

Developing Critical Thinking Skill among Prospective Teachers at the Undergraduate Level: An Experimental Study

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Abstract

The present study aimed to develop critical thinking skills among prospective teachers at the undergraduate level. The present study was experimental in nature. The population of the present study consisted of all prospective teachers from the Department of Education at the University of Lahore. The study sample comprised eight students from the B.Ed. (Hons) Elementary 2nd semester. The experiment consisted of 16 weeks. The researcher used an A-B-A withdrawal design of single-subject research, which is an adaptation of the basic time series design. The experiment consisted of three phases: an initial baseline phase without treatment, a treatment phase introducing critical thinking strategies, and a withdrawal phase reverting to baseline conditions. Findings indicated that treatment significantly developed the critical thinking skills among prospective teachers at the undergraduate level. Moreover, visual analysis indicated the same results during the withdrawal phase. The present study recommends embedding critical thinking goals in all education courses, with emphasis on teaching, lesson planning, and assessment. Focus on developing critical thinking skills in students to analyse, evaluate, and synthesise ideas.

Key Words

Critical Thinking, Prospective Teachers, Undergraduate Level

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Introduction

Critical Thinking (CT) has been recognised as one of the most important thinking skills and one of the most important indicators of student learning quality. In order to develop successful critical thinkers, critical thinking must be incorporated into the curriculum content and teaching approaches and sequenced at all grade levels with a view to improving it. Critical Thinking (CT) is widely regarded as one of the most essential higher-order thinking skills and a vital component of academic success in higher education. For prospective teachers, critical thinking is not only crucial for their own academic performance but also for developing the capacity to foster similar skills in their future students. As future educators, undergraduate teacher trainees must be equipped with the ability to think analytically, evaluate evidence, and make informed pedagogical decisions.

The roots of critical thinking in education can be traced back to John Dewey (1916, as cited in Kuhn, 1999), who described it as a reflective thinking process that begins with a problem and concludes with a reasoned judgment. Dewey's emphasis on inquiry, reflection, and problem-solving laid the foundation for modern

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conceptions of CT in teacher education. Building upon this, Keith and Kurfiss (1990) defined critical thinking as “an investigation whose purpose is to explore a situation, phenomenon, question, or problem to arrive at a hypothesis or conclusion that can therefore be convincingly justified.” This perspective underlines the role of critical thinking in deepening understanding and enhancing learning outcomes.

Paul (1991) offered a more detailed definition, referring to critical thinking as “the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a rubric to belief and action.” Later, Paul and Elder (2019) expanded this view, describing critical thinking as “the art of analyzing and evaluating thinking with a view to improving it.” These definitions highlight CT as a complex set of cognitive operations that support better thinking and problem-solving.

From the standpoint of cognitive psychology, Halpern (1997) defined CT as the “use of those cognitive skills or strategies that increase the probability of a desirable outcome.” She emphasises that critical thinking is purposeful, reasoned, and goal-oriented thinking that supports effective problem-solving and decision-making. Such skills are particularly significant for prospective teachers, who must continually analyse classroom situations, assess student needs, and make informed instructional choices.

Pithers and Soden (2000) also highlighted that critical thinking involves recognising the value of worthwhile questions, conducting self-directed inquiry, and supporting arguments with evidence. These abilities are directly linked to the academic demands of teacher training programs, where prospective teachers are expected to critically engage with theoretical and practical knowledge. Despite general agreement on its importance, the definition and implementation of CT vary across disciplines and contexts (Condon & Kelly-Riley, 2004). Researchers such as Rivas et al. (2023) have pointed out that while critical thinking is acknowledged as a significant determinant of student success, there remains limited consensus on how it should be defined and measured in educational settings. This challenge is particularly relevant in teacher education, where CT must be aligned with both academic and professional competencies.

Bean (2011) argued that critical thinking is best cultivated through problem-based learning that stimulates curiosity and critical inquiry. For prospective teachers, such an approach not only supports academic achievement but also models effective teaching strategies that they can apply in their future classrooms. Given these perspectives, it becomes evident that CT plays a pivotal role in shaping the academic performance of undergraduate students in teacher education programs. Therefore, this study seeks to examine the effect of critical thinking on the academic performance of prospective teachers at the undergraduate level, with the aim of informing curriculum development and instructional practices in teacher education.

Condon and Kelly-Riley (2004) emphasised that while critical thinking is widely acknowledged as a high-level thinking skill, the specific cognitive skills involved may vary depending on teachers' goals, students' needs, and disciplinary contexts. Rivas et al. (2023) further noted the lack of consensus on CT's precise definition and how it should be taught or assessed.

Empirical studies suggest that critical thinking is one of the most influential factors affecting students' academic performance. Learners who engage in critical thinking develop a range of transferable skills that enhance their productivity and learning outcomes (Taghva et al., 2014). Numerous studies conducted primarily in higher education contexts have found a strong correlation between critical thinking and academic success, particularly as measured by cumulative GPA (Williams et al., 2003; Williams & Stockdale, 2003). Specifically, it explores the presence and levels of critical thinking across three divisions of a teacher education institute and examines how these skills relate to academic achievement. The findings of this research are expected to inform curriculum development, enhance the professional preparation of future teachers, and contribute to ongoing discussions in the field of educational research.

Critical Thinking

Critical thinking is commonly understood as sound judgment, in contrast to irrational or flawed reasoning, and its development requires the engagement of several cognitive abilities. These include interpretation, or the ability to comprehend the meaning and context of information; analysis, which involves drawing conclusions about a particular issue; evaluation, which entails assessing the credibility and relevance of statements or claims; inference, the capacity to derive logical conclusions and hypotheses from available evidence; explanation, which is the clear and coherent communication of one's reasoning; and self-regulation, the ability to critically reflect on and refine one's own thought processes (Facione, 2020).

Beyond these cognitive components, dispositions toward critical thinking are equally vital for effective, reflective reasoning. These include traits such as open-mindedness, curiosity, adaptability, fairness, persistence in seeking truth, and confidence in rational inquiry (Facione, 2020). Such dispositions shape how individuals choose to engage their cognitive skills across different contexts. They are considered enduring internal motivations that foster a consistent commitment to critical thinking, intellectual humility, recognition of personal and external biases, and a readiness to explore new ideas and perspectives (Mpofu & Nthontho, 2017). As Krupat et al. (2024) emphasise, possessing critical thinking skills alone is insufficient; what defines a true critical thinker is the inclination to apply those skills when needed.

This study aims to develop critical thinking skills among prospective teachers at the undergraduate level, with a specific focus on teacher education institutions. The research investigates the extent to which critical thinking skills are developed among prospective teachers and examines how these skills influence their academic outcomes.

Objectives of the Study

The objectives of the study are to,

1. Develop critical thinking skills among prospective teachers at the undergraduate level.

Hypotheses of the Study

H₀₁: There is no significant effect of treatment on developing critical thinking skills among prospective teachers at the undergraduate level.

Methodology

The present study aimed to develop critical thinking skills among prospective teachers at the undergraduate level. An A-B-A single-subject experimental design was employed. This design, which is a variation of the time-series design, is well-suited for examining the influence of an independent variable by comparing performance across three distinct phases: an initial baseline phase (A), an intervention phase (B), and a withdrawal or return-to-baseline phase (A). During the first phase, participants' critical thinking skill was observed without any intervention. In the second phase, critical thinking skill was developed by applying critical thinking skill techniques/ strategies during treatment, while in the final phase, the experiment was withdrawn to determine if changes in behaviour could be attributed to the intervention.

The population of the present study comprised all prospective teachers enrolled in the Department of Education at the University of Lahore. A purposive sampling technique was used to select a sample of eight students from the B.Ed. (Hons) Elementary 2nd-semester program. The experimental procedure lasted for 16 weeks and was carefully divided into the three phases mentioned above. Throughout the study, data points were collected to develop critical thinking skills among prospective teachers during the intervention. Data were analysed using inferential statistics, specifically a one-way repeated measures ANOVA, which was suitable for assessing within-subject changes over time.

Intervention

The implementation of the A-B-A single-subject research design in this study involved three distinct phases to develop the critical thinking skills among prospective teachers at the undergraduate level. In the first phase (A), a baseline was established by observing prospective teachers' critical thinking skills without any intervention. This phase served as the control condition, allowing the researcher to assess students' natural academic output prior to the introduction of critical thinking strategies. Multiple assessments were conducted during this period, and the average performance scores were plotted on a line graph to represent the baseline level.

The second phase (B) introduced the intervention, which consisted of structured critical thinking strategies integrated into regular instruction. This phase was implemented in two stages. In the first stage, the researcher modelled critical thinking practices during classroom instruction, demonstrating how to apply analytical and reflective thinking in academic tasks. In the second stage, students engaged in activities such as problem-solving, argument analysis, and decision-making exercises, designed to develop and reinforce their critical thinking skills. Their performance during this phase was monitored and recorded for comparison with baseline data.

The final phase (A), or the withdrawal phase, was observed after the intervention was removed. During this phase, students returned to regular academic activities without the deliberate inclusion of critical thinking strategies. Their performance was observed three times, and the average scores were again plotted to evaluate any sustained effects of the prior intervention. Repeated measures ANOVA was used to analyse data collected across all three phases: baseline, intervention, and withdrawal, to determine the impact of treatment.

Results

Table 1

Mauchly's Test of Sphericity of Critical Thinking Skills among Prospective Teachers During Baseline

Within Subject Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Greenhouse-Geisser (Epsilon ^a)
Baseline Period	.927	.456	2	.796	.932

Mauchly's Test of Sphericity was conducted to assess the assumption required for Repeated Measures ANOVA. The test yielded a non-significant result ($p = 0.796$), which exceeds the threshold of 0.05, indicating that the assumption of sphericity was met and there were no significant differences in the variances of the differences between conditions. The Greenhouse-Geisser epsilon (ϵ) value, which typically falls between 1 and $1/k$ (with k being the number of repeated measures), was also considered. In this study, the calculated value of $1/(k-1)$ was 0.5, which is below the 0.75 threshold, guiding the choice of the Greenhouse-Geisser correction if needed.

Table 2

Critical Thinking Skills among Prospective Teachers during baseline across Three Steps of Intervention

Measures	Baseline Period		
	N	Mean	SD
Test 1	08	2.87	1.12
Test 2	08	3.12	1.55
Test 3	08	2.50	.755
F		61.303	
df		7	
Sig.		.796	
Partial Eta squared		.898	

The results of Table 2 show that the value of critical thinking skills among prospective teachers was $F(61.303)$, $p .796 > .05$ significance level. It is concluded that no significant differences among prospective teachers' performance during the baseline period were found at the undergraduate level.

Figure 1

Estimated Marginal Means of Measure

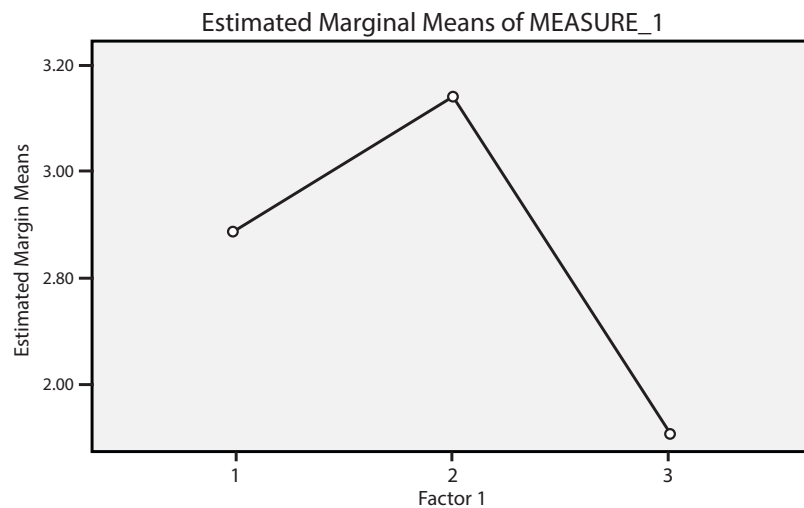


Table 3

Mauchly's Test of Sphericity: Significant Effect of Treatment on Critical Thinking among Prospective Teachers During Treatment Phase

Within Subject Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Greenhouse-Geisser (Epsilon ^b)
Treatment Phase	.207	8.536	9	.000	.604

Mauchly's Test of Sphericity indicated a significant result ($p = .000$), violating the sphericity assumption in Repeated Measures ANOVA and suggesting a significant treatment effect. Since the Greenhouse-Geisser estimate (ϵ) ranged below the 0.75 threshold ($1/(k-1) = 0.5$), the Greenhouse-Geisser correction was applied.

Table 4

Critical Thinking Skills among Prospective Teachers during Treatment Phase across Five Steps of Intervention

Measures	Baseline Period		
	N	Mean	SD
Test 1	08	9.37	.517
Test 2	08	9.62	1.06
Test 3	08	10.37	.916
Test 4	08	11.87	1.45
Test 5	08	14.87	.834
F		2719.089	
df		7	
Sig.		.000	
Partial Eta squared		.997	

The results of Table 4 show that the value is significant at $F(2719.089)$, $p = .000$ at $p < .05$ significance level, therefore, it is concluded that the significant effect of treatment on developing critical thinking skills among prospective teachers was found at the undergraduate level.

Figure 2

Estimated Marginal Means of Measure

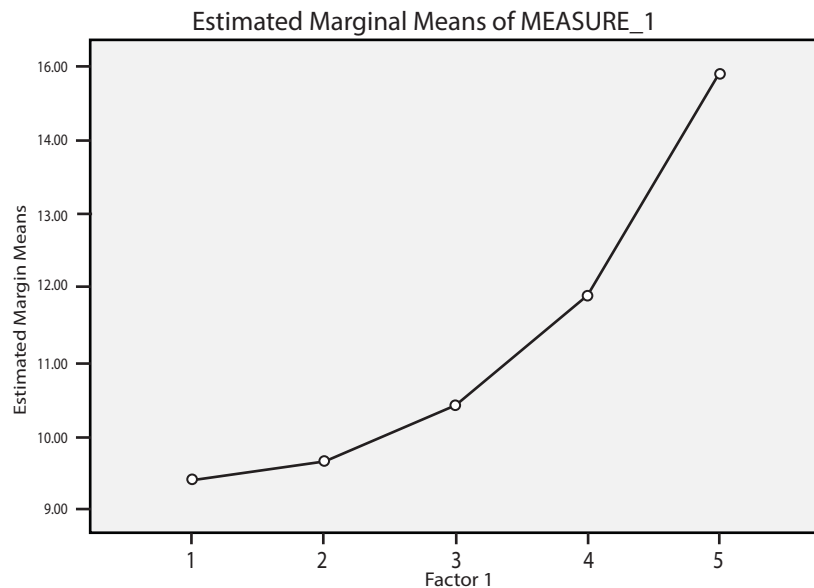


Table 5

Mauchly's Test of Sphericity on Critical Thinking Skills among Prospective Teachers during Withdrawal Phase

Within Subject Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Greenhouse-Geisser (Epsilon ^b)
Baseline Period	.858	.920	2	.000	.876

Mauchly's Test of Sphericity was used to validate the assumption for Repeated Measures ANOVA. The significant result ($p = .000$) indicates a violation of sphericity and significant differences between variances. Since the Greenhouse-Geisser estimate (ϵ) falls below 0.75 (with $1/(k-1) = 0.5$), the Greenhouse-Geisser correction was applied.

Table 6

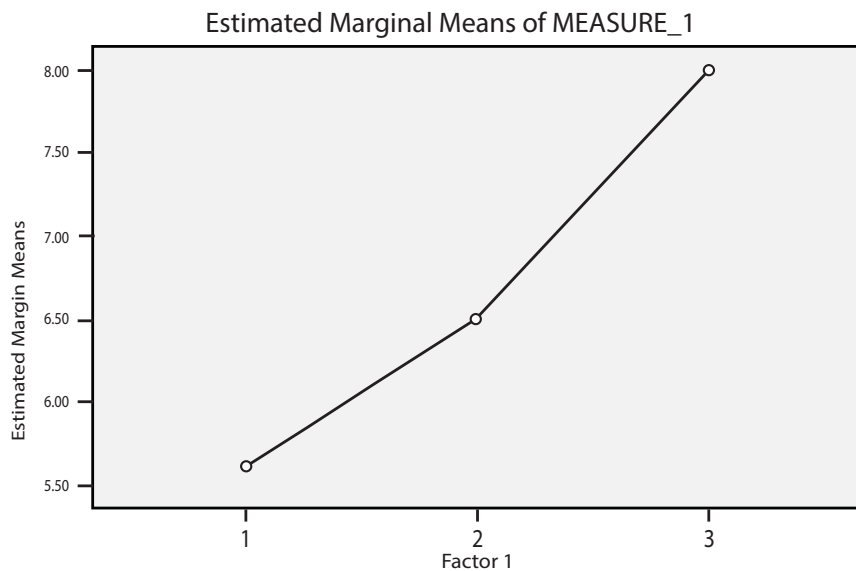
Critical Thinking Skills among Prospective Teachers during Withdrawal Phase Across Three Steps of Intervention

Measures	Baseline Period		
	N	Mean	SD
Test. 1	08	5.62	1.30
Test 2	08	6.50	1.41
Test.3	08	8.00	1.19
F		554.884	
Df		7	
Sig.		.000	
Partial Eta squared		.988	

The results of Table 6 show that the value is significant at $F(5923.604)$, $p .000 < .05$ significance level; therefore, it is concluded that the significant effect of treatment in developing critical thinking skills among prospective teachers was found at the undergraduate level.

Figure 3

Estimated Marginal Means of Measure



Discussion

The findings of this study offer meaningful insights into the development of critical thinking skills (CT) among prospective teachers at the undergraduate level. Using an A-B-A single-subject design, the study measures the performance changes across three phases: baseline, intervention, and withdrawal. Results from the repeated measures ANOVA revealed no significant effect during the baseline phase, suggesting that in the absence of deliberate critical thinking strategies, the students' performance remained stable and relatively low.

However, the introduction of structured critical thinking strategies during the treatment phase resulted in a marked and statistically significant improvement in performance. This aligns with existing literature that emphasises the impact of critical thinking on higher-order thinking, academic success, and student engagement (Paul & Elder, 2019; Taghva et al., 2014). Notably, the continued positive trend during the withdrawal phase, albeit to a lesser degree, suggests that critical thinking skills, once introduced and practised, may have a lasting impact on learners' cognitive engagement and performance.

These results also support Dewey's (1916) conception of reflective thought and Halpern's (1997) assertion that critical thinking is goal-directed, purposeful reasoning that leads to improved outcomes. The integration of reflective practices and problem-solving activities proved to be an effective pedagogical tool in fostering analytical reasoning, inference, and self-regulation, core components of critical thinking.

The study also addresses an important gap in education by empirically demonstrating the value of embedding critical thinking into undergraduate curricula. Despite the small sample size, the consistency of improvement during the intervention and partial retention during the withdrawal phase provides robust evidence of CT's effectiveness. This reinforces Bean's (2011) argument for CT-driven, problem-based learning in education programs.

Recommendations

The following were the recommendations of the present study.

1. Incorporate active teaching strategies such as debates, problem-solving tasks, role-plays, and inquiry-based learning to promote independent thinking, multiple perspectives, and evidence-based reasoning.
2. Assign complex or controversial readings that prompt students to reflect, critique, and compare ideas, enhancing their ability to think critically across diverse viewpoints.
3. Facilitate peer review activities where students provide constructive feedback on each other's lesson plans, teaching strategies, or reflections to strengthen evaluative and reasoning skills.
4. Develop questioning techniques by training students to ask open-ended, thought-provoking questions that nurture curiosity and critical inquiry in both learning and teaching contexts.
5. Engage students with real or simulated teaching scenarios and ethical dilemmas that require them to analyse issues, consider alternatives, and justify decisions using logic and ethical reasoning.

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