skills and systemic barriers interact. These findings align with **Bandura's (1997)** self-efficacy theory, suggesting confidence enhances adaptability to new technologies. Similarly, **Li et al. (2023)** confirmed that self-efficacy strongly predicts AI adoption, even when challenges exist. On the other hand, some studies disagree: **Emon et al. (2025)** argued that challenges fully mediate the relationship, diminishing the direct effect of self-efficacy. Likewise, **Johnson and Patel (2023)** found no significant mediating effect, suggesting contextual factors such as institutional support play a stronger role.

This study has several strengths, including the use of a relatively large sample size representing nursing students across all four academic levels, which enhances the generalizability of the findings within the study setting. Furthermore, the comprehensive understanding of both direct and indirect effects provides valuable insights into the mediating role of AI challenges. Another notable strength is that the study focused on nursing students, an underexplored population in the context of AI adoption, thereby contributing to the limited body of knowledge in this field. However, some limitations should be acknowledged. The use of convenience sampling may have introduced selection bias, while the cross-sectional design restricts the ability to infer causal relationships among AI attitude, AI challenges, and self-efficacy. Additionally, the study was also limited to a single institution, which may reduce the generalizability of the results to other settings with different educational and technological infrastructures.

Conclusion

The study concluded that fostering positive attitudes toward AI and addressing perceived challenges are essential for improving nursing students' self-efficacy. By reducing technical, ethical, and security concerns through targeted training and support, educators can maximize the benefits of AI utilization and strengthen nursing students' confidence in applying AI in their academic and clinical practices.

Implication

The findings of this study have important practical implications for nursing education

1. Develop and communicate clear institutional policies on AI use in academics, ensuring students understand expectations and boundaries.

2. Emphasize AI's role in augmenting clinical judgment, rather than replacing it, to alleviate fears and promote confident use.

3. Provide supportive guidance from faculty members how model effective AI use, address student concerns, and foster a positive learning environment.

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