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Writing Ability and Critical Thinking Among Nursing Students Using AI-Assisted Learning Versus Independent Writing: A Comparative Cross-Sectional Study in a Selected Nursing College of Kanpur, Uttar Pradesh, India.

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Abstract

Background: Artificial intelligence (AI) tools are increasingly used by nursing students for academic writing, raising questions about their effect on writing ability and critical thinking. This study aimed to compare writing ability and critical thinking between nursing students using AI-assisted learning and those practising independent writing.

Methodology: A comparative cross-sectional study was conducted among 60 third-year B.Sc. Nursing students at Regency Institute of Nursing, Kanpur, Uttar Pradesh, India, from January 2026 to March 2026. Participants were selected by systematic random sampling, classified by self-reported writing practice into an AI-assisted learning group (Group A, n = 30) and an independent writing group (Group B, n = 30). Each participant wrote a 500–700-word essay, which was scored using investigator-developed, expert-validated rubrics for writing ability and critical thinking (0–25 each). Data were analysed using frequencies, percentages, means, standard deviations and the independent samples t-test at a 0.05 level of significance.

Results: Most participants were aged 21–23 years (68.3%), female (90.0%) and daily users of AI tools (61.7%). Excellent or good writing ability was observed in 73.3% of Group A and 23.3% of Group B, and excellent or good critical thinking in 56.7% and 10.0%, respectively. Group A had significantly higher mean writing ability scores (18.00 ± 3.64 vs 13.16 ± 3.53; $t = 5.20$, $df = 58$, $p < 0.001$) and critical thinking scores (16.50 ± 3.90 vs 11.00 ± 3.78; $t = 5.55$, $df = 58$, $p < 0.001$). The null hypothesis was rejected.

Conclusion: Nursing students using AI-assisted learning demonstrated significantly better writing ability and critical thinking than those practising independent writing, particularly in clarity of language, organisation and logical flow.

Recommendation: Nursing institutions should integrate AI tools in a guided and ethical manner that supports, rather than replaces, independent reasoning. Multicentre longitudinal studies assessing originality and long-term competence are recommended.

Keywords: *Artificial intelligence; Critical thinking; Cross-sectional studies; Nursing education; Nursing students; Writing ability*

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1. Introduction

The goal of nursing education is to equip students with the knowledge, skills and professional competencies required to provide safe and effective patient care. Writing proficiency and critical thinking are among the most important of these competencies because they underpin professional communication, clinical decision-making and academic performance. Nursing students are expected to demonstrate these abilities through written assignments, clinical documentation, reflective writing and research activities (1). Critical thinking is a fundamental component of nursing education on which clinical decision-making, problem-solving and the prioritisation of patient care depend. It involves the capacity to apply logical reasoning, appraise evidence and analyse information in both academic and clinical contexts (2,3). Writing exercises contribute to the development of critical thinking because they require students to organise concepts, synthesise information and articulate clinical judgements clearly (2).

In recent years, artificial intelligence (AI) has become a powerful instrument in education. AI-assisted learning tools are increasingly used by students to support academic writing by offering grammar correction, content organisation, idea generation and instant feedback (4,6). When used appropriately, these tools may improve writing efficiency, language accuracy and engagement with academic tasks (4,8). However, concerns have been raised that excessive reliance on AI may compromise originality,

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academic integrity and the capacity for independent thought and critical reasoning (9,10).

Most existing research on AI in education has been conducted outside health disciplines and has focused on learning efficiency rather than on core nursing competencies such as professional judgement and critical thinking (4,6,8). Comparative evidence on the writing practices of nursing students who use AI-assisted learning and those who write independently is limited, particularly within the Indian nursing education system (5,7). Such evidence is needed to guide nursing educators, curriculum planners and administrators in integrating AI ethically and effectively into nursing education.

1.1 Objectives of the study

1. To assess writing ability and critical thinking among nursing students using AI-assisted learning in a selected nursing college of Kanpur, Uttar Pradesh.
2. To assess writing ability and critical thinking among nursing students practising independent writing in a selected nursing college of Kanpur, Uttar Pradesh.
3. To compare writing ability and critical thinking between nursing students using AI-assisted learning and those practising independent writing.

1.2 Hypotheses

1. **H_1:** There is a significant difference in mean writing ability and critical thinking scores between nursing students using AI-assisted learning and those practising independent writing at the 0.05 level of significance.
2. **H_0:** There is no significant difference in mean writing ability and critical thinking scores between nursing students using AI-assisted learning and those practising independent writing at the 0.05 level of significance.

2. Methods and Materials

2.1 Study design and approach

A quantitative research approach with a comparative cross-sectional design was adopted. Writing ability and critical thinking were measured at a single point in time in two naturally occurring groups of students, those who habitually used AI-assisted learning tools for academic writing and those who wrote independently, and the two groups were compared. The study is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline for cross-sectional studies (17).

2.2 Study setting and period

The study was conducted at Regency Institute of Nursing, Kanpur, Uttar Pradesh, India, a private nursing college affiliated to Atal Bihari Vajpayee Medical University, Lucknow, and recognised by the Indian Nursing Council and the Uttar Pradesh State Medical Faculty, offering General Nursing and Midwifery, B.Sc. Nursing and Post Basic B.Sc. Nursing programmes. This institution was purposively selected as the study site because of administrative feasibility and the availability of an adequate number of third-year students. Data were collected from January 2026 to March 2026.

2.3 Population

The target population comprised all third-year B.Sc. Nursing students enrolled in nursing colleges of Kanpur, Uttar Pradesh. The accessible population comprised third-year B.Sc. Nursing students of Regency Institute of Nursing, Kanpur, who were present during the data-collection period and fulfilled the eligibility criteria.

2.4 Eligibility criteria

Students were included if they were enrolled in the third year of the B.Sc. Nursing programme at the study institution, were present on the day of data collection, were able to read and write in English, and gave written informed consent. For allocation to Group A, students had to report regular use (at least weekly) of AI-assisted tools such as ChatGPT, Gemini, Grammarly or similar applications for academic writing during the preceding six months; for allocation to Group B, students had to report that they did not use AI tools for academic writing and completed their assignments independently. Students were excluded if they were absent on the day of the writing assessment, had been involved in the pilot study, could not be clearly classified into either group (for example, occasional or one-time users), or did not complete the essay.

2.5 Sample size estimation

The sample size was estimated using the formula for comparing two independent means (15):

$$n = 2\,(Z\alpha/2 + Z\beta)^2\,\sigma^2 / d^2$$

where n is the required sample size per group, $Z\alpha/2 = 1.96$ for a two-sided 5% level of significance, $Z\beta = 0.84$ for 80% power, $\sigma = 3.6$, the anticipated pooled standard deviation of rubric scores obtained in the pilot study, and $d = 3$, the minimum difference in mean score (out of 25) considered educationally meaningful. Substituting these values, $n = 2 \times (2.80)^2 \times (3.6)^2 / (3)^2 = 22.6$, which was rounded up to 23 per group. Allowing for approximately 25% non-response or incomplete essays, the final sample size was fixed at 30 per group, giving a total of 60 participants.

2.6 Sampling technique and group allocation

A screening questionnaire on AI-tool use for academic writing was first administered to all eligible third-year students, and each respondent was classified as either an AI-assisted learner or an independent writer. Separate sampling frames were then prepared for the two groups by arranging names in order of university roll number. Systematic random sampling was applied within each frame: the sampling interval (k) was calculated by dividing the number of students in the frame by the required sample size (k =

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N/n), a random starting number between 1 and k was selected by lottery, and every k^{th} student was selected thereafter until 30 students had been selected for Group A (AI-assisted learning) and 30 for Group B (independent writing). In total, 112 students were screened; 64 were classified as AI-assisted learners ($k \approx 2$) and 38 as independent writers ($k \approx 1$), and 10 could not be clearly classified.

2.7 Study variables

The grouping variable was the students' writing practice (AI-assisted learning versus independent writing). The outcome variables were writing ability and critical thinking, measured as rubric scores. The socio-demographic variables were age, gender, religion, marital status, frequency of AI-tool use for learning, and source of information about AI tools.

2.8 Data-collection instrument

The instrument was developed by the investigators after an extensive review of the literature on artificial intelligence in education, writing ability and critical thinking (1–5). Content validity was established by seven experts in nursing education and research methodology, and their suggestions were incorporated into the final version. The instrument consisted of four sections.

Section A: Socio-demographic profile. This section recorded age, gender, religion, marital status, frequency of AI-tool use for learning, and source of information about AI tools.

Section B: Structured writing task. Each participant wrote an essay of 500–700 words on the topic "Women Empowerment". The same topic, instructions and time limit were applied to all participants.

Section C: Writing ability rubric. The essay was scored on five criteria: clarity and correctness of language; organisation and structure; coherence and logical flow; relevance and adequacy of content; and appropriate use of vocabulary and conventions. Each criterion was rated from 0 to 5, giving a total score of 0–25.

Section D: Critical thinking rating scale. The same essay was rated on five criteria: analysis of the issue; evaluation of evidence and viewpoints; logical reasoning and inference; relevance to nursing and clinical practice with a clear rationale; and originality of ideas and conclusions. Each criterion was rated from 0 to 5, giving a total score of 0–25.

For both Sections C and D, total scores were categorised as excellent (21–25), good (16–20), average (11–15), poor (6–10) and very poor (0–5). The reliability of the rubrics was established during the pilot study using inter-rater reliability (intraclass correlation coefficient = 0.86), and the instrument was found to be reliable.

2.9 Pilot study

A pilot study was conducted among six third-year B.Sc. Nursing students who were not included in the main study, to assess the clarity of the instrument, the feasibility of the procedure and the time required. No major modifications were needed.

2.10 Data-collection procedure

After obtaining ethical approval and administrative permission from the Principal of Regency Institute of Nursing, the investigators explained the purpose of the study to eligible students and obtained written informed consent. The screening questionnaire was administered and the participants were selected as described above. Section A was completed by each participant. The essay (Section B) was then written in a classroom under the supervision of the investigators within 60 minutes; mobile phones and internet-enabled devices were not permitted, so that the essay reflected each student's own writing and thinking. Completed essays were coded with an identification number and scored using Sections C and D.

2.11 Efforts to address bias

Several measures were taken to minimise bias. Selection bias was reduced by using clearly defined group criteria and systematic random sampling within each group. Information and performance bias were reduced by giving both groups the same essay topic, instructions, setting and time limit, and by conducting the task under supervision. Measurement bias was reduced by using standardised, expert-validated rubrics; essays were coded so that the evaluator was unaware of the group to which each participant belonged, and a second evaluator independently scored a random 20% of the essays to check consistency. Social desirability bias in self-reporting AI use was reduced by assuring participants of confidentiality and that their responses would not affect their academic grades.

2.12 Ethical considerations

Ethical approval was obtained from the Institutional Ethics Committee, Rama University, Kanpur and administrative permission was obtained from the Principal of Regency Institute of Nursing, Kanpur. Written informed consent was obtained from all participants after the purpose, procedure, voluntary nature of participation and right to withdraw at any time without penalty had been explained. Confidentiality and anonymity were maintained by using identification codes, and the data were used only for research purposes. The study was conducted in accordance with the principles of the Declaration of Helsinki.

2.13 Statistical analysis

Data were entered in Microsoft Excel and analysed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Categorical variables (socio-demographic characteristics and levels of writing ability and critical

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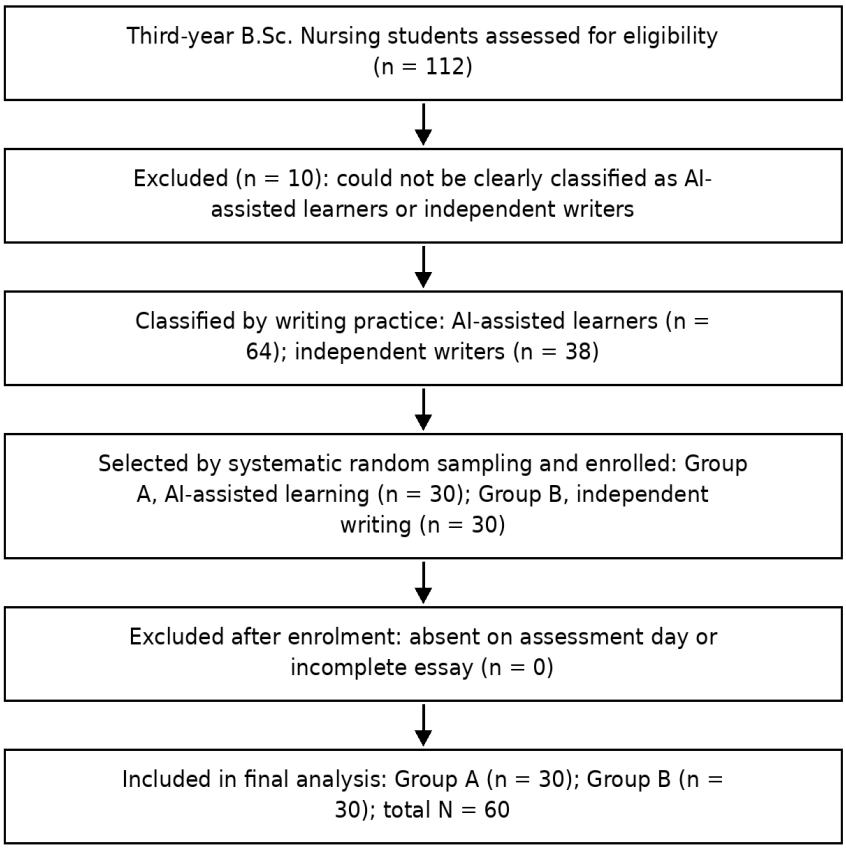
thinking) were presented as frequencies and percentages. Continuous variables (writing ability and critical thinking scores) were presented as means and standard deviations (SD). The normality of score distributions was checked with the Shapiro–Wilk test. Because the two groups comprised different, unrelated students, mean scores were compared using the independent samples t-test, and the mean difference with its 95% confidence interval (CI) and Cohen's d effect size (16) were calculated. A p-value of less than 0.05 was considered statistically significant.

3. Results

3.1 Participant flow

Figure 1

Flow diagram of participant screening, selection and analysis



As shown in Figure 1, 112 third-year students were assessed for eligibility, of whom 10 were excluded because their writing practice could not be clearly classified. From the remaining students, 30 were selected for each group. All 60 enrolled students completed the essay, and all were included in the final analysis.

3.2 Socio-demographic characteristics

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Table 1

Socio-demographic characteristics of the participants (N = 60)

Variable	Category	n	%
Age (years)	21–23	41	68.3
	Other age groups	19	31.7
Gender	Female	54	90.0
	Male	6	10.0
Religion	Hindu	56	93.3
	Others	4	6.7
Marital status	Unmarried	59	98.3
	Married	1	1.7
Frequency of AI-tool use for learning	Daily	37	61.7
	Less than daily	23	38.3
Source of information about AI tools	Social media	24	40.0
	Other sources	36	60.0

Table 1 shows that more than two-thirds of the participants (68.3%) were aged 21–23 years, and the vast majority were female (90.0%), Hindu (93.3%) and unmarried (98.3%). Most participants (61.7%) reported using AI tools for learning daily, and social media was the most common single source of information about AI tools (40.0%).

3.3 Writing ability in the two groups

Table 2

Distribution of writing ability levels in the AI-assisted learning and independent writing groups

Level of writing ability (score)	Group A n	Group A %	Group B n	Group B %
Excellent (21–25)	8	26.7	0	0.0
Good (16–20)	14	46.7	7	23.3
Average (11–15)	8	26.7	18	60.0
Poor (6–10)	0	0.0	4	13.3
Very poor (0–5)	0	0.0	1	3.3
Total	30	100.0	30	100.0

Group A, AI-assisted learning (n = 30); Group B, independent writing (n = 30). Percentages may not total 100 because of rounding.

Table 2 shows that in Group A, 26.7% of students had excellent, 46.7% good and 26.7% average writing ability, and none had poor or very poor writing ability. In Group B, no student had excellent writing ability; 23.3% had good, 60.0% average, 13.3% poor and 3.3% very poor writing ability. Thus, 73.3% of Group A compared with 23.3% of Group B achieved excellent or good writing ability.

3.4 Critical thinking in the two groups

Table 3

Distribution of critical thinking levels in the AI-assisted learning and independent writing groups

Level of critical thinking (score)	Group A n	Group A %	Group B n	Group B %
Excellent (21–25)	5	16.7	0	0.0
Good (16–20)	12	40.0	3	10.0
Average (11–15)	12	40.0	14	46.7
Poor (6–10)	1	3.3	11	36.7
Very poor (0–5)	0	0.0	2	6.7
Total	30	100.0	30	100.0

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Group A, AI-assisted learning (n = 30); Group B, independent writing (n = 30). Percentages may not total 100 because of rounding.

Table 3 shows that in Group A, 16.7% of students had excellent, 40.0% good, 40.0% average and 3.3% poor critical thinking. In Group B, no student had excellent critical thinking; 10.0% had good, 46.7% average, 36.7% poor and 6.7% very poor critical thinking. More than half of Group A (56.7%) but only one in ten students in Group B (10.0%) had excellent or good critical thinking, whereas 43.4% of Group B had poor or very poor critical thinking.

3.5 Comparison of mean scores between the groups

Table 4

Comparison of mean writing ability and critical thinking scores between the AI-assisted learning and independent writing groups (N = 60)

Outcome	Group	n	Mean ± SD	Mean difference (95% CI)	t	df	p-value	Cohen's d
Writing ability	Group A	30	18.00 ± 3.64	4.84 (2.99 to 6.69)	5.20	58	< 0.001	1.35
	Group B	30	13.16 ± 3.53					
Critical thinking	Group A	30	16.50 ± 3.90	5.50 (3.52 to 7.48)	5.55	58	< 0.001	1.43
	Group B	30	11.00 ± 3.78					

Independent samples t-test; maximum possible score for each outcome = 25. Group A, AI-assisted learning; Group B, independent writing; SD, standard deviation; CI, confidence interval; df, degrees of freedom.

Table 4 shows that the mean writing ability score of Group A (18.00 ± 3.64) was higher than that of Group B (13.16 ± 3.53), with a mean difference of 4.84 points ($t = 5.20$, $df = 58$, $p < 0.001$). Similarly, the mean critical thinking score of Group A (16.50 ± 3.90) was higher than that of Group B (11.00 ± 3.78), with a mean difference of 5.50 points ($t = 5.55$, $df = 58$, $p < 0.001$). Both differences were statistically significant and represented large effect sizes (Cohen's $d > 0.8$). Therefore, H1 was accepted and H0 was rejected.

4. Discussion

4.1 Key results

This comparative cross-sectional study compared writing ability and critical thinking between third-year B.Sc. Nursing students who used AI-assisted learning and those who practised independent writing. The participants were predominantly young (21–23 years), female, Hindu and unmarried, and most used AI tools daily, mainly learning about them through social media (Table 1). In relation to the first objective, nearly three-quarters of students using AI-assisted learning had excellent or good writing ability and more than half had excellent or good critical thinking (Tables 2 and 3). In relation to the second objective, most students practising independent writing had average writing ability, and almost half had poor or very poor critical thinking (Tables 2 and 3). In relation to the third objective, students using AI-assisted learning scored significantly higher than independent writers in both writing ability and critical thinking, with large effect sizes (Table 4).

4.2 Interpretation and comparison with previous literature

The high frequency of daily AI-tool use (Table 1) reflects the rapid adoption of generative AI among health-professions students. Reviews of AI in higher education and health-care education have described students' widespread use of these tools for drafting, editing and summarising content, often learned informally rather than through structured instruction (4,11). The finding that social media was the most common source of information about AI tools suggests that most students have not received formal guidance on appropriate use, a gap also highlighted by nursing educators (10,12).

The higher writing ability scores of the AI-assisted learning group (Tables 2 and 4) may be explained by repeated exposure to well-structured, grammatically accurate text and to the immediate feedback that AI tools provide on language, organisation and coherence. Previous reviews have reported that AI applications can provide individualised feedback and scaffolding that improve the quality and organisation of student writing (4,6,9). Because the essay in the present study was written under supervision without AI support, the difference suggests that habitual AI-assisted learning may have helped students internalise conventions of clarity, structure and logical flow that they could reproduce independently. The absence of poor or very poor writing in the AI-assisted group is consistent with the view that AI tools can act as a supportive scaffold for students with weaker language skills (8,11).

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The higher critical thinking scores of the AI-assisted group (Tables 3 and 4) are less expected, because concerns have been widely expressed that AI may encourage cognitive offloading and reduce independent reasoning (13,14). Zhai and colleagues concluded in a systematic review that over-reliance on AI dialogue systems may impair decision-making, critical thinking and analytical reasoning (13), and Gerlich reported a negative association between frequent AI-tool use and critical thinking, mediated by cognitive offloading (14). The present findings do not necessarily contradict these reports. When AI is used interactively, to question, compare viewpoints and refine arguments, it can model reasoning that students subsequently apply (9,12). In addition, the rubric criteria for analysis, logical reasoning and clinical rationale may partly overlap with the structural and expressive qualities that AI-assisted learners had strengthened. It is also possible that students who adopt AI tools are more academically engaged or digitally literate, which may independently contribute to their higher scores.

At the same time, the findings should not be interpreted as evidence that AI tools should replace independent writing. Originality, depth of personal reflection and the risk of academic misconduct were not directly measured, and these remain the most frequently cited concerns about AI use in nursing education (10,11,12). Nursing students must ultimately be able to reason independently at the bedside, where AI support may not be available. The results therefore support a balanced position: guided, transparent and ethical use of AI as a learning aid, combined with deliberate opportunities for independent writing and reflection that build critical thinking (2,5,10).

4.3 Generalisability

The study was conducted in a single private nursing college in Kanpur, with a small sample of third-year students who were predominantly female, Hindu and unmarried. The findings may therefore be generalised only cautiously to third-year B.Sc. Nursing students in similar institutions in northern India. They may not apply to students in other years of study, to government institutions, to institutions with different policies on AI use, or to postgraduate and diploma nursing programmes. The use of a single, general essay topic rather than a clinical writing task further limits the extent to which the findings can be generalised to clinical documentation and clinical reasoning.

4.4 Limitations

1. The cross-sectional design measured outcomes at a single point in time and cannot establish a causal relationship between AI-assisted learning and writing ability or critical thinking; the observed differences may reflect pre-existing differences between the groups.
2. Group membership was based on self-reported AI use, which is subject to recall and social desirability bias. Misclassification of participants would most likely reduce the observed difference between the groups.
3. Participants were not randomly assigned to groups, and potential confounders such as previous academic performance, English language proficiency and digital literacy were not measured or adjusted for. This selection bias may have inflated the difference in favour of the AI-assisted group.
4. The investigator-developed rubrics, although expert-validated, have not been externally standardised, and the use of a single essay topic ("Women Empowerment") may not fully capture clinical reasoning. This may introduce measurement bias and limit comparability with studies using standardised instruments.
5. The small sample size from a single institution reduces the precision of the estimates, as reflected in the width of the confidence intervals, and limits external validity.
6. Originality, plagiarism and the quality of reasoning in AI-assisted assignments were not assessed, so the study cannot address concerns about academic integrity.

5. Conclusion

Third-year B.Sc. Nursing students who used AI-assisted learning demonstrated significantly better writing ability and critical thinking than those who practised independent writing, with large differences in clarity of language, organisation, logical flow and clinical reasoning. Students practising independent writing more often produced essays with limited clarity, weaker structure and minimal clinical relevance. These findings suggest that, when used as a supportive learning aid rather than as a substitute for students' own effort, AI tools may strengthen academic writing and reasoning skills. Because originality and long-term competence were not assessed, AI-assisted learning should be integrated thoughtfully and under supervision.

6. Recommendations

6.1 Implications for nursing education and practice

1. Nursing institutions should develop clear policies on the ethical and transparent use of AI tools in academic writing, including requirements for disclosure of AI assistance.
2. Nurse educators should incorporate structured training in AI literacy, so that students learn to use AI for feedback, revision and idea exploration rather than for generating complete assignments.
3. Curricula should continue to include supervised independent writing, reflective journals and case-based clinical reasoning exercises, so that students develop critical thinking that does not depend on AI.

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4. Faculty should provide additional support in academic writing to students who do not use AI tools, many of whom showed average or poor writing ability.

6.2 Suggestions for future research

1. Multicentre studies with larger samples, including government and private institutions and students from all years of study, should be conducted to improve generalisability.
2. Longitudinal and experimental (randomised controlled) studies should be undertaken to establish whether AI-assisted learning causes improvement in writing ability and critical thinking over time.
3. Future studies should use standardised critical thinking instruments, clinical writing tasks and assessments of originality and plagiarism, and should adjust for confounders such as prior academic performance and language proficiency.
4. Qualitative studies exploring students' and teachers' experiences of AI-assisted learning would provide insight into how AI tools are actually used in nursing education.

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List of abbreviations

AI – Artificial intelligence
B.Sc. – Bachelor of Science
CI – Confidence interval
df – Degrees of freedom
H0 – Null hypothesis
H1 – Research (alternative) hypothesis
IEC – Institutional Ethics Committee
SD – Standard deviation
SPSS – Statistical Package for the Social Sciences
STROBE – Strengthening the Reporting of Observational Studies in Epidemiology
U.P. – Uttar Pradesh

Conflict of interest

The authors declare that they have no conflict of interest.

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Data availability

The data supporting the findings of this study are not publicly available to protect participant confidentiality, but are available from the corresponding author upon reasonable request.

Author contributions

Manisha Kumari: Conceptualisation, Investigation, Data curation, Writing – original draft.
Mansi Pal: Methodology, Investigation, Data curation, Writing – original draft.
Mohini: Investigation, Formal analysis, Visualisation, Writing – review & editing.
Muskan Bano: Investigation, Resources, Writing – review & editing.
Muskan Pal: Investigation, Validation, Writing – review & editing.
Sneha Dixit: Conceptualisation, Methodology, Supervision, Project administration, Formal analysis, Writing – review & editing.
All authors read and approved the final manuscript.

Author biography

Manisha Kumari, Mansi Pal, Mohini, Muskan Bano and Muskan Pal are B.Sc. Nursing students at Rama College of Nursing, Rama University, Kanpur, Uttar Pradesh, India. This study was undertaken as part of their undergraduate nursing research project. Their research interests include nursing education, educational technology and the role of artificial intelligence in learning.

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