



## Original Research Article

## Learning with peers: Does that foster critical reasoning?

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## ABSTRACT

**Background:** Health science education is competency based education where one needs to critically think and analyse the problem. Critical thinking is meta-cognitive process where self-learning and meaningful learning are integral. Peer-learning helps in fostering higher order thinking and provides the environment for meaningful learning. There is a mixed evidence of effectiveness of peer learning. Very few studies have addressed changing group dynamics, group composition and its effect on critical reasoning ability. Hence present study aimed to assess effectiveness of peer-learning on critical reasoning ability, in physiotherapy undergraduate students, with changing group composition.

**Methodology:** This quasi experimental two group crossover study was conducted in two phases. Total 37 fourth year physiotherapy students were involved in the study by convenient sampling. The students were randomly allocated in two groups. In first phase, Group One was sub-grouped based on scores of content knowledge test taken before experiment, by grouping high, medium and low scorers together. Group Two was given a freedom to choose their partners. In second phase groups crossed over. Five case-based sessions were conducted in each phase and both groups fulfilled the objectives, by peer discussion within their sub-group. Outcome measure was health science critical reasoning ability using Health Science Reasoning Test score.

**Results:** There was no significant difference found in the test scores between both the groups. This study does not favour the effectiveness of the peer-learning in improving critical reasoning skills. There found no effect of changing group composition on critical reasoning ability. The results could be content and discipline specific.

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## 1. Introduction

Health science education is competency based education. There are various implicit and explicit ways by which students learn e.g. in classroom lectures, clinical postings, laboratories. They learn through observations, practice, discussions, with and from each other. Thus peer learning is integral part of health science education. In order to be competent health professional one needs to possess ability to critically think and analyse the problem. Meaningful learning is important component of critical thinking.<sup>1</sup> Peer learning provides students meaningful learning environment

through social interactions.<sup>2</sup>

There has been research on effectiveness of peer learning on improving critical thinking or reasoning abilities. When the literature was searched for the present paper there was mixed evidence found in favor and in contrast to the effectiveness peer learning in improving critical reasoning abilities. Also it highlighted pitfalls in the research on the critical reasoning. Literature showed mixed evidence and was inconsistent as far as peer group design was concerned. There were very few researches found addressing the crucial part of group design and its effect on learning outcomes. Group dynamics was found to affect amount and quality of communication between peers which ultimately affects learning outcomes.<sup>3</sup> Therefore this study was undertaken to

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find effectiveness of peer learning on critical reasoning with changing group composition in physiotherapy education.

## 2. Review of Related Literature

In literature peer learning takes various terminologies like

1. Peer tutoring,
2. Peer mentoring
3. Collaborative learning,
4. Co-operative learning,
5. Near peer teaching,
6. Group learning.

### 2.1. Conceptual frame work

Literature provides the conceptual framework of the peer learning as well as addresses the key concepts to be considered in designing the research.

1. Falchikov (2003) have focused, on design, delivery, and evaluation of peer-tutoring, and its context. Report explores the key terms and issues around “peer”. It gives the context and provide practical guide for implementing the peer-learning. Importantly the report details the interactive factors operating and interacting with respect to the group design and characteristics and roles of the peers which were the focus of this paper.<sup>3</sup>
2. Topping (1996) in their review article have highlighted the need of quality in research design. They reported that peer learning being a very small part of curriculum its benefits can't be ascertained in terms of generalizability and measurability.<sup>4</sup>
3. Topping (2005) have explored more details on peer learning in their article, where important factors and variables affecting the study design and ultimately the learning outcome have been highlighted which was relevant to the present study.<sup>5</sup>

### 2.2. Critical reasoning

Literature on critical reasoning had the consensus on the importance of critical reasoning and how difficult it is to teach.

1. Willingham (2008) in their report have explored extensively on misconceptions, factors to be addressed while teaching the critical reasoning to the students. They highlighted importance of integrated approach, role of domain knowledge, self-learning and imbibing the “right type of thinking at right time” when it comes to critical thinking.<sup>1</sup>
2. Persky et al. (2019) in their review article have focused on the importance and barriers of the critical thinking. They report the personal perceptive and cognitive characteristics can influence the critical thinking

ability. Critical thinking ability can be enhanced however takes lot of practice and efforts.<sup>6</sup>

3. Edwards (2007) highlighted difficulties of teaching critical thinking due to complexity of concept. Researcher emphasizes the need of critical thinking to be cultivated, learned, developed and practiced.<sup>7</sup>

## 3. Review of Related Research

As mentioned earlier when the research was reviewed on the effectiveness of peer learning on critical thinking there was mixed evidence found.

1. Gokhale (1995) when studied individualized versus collaborative learning, concluded that both are effective to improve factual knowledge but for critical thinking collaborative learning was more beneficial.<sup>8</sup> Whereas Johnson et al. (2010) when used combined model of collaborative, team based social annotation model learning system they found no improvement in critical thinking.<sup>9</sup>
2. Dornier et al. (2019) found 2:1 peer learning model in clinical set ups enhances the critical thinking abilities among respiratory physical therapists.<sup>10</sup> Burns et al. (2013) in their pilot study in anesthesia nursing students found no improvement in critical thinking and highlighted the need to explore more on instructional strategies.<sup>11</sup>
3. Karami et al. (2012) in their quasi experimental study found that collaborative learning is effective in improving critical thinking.<sup>12</sup> When it comes to effectiveness of peer learning, literature highlights the importance of group dynamics as it affects amount and quality of communication between peers which ultimately affects learning outcomes. Group dynamics is complex as it is influenced by the group design, characteristics and role of peers.<sup>3</sup> However research reports give mixed evidence and are inconsistent as far as peer group design is concerned.
4. Damodar et al. (2009) studied the effect of random allocation of peer group versus combined group of low, medium and high scorers.<sup>13</sup> They found better achievement in combined group. Whereas Wing-yi Cheng et al. (2008) found that heterogeneity is not the determinant of learning efficacy.<sup>14</sup>
5. Senior and Howard (2014) studied the factor of friendship in group formation and found it to be effective.<sup>15</sup> Similar findings were reported by Roberts (2009).<sup>16</sup> However Greco & Morris, (2005) contradict the assumptions.<sup>17</sup>

There found no research report, addressing the crucial part of group design and its effect on critical reasoning. Thus the research question emerged as follows.

### 3.1. Research question

“What is the effect of changing group composition in peer learning on critical reasoning ability?”

To address this research question following study was conducted under title “Learning with Peers: Does that Foster Critical Thinking?”

### 3.2. Research objective

Objective intended to be fulfilled through the study was as follows

To compare effectiveness of groups formed through equating peer-led approach and groups formed through learners’ choices peer-led approach to case-based learning in physiotherapy education in terms of health science critical reasoning ability.

### 3.3. Hypothesis

In context of the present study following null hypothesis was to be tested.

There is no difference in the effectiveness of groups formed through equating peer-led approach and groups formed through learners’ choices peer-led approach to case-based learning in physiotherapy education in terms of health science critical reasoning ability

### 3.4. Methodology

The research methodology adopted for the present study was as follows;

#### 3.4.1. Research design

This was quasi experimental two group pre-test post-test cross over study design. It was conducted in two phases. All the eligible participants were involved after obtaining the written informed consent. Study was approved by Institutional Ethics Committee of the researcher’s institution.

#### 3.4.2. Population

Physiotherapy education is a UGC approved discipline. In Maharashtra it is under the Maharashtra University of Health Sciences, (MUHS), Nashik. Approximate population size was 1500 fourth year physiotherapy students from 40 colleges of physiotherapy across State of Maharashtra

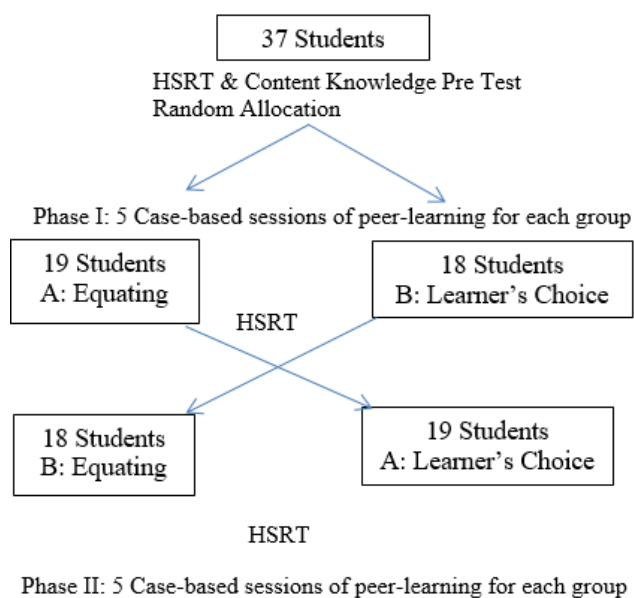
#### 3.4.3. Sample

All the participants were selected by convenient sampling from the Physiotherapy School and Centre. Sample size was 40. Student sample was between 21 to 23 years of age. However repeater students were excluded from the study. The resultant 37 students were included in the study.

#### 3.4.4. Experimental treatment

Before the experiment began all the participant students underwent the content knowledge pre-test. Then the students were randomly allocated in two groups A & B. Group A was sub-grouped on basis of this pre-test score. High, medium and low scorers were grouped together in such a way that mean scores of all subgroups is equal. This group was the equating group. Group B was allowed to choose their sub-group partners. This group was learner’s choice group. After 20 days of wash out period these groups crossed over. Group A, then was allowed to choose their partners whereas Group B was sub-grouped on basis of equating scores. In each phase five case-based sessions were conducted where real life case scenarios were presented. Students were also given the objectives to fulfill by peer group discussion. Students were allowed to refer the resources like internet, books, and notes during the peer group discussions. They were expected to brain storm and discuss within their sub-group. Discussions or taking help from the other sub-groups were not permitted. After each session they were given the related case-let to solve. Students underwent the health science critical reasoning ability assessment before the beginning of experiment and after each phase of experiment.

Design and flow of participants through experiment is depicted in Figure 1.



**Fig. 1:** Design & flow of participants through experiment

#### 3.4.5. Tools for data collection

The tool used to assess the critical reasoning ability was Health Science Reasoning Test (HSRT). This instrument is developed by Insight Assessments.<sup>18</sup> It is commercially available standardized tool to test critical reasoning skills

**Table 1:** Statistical analysis of normality testing for health science critical reasoning ability

Parameter	Mean	SD	SE	n	D	$D_{n,\alpha}$ 0.05	$D_{n,\alpha}$ 0.01	Distribution
Learner's Choice	15.37	5.27	0.86	37	0.16	0.14	0.16	Normal
Equating	15.13	4.86	0.79	37	0.13			Normal

D= Observed value,  $D_{n,\alpha}$  = Critical Value

**Table 2:** Summary of inferential statistics for health science critical reasoning ability between equating and learner's choice group

	Mean	df	't' Obs	Table value 0.05	Table Value 0.01	CI 95%	'p' Value	Significance
Equating	15.13	36	0.41	2.03	2.72	-0.14 To 0.94	0.67	No
Learner's Choice	15.37	36						

df = Degrees of freedom, 't' obs = Observed 't' value, CI= Confidence Interval

specifically in health science professionals. This test is specially calibrated for trainees in Health Sciences educational programs, undergraduates and graduates. The HSRT overall score targets the strength and weakness of one's skill in making reflective and reasoned judgments.<sup>18</sup> The test was administered online.

### 3.5. Results and findings

The data of the test scores were subjected to normality testing using Kolmogorov Smirnov Test.<sup>19</sup> The statistical analysis is summarised in the Table 1.

#### 3.5.1. Observations

1. The mean test scores in group formed through learner's choice peer-led approach were higher than group formed through equating for health science critical reasoning.
2. Data were normally distributed.<sup>19</sup>

Data were normally distributed, hence analysis for the significance of difference of mean between both the groups for health science critical reasoning ability was done using paired 't' test.<sup>20</sup> Inferential statistics is summarized in Table 2.

#### 3.5.2. Observations and interpretations

1. Mean scores of HSRT were more in the learner's choice group as compared to equating group.
2. Observed 't' value was lower than critical 't' at 0.05 and 0.01.
3. The calculated 'p' value for significance of difference of mean between the groups was observed to be higher than the desired significance level ( $p > 0.05$ ).

#### 3.5.3. Findings

1. Difference of mean in HSRT scores between group formed through equating and through learner's choice peer-led approach was found to be statistically not significant.

2. As the difference between the groups was statistically not significant the null hypothesis was retained.

## 4. Discussion of Results

The striking finding of the present study was, no improvement seen in the health science critical reasoning ability in both the groups. There was no significant difference between both the groups.

1. Previous literature has shown that peer learning or collaborative learning helps improving critical thinking which is core competency.<sup>1,21</sup> Peer discussions, brainstorming, conflicts and disagreements are termed as "Cognitive conflicts" which contributes to learning.<sup>22</sup> Dealing with conflicts fosters higher order critical thinking. However the present study findings contradict these findings.
2. Previous study done in nursing anaesthesia practice has shown similar results as present study, where they found no improvement in critical reasoning skills in their pilot analysis, where they used concept mapping technique.<sup>23</sup> That puts forth the need of more in depth research on the instructional strategies.
3. In nursing practice, studies have shown the traditional care practices have been shown to be superior in teaching critical reasoning skills.<sup>11</sup> Critical reasoning is one of the core competences which play a crucial role in problem solving.<sup>1</sup>
4. However studies showed that critical or scientific thinking is based on domain and practice. It is not a set of skills which can be taught or deployed regardless of context or cannot assure once learnt can be applied in any situation. Process of thinking is not a skill. It is inter-wined with domain of knowledge. It is a thought process. It is seen that those with better prior integrated knowledge perform better.<sup>1</sup>
5. Certain personal barriers have been identified which may hinder enhancement of critical thinking. Those are students' perceptual problem, weak metacognitive

skills, fixed mind set, heuristic or short cut way of thinking, inherent biases. In present study there could have been the influence of the personal attributes of the students influenced the results, however that cannot be endorsed due to lack of evidence.

6. Critical thinking is difficult to be developed and requires enormous practice. It is estimated about ten years of practice to develop critical thinking.<sup>6</sup>
7. Scientific thinking needs to be taught hand in hand with scientific content. Present experiment was based on the existing curricular program and the results highlight the need of strategic thinking on the curricular reforms which requires more integrated approach.
8. This was first ever formally designed experiment for the participating students where they were involved in brainstorming, group discussion which was self-regulated.
9. Probably the long term exposure and in depth exploration of the instructional strategy, nurturing and inculcating all throughout curriculum may foster better outcomes. That puts forth need of future research on role of peer-learning in improving critical reasoning.

## 5. Conclusions

This study does not favour the effectiveness of differential group composition in peer learning in improving critical reasoning skills. There found no effect of changing group composition on critical reasoning ability.

## 6. Limitations

The results could be content and discipline specific. Hence may not be generalised for different domain, content or discipline

## 7. Remedial Measures and Future Suggestions

This study has put forth the need of the future in depth research on the peer-learning instructional strategy and critical reasoning ability. Integrated curricular approach where scientific thinking goes hand in hand with scientific content and long term exposure may help in exploration of development of critical thinking.

## 8. Source of Funding

None.

## 9. Conflict of Interest

None.

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