

Original Research Article

Effectiveness of an interactive Zotero training session on knowledge and practice of reference management among nursing students in selected institutions of Kamrup, Assam: a quasi-experimental study

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ABSTRACT

Background: Reference management software such as Zotero improves accuracy and efficiency of citation, yet many nursing students do not fully adopt such tools due to limited exposure and training. Objectives were to assess knowledge and practice regarding the compiling reference tool Zotero (CRTz), evaluate an interactive training session's effectiveness, and determine associations of post-test scores with demographic variables among nursing students.

Methods: A quasi-experimental, non-equivalent control group design was used. Two-hundred final-year nursing students (100 experimental, 100 control) from two institutions in Kamrup, Assam were enrolled by total enumerative sampling. The experimental group received a 30-minute interactive Zotero session; the control group received no intervention. A 15-item knowledge questionnaire and 20-item practice checklist were administered pre- and post-intervention and analysed using descriptive statistics, paired t-test and chi-square test ($p < 0.05$).

Results: At pre-test, most students showed poor-to-moderate knowledge and average practice in both groups. The experimental group showed a significant rise in mean knowledge (5.34 ± 2.31 to 8.97 ± 2.32 ; $t = 16.71$, $p < 0.001$) and practice (13.53 ± 4.41 to 17.01 ± 2.63 ; $t = 11.1$, $p < 0.001$), while the control group showed no significant change ($p > 0.05$). Post-test knowledge was significantly associated with age, religion and residence (experimental group) and gender (control group); post-test practice was significantly associated with prior tool knowledge (experimental group) and course type (control group).

Conclusions: A brief interactive session substantially improves nursing students' knowledge and practice regarding Zotero, supporting integration of structured, hands-on reference-management training into nursing curricula.

Keywords: Interactive teaching, Knowledge, Nursing students, Practice, Quasi-experimental study, Reference management, Zotero

INTRODUCTION

Accurate citation and systematic organisation of literature are fundamental to sound academic writing and research integrity. Open-source reference management tools such as Zotero allow students and researchers to collect, organise, cite and share research material, thereby reducing referencing errors and time spent on manual

bibliography preparation.¹⁻³ Globally, Zotero is reported to have more than six million registered users, reflecting steady adoption over the past five years; however, availability of the tool does not guarantee competent use.^{4,5} In India, academic reforms promoted by the University Grants Commission have increased emphasis on research and publication, yet structured training in citation software is not uniformly embedded in curricula.⁶

Surveys of Indian university students conducted between 2019 and 2023 indicate that fewer than half are adequately trained in reference management tools, and recent reports describe a persistent “competency gap” in which awareness of such tools exceeds the ability to perform advanced referencing tasks.^{7,8} In Assam, and specifically in the Kamrup district, formal instruction dedicated to Zotero remains uncommon, and many students continue to rely on manual referencing methods that increase the risk of citation error and plagiarism.⁹

Educational research consistently supports interactive, hands-on instructional strategies over passive lecture-based methods for building technical competency, as live demonstration and guided practice foster experiential learning and better retention.^{10,11} For nursing students in particular, who must produce dissertations and evidence-based project reports that meet standardised citation formats, strengthening digital literacy in reference management contributes directly to research quality, academic integrity and confidence.¹² Given the limited empirical evidence on nursing students’ knowledge and practice of Zotero in this region, a quasi-experimental design was chosen to generate localised, comparative evidence on the value of a structured interactive session.

The present study was therefore undertaken to assess baseline knowledge and practice regarding the compiling reference tool Zotero (CRTz), to evaluate the effectiveness of a single interactive training session in improving these outcomes, and to identify demographic correlates of post-test performance among final-year nursing students in selected institutions of Kamrup, Assam.

Objectives

To assess knowledge and practice regarding CRTz among students. To evaluate the effectiveness of an interactive session on CRTz among students. To determine the association between post-test knowledge score on CRTz and selected demographic variables. To determine the association between post-test practice score on CRTz and selected demographic variables.

Hypotheses

H₁: There is significant difference between pre-test and post-test knowledge and practice scores on CRTz. H₂: There is significant association between post-test knowledge and practice scores and selected demographic variables. All hypotheses were tested at the 0.05 level of significance.

METHODS

Study design and setting

A quantitative, quasi-experimental study using a non-equivalent control group (pre-test/post-test) design was

conducted at NEMCARE Institute of Nursing Sciences, Mirza (experimental) and Arya Nursing College, Kamrup (control), Assam, India, between June 2025 (pilot 18-21 June; main study 21-25 June 2025).

Participants and sampling

The accessible population comprised final-year B.Sc. Nursing and General Nursing and Midwifery (GNM) students present at the time of data collection. A total of 200 students were enrolled by total enumerative sampling: 100 from NEMCARE Institute of Nursing Sciences formed the experimental group and 100 from Arya Nursing College formed the control group. Students willing to participate were included; those previously sensitized to similar training or absent during data collection were excluded. A pilot study among 20 students at St. Martha Institute of Nursing, Guwahati, confirmed feasibility; these participants were excluded from the main study.

Intervention

The experimental group received a single 30-minute interactive session on CRTz comprising live demonstration, guided hands-on practice and discussion covering installation, collecting and organizing references, generating in-text citations and bibliographies, and exporting formatted reference lists. The control group received no intervention during the study period.

Instruments

Three researcher-developed tools were used: (1) a 10-item demographic proforma (age, gender, religion, residence, course, prior exposure to reference management tools, computer literacy level, frequency of internet use for academic purposes, access to a personal computer/laptop, and prior knowledge of the tool); (2) a 15-item structured knowledge questionnaire scored 1 for each correct response (total 15; 0-5 poor, 6-10 moderate, 11-15 good knowledge); and (3) a 20-item observational practice checklist scored 1 for each affirmative response (total 20; 0-7 poor, 8-14 average, 15-20 good practice). Content validity was established by five subject experts, and reliability was determined among 20 students by Spearman’s rank correlation coefficient (knowledge questionnaire $r=0.91$; practice checklist $r=0.86$).

Data collection procedure

Following institutional ethical clearance and administrative permission, and after obtaining oral and written informed consent, both groups completed the demographic proforma, knowledge questionnaire and practice checklist as a pre-test. The experimental group then received the interactive session, after which both groups completed identical post-test knowledge and practice instruments. Each assessment took 15-20 minutes

per student, and the intervention took approximately 30 minutes.

Ethical considerations

Institutional ethical approval was obtained from the ethics committee of NEMCARE Institute of Nursing Sciences. Administrative permission was obtained from the principals of both participating institutions. Written informed consent was obtained from all participants, voluntary participation and confidentiality were assured, and data were anonymized prior to analysis.

Statistical analysis

Data were analysed using descriptive statistics (frequency, percentage, mean, standard deviation) and inferential statistics (paired t-test for within-group pre-post comparison; chi-square test for association between post-test scores and demographic variables), with significance set at $p < 0.05$.

RESULTS

Sample characteristics

Of 200 participants, the majority in both the experimental and control groups were aged 21-22 years (68% and 48%, respectively) and female (93% and 79%). In the experimental group, 68% were Hindu, 76% resided in urban areas, 52% were enrolled in B.Sc. Nursing, 64% had no prior exposure to reference management tools, 71% reported basic computer literacy, 65% used the internet daily for academic purposes, 58% had personal computer/laptop access, and 78% had no prior knowledge of the reference tool before the session. Corresponding control-group figures were 61% Hindu, 36% urban residence, 56% B.Sc. Nursing, 74% no prior exposure, 69% basic computer literacy, 63% daily internet use, 46% personal computer/laptop access and 61% no prior tool knowledge (Table 1).

Table 1: Frequency and percentage distribution of selected demographic variables of students (experimental group n=100, control group n=100).

Demographic variables	Experimental (%)	Control (%)
Age (years)		
<19	1 (1)	1 (1)
19-20	12 (12)	18 (18)
21-22	68 (68)	48 (48)
>22	19 (19)	33 (33)
Gender		
Male	7 (7)	21 (21)
Female	93 (93)	79 (79)
Religion		
Hindu	68 (68)	61 (61)
Muslim	24 (24)	24 (24)
Christian	8 (8)	15 (15)
Residence		
Urban	76 (76)	36 (36)
Rural	24 (24)	64 (64)
Course		
B.Sc. Nursing	52 (52)	56 (56)
GNM	48 (48)	44 (44)
Prior tool exposure		
Yes	36 (36)	26 (26)
No	22 (22)	39 (39)

Table 2: Pre-test knowledge and practice levels of experimental and control groups.

Group	Domain	Poor (%)	Moderate/Average (%)	Good (%)	Mean±SD
Experimental	Knowledge	52 (52)	44 (44)	4 (4)	5.34±2.31
Control	Knowledge	36 (36)	49 (49)	15 (15)	6.37±3.61
Experimental	Practice	7 (7)	56 (56)	37 (37)	13.53±4.41
Control	Practice	15 (15)	43 (43)	42 (42)	12.49±5.08

Table 3: Pre-test to post-test comparison of knowledge and practice scores (paired t-test).

Group	Domain	Pre-test Mean±SD	Post-test Mean±SD	t (df=99)	P value
Experimental	Knowledge	5.34±2.31	8.97±2.32	16.71*	<0.001
Control	Knowledge	6.37±3.61	6.74±3.19	0.77 NS	0.445
Experimental	Practice	13.53±4.41	17.01±2.63	11.1*	<0.001
Control	Practice	12.49±5.08	12.76±4.80	0.37 NS	0.712

*Significant at $p < 0.05$; NS = not significant.

Table 4: Association of post-test knowledge and practice scores with demographic variables (chi-square test).

Group	Outcome	Significant variable(s)	χ^2	P value
Experimental	Knowledge	Age	28.89	<0.05
Experimental	Knowledge	Religion	15.20	0.01
Experimental	Knowledge	Residence	7.75	0.02
Control	Knowledge	Gender	24.95	<0.001
Experimental	Practice	Prior knowledge of tool	74.37	<0.05
Control	Practice	Course type	17.15	<0.001

No other demographic variable showed a statistically significant association ($p > 0.05$) in either group.

Table 5: Study instruments: content, scoring and reliability.

Tool	Items	Scoring/categories	Reliability
Demographic proforma	10	Not applicable	Not applicable
Structured knowledge questionnaire	15	0-5 poor, 6-10 moderate, 11-15 good	Spearman $r=0.91$
Observational practice checklist	20	0-7 poor, 8-14 average, 15-20 good	Spearman $r=0.86$

Pre-test knowledge and practice

At pre-test, 52% of the experimental group and 36% of the control group had poor knowledge, while 44% and 49%, respectively, had moderate knowledge (mean±SD: 5.34±2.31 versus 6.37±3.61). For practice, 7% of the experimental group and 15% of the control group had poor practice, with the majority in both groups showing average-to-good practice (mean±SD: 13.53±4.41 versus 12.49±5.08) (Table 2).

Effectiveness of the interactive session

In the experimental group, mean knowledge score rose from 5.34±2.31 at pre-test to 8.97±2.32 at post-test (paired $t=16.71$, $df=99$, $p < 0.001$), and mean practice score rose from 13.53±4.41 to 17.01±2.63 (paired $t=11.1$, $df=99$, $p < 0.001$). In the control group, neither knowledge (6.37±3.61 to 6.74±3.19; $t=0.77$, $p=0.445$) nor practice (12.49±5.08 to 12.76±4.80; $t=0.37$, $p=0.712$) changed significantly. These results support hypothesis H_1 for the experimental group and indicate that the interactive session, rather than repeated testing alone, accounted for the improvement (Table 3).

Association with demographic variables

Chi-square analysis showed that post-test knowledge score was significantly associated with age ($\chi^2=28.89$, $p < 0.05$), religion ($\chi^2=15.20$, $p=0.01$) and residence ($\chi^2=7.75$, $p=0.02$) in the experimental group, and with

gender ($\chi^2=24.95$, $p < 0.001$) in the control group. Post-test practice score was significantly associated with prior knowledge of the reference tool before the session ($\chi^2=74.37$, $p < 0.05$) in the experimental group, and with course type ($\chi^2=17.15$, $p < 0.001$) in the control group. No other demographic variables showed a statistically significant association in either group (Table 4).

DISCUSSION

The present study demonstrates that a brief, single-session interactive intervention produced a statistically significant improvement in both knowledge and practice regarding the reference management tool Zotero among nursing students, whereas scores in the untrained control group remained essentially unchanged. This pattern is consistent with the broader literature on reference-management training. A study evaluating Zotero training reported that students who initially lacked awareness and skill in using reference management software showed marked improvement in knowledge and practical citation ability after structured training, mirroring the shift from predominantly poor/moderate to predominantly moderate/good knowledge observed here.¹³

Similarly, an exploration of Zotero use among university students found that guided, structured exposure improved students' ability to organise references, generate citations and manage bibliographies, and that instructional support enhanced both practical skill and confidence-findings that parallel the rise in practice scores seen in the present

experimental group.¹⁴ A quasi-experimental evaluation of a hands-on reference-management workshop among postgraduate students likewise reported a statistically significant post-intervention improvement, reinforcing the conclusion that interactive, hands-on instruction is superior to passive or self-directed learning for teaching digital research tools, as reflected by the absence of significant change in this study's control group.¹⁵

The significant associations between post-test knowledge and age, religion and residence, and between post-test practice and prior exposure to the tool, echo earlier work showing that demographic and experiential factors-such as field of study or previous exposure to research software-shape how effectively students adopt citation tools.¹⁶ The particularly strong association between prior knowledge of the tool and post-test practice score suggests that even minimal pre-existing familiarity may amplify the benefit of a short structured session, an observation with direct implications for how such sessions are timed and targeted within a curriculum.¹⁷

These findings align with a wider body of evidence indicating that structured Zotero or citation-software training reduces referencing errors, improves bibliography accuracy and strengthens academic integrity across disciplines and educational levels, from undergraduate to postgraduate and health-science student populations.¹⁸⁻²⁴ Consistent with reports that awareness of digital tools often exceeds actual competency, the low proportion of students in both groups who reported prior exposure to reference management tools or prior knowledge of Zotero before the session underscores a persistent awareness-practice gap that structured, hands-on instruction can help close.^{25,26}

This study has some limitations. It was confined to nursing students at two institutions in a single district, which may limit generalisability to other disciplines or regions; the non-equivalent control group design, although appropriate given ethical and logistic constraints on randomisation in an academic setting, cannot fully exclude the influence of unmeasured confounders; and the sustainability of the observed gains beyond the immediate post-test was not assessed. Future studies should evaluate larger and more diverse samples, incorporate longer follow-up to determine retention of skills, and compare Zotero training with other citation-management software.³⁰

CONCLUSION

For nursing education specifically, these results support integrating brief, interactive reference-management sessions into research methodology components of the curriculum, since competency in tools such as Zotero directly supports evidence-based practice, reduces the burden of manual referencing during dissertation and project work, and fosters academic integrity.^{27,28} At the institutional level, facilitating access to computers and

reliable internet, and offering periodic refresher workshops for both students and faculty, may sustain the gains demonstrated here.²⁹

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