

# The Effect of Case-Based Learning on Nursing Students' Critical Thinking Skills Acquisition at Higher Educational Institutions in Northern Region of Malaysia

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DOI: <https://doi.org/10.47772/IJRISS.2026.100800645>

Received: 24 August 2026; Accepted: 29 August 2026; Published: 15 September 2026

## ABSTRACT

**Background:** Critical thinking skills (CTS) are fundamental to effective decision-making in emergency nursing. However, many nursing students continue to demonstrate inadequate levels of critical thinking skills competence.

**Objective:** This study aimed to examine the effectiveness of case-based learning (CBL) in enhancing nursing students' CTS acquisition in emergency nursing subject.

**Methods:** A quasi-experimental design with non-equivalent groups was conducted at two higher educational institutions located in Northern region of Malaysia. A total of 101 participants recruited with 50 in control group received didactic lectures (DL), while another 51 in experimental group took part in CBL. Critical thinking skills were assessed using a standardized multiple-choice CTS assessment tool.

**Results:** Results at baseline found most students demonstrated low to moderate levels of CTS in emergency nursing. Analysis of demographic factors on academic grade, prerequisite qualification, and nursing as a first-choice career found non-significant association with CTS acquisition. Following the intervention, students in the CBL group demonstrated significantly greater improvements in CTS compared to those in the DL group ( $p < .001$ ) with a significant effect size ( $d = 1.25$ ).

**Conclusions:** Overall, the findings suggest that CBL is a more effective and engaging pedagogical approach than traditional lecture method for enhancing critical thinking skills in emergency nursing education, regardless of students' academic background or career preference.

**Keywords:** Case-based learning; Critical thinking skills; Emergency nursing education; Didactic lecture; Nursing students; Quasi-experimental study

## INTRODUCTION

There has been growing recognition of the need for nursing students to develop strong critical thinking skills (CTS) in nursing training. These skills are not only vital for navigating today's competitive global healthcare environment but also for making sound clinical decisions that can directly impact patient care. Sound decision made by nursing students underpinned by their strong CTS, which serves as the foundation for effective nursing practice. CTS are essential competencies that must be developed among nursing students, particularly

those preparing to work in emergency care settings. Patients who seek emergency medical services often present with acute, complex, and life-threatening conditions that require nurses to perform rapid patient assessments, prioritize care based on severity, make accurate clinical judgments, deliver timely interventions. Nursing students are expected to integrate emergency nursing knowledge with sound clinical reasoning to ensure safe and effective patient care.

Despite the recognized importance of CTS in emergency nursing, it was observed that many final-year nursing students posted to emergency care units do not consistently demonstrate the level of CTS competence required in high-pressure clinical situations. The key factor contributing to this issue is the traditional structure of emergency nursing curricula, which emphasizes didactic, lecture-based teaching of topics in emergency and acute care curriculum. Although, this approach is effective for transmitting knowledge, but it provides limited opportunities for students to apply theory to practice or develop higher-order thinking skills. This drawback has been highlighted in a Malaysian study by Lee et al. (2020), which reported low levels of CTS among registered nurses due to the use of content-driven curricula that limit the development of thinking abilities. Similarly, studies by Luciani et al. (2020) and Zhang and Chen (2020) indicated that continued reliance on didactic lecture-based instruction restricts opportunities for in-depth reflection and collaborative learning, thereby hindering the development of CTS in nursing students.

This pedagogical limitation further reflected by students' itself during clinical experiences, where many of them reported difficulty in managing fast-paced emergency environments and prioritizing complex patient needs. Greenway et al. (2019) also noted that nurses often feel unprepared to care for patients with multiple comorbidities due to inadequate critical thinking abilities. This lack of confidence, closely associated with insufficient CTS, increases the risk of clinical errors. Supporting this concern, Gonzalez et al. (2020) reported that medication errors occurred in 88% of novice nurses, with approximately 30% of these errors attributed to deficiencies in critical thinking skills. These findings underscore the need for more active, student-centred, and practice-oriented teaching approaches in emergency nursing education. In this regard, CBL has gained increasing attention across health-related programmes, including nursing, medicine, and pharmacy, as well as in non-health disciplines. Evidence suggests that CBL has the potential to enhance students' academic performance, critical thinking skills, and self-confidence (Englund, 2020; Ma & Zhou, 2022). Nishal et al. (2022) further advocated CBL as an effective strategy for strengthening logical reasoning, analytical thinking, and clinical decision-making skills, making it a promising pedagogical approach for emergency nursing education.

However, despite substantial evidence supporting the superiority of CBL over traditional lecture-based methods (Vedi & Dulloo, 2021), findings in the literature remain inconsistent. Moreover, the theoretical evidences supporting the effectiveness of CBL teaching approach in improving CTS is evidently limited especially in the Malaysian emergency nursing context. Therefore, this study aims to provide evidence on the effectiveness of CBL in facilitating nursing students' acquisition of CTS in emergency nursing education based on Facione's Critical Thinking Model. Primarily, the objective of this study is to investigate the effect of CBL on CTS acquisition among nursing students, and specifically to assess their level of CTS on emergency nursing subject after CBL and DL intervention; comparing the effectiveness of intervention between control and experimental group, and lastly to examine any association between demographic factors and CTS acquisition. In addition, this study hypothesized that CBL was significantly more effective than DL in CTS acquisition; and lastly there was significant association between demographic factors on grade point average, prerequisite qualification, nursing as first-choice career and CTS acquisition.

## METHODOLOGY

### Research Design

This was a Quasi Experimental Design (QAD) conducted to measure the level of CTS acquisition among nursing students. The quantitative approach employed a non-equivalent control and experimental group with pretest and post-test design to examine the effectiveness of CBL on CTSs acquisition among nursing students that enrolled in the emergency nursing subject. The effectiveness of the CBL and DL teaching strategy was measured through a pretest and post-test assessment for the experimental and control group respectively.

## Study Setting

This study was conducted between January to December 2024 among final-year undergraduate nursing students at two higher educational institutions situated in the northern region of Malaysia.

## Population and Sample

The target population for this study consisted of semester 6 students in the final year of the Diploma in Nursing program who registered for an emergency nursing subject for the academic session of 2024. The accessible population comprised 107 students from two nursing institutions (College A = 54; College B = 53).

## Sample Size

The sample size for this study was calculated using the G \*Power 3.1 software (Erdfelder & Buchner, 1996). An independent sample t-test was applied with a significance level of  $\alpha = .05$ , a statistical power of 0.80, an allocation ratio of 1:1, and a medium effect size (Cohen's  $d = 0.5$ ). Based on these parameters' calculation, a minimum of 102 participants (51 per group) was required to achieve adequate statistical power in this study. It was recommended raising sample size to account for 10% expected attrition (Andrade, 2020), therefore, the final sample size calculated should be 112 participants (56 per group). Since the total number of available samples in this study was only 107 students (College A = 54; College B = 53), which is slightly lower than the calculated final sample size. Thus, the study included all the 107 eligible participants in the study to maximize adequate representation of the target population.

## Sampling Method

A non-probability total population sampling method was employed. This decision was made in consideration to the limited number of nursing students enrolled to the emergency nursing program. Total population sampling is an appropriate technique when the population is small and participants possess specific skills or experiences relevant to the research (Etikan, 2016). The inclusion criteria for the study are (a) nursing student enrolled in the diploma in nursing program in the school of nursing at the selected institution (b) final year Diploma nursing students that enrolled for emergency nursing course (c) no previous experience in CBL model (d) nursing students who agreed to participate as voluntarily participants. The exclusion criterion includes (a) students that involved in the pilot study (b) refused to participate. Participants from College A ( $n = 50$ ) were assigned to the control group, while participants from College B ( $n = 51$ ) were assigned to the experimental group.

## Research Procedure

The research procedure for this study was conducted in two phases. The first phase involved the development and validation of educational materials and research instruments. This included adapted and adopted five case scenarios; evaluating the content validity of the educational materials using the Content Validity Index (CVI) and S-CVI (Yusoff, 2019); constructing 50 MCQs based on facione's CT model, using a table of specifications; conducting pre-testing of all instruments to evaluate reliability and validity, including test-retest for the CT multiple-choice test. The second phase involved the implementation of the QAD study through three main steps including pretest, intervention, and post-test. A pretest was conducted for both the intervention and control groups to assess their baseline level of CTS for the emergency nursing course. The pretest for both groups was carried out 1 week before the intervention commencement. The pretest conducted about 90 minutes physically in the examination room.

For educational intervention, preparation of the facilitator for CBL was necessary. Two facilitators facilitated the role-play activity for the case scenario in the simulation ward. Students were prepared for the CBL session by first being introduced to the concept and purpose of CBL. Following the preparation of students and facilitator, the intervention group participated in a structured CBL programme in which students were divided into small groups of 14–15 and engaged in discussions based on case scenarios related to acute emergency conditions. Toward the end, a debriefing session was held by facilitators to address the gaps that the students

demonstrated in their behaviours, knowledge, and skills during the emergency management. For intervention with didactic lecture in control group, five emergency nursing topics were delivered to nursing students over 5 sessions in control group following the emergency nursing teaching curricula. The topic selection for the DL was the same as for the CBL instructional sessions. Upon completion of educational interventions, both groups of participants were undertaking a post-test assessment in the seventh week. The post-test was physically administered for about 90-minutes. The reason for the six-week gap between the pretest and post-test was intended to prevent students from memorizing the pretest assessments. The post-test questions were similar to pretest assessment.

## Research Instrument

The research instruments used in this study consisted of two sections. Section A consists of 7 items on demographic profile and Section B contains 50 items in Multiple Choice Questions (MCQs) focused on the five key CTi (critical thinking indicator) namely interpretation, analysis, inference, evaluation, and explanation with each CTi was represented by ten items. Each MCQs has four response options (A, B, C, and D) with one single correct answer. Scoring is determined by the total number of correct answers. Each correct answer was awarded one point while incorrect responses were given zero point. The maximum score for the test is 50 points which was subsequently converted into hundred percentage for easier interpretation. The final percentage score is categorized into three levels as high, moderate and low level of CTS according to the Insight Assessment (2017) criteria with high-level of CTS when the score is above 75%, the moderate level when the score is around 50-74%, and the low level when the score is below 49%.

## Validity and Reliability

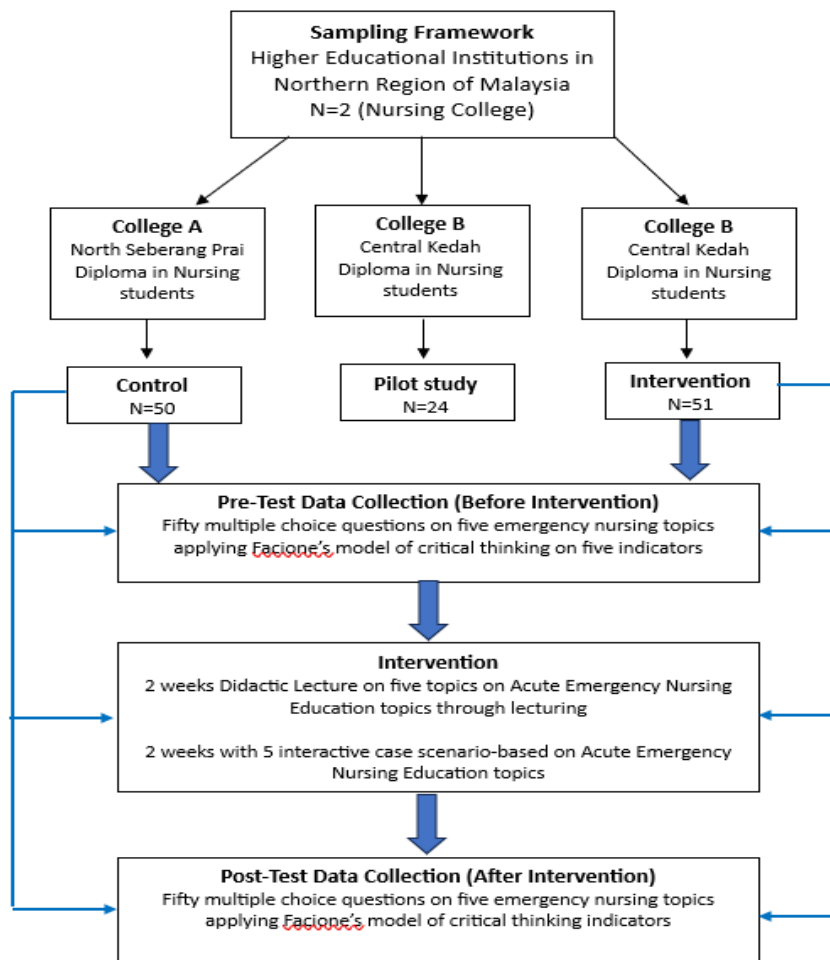
In this study, validity of CT test underwent content validity, face validity, and finally a pilot study.

Since the instruments were developed in the English language, translation was not required as the participants in this study were proficient in English. However, two English language experts were engaged to review the wording in the instrument that was accurate and easily understood for the respondents. A pilot study was conducted after obtaining approval from the Research Ethics Committee at College A. Based on 10% of the sample calculation as recommended (Ying et al., 2025) of total sample size of 101 participants, the requirement number respondents equate to eleven respondents. However, the study opted to follow a more conservative approach by selecting 24 respondents for the pilot study. A pretest was administered to assess the baseline level of CTS. Upon completion of the pretest, the participants from the pilot study were divided randomly into two groups with twelve participants respectively in each group. The intervention was conducted over three weeks, utilizing five case scenarios that were tailored to the emergency nursing course. Each case scenario was conducted over two hours face to face discussions and role-playing activities. The discussion was carried out for an hour in the nursing classroom, followed by an hour of role play in the clinical skill lab with use of stimulation mannequin. After completion of the CBL and didactic lecture intervention, the participants were given a post-test. Reliability test was conducted on the pilot study data and the Cronbach's alpha was 0.761 for pre-test, while the post-test was 0.784. these values signify acceptable level of reliability (Khanal & Chhetri, 2024), and both pretest and post-test showed a good level of internal consistency, and deemed suitable for further data collection in the main study. Following a four-week gap from the pilot study, a test-retest was carried out to check for consistent results between the pretest and post-test. The Pearson correlation coefficient ( $r$ ) between the pretest and post-test scores in the pilot study was found to be a high correlation coefficient ( $r = 0.892$ ). Since the correlation coefficient is above 0.65, it was considered an acceptable reliable instrument in measuring nursing students CTS.

## Data Collection

As the first step of the data collection process, both groups of participants completed the pretest as measured by their baseline level of CTS score. Prior to the pretest, the participants were clearly briefed on the objective of data collection, test instructions, timing, and clarification of the MCQ stems and options. The data were collected using Optical Mark Recognition (OMR) answer sheets, administered physically in the examination rooms of each respective institution. The pretest data collection for both groups was conducted by the

researcher and one facilitator, Following the intervention, both groups of participants completed the post-test. The post-test assessment was conducted similarly to the pretest to maintain consistency and reliability in the data collection process (Figure 1).



**Figure 1: Flow chart of data collection**

## Data Analysis

Data collected were compiled accordingly and analyzed with IBM SPSS version 26. The data analysis plan for quantitative study was structured according to the study objectives and research questions. The items with missing complete data on one or more measures of interest were excluded from the analysis. Three types of analysis were applied: descriptive, correlational, and inferential. Specifically, descriptive statistics, including mean, standard deviation, frequency, and percentage, were used in this study. Inferential statistics with appropriate tests were utilized to determine the significance of observed differences within and between the groups.

## Ethical Approval

Ethical approval for the study was obtained from both institutions through the university's Ethical Approval Committee. Following ethical approval, informed consent was obtained from participants at both institutions. Before providing consent, participants were fully informed about the purpose, process, and duration of the study, as well as the potential benefits of participation. To ensure confidentiality, participants' actual names were anonymized and coded to protect their personal identities. In addition, participants were informed of their right to withdraw from the study at any stage without impacting their academic performance or progress.

## RESULTS

A total of 107 participants were eligible for inclusion in the study. Of these, four participants from College A (Control Group) declined to participate, while two participants from College B (Experimental Group) were excluded as they had been granted a semester deferment for personal reasons. After these exclusions, the final sample consisted of 101 participants who met the inclusion criteria and completed the study. This represents a response rate of 94.4%, as 101 out of the 107 eligible participants completed the study.

The baseline demographic characteristics analysis revealed a notable difference between the control (n=50) and experimental (n=51) groups. Predominantly, 86.0% of participants in the control group were female, with 100% belonged to Malay ethnicity whereas the experimental group, with a higher percentage of females (96.1%), had a diverse ethnic background. This includes Indian (39.2%), Malay (31.4%), Chinese (25.5%), and others (3.9%). Participants in the experimental group were slightly older (M = 21.76 years) and had a higher mean GPA (M = 3.52) compared to the control group (M = 20.44 years, M = 3.28 GPA). In terms of considering nursing as their first-choice career, the control group had a higher percentage of 72.0% and both groups had almost similar percentages of participants from the arts stream (control: 68.0%; experimental: 64.7%).

### Level of CTS

The baseline levels of CTS among diploma nursing students in both the control and experimental groups were assessed using pretest scores. The pretest consisted of 50 MCQs, each with four response options and a single correct answer. Scores were dichotomously assigned: "1" for a correct response and "0" for an incorrect one. Raw scores, with a maximum of 50, were then converted to percentage values for analysis. For analysis, raw scores were converted into 100 percentages and subsequently categorized following the Insight Assessment (2017) classification: scores. Descriptive analysis of the entire students (n=101) revealed that most students demonstrated low to moderate levels of CTS at baseline. Specifically, 41.58% (n=42) of students were in the low category, while 54.5% (n=55) were in the moderate category. Only a small proportion, 4.0% (n=4), achieved a high level of CTS competency. The overall mean pretest score across all participants was 49.92 (SD=13.69), with scores ranging from 16 to 82. To examine differences across the three classification levels, a one-way ANOVA test was conducted. The analysis revealed a statistically significant difference in mean pretest scores among the low, moderate, and high groups ( $F(2,98)=165.06$ ,  $p < .001$ ). These findings reveal that baseline CTS levels varied considerably across students, with the majority performing within the moderate range and only a very small proportion reaching a high level of CT competency (Table 1).

**Table 1: Level of CTS at baseline among participants at pretest (N =**

| Level    | N   | %     | M     | Median | SD    | F (df)           | p     |
|----------|-----|-------|-------|--------|-------|------------------|-------|
| Low      | 42  | 41.58 | 36.67 | 38.00  | 8.12  | 165.06<br>(2,98) | <.001 |
| Moderate | 55  | 54.45 | 57.85 | 58.00  | 5.41  |                  |       |
| High     | 4   | 3.96  | 80.00 | 80.00  | 1.63  |                  |       |
| Total    | 101 | 100   | 49.92 | 52.00  | 13.69 |                  |       |

Note: N: Number of participants; %: Percentage; M: Mean; SD: Standard deviation;  
df: Degree of freedom; Significance level at  $p < .05$ .

### Association between demographic characteristics (GPA, arts versus science background, and nursing as the first career choice) and nursing students' CTS acquisition

To determine the association between GPA and CTS gain score, Pearson correlation was conducted for the control group and experimental group. These results suggest that GPA did not significantly associate with CTS acquisition in control ( $r=-.173$ ,  $p=.229$ ) and experimental group ( $r=-.152$ ,  $p=.288$ ). For prerequisite

qualification, and nursing was selected as the first-choice career, point-biserial correlation test was conducted to assess for association. The results revealed no significant association between prerequisite qualification and CTS gain score in both control group ( $r = -.213$ ,  $p = .138$ ) and experimental group ( $r = .026$ ,  $p = .859$ ). Likewise for nursing was selected as the first-choice career, point-biserial correlation tests found no statistically significant association for control ( $r = -.161$ ,  $p = .263$ ) and experimental group ( $r = .070$ ,  $p = .627$ ) (Table 2).

**Table 2: Correlation coefficient between GPA, prerequisite qualification, nursing as first career and CTS acquisition in**

| Control group                        |            |                                    |                |      |                            |
|--------------------------------------|------------|------------------------------------|----------------|------|----------------------------|
| Variable                             | M±SD       | N (%)                              | Post CTS score | p    | Test                       |
| 1. CTS gain score                    | 6.60±6.53  | -                                  | -              | -    | -                          |
| 2. GPA                               | 3.28±0.28  | -                                  | $r = -.173$    | .229 | Pearson correlation        |
| 3. Prerequisite qualification        | -          | Art:31 (62)<br>Science:19 (38)     | $r = -.213$    | .138 | Point-biserial correlation |
| 4. Nursing as first choice of career | -          | Yes:36 (72)<br>No:14 (28)          | $r = .114$     | .429 | Point-biserial correlation |
| Experimental group                   |            |                                    |                |      |                            |
| 1. CTS gain score                    | 11.31±4.30 | -                                  | -              | -    | -                          |
| 2. GPA                               | 3.52±0.29  | -                                  | $r = -.152$    | .288 | Pearson correlation        |
| 3. Prerequisite qualification        | -          | Art:33 (64.7)<br>Science:18 (35.3) | $r = -.026$    | .859 | Point-biserial correlation |
| 4. Nursing as first choice of career | -          | Yes:35 (68.6)<br>No:16 (31.4)      | $r = -.070$    | .627 | Point-biserial correlation |

Note. CTS: Critical thinking skills; N = number of participants; M = mean; SD = standard deviation; r: correlation coefficient; Statistical significance at  $p < .05$

## Comparison Pretest and Post-Test Mean Score Within Groups

In the control group ( $n=50$ ), the mean pretest score was 48.56 ( $SD=16.50$ ), which increased slightly to 61.76 ( $SD=10.22$ ) at post-test. The paired-samples t-test indicated statistically significant improvement ( $t(49)=7.15$ ,  $p < .001$ ) with a small effect size ( $d=0.22$ ). However, the experimental group ( $n=51$ ) showed a marked increase, with pretest scores rising from 51.25 ( $SD=10.22$ ) to 73.88 ( $SD=8.35$ ) at post-test. The paired-samples t-test for the experimental group revealed a statistically significant improvement from pretest to post-test ( $t(50)=18.81$ ,  $p < .001$ , with an extremely larger effect size, ( $d=2.63$ ) than control group (Table 3).

**Table 3: Comparison of pre-test and post-test mean score within control and experimental group**

| Group        | Test      | M     | SD    | Mean<br>Difference | 95%<br>Confidence<br>Interval of the<br>Difference |       | t(df)         | p      | Cohen's d |
|--------------|-----------|-------|-------|--------------------|----------------------------------------------------|-------|---------------|--------|-----------|
|              |           |       |       |                    | Lower                                              | Upper |               |        |           |
|              |           |       |       |                    |                                                    |       |               |        |           |
| Control      | Pre-test  | 48.56 | 16.50 | 13.20              | -8.10                                              | 2.71  | 7.15<br>(49)  | <.001* | 0.22      |
|              | Post-test | 61.76 | 10.22 |                    |                                                    |       |               |        |           |
| Experimental | Pre-test  | 51.25 | 10.22 | 22.67              | -15.80                                             | -8.44 | 18.81<br>(50) | <.001* | 2.63      |
|              | Post-test | 73.88 | 8.35  |                    |                                                    |       |               |        |           |

Note. M= Mean; SD= Standard deviation; CI= Confidence interval; t= t-statistic; df = Degrees of freedom; Cohen's d= Effect size. Significance level at  $p < .05$ .

## Comparison Pretest and Post-Test Mean Score Between Groups

In addition, comparison between groups was conducted on pretest and post-test scores using an independent samples t-test. The findings for the pretest showed no statistically significant difference between the control group and experimental group ( $t(99)=-0.99$ ,  $p=.328$ ). This suggests that both groups started at a comparable low to moderate baseline level of CTS. The effect size, Cohen's  $d = 0.27$ , indicated a small difference in pretest performance between the groups. However, group comparison in post-test scores revealed a significant difference among the experimental group ( $M=73.88$ ,  $SD=8.34$ ) than the control group ( $M=61.76$ ,  $SD=10.21$ ), with a mean difference of 12.12 points ( $t(99)=-6.53$ ,  $p<.001$ ). The effect size, Cohen's ( $d = 1.25$ ), indicates a large difference favoring the experimental group in CBL pedagogy. Furthermore, analysis of gain scores confirmed these results. The experimental group achieved a mean improvement of 22.63 ( $SD=13.19$ ), compared with only 13.20 ( $SD=19.40$ ) in the control group. This difference was statistically significant ( $t(99)=-2.95$ ,  $p=.004$ ), with a moderate effect size ( $d = 0.57$ ) (Table 4).

**Table 4: Comparison of pretest, post-test, and gain scores between control and experimental Group**

| Test       | Group        | M     | SD    | Mean Difference | 95% Confidence Interval of the Difference |       | t(df)      | p      | Cohen's d |
|------------|--------------|-------|-------|-----------------|-------------------------------------------|-------|------------|--------|-----------|
|            |              |       |       |                 | Lower                                     | Upper |            |        |           |
| Pretest    | Control      | 48.56 | 16.50 | -2.69           | -8.10                                     | 2.71  | -0.99 (99) | .328   | 0.27      |
|            | Experimental | 51.25 | 10.22 |                 |                                           |       |            |        |           |
| Post-test  | Control      | 61.76 | 10.21 | -12.12          | -15.80                                    | -8.44 | -6.53 (99) | <.001* | 1.25      |
|            | Experimental | 73.88 | 8.34  |                 |                                           |       |            |        |           |
| Gain Score | Control      | 13.20 | 19.40 | -9.43           | -15.91                                    | -2.85 | -2.95 (99) | .004*  | 0.57      |
|            | Experimental | 22.63 | 13.19 |                 |                                           |       |            |        |           |

**Note.** M=Mean; SD= Standard deviation; CI: Confidence interval; t=t-statistic; df: Degree of freedom; Cohen's d= effect size; Significance level at  $p < .05$ .

## DISCUSSION

The findings revealed the majority of students fall into a low to moderate level of CTS at baseline, with only a small portion of students attaining high levels of CTS. These findings align with a recent local study by Mohammed et al. (2024) among (N=115) nursing students in Malaysia. The result showed that the overall level of CT was at an intermediate level across CTS domains in systematic analysis and critical thinking process. Consistent findings were also reported in international studies by Nes et al. (2022), as well as Babazhanova (2020), Arli et al. (2017), and Gezer et al. (2017) as all these studies found that generally nursing students exhibited only moderate levels of CTS despite being in their final year of study. Preferably, students in their final year of study journey should demonstrate adequate professional and personal development such as good attitude towards patients, strong cognitive abilities, and sound clinical reasoning skills in patient care. The present study found no significant association between GPA and CTS. These findings are in line with many previous studies. For example, Sacgaca (2022) reported no significant correlation between GPA and CTS among undergraduate nursing students in Saudi Arabia. Similarly, Shirazi et al. (2019), a study involving 139 second to final-year nursing students at Islamic Azad University in Urmia, Iran, also found no meaningful relationship between these two variables. This trend is not only limited to undergraduate nursing students. A study by Tafazzoli et al. (2017) among midwifery students at Mashhad University of Medical Sciences in Iran also reported comparable findings, which showed that high academic grades do not necessarily reflect learners' stronger CTS competence. The analysis of prerequisite qualification in this study revealed no significant association with CTS in both groups. This finding aligns with previous research by Williamson (2011), which also reported no significant association between CTS and academic stream. However, these results diverge from studies by Liu and Pásztor (2022) and Selen and Filiz (2015), which found that CTS tended to be higher among science stream students compared to arts stream students, as students in the present

study mostly (62 - 64.7%) were art stream students. The present findings found not significant association between choosing nursing as a primary career choice and CTS in control group and experimental group. This finding is consistent with a study by Tong et al. (2023), and Sacgaca et al. (2022), which also found no correlation between nursing as a first-choice study and CTS acquisition. All these findings suggest that a student's preference of choosing nursing as their first choice of study did not directly correlate with their CTS. Perhaps, students who did not choose nursing as their first-choice study pathway may have demonstrated good decision-making skills compared to those who did. Nevertheless, students may choose nursing based on various reasons which are not unrelated to their inherent CT abilities.

In terms of effectiveness of CBL strategy, the finding of present study aligns with the study by Surin-arnhorn and Deprasit (2024), who reported CBL approach had significantly contributed to higher CTS among nursing students. Similarly, Hong and Yu (2016) found a significant positive impact of CBL on nursing students' CTS while Kantar and Sailian (2018) also reported the essence of CBL is enhancing judgment skills among nursing students, particularly in the critical care areas where CTS competencies deemed needed. Equally, Nishal et al. (2022) found that CBL significantly improved clinical decision-making and knowledge retention within medical students. In comparison, traditional DL methods, which remain a common practice in Malaysian nursing education, they often rely on one-way instruction with the use of PowerPoint presentations. In this approach, little opportunity is emphasized for feedback and debriefing. Students tend to be silent and take notes passively without cultivating any reflection or critical engagement with the learning material. This limitation widens the gap between academic concepts and clinical realities, limiting students' deeper understanding of complex patient care scenarios. DL is primarily teacher-centered and emphasizes knowledge transmission from textbooks (Zhang and Chen, 2020). However, this paradigm may not adequately equip nursing students with the necessary capabilities to drive the fast-paced and demanding clinical environments where rapid and well-informed decisions are required. However, to enhance CTS acquisition, a mixed teaching approach by combining CBL and DL was recommended to optimize memory retention, retrieval, and cognitive development (Phillips & Wiesbauer, 2022). All in all, the findings of this study underscore the importance of equipping nursing students with CTS, particularly those placed in emergency environments. In this context, CBL and its evolution as an instructional and pedagogical practice for CT enhancement is highly pertinent for nursing students who are going to serve as front-line providers in future healthcare practice because CTS may enable them to be an effective front-line healthcare providers in rendering timely and safe patient care.

## LIMITATIONS OF THE STUDY

The first limitation identified in this study was students' inability to effectively link theory to practice, primarily due to inadequate practical knowledge in emergency nursing concepts and management. The second limitation was the assessment tool that developed in MCQ format. Although this tool was validated by an expert panel, there are still some limitations encountered particularly in few sub-scales which is uncertain for assessment in specific domains. The subsequent limitation encountered was the sample of the study which focus only on final year students may limit the generalizability of the findings to other academic disciplines or student populations. Another limitation apparent in this study was the use of a non-probability sampling method without randomization could potentially be difficult to generalize the findings of the study beyond this population.

## CONCLUSION

In a nutshell, nursing students generally demonstrated low to moderate levels of CTS, indicating a need for pedagogical strategies that could actively develop higher-order thinking. Following the CBL intervention, students in the experimental group showed marked improvements, achieving moderate to high CTS levels, while students in the control group, exposed to traditional DL, experienced only modest gains in CTS. The findings revealed that demographic factors in GPA, prerequisite qualification, and first career choice in nursing did not significantly associate with CTS acquisition. This finding underscores that the teaching approach itself is more influential than students' prior characteristics in fostering CTS. While traditional lecture-based teaching effectively delivers factual knowledge, it alone is insufficient to cultivate CTS required

in emergency nursing practice. Integrating DL with CBL, through structured case scenario discussions and role-play activities, offers a more effective, student-centered approach that strengthens CTS and better prepares nursing graduates for the complex, high-stakes demands of emergency care. These findings provide a strong rationale for curriculum developers and educators to adopt active, experiential learning strategies in nursing education, bridging the theory practice gap while promoting higher-order thinking essential for safe, competent clinical practice.

**Conflict of Interest:** All authors declare no conflict of competing interest.

**Data Availability:** The data that support the findings of this study are available from the corresponding author upon reasonable request.

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