

Effectiveness of case scenario-based teaching to transition international Master of Public Health students specialising in health promotion from memorization to critical thinking

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Abstract

Issue addressed: Critical thinking is essential to health promotion to overcome increasingly complex health issues. International students from Middle East and Asia are however disadvantaged when required to demonstrate critical thinking mainly because of their previous training in memorisation. This study addresses this need by evaluating the effect of case scenario-based teaching on transition from memorisation to critical thinking among international students in an Australia university.

Methods: This was a pre and post intervention study and data were collected from a convenience sample of 79 international Master of Public Health students specialising in health promotion in 2019 at the University of Wollongong.

Results: Most of the participants were female (73.4%) and aged 25 years or older (64.6%), predominantly from India (40.5%), Nepal (31.6%) and Saudi Arabia (11.4%). A paired t-test analysis showed that the intervention – case scenario-based teaching – significantly improved the mean post-intervention critical thinking skills ($P < 0.001$). Case studies improved critical thinking among international students, irrespective of demographic attributes. Multiple regression analyses indicated that critical thinking predicted 78.6 of the total marks, after controlling for demographic attributes. In terms of assessment marks, improved multiple solutions skills yielded better marks for tutorial participations; while improved problem identification skills improved marks for report assessments and exams. Improved communication skills led to better marks for essay assessments.

Conclusions: Case studies improved critical thinking and was a reliable predictor of student performance among the participants.

So what?: This study makes a strong case for case scenario-based teaching to improve critical thinking among international students. However, given the limitations of this study, including the small, non-representative sample, further testing is required.

KEYWORDS

case study, critical thinking, international student, memorization, scenario-based teaching

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1 | INTRODUCTION

Critical thinking is essential to health promotion to overcome increasingly complex health issues including disease management and prevention, ongoing changes in economic policies, complex environmental hazards, natural disasters, technological advances in health care delivery and socioeconomic impacts of diseases and unhealthy behaviours on individuals and societies.¹⁻³ Dealing with such multifaceted challenges without critical thinking can lead to dire consequences and health outcomes such as health disparities and wasting health care resources.² Furthermore, managing competing political and public perspectives on health issues requires health practitioners to be open-minded to all alternatives and suggestions and use a holistic approach to introduce change at individual and population levels.^{2,3} The complexities of health promotion and availability of multiple solutions necessitates fostering critical thinking among health promotion students.

Critical thinking enables individuals to interpret complicated information, question assumptions, draw sound conclusions and consider alternatives.^{2,4} It involves using cognitive skills to increase the probability of a desired outcome by adopting an evidence-based approach with dispassionate reasoning.⁵ It requires a capacity to ask questions, seek relevant data and information, critique these data and information and communicate reasonable solutions.⁶ Given the importance of critical thinking, it is an essential attribute of many, if not all university graduates as they prepare for “the complex and globalized economies and societies of the 21st century.”⁷

International students from Middle East and Asia are often disadvantaged when required to demonstrate critical thinking. Many are trained in education systems that emphasise memorisation, rather than self-directed learning and critical thinking.⁸ The memorisation approach is highly structured and teacher-centred – students are largely passive recipients of knowledge, and their learning achievements are measured by standardised quantitative tests. Conversely, Western education systems – including Australian universities – emphasise critical thinking.⁹ This approach is relatively more flexible and student-centred – students are active participants in the learning process and learning achievements are assessed by various tools that evaluate student capacity to self-evaluate, critically analyse, as well as develop and justify their views.⁹

International students' experience of their learning environment in Western education systems has been described as a cultural shock.¹⁰ Students from the Middle East and Asia often need to overcome cross-cultural differences in education systems while growing to acclimatise to an education system that prizes creativity and critical thinking, rather than rote learning.^{11,12} This scenario stems from the dichotomy between non-Western education systems and the Western approach. The former relies more on memorization and exams while the latter promoted creativity, critical thinking and a research-based essay writing.¹² In a more recent article, it was reported that Indonesian students studying Public Health in Australia struggle to sharpen critical-thinking skills.¹³ Some studies cited that international students in Australia engage in more than twice as much plagiarism than domestic students and the challenges go beyond writing skills to understanding the assignment at hand, knowing what copying content and non-attribution and the cultural differences

leading to a pedagogic technique they cannot quickly adapt to.¹⁴ Rather than reflecting deliberate misconduct, these problems are more likely to stem from different learning styles and attitudes, a reflection of the memorization learning style that they have experienced in their countries of origin. While language deficiencies (English as a second language) cannot be ignored, the memorisation legacy cannot prevent the development of critical thinking skills. What is needed is a technique to transition from memorisation to critical thinking, capitalising on students' inherent abilities, regardless of their inherited pedagogy. Active learning methods such as case studies, field trips and role play have shown promising results by engaging students in critical thinking.¹⁵

Case studies have been used within different disciplines – including law, business and social sciences – to improve student capacity to: engage; apply theory to practice; consider different views; and analyse data. Cases studies can also enable students to: develop listening and cooperation skills; build partnerships; and brainstorm.^{15,16} A case study is a “description of an actual situation, commonly involving a decision, a challenge, an opportunity, a problem or an issue faced by a person or persons in the organization.”¹⁵ By encouraging reflection beyond the classroom,¹⁷ case scenario-based teaching represents a way to bridge the gap between theory and practice. They serve to: contextualise learning; project the mind to consider real-world possibilities; and foster critically thinking.¹⁸ In other words, it can be argued that the gap between rote learning and critical thinking is the bridge between theory and practice. The premise for case scenario-based learning is that learning is contextualized and projects the mind to interact with real-world possibilities thereby drawing upon critical thinking to supplement the learning content that is traditionally delivered via a lecture-approach.¹⁸

Despite the potential value of case studies, they are yet to be evaluated as a way to transition international students from memorisation to critical thinking.^{4,19,20} This pre and post intervention study addresses this gap by evaluating the effect of case scenario-based teaching on international students in an Australia university. In this study we hypothesized that case studies will lead to higher levels of critical thinking skills among international students.

2 | METHODS

2.1 | Research design, participants and procedure

This was a pre and post intervention study and data were collected using a convenience sample of 79 international Master of Public Health students specialising in health promotion enrolled in HAS 948 health promotion subject in 2019 at the school of health and society within the University of Wollongong (UOW). This study was reviewed and approved by the Social Sciences Human Research Ethics Committee at UOW (Ethics Number: 2019/005). To improve students' critical thinking skills, a series of unfolding case studies was developed, informed by relevant literature²¹⁻²⁶ and the lead author's teaching expertise in health promotion. Case study conventionally provides students with all relevant information and questions. In this study however we used unfolding case studies that were unfolding and intentionally

incomplete to encourage students to participate in critical thinking activities including problem identification, information seeking, context assessment, logical reasoning and data analysis.^{27,28} The unfolding case studied were strategically designed to be unpredictable and evolve over time to encourage active learning among students.²⁸ The case studies addressed: the five strategies of the Ottawa charter for health promotion; healthy schools; chronic disease management^{29–34}; the role of culture, beliefs, and values in health promotion; and the evaluation of a community-based health promotion intervention.^{23–25,35–38} The case studies were purposely complex to encourage students to employ health promotion concepts to justify their solutions. The case studies were based on real scenarios with supporting data and documents to be analysed during the lecture. In preparation for the intervention, the students were asked to read UOW Critical Analysis³⁹ concept prior to the intervention. To provoke critical thinking, they discussed open-ended questions during the lectures in groups of five to eight.¹⁵ The case studies were delivered using five case scenarios-based lectures from week three to seven of a 12-week semester.

The post intervention period was 7 weeks. Student critical thinking was evaluated with reference to performance during the tutorial sessions of HAS948 health promotion subject, which were facilitated after the lectures. Pre intervention critical thinking data were collected during the week two tutorial. Students were provided with formative feedback about their progress in all dimensions of critical thinking. They were provided with further information about critical thinking and extra support of working with case studies based on their progress. Post intervention critical thinking data were gathered during the last tutorial session in week 12, 7 weeks post intervention. Assessments were marked by an academic, not involved in the intervention design or delivery to prevent bias.

2.2 | Study measures

2.2.1 | Demographic attributes

Student demographic attributes considered for this study included gender, age, and country of origin.

2.2.2 | Critical thinking measure

An adapted version of the critical thinking rubric developed and validated by the Centre for Teaching, Learning, and Technology at the Washington State University was used to measure students' critical thinking score, pre and post intervention.⁴⁰ The adaptations served to adjust the language, to ensure appropriateness for case scenario-based teaching. The rubric examined seven dimensions of critical thinking, including: problem identification; context assessment; demonstrating ownership; data analysis; multiple solutions; conclusion and implications; and communication (see Table 1). These were measured via a Likert scale from one to six, which culminated with three categories – namely, emerging (scores of 1–2), developing (scores of 3–4) and mastering (scores of 5–6). A score of one denoted the lowest level of critical thinking, while six was the highest.

TABLE 1 An example case study

Biren Kesang is the only child of a recent migrant family from Asia. Biren is 7 years old. As he is not familiar with English, Biren has to attend Year 1 in an Australian school although he has completed 2 years of primary school in his country of origin. Biren is about 100 cm tall and weighs about 28 kg. He is relatively short compared to his classmates although he is 2 years older. Biren comes from a village in Asia where being fat is associated with being wealthy. His personal appearance was never considered unhealthy in his country of origin. Given his stubby appearance, he has been repeatedly bullied by some students in the school. In fact, most students call him B.K. using his initials as a reference for “Big Kid.”

Biren's parents are both obese. His grandmother had type 2 diabetes as does his mum. The incidence of diabetes is generally low in the village in their country of origin. Both his parents feel that diabetes is just passed on from one generation to another by gender association. In terms of beliefs, Biren's family engages in ancestral worship and karma. The mother works in a neighbourhood bakery while the dad is a car mechanic. The mother loves to bake cookies and cakes. Biren lives with his parents in a low socio-economic neighbourhood. The residents are primarily of Australian, English and Irish ancestries. This is in sharp contrast to nearby towns approximately 20 km away with 10% to 15% of the population being of Asian origin. Biren's school is located in one of these other towns in a relatively higher socio-economic region.

Biren is often reluctant to participate in school-run physical activities as he does not like to be the target of bullying and also feels he cannot participate competitively. However, he likes rugby as his weight gives him a distinct advantage though he lacks the speed and agility. Biren's parents are always busy and do not involve themselves in the Biren's progress at school. It is highly likely that Biren has depression given the new environment and bullying he has experienced. As much of the bullying has not been physical, this issue remains undealt by the school.

Question 1. Describe the family's experience using the development stages of social structure taking into consideration the role of culture, beliefs and values in the case scenario above.

Question 2. Explain the tension between healthy school by input and healthy school by outcomes and the coping mechanism (s) that may be suitable for Biren's depression.

Question 3. Apply the five action strategies of the Ottawa Charter for Health Promotion (1986), to suggest how Biren and his parents can be supported.

2.2.3 | Assessment marks

The health promotion subject involved four assessments that totalled 100 marks.⁴¹ Assessment 1 was a 500-word essay to discuss the relevance of the Ottawa charter for health promotion (1986) in the 21st century, by developing one counter and three supporting arguments (weight: 10%). Assessment 2 was a 1500-word report to: select a health promotion issue; compare four population-based interventions that have been implemented to produce individual behavioural change by drawing on scholarly literature; and determine the interventions that were most effective and why (weight: 30%). Assessment 3 was a 2-h examination comprised of 20 multiple choice items and two case studies (weight: 40%), whereby students were assessed on whether they: demonstrated an understanding of the impact of globalisation

TABLE 2 Participants' critical thinking scores; mean score (\pm SD); Pre intervention = 16.1 (\pm 7.1), post intervention = 27.7 (\pm 7.4); $n = 79$

Score	Emerging			Developing			Mastering		
	1 n (%)	2 n (%)	3 n (%)	4 n (%)	5 n (%)	6 n (%)			
Problem identification	Does not attempt to or fails to identify and summarise accurately	Summarises issue, although some aspects are incorrect or confused. Nuances and key details are missing or glossed over	Clearly identifies the challenge and subsidiary, embedded, or implicit aspects of the issue. Identifies integral relationships essential to analysing the issue						
Pre	48 (60.3%)	19 (24.1%)	5 (6.3%)	5 (6.3%)	2 (2.5%)	0 (0.0%)			
Post	0 (0.0%)	8 (10.1%)	20 (25.3%)	25 (31.6%)	15 (19.0%)	11 (13.9%)			
Context assessment	Approach to the issue is in egocentric and sociocentric terms. Does not relate to other contexts. Analysis is grounded in absolutes, with little acknowledgement of own biases. Does not recognise context and underlying ethical implications	Presents and explores relevant contexts and assumptions, although in a limited way. Analysis includes some outside verification, but primarily relies on directions. Provides some consideration of assumptions and their implications	Analyses the issue with a clear sense of scope and context. Identifies influence of context. Questions assumptions, addressing ethical dimensions underlying the issue						
Pre	15 (19.0%)	42 (53.2%)	10 (12.7%)	7 (8.9%)	5 (6.3%)	0 (0.0%)			
Post	0 (0.0%)	7 (8.9%)	22 (27.8%)	29 (36.7%)	14 (17.7%)	7 (8.9%)			
Demonstrating ownership	Position is clearly adopted with little consideration. Addresses a single view of the argument, failing to clarify the position relative to one's own. Fails to justify own opinion or hypothesis is unclear or simplistic	Presents own position, which includes some original thinking, though inconsistently. Justifies own position without addressing other views or does so superficially. Position is generally clear	Position demonstrates ownership. Appropriately identifies own position, drawing support from experience and information not from assigned sources. Justifies own view while integrating contrary interpretations. Hypothesis demonstrates sophisticated thought						
Pre	20 (25.3%)	29 (36.7%)	17 (21.5%)	8 (10.1%)	5 (6.3%)	0 (0.0%)			
Post	0 (0.0%)	12 (15.2%)	21 (26.6%)	22 (27.8%)	11 (13.9%)	13 (16.5%)			
Data analysis	No evidence of selection or source evaluation skills. Repeats information without question or reports evidence without justification. Does not distinguish between fact and opinion. Evidence is simplistic, inappropriate, or not related to topic	Demonstrates adequate skill in selecting and evaluating sources to meet information need. Use of evidence is selective, discerns fact from opinion and might recognise bias. Appropriate evidence is provided although exploration is routine	Evidence of source evaluation skills. Examines evidence and questions accuracy and relevance. Recognises bias. Sequence of presentation reflects clear organisation of ideas, importance and impact						
Pre	14 (17.7%)	31 (39.2%)	20 (25.3%)	7 (8.9%)	7 (8.9%)	0 (0.0%)			
Post	0 (0.0%)	6 (7.6%)	25 (31.6%)	23 (29.1%)	15 (19.0%)	10 (12.7%)			
Multiple solutions	Deals with a single perspective and fails to discuss others' perspective. Adopts a single idea. Alternatives are not integrated. Avoids challenging other ideas presented. Treats other positions superficially. No evidence of self-assessment	Begins to relate alternative views. Rough integration of multiple viewpoints. Might overstate conflict or dismiss alternative views hastily. Analysis of other views mostly accurate. Some evidence of self-assessment	Addresses diverse perspectives from a variety of sources to qualify analysis. Any analogies are used effectively. Clearly justifies own view while respecting views of others. Analysis of other positions is accurate and respectful. Evidence of reflection and self-assessment						
Pre	31 (39.2%)	23 (29.1%)	13 (16.5%)	8 (10.1%)	4 (5.1%)	0 (0.0%)			
Post	0 (0.0%)	9 (11.4%)	19 (24.1%)	30 (38.0%)	12 (15.2%)	9 (11.4%)			

TABLE 2 (Continued)

Score	Emerging		Developing		Mastering	
	1 n (%)	2 n (%)	3 n (%)	4 n (%)	5 n (%)	6 n (%)
Conclusion and implications	Fails to identify conclusions, implications, and consequences, or conclusion is a simplistic summary. Conclusions are absolute and might attribute conclusion to external authority		Conclusions consider evidence of consequences extending beyond a single issue. Presents implications that might impact other people or issues. Presents conclusions as only loosely related to consequences. Implications might include vague reference to conclusions		Identifies and discusses conclusions, implications, and consequences. Considers context, assumptions, and evidence. Qualifies own assertions. Consequences are considered and integrated. Implications are developed and consider ambiguities	
Pre	16 (20.3%)	30 (38.0%)	21 (26.6%)	5 (6.3%)	7 (8.9%)	0 (0.0%)
Post	0 (0.0%)	6 (7.6%)	29 (36.7%)	21 (26.6%)	14 (17.7%)	9 (11.4%)
Communication	In many places, language obscures meaning. Grammar or other errors are distracting or repeated. Style is inconsistent or inappropriate. Communication is unfocused and poorly organised; lacks logical connection of ideas		In general, language does not interfere with communication. Errors are not distracting or frequent, although there might be some problems with style and voice		Language clearly and effectively communicates ideas. Might at times be nuanced and eloquent. Errors are minimal. Style is appropriate for audience	
Pre	11 (13.9%)	28 (35.4%)	25 (31.6%)	8 (10.1%)	7 (8.9%)	0 (0.0%)
Post	0 (0.0%)	1 (1.3%)	26 (32.9%)	25 (31.6%)	14 (17.7%)	13 (16.5%)

on health promotion, with a specific focus on the Bangkok Charter; applied a health promotion perspective within different settings; and critically discussed the application of theories within health promotion initiatives. Assessment 4 was tutorial participation, whereby students were assessed on whether they: contributed to the development of new understandings in their group, based on the weekly readings and lectures; contributed respectfully and meaningfully to debates and ideas presented within their group; contributed to group discussions by identifying strengths and weaknesses in the material discussed and explaining their reasons; and related their own ideas to those articulated by others in their group (weight: 20%). Participation for each tutorial session were assessed using a modified tutorial participation rubric developed by Eberly Center for Teaching Excellence.⁴² The rating scale ranged from 1 to 4 for each criterion. A score of 4 in any criterion represents the attainment of the highest standard of participation.

2.2.4 | Grades

Based on their total assessment mark, students received a grade of: fail (<50% of total mark); pass (50%-64% of total mark); credit (65%-74% of total mark); distinction (75%-84% of total mark); or high distinction (85%-100% of total mark).⁴³

2.3 | Data analysis

Univariate statistics were used to describe student demographic attributes, critical thinking scores, assessment marks and grades. Paired t-tests were performed to compare critical thinking scores, pre and post intervention. A one-way ANOVA and an independent sample t-test analysis were used to examine the association of critical thinking scores with demographic attributes. Finally, regression analyses were performed to determine whether critical thinking and its dimensions reliably and significantly predict assessment marks while controlling for demographic attributes.

3 | RESULTS

3.1 | Demographics

A total of 79 international public health postgraduate students specialising in health promotion participated in this study. Most were female (73.4%) and aged 25 years or older (64.6%). Students were from 12 countries, predominantly India (40.5%), Nepal (31.6%) and Saudi Arabia (11.4%).

3.2 | Critical thinking scores

Table 2 summarizes critical thinking scores pre and post intervention. Before the intervention, student mean critical thinking score was 16.1 of 42 (SD = ±7.1; min. = 7, max. = 35). Most students had “emerging”

TABLE 3 Comparison of critical thinking scores pre and post intervention and across demographics post-intervention ($n = 79$)

Variables	Critical thinking mean difference (\pm SD)	t Value	95% confidence interval of the difference
Critical thinking			
Pre vs post	11.7 (\pm 6.4)***	16.1	10.2-13.1
Mean difference of critical thinking across attributes post intervention			
Male vs female	-1.5 (\pm 1.8)	-0.8	-5.3-2.2
\leq 25 vs \geq 26 years	-3.2 (\pm 1.7)	-01.8	-6.6-0.2
Country of origin ^a			
Nepal vs India	0.7 (\pm 1.9)	0.5	-3.2-4.6
Saudi Arabia vs India	-0.8 (\pm 2.6)	-0.4	-6.2-4.5
Other countries vs India	1.8 (\pm 2.4)	1.7	4.1-6.6

$P < 0.05$, ** $P < 0.01$ and *** $P < 0.001$.

^aCountry of origin was categorised in four groups for this study.

and “developing” levels of critical thinking across the six dimensions. For instance, students' problem identification (84.8%), context assessment (72.2%) and multiple solutions (68.4%) skills were largely at a “developing” level. Similarly, 41.7% and 34.2% of students had an “emerging” level of communication and data analysis skills, respectively. Only 2.5%-8.9% of the students had a “mastering” level of critical thinking skills.

Post intervention, students' mean critical thinking score increased to 27.7 of 42 (SD = \pm 7.4; min. = 7; max. = 42). Most students had a “developing” level of critical thinking skills. The students' “developing” skills increased across critical thinking dimensions, including: problem identification (pre = 12.6%; post = 56.9%); context assessment (pre = 21.6%; post = 64.5%); demonstrating ownership (pre = 31.6%; post = 54.4%); data analysis (pre = 34.2%; post = 60.6%); multiple solutions (pre = 26.6%; post = 62.1%); conclusion and implications (pre = 32.9%; post = 63.3%); and communication (pre = 41.7%; post = 64.5%). Approximately 30% of the students reached “mastering” critical thinking skills, post intervention.

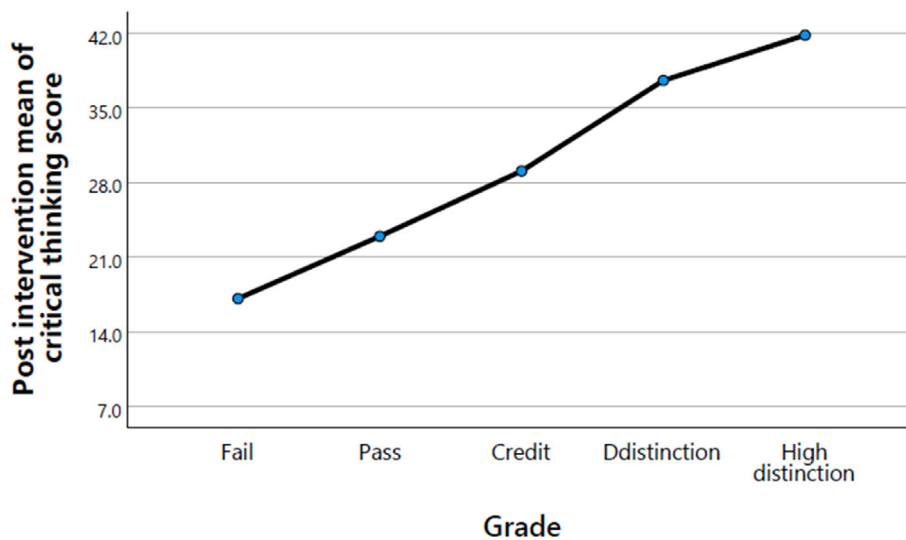


FIGURE 1 Means plot of post intervention critical thinking scores across grades

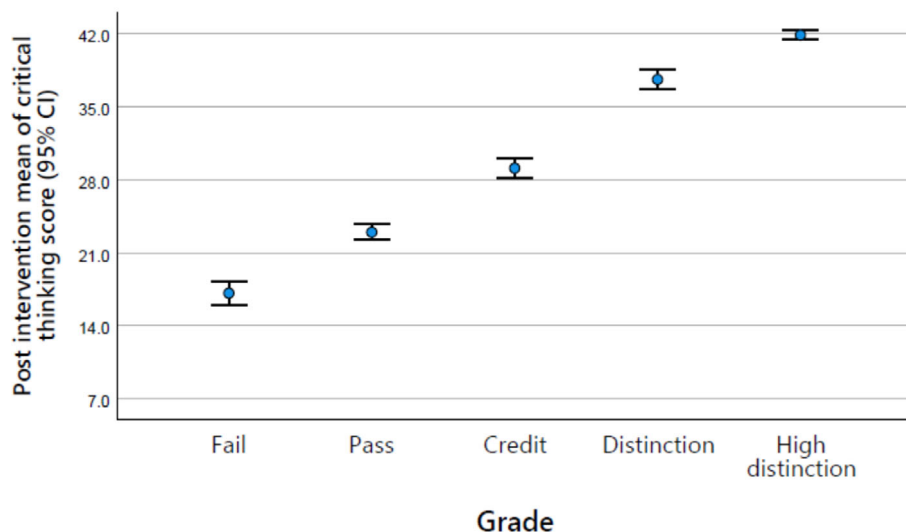


FIGURE 2 Error bars of post intervention critical thinking mean scores

TABLE 4 Multiple and stepwise regression analyses for critical thinking and its dimensions predicting the total mark while for controlling demographic attributes ($n = 79$)

Predictors	Total mark B (β)	t value	95.0% CI for B	UV (%)
Multiple regression analyses for critical thinking predicting final mark				
Critical thinking	1.6 (0.9)	16.3	1.4-1.8	78.6***
Male vs female	-1.2 (-0.4)	-0.9	-4.1-1.6	-1.1
≤ 25 vs ≥ 26 years	-0.3 (-0.1)	-0.2	-3.1-2.5	-0.6
India vs other countries	-0.3 (-0.01)	-0.1	-4.1-4.1	-0.0004
Nepal vs other countries	0.5 (.02)	0.3	-3.6-4.7	0.09
Saudi Arabia vs other countries	2.2 (0.5)	0.8	-3.1-7.3	0.9
$(R^2 = 81.2\%, df = 6, F = 57.1^{***})$				
A stepwise regression analysis for critical thinking dimensions predicting final marks				
Problem identification	4.5 (0.4)	5.0	2.7-6.4	24.7***
Multiple solutions	4.1 (0.4)	4.3	2.1-5.9	20.1***
Communication	2.4 (-0.1)	2.5	0.5-24.3	7.8*
$(R^2 = 86.3\%, df = 3, F = 157.9^{***})$				

Abbreviations: CI, confidence interval; UV (%), unique variance because of variable (%).
* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

3.3 | Marks and grades post intervention

The mean total mark was 64.3 (SD = ± 12.9 ; min. = 29; max. = 87). This was calculated by adding marks for Assessment 1 (mean = 7.4; SD = ± 1.9), Assessment 2 (mean = 20.6; SD = ± 5.4), Assessment 3 (mean = 22.9; SD = ± 7.1), and Assessment 4 (mean = 13.1; SD = ± 2.3). Most students received a grade of: pass (39.2%; $n = 31$) or credit (27.8%; $n = 22$). One in 10 (10.1%; $n = 8$) received a fail grade, while 7.6% ($n = 6$) and 15.2% ($n = 12$) achieved distinction and high distinction grades, respectively.

3.4 | Mean difference of critical thinking score pre and post intervention

A paired t -test showed that the mean difference of critical thinking scores, pre and post intervention, was significant (see Table 3). The intervention improved the post intervention mean by 11.7 points (SD = ± 6.4) compared to the pre intervention mean ($P < 0.001$). In other words, the mean post intervention score (27.7; SD = ± 7.4) was significantly higher than the mean pre intervention score (16.1; SD = ± 7.1). t -Test and one-way ANOVA using post-hoc Dunnett analyses indicated that the mean difference of post intervention critical thinking scores between gender, age, and country of origin groups were not significant.

3.5 | Mean difference of post intervention mean critical thinking scores between grades

One-way ANOVA using post-hoc Dunnett analyses showed that the mean difference of post intervention critical thinking scores between

grades were significant. The mean post intervention critical thinking scores among students who received a high distinction (mean difference = 24.7, $P < 0.001$), distinction (mean difference = 20.5, $P < 0.001$), credit (mean difference = 12, $P < 0.001$), or pass (mean difference = 5.7, $P < 0.001$) were significantly higher than those who failed. A post intervention mean plot suggested that the mean critical thinking scores increased exponentially with higher grades (see Figure 1). An error bars graph (small bar = more reliable; larger bar = less reliable) showed that improvement in critical thinking across all grades was reliable; however, it was more reliable within the group of students who received a high distinction (see Figure 2).

3.6 | Regression analysis: Predictive power of critical thinking and its dimensions predicting total marks

A multiple regression analysis indicated that critical thinking was positively and significantly correlated with final marks (see Table 4). After controlling for demographic attributes, critical thinking predicted 78.6% of the variance in final marks. None of the demographic attributes predicted variance in the total marks.

After revealing the strong correlation and predictive power of critical thinking, a stepwise regression analysis controlling for demographic attributes was performed to determine which critical thinking dimensions predicted the total marks, while competing with each other and the demographic attributes. The dimensions of problem identification, multiple solutions, and communication significantly predicted the final marks in the presence of the other dimensions as well as the demographic attributes. The dimension, problem identification, was the strongest predictor of the final marks, with a predictive power of 24.7%.

Predictors	Assessment B (β)	t value	95.0% CI for B	R ²
Assessment 1 (Essay, 10%)				
Critical thinking (total score)	0.1 (0.5)	4.6	0.07-0.2	21.3%***
Problem identification	0.6 (0.4)	3.7	0.3-0.9	13.7%***
Context assessment	0.7 (0.4)	3.8	0.3-1.0	14.4%***
Demonstrating ownership	0.6 (0.4)	3.6	0.3-0.9	13.1%***
Data analysis	0.7 (0.4)	4.1	0.4-1.0	16.7%***
Multiple solutions	0.8 (0.5)	4.5	0.4-1.1	19.5%***
Conclusion and implications	0.7 (0.4)	4.1	0.4-1.1	16.5%***
Communication	0.9 (0.5)	5.1	0.6-1.3	24.4%***
Assessment 2 (Report, 30%)				
Critical thinking (total score)	0.5 (0.6)	8.4	0.6-0.7	47.8%***
Problem identification	3.2 (0.7)	8.6	2.5-4.0	48.2%***
Context assessment	3.2 (0.6)	7.0	2.2-4.1	37.7%***
Demonstrating ownership	2.5 (0.6)	6.4	1.7-3.3	33.7%***
Data analysis	3.2 (0.7)	7.7	2.3-3.9	42.4%***
Multiple solutions	3.1 (0.7)	7.6	2.3-3.9	42.1%***
Conclusion and implications	2.9 (0.6)	6.6	2.0-13.7	35.0%***
Communication	3.0 (0.6)	6.5	2.1-3.9	34.4%***
Assessment 3 (Case study exam, 40%)				
Critical thinking (total score)	0.7 (0.8)	11.6	0.6-0.9	63.6%***
Problem identification	4.8 (0.8)	12.1	4.1-5.6	65.2%***
Context assessment	4.4 (0.6)	8.1	3.4-5.5	45.6%***
Demonstrating ownership	3.8 (0.7)	8.6	2.9-4.7	48.4%***
Data analysis	4.2 (0.7)	8.1	3.1-5.2	45.3%***
Multiple solutions	4.7 (0.8)	10.5	3.8-5.6	58.1%***
Conclusion and implications	4.2 (0.7)	8.3	3.2-5.3	46.2%***
Communication	4.9 (0.8)	10.5	4.0-5.6	58.2%***
Assessment 4 (Tutorial participation, 20%)				
Critical thinking (total score)	0.2 (0.6)	6.5	0.1-0.2	35.5%***
Problem identification	1.0 (0.5)	5.1	0.6-1.3	24.0%***
Context assessment	1.1 (0.5)	5.5	0.7-1.5	27.0%***
Demonstrating ownership	0.9 (0.6)	5.9	0.6-1.3	30.3%***
Data analysis	1.2 (0.6)	6.4	0.8-1.5	34.2%***
Multiple solutions	1.2 (0.6)	6.6	0.8-1.6	35.3%***
Conclusion and implications	1.0 (0.5)	5.1	0.6-1.4	24.6%***
Communication	1.1 (0.5)	5.2	0.6-1.5	25.2%***

TABLE 5 Regression analyses for critical thinking and its dimensions predicting final and assessments marks ($n = 79$)

Abbreviation: CI, confidence interval.

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

3.7 | Regression analysis: Predictive power of critical thinking dimensions predicting assessment marks

After revealing the correlation and predicting power of critical thinking and its dimensions for the final marks, regression analyses were performed to determine the predictive power of the critical thinking dimensions for each assessment mark. Critical thinking and its dimensions significantly predicted the marks of each assessment (see Table 5).

Critical thinking (total score) strongly predicted student performance in the examination (63.6%) and the report assessments (47.8%), compared to tutorial participation (35.5%) and the essay assessments (21.3%). In terms of critical thinking dimensions, the communication dimension was the strongest predictor of student performance in the essay assessments (24.4%), while the problem identification dimension was the strongest predictor of student performance in the report assessments (48.2%) and the examination (65.2%). The dimension, multiple solutions, was the strongest predictor of student participation in the tutorials (35.3%).

4 | DISCUSSION

Critical thinking is a fundamental competency to improve the ability to interpret, evaluate and analyse arguments and ideas.⁴⁴ However, critical thinking skills are limited among international students from the Middle East and Asia, mainly due to previous training in memorisation rather than self-directed learning and critical thinking.⁸ They need to overcome cross-cultural differences in education systems while growing to appreciate the distinct education system that places pride in enforcing critical thinking.¹¹ Memorization relies more on exams while critical thinking focuses on a research-based essay writing.¹² The complexity and dynamic nature of health promotion practice necessitates alternative learning modalities to equip students with critical thinking skills.^{4,45} In line with extant literature,^{16,20} results from this study suggested that case studies significantly improved critical thinking skills among international students from the Middle East and Asia. A paired *t*-test analysis showed that the intervention – case scenario-based teaching – significantly improved the mean post-intervention critical thinking skills. A *t*-test and one-way ANOVA indicated that post intervention improvements in critical thinking skills were not related to student gender, age, or country of origin. This is a significant finding, demonstrating that the impact of case study-based teaching on students' critical thinking skills is not influenced by their demographic attributes. As such, case studies can improve critical thinking skills among international students from Middle East and Asia.

The mean critical thinking scores increased exponentially with the increase of grades. However, improvement among the students who received a high distinction was more reliable, relative to their counterparts who received lower grades. This finding indicates that case scenario-based teaching generates different levels of critical thinking, depending on grade level. In other words, high performing students are more likely to benefit from case studies. Furthermore, those who receive a high distinction are likely to experience improved critical skills for a longer period. This suggests that students with lower grades will need more cases to practise if case studies are selected to improve critical thinking.

Critical thinking predicted 78.6 of the total marks, after controlling for demographic attributes. In relation to the dimensions of critical thinking, problem identification, multiple solutions, and communication were the main predictors of the total marks, while competing with other dimensions as well as the demographic attributes. The problem identification dimension was the strongest predictor of the total marks. These findings demonstrate that improving critical thinking is a reliable way to improve student marks and their grades. However, improving the dimensions of problem identification, multiple solutions, and communication of critical thinking are more likely to yield promising outcomes.

Improved critical thinking improved student performance in the examination and report assessments, relative to tutorial participation and the essay assessments. In terms of the critical thinking dimensions, improved communication resulted in better marks for the essay assessments. Improved multiple solutions skills yielded better marks for tutorial participations; while improved problem identification skills improved marks for the report assessments and examination. This finding demonstrates how critical thinking and its dimensions impact

performance in different assessments. It suggests the impact of critical thinking on different assessments varies; as such, the different dimensions of critical thinking should be targeted for different assessments. For instance, multiple solutions are necessary for tutorial participation, while problem identification is key to report assessments.

5 | CONCLUSION

Our findings suggest case studies can be used to improve critical thinking among international students. Interestingly, case study induced improvement in critical thinking does not differ by demographics characteristics, which make it a great modality for critical thinking teaching. This study's results showed that critical thinking reliably improves student marks however it works much better for high achiever students – as such, students who struggle with their academic studies will require more practice when using case scenario-based teaching. Our finding sheds light on how critical thinking and its dimensions impact marks for different assessments and has important implications for teachers in university settings. Our result showed that the different dimensions of critical thinking impact assessment marks differently. As such, it is important to purposely target different dimensions in different assessments. In other words, different dimensions of critical thinking work for different assessments therefore targeting different dimensions of critical thinking is necessary for achieving better marks among international students.

This study makes a strong case for case scenario-based teaching to improve critical thinking among international students. However, given the limitations of this study, including the small, non-representative sample, further testing is required. Specifically, to improve teaching strategies, research is required to: test variations of the case scenario-based teaching used in this study; involve a greater variety of students; and consider their confidence, anxiety, and self-efficacy levels when using their critical thinking skills. This might involve a case control or randomised control study design to enhance the veracity of the findings. Qualitative study in conjunction with randomised control study might help suggest why critical thinking skills are less present in lower scoring students.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

ETHICS STATEMENT

The study was granted ethics approval by Human Research Ethics Committee at the University of Wollongong.

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