Exploring Critical Thinking Disposition of Prospective Educators: Implications for Pedagogical Augmentation

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Received: July 4, 2024 Accepted: October 7, 2024 Online Published: November 12, 2024

doi:10.5430/jct.v13n5p233 URL: https://doi.org/10.5430/jct.v13n5p233

Abstract

This research endeavours to explore the critical thinking disposition observed within the cohort of pre-service teachers, subsequently establishing its potential interplay with pertinent demographic variables encompassing academic lineage, high school categorization, and parental employment status. This study delves into the critical thinking disposition of prospective educators within the context of India's National Education Policy (NEP) 2020. This exploration resonates with the NEP's overarching emphasis on fostering multidisciplinary education and innovative pedagogical approaches. By means of investigating the intricate correlations underpinning these dimensions, this study seeks to not only unravel the prevailing level of critical thinking disposition amongst aspiring educators but also to discern any discernible differentials predicated upon the elucidated demographic factors. In doing so, the research aspires to furnish nuanced insights into the putative ramifications of these demographic determinants upon the cognitive proclivities of nascent pedagogues. The research cohort encompasses 170 potential educators drawn from diverse private and public universities, employing a stratified random sampling approach for selection. Data acquisition was carried out through the application of the Florida Critical Disposition Scale (UF/EMI), encompassing three fundamental constructs: Engagement, Innovativeness, and Cognitive Maturity. In adherence to the tenets of quantitative inquiry, the survey methodology was deployed to amass the requisite data. Subsequently, a blend of descriptive statistics, t-test, ANOVA, and point-biserial correlation analysis was enlisted to meticulously scrutinize and interpret the acquired dataset. The study's findings hold potential to enhance teacher education quality, aligning with NEP 2020's focus on professional development and curriculum enrichment, fostering educators adept in cultivating critical thinking skills for dynamic learning environment.

Keywords: critical thinking, critical thinking disposition, teacher education, education policy

1. Introduction

The education system exercises a paramount influence in shaping the trajectory and overall welfare of a society. An inadequate educational framework, deficient in fostering autonomous thinking, gives rise to individuals who passively adhere to authority and grapple with decision-making. Such archaic systems find themselves incongruous with the contemporary global milieu. Modern educational paradigms are meticulously crafted to nurture individuals exemplifying inventiveness, literacy, and proficiency in both creative and critical thinking (Akinoglu, 2002). Dewey postulated that certain attributes are imperative for individuals to partake in reflective actions, encompassing receptiveness, accountability, and wholehearted engagement – attributes integral to critical thinking. These attributes are universally acknowledged as indispensable for thriving in the 21st century (Huitt, 1998).

In the twenty-first century, the rapid progression of knowledge and technological advancements has prompted a shift in education towards prioritizing a diverse range of skills. This adjustment aims to empower individuals to navigate the information era effectively. Critical thinking, among these abilities, emerges as a foundational requisite for fostering several other proficiencies, encompassing entrepreneurship, logical reasoning, and effective problem-solving. Moreover, critical thinking is recognized as an essential competence for professionals across various fields. Its significance amplifies for classroom educators operating in the initial stages of compulsory

education, where they play a pivotal role in moulding the critical developmental phase of children (Çelik et al., 2018). Amid educators and professionals in diverse educational domains, the quest for methods to nurture critical thinking aptitude is palpable (King et al., 1990). Notably, employers also acknowledge critical thinking as a pivotal attribute in college graduates (Lederer, 2007). Equipping students with the prowess to engage in critical thinking assumes paramount importance within the educational framework, particularly as university students are expected to demonstrate mastery in critical thinking skills (Kromney and Reed, 2001).

The concept of critical thinking has garnered considerable attention in recent times (Tony et al., 2001). Considerable discourse surrounds the inquiry, "What is critical thinking?" However, a universally endorsed definition of critical thinking remains elusive (Brookfield, 1987; Cassel & Congleton, 1993; Thurmond, 2001; Yeh, 2002). The variability in the definition of critical thinking can be attributed to its inherently abstract nature. In 1980, Watson and Glaser conceptualized critical thinking as an amalgamation of attitude, knowledge, and skill. This encompasses the disposition to identify issues and acknowledge the overarching necessity for substantiating claims with evidence, referred to as attitude. Knowledge encompasses a fusion of precise inferences, abstractions, and generalized information, highlighting the precision of logically derived conclusions.

It is possible to run across various definitions and methods when researching the idea of critical thinking. Drawing from Paul and Elder's perspective, "critical thinking is the skill of engaging in thought while actively refining thought itself. This process encompasses three interconnected stages: the analysis of thought, the evaluation of thought, and the enhancement of thought." In essence, critical thinking represents a form of cognition in which the thinker elevates their mental processes by scrutinizing aspects like purpose, inquiry, and information. Moreover, this involves the appraisal of clarity, accuracy, and relevance to ensure the quality of the thought. Furthermore, critical thinking entails a reconstruction phase wherein strengths are bolstered, and weaknesses are mitigated (Paul and Elder, 2006).

With reference to Facione (2011), the concept of critical thinking can be illustrated through the analogy of proficient trial lawyers. Just as these lawyers meticulously gather evidence, analyse it, evaluate its merits, and consider opposing viewpoints before presenting their case to judges and juries, a critical thinker follows a similar process. This involves attentive listening, evidence collection, analysis, evaluation, and the incorporation of perspectives from opposing arguments. A critical thinker avoids the extremes of being dogmatic or overly gullible; instead, their disposition is characterized by traits like open-mindedness, intellectual humility, and scepticism (Carroll, 2000). Such an individual employs discerning criteria to assess reasoning and guide decision-making (Diestler, 2001). The ramifications of a deficiency in critical thinking become evident in various aspects of our lives, as elucidated by Facione (2011). Failures in critical thinking can contribute to ineffective law enforcement, professional setbacks, distorted communication, poor decision-making, mismanagement, academic underachievement, and more.

Drennan, 2010 characterizes it in terms of problem-solving, judgement, inference-making, and reasoning; Ennis, 1989 defines it as a method of making judgments by thinking deeply and sanely; Halpern, 2013 defines it is as a way to increase desired behaviours through the use of cognitive skills or strategies; Paul and Elder, 2008 define it as the art of analysis and evaluation to foster thinking; McPeck, 1981 defines it as the skill of sceptical analysis of the encountered new information. When all these definitions are taken into consideration, critical thinking can be defined as a thinking and learning activity including higher order cognitive skills.

Upon delving into the pertinent literature, it becomes evident that critical thinking has garnered extensive examination across diverse academic domains. Furthermore, an exploration into research focused on critical thinking within the educational context reveals a salient linkage between critical thinking and the augmentation of performance, attitudes, and competencies across various disciplines. Additionally, critical thinking is posited to exert a constructive influence on the art of teaching itself. Educators in the classroom realm are tasked with meticulous lesson planning and deep subject engagement to adeptly address student inquiries. This reinforces the imperative of consistently refining and revitalizing the critical thinking acumen of teacher educators to navigate this intricate landscape effectively.

Promoting the enhancement of students' critical thinking abilities stands as a declared objective for most higher education institutions. Nevertheless, assessing a student's propensity to engage in critical thinking processes when tackling challenges is equally significant. The inclination of an individual to apply critical thinking methodologies holds comparable importance to the development of their critical thinking skills. While scholars have predominantly concentrated on the outcomes stemming from critical thinking endeavours, there has been a notable oversight in the empirical exploration of the precursors of critical thinking. A critical thinking disposition has been defined as an inherent drive to employ critical thinking skills (Pascarella & Terenzini, 2005).

Numerous studies have explored strategies for nurturing individuals' critical thinking abilities. Various approaches, including reading courses, science curricula, and history courses, have been reported to enhance students' critical thinking skills (Ron & Randy, 1995). Richard (2004) emphasized that the proper adoption of teaching methods, models, and relevant content by instructors could contribute to improving students' critical thinking prowess. Zhou et al., (2010) contended that inquiry-based chemical experiments can effectively enhance the critical thinking skills of pre-service teachers. Moreover, question-based learning within chemistry experiment instruction has also been identified as conducive to developing critical thinking.

In the present era, heightened attention is directed towards the quality of teachers. Numerous studies delve into teachers' imaginative and creative thinking (Beghetto, 2008; Kampylis et al., 2009). Likewise, scholars have explored teachers' critical thinking abilities (Grosser & Lombard, 2008; Cherubini, 2009; Torff & Sessions, 2006). The beliefs teachers hold about critical thinking have emerged as a prominent topic within the expanding landscape of teacher education literature (Torff, 2005; Zohar & Dori, 2003). Research indicates that these beliefs significantly shape how teachers interact with students and structure classroom activities (Fang, 1996; Putman & Borko, 2000).

While critical thinking was recognized as a significant educational objective throughout the 20th century, it did not receive substantial attention until the latter part of that century (Ennis, 1993). In the latter part of the 20th century, certain researchers directed their focus towards the dispositional aspects of critical thinking, whereas others gave their attention to the cognitive skills associated with critical thinking (Perkins et al., 1993). Colucciello (1997) presented findings demonstrating a substantial positive correlation between critical thinking and critical thinking dispositions. Lederer (2007) characterizes critical thinking dispositions as foundational elements preceding the cultivation of critical thinking skills. Paul (1995) delineated critical thinking dispositions as intellectual traits such as intellectual humility, intellectual civility, and intellectual curiosity (Colucciello, 1999). Facione (2011), in turn, delineated critical thinking dispositions encompassing seven components: truth-seeking, open-mindedness, analyticity, systematicity, self-confidence, inquisitiveness, and maturity. Scholars have recently advocated for heightened empirical investigations into students' critical thinking disposition (Stupnisky et al., 2008). This disposition is often strengthened by a high self-concept, which bolsters individuals' confidence and capacity for critical engagement. According to Jain et al. (2024), significant gender-based differences in self-concept indicate that female students typically exhibit higher self-concept than males, suggesting that gender may play a meaningful role in shaping self-concept. This influence could extend to how students engage with and develop their critical thinking abilities.

Ishiyama et al. (1999) investigating critical thinking dispositions across various variables through their research, established a significant correlation between the inclination towards critical thinking and prevailing educational methodologies. Similarly, Seferoglu and Akbiyik (2006) have pointed out notable disparities between individuals proficient in critical thinking skills and those deficient in such abilities, particularly in how they engage with data, encompassing its selection, organization, and utilization. Existing literature further suggests that students who possess and employ critical thinking skills exhibit enhanced learning efficacy.

The ability to think critically in challenging settings is gaining popularity as a goal for education. Critical thinking is frequently referred to as a skill or an ability. Ability, however, is just one component of critical thinking. People's actions are intelligently controlled by their predispositions or tendencies in addition to their abilities. Several educational scholars and philosophers have referred to this extra component of critical thinking as disposition (Baron, 2005; Cacioppo & Petty, 1982; Ennis, 1987). According to Norris (1985), "One must have the disposition to think productively and critically about issues, or else no amount of skill in doing so will be helpful."

To excel in their careers, teachers must think critically, adopt a deep learning approach, and understand how students' learning preferences affect their ability to learn (Beşoluk & Onder, 2010). In alignment with the visionary National Education Policy (NEP) 2020 of India, which places a strong emphasis on transforming education through multidisciplinary approaches and innovative pedagogies, this research paper holds significant relevance. The NEP 2020 emphasizes the need to cultivate educators who possess not only subject expertise but also critical thinking skills essential for fostering holistic learning experiences. By delving into the critical thinking disposition of aspiring educators, this paper contributes to the NEP's objective of enhancing the quality of teacher education. The findings of this study hold the potential to align with the NEP's focus on continuous professional development, curriculum enrichment, and the nurturing of teachers capable of adapting pedagogical approaches that empower students with critical thinking skills. As the NEP envisions a transformative landscape for education, this research paper offers insights that can shape the development of teachers who are well-equipped to create dynamic and interactive learning environments, thus catalysing the realization of the policy's broader goals.

Educators devoid of robust critical thinking skills and a disposition towards critical thinking find themselves inept at adeptly guiding their students in these realms. It remains evident that individuals can only impart knowledge commensurate with their own comprehension and awareness. Consequently, if instructors lack these competencies and a mindset attuned to critical thinking, students could potentially be deprived of cultivating vital critical thinking proficiencies. Consequently, it is imperative to establish an environment conducive to nurturing thinking dispositions among teacher candidates who, in turn, are tasked with fostering critical thinking abilities in their students during pre-service training.

Therefore, it stands to reason that the preparation of instructors geared towards instilling critical thinking abilities in their students necessitates an examination of teacher candidates' own critical thinking dispositions. Furthermore, these candidates should be engaged in activities calibrated to elevate and enhance such dispositions (Uslu, 2020). This study seeks to delve into the critical thinking dispositions of teacher candidates in relation to their demographic attributes. A notable gap in the existing literature pertains to the absence of research encompassing this comprehensive exploration of teacher candidates. Therefore, this study is poised to make a substantial scholarly contribution by addressing this uncharted territory.

There have been several taxonomies developed on the concept of critical-thinking disposition (e.g., Ennis, 1986). They all put more emphasis on attitude towards and awareness of the opportunity for critical thinking than they do on cognitive task performance analysis. For instance, Taube (1993) lists open-mindedness, cognitive complexity, demand for cognition, tolerance of ambiguity, and reflectiveness as traits of competent critical thinkers. The seven attitudes that Perkins et al. (1993) believe are essential to sound reasoning are described. These are the dispositions: to be open-minded and daring, with a commitment to continuous intellectual curiosity, to seek clarification and comprehension, to exercise intellectual caution, to look for and assess arguments, and to engage in metacognition. Taxonomies of cognitive dispositions are normative, reflecting the authors' cultural orientation and ideas about the best ways to learn. Leshowitz et al. (1999); Ritchhart and Perkins (2000), for example, focus on learners and how to foster the development of these dispositions in learners as part of their attempts to promote critical thinking dispositions (Hough et al., 2004). The central focus of this research centres on the same theme. This research paper elucidates the pivotal role of dispositions as an integral facet of critical thinking, underscoring its significance. Furthermore, the paper provides insightful recommendations concerning the structuring of instructional methods aimed at fostering the nurturance of students' dispositional facet within the realm of critical thinking.

Duncan et al. (2016), in their study titled 'Comparing Critical Thinking Dispositions of Students Enrolled in a College Level Global Seminar Course', highlight a significant finding that despite their thorough examination of critical thinking across various educational stages, they had not previously encountered critical thinking disposition scores as low as those observed in their research. This alarming discovery accentuates the need for continued investigation to determine which demographic variables may enhance or hinder the development of critical thinking during a student's academic journey.

While previous research has explored various factors, the demographic variables chosen by the researchers in this current study—academic background, type of high school, and parental employment status—remain relatively understudied in relation to their impact on critical thinking dispositions among pre-service teachers. As societal contexts evolve, ongoing research is essential to keep up with these changes and to examine the interplay of these demographic factors with critical thinking dispositions. Guided by the principles of NEP 2020, this study embarks on a comprehensive exploration of these variables to address key questions central to understanding how critical thinking disposition can be effectively fostered in the modern educational landscape.

1.1 Research Questions

- What is the level of critical thinking disposition of pre-service teachers?
- Does the critical thinking disposition of pre-service teachers differ significantly in terms of their academic background?
- Does the critical thinking disposition of pre-service teachers differ significantly in terms of the graduated school?
- Does the critical thinking disposition of pre-service teachers differ significantly in terms of the status of their parent(s) employment?
- What is the relationship between critical thinking disposition and academic background of pre-service teachers?
- Is there a significant relationship between critical thinking disposition and the type of high school attended by pre-service teachers?

- Does the employment status of parent(s) have a significant relationship with the critical thinking disposition of pre-service teachers?

1.2 Demographic Variables

Academic Background (Science, Commerce, Humanities)

Type of High School (Government School, Private School)

Parent Employment Status (Both Parents Working, Single Parent Working)

1.3 Research Objectives

- To study the level of critical thinking disposition of pre-service teachers.
- To investigate whether there is a significant difference in the critical thinking disposition of pre-service teachers based on their academic background (Science, Commerce and Humanities/Arts).
- To determine whether there is a significant difference in the critical thinking disposition of pre-service teachers based on the type of high school they attended.
- To examine whether there is a significant difference in the critical thinking disposition of pre-service teachers based on the employment status of their parent(s).
- To examine the relationship between critical thinking disposition and academic background (science vs non-science) of pre-service teachers.
- To examine the relationship between critical thinking disposition and type of high school of pre-service teachers.
- To examine the relationship between critical thinking disposition and parent(s) employment status of pre-service teachers.

1.4 Hypothesis

H_{01}: There is no significant difference in the critical thinking disposition of pre-service teachers based on their academic background.

H_{02}: There is no significant difference in the critical thinking disposition of pre-service teachers based on the type of high school they attended.

H_{03}: There is no significant difference in the critical thinking disposition of pre-service teachers based on the employment status of their parent(s).

H_{04}: There is no significant relationship between critical thinking disposition and academic background of pre-service teachers.

H_{05}: There is no significant relationship between critical thinking disposition and type of high school attended by pre-service teachers.

H_{06}: There is no significant relationship between critical thinking disposition and employment status of parent(s) of pre-service teachers.

2. Methodology

2.1 Design of the Study

A quantitative research design was adopted to explore the relationship between variables. The researchers conducted the study employing the descriptive survey method. The sample was selected using the stratified random sampling technique. By utilizing this approach, the researcher was able to capture a broad spectrum of insights, ensuring that the findings reflected the diverse perspectives and experiences of the participants, thereby contributing to a deeper understanding of the subject matter. The study employed descriptive and inferential statistics to measure critical thinking dispositions of prospective educators.

2.2 Participants

The research cohort comprised 170 pre-service teachers coming from a mix of private and government universities. This selective grouping was purposefully chosen as study participants due to their active engagement in teacher training programs. The term "pre-service teachers" pertains to individuals who are in the preparatory phase of their journey towards becoming educators, yet to embark on their professional teaching endeavours. These individuals are enrolled in educational programs provided by universities or educational institutions, intended to furnish them with

the essential knowledge, skills, and proficiencies requisite for effective pedagogy.

The inclusion of candidates representing both private and government universities ensures a diverse array of educational backgrounds and experiences. By involving these pre-service teachers, the research stands to gather invaluable insights into the perspectives and experiences of prospective educators. This, in turn, has the potential to encourage enhancements within teacher education paradigms, thereby elevating the overall capacity of education instruction across schools and classrooms.

2.3 Checking Level of Normality

To check whether the sample data is normally distributed or not, the researcher conducted a Shapiro-Wilk test on the data collected. To determine whether the sample is normally distributed or not at a 0.05 significance level using the Shapiro-Wilk test, we compare the calculated test statistic value (0.989) with the critical value from the Shapiro-Wilk test table for a sample size of 170, which is 0.958.

Since the calculated test statistic value (0.989) is greater than the critical value (0.958), it is appropriate to infer that the sample is normally distributed at a 0.05 significance level. Therefore, based on the Shapiro-Wilk test, we can conclude that there is sufficient evidence to suggest that the sample is normally distributed at a 0.05 significance level.

2.4 Data Collection Tool

The evaluation of critical thinking disposition among pre-service teachers was facilitated using the University of Florida–Engagement, Maturity, and Innovativeness (UF-EMI) assessment. This survey tool, comprising a 33-item, five-point Likert-type scale, with a demographic segment appended, is rooted in Facione's (1990) original Delphi study, which ultimately gave rise to the California Critical Thinking Disposition Inventory (CCTDI). The CCTDI encompasses distinct sub-constructs, including truth-seeking, open-mindedness, analyticity, systematicity, self-confidence, inquisitiveness, and maturity (Facione, Facione, & Giancarlo, 2001).

Addressing concerns about the CCTDI's validity and other aspects (Bondy et al., 2001; Walsh & Hardy, 1997), the UF-EMI was designed to serve as a more context-specific gauge of critical thinking dispositions (Ricketts & Rudd, 2005). The UF-EMI revolves around three focused subscales or constructs:

- The engagement disposition evaluates individuals' predisposition to seek out reasoning opportunities, anticipate situations necessitating reasoning, and maintain confidence in their reasoning capabilities.
- The cognitive maturity disposition assesses a proclivity towards acknowledging problem complexity, embracing diverse perspectives, and recognizing personal and others' biases and predispositions.
- The innovativeness disposition gauges a predisposition for intellectual curiosity and a thirst for truth-seeking.

2.5 Data Analysis

The data analysis phase involved using SPSS 22.0 to analyse the dataset obtained from the sample of 170 responses.

3. Findings

Following is a discussion of the study's findings according to each objective.

3.1 Objective 1:

To study the level of critical thinking disposition of pre-service teachers based on:

a) Constructs of Critical Thinking Disposition

b) Academic Background and Constructs of Critical Thinking Disposition

c) Type of School and Constructs of Critical Thinking Disposition

d) Academic Background, Type of School, and Constructs of Critical Thinking Disposition

Table 1. Segregation of Critical Thinking Disposition Assessment by Constructs

Critical Thinking Disposition of Pre-Service Teachers	Sum of Scores	Percentage of Scores (%)
Engagement Construct	7083	42.79
Cognitive Maturity Construct	4960	29.96
Innovativeness Construct	4511	27.25

The results in Table 1 indicate that the pre-service teachers being assessed have the highest scores in the Engagement construct (42.79%), followed by the Cognitive Maturity (29.96%) construct and the Innovativeness construct (27.25%).

The Engagement construct represents a disposition towards active and open-minded engagement with ideas, arguments, and evidence. The high score in this construct suggests that the pre-service teachers are likely to be curious, open-minded, and willing to explore different perspectives and arguments.

The Cognitive Maturity construct represents a disposition towards reflective and careful thinking. The score in this construct suggests that the pre-service teachers are likely to be thoughtful and deliberate in their reasoning and may be more cautious in accepting conclusions without sufficient evidence.

The Innovativeness construct represents a disposition towards creativity and originality. The score in this construct suggests that the pre-service teachers may be less inclined towards unconventional or novel ideas.

Overall, these results suggest that the pre-service teachers are likely to be engaged and thoughtful thinkers who value evidence and careful reasoning. This is a positive disposition for future teachers, as they will need to be able to think critically and engage with new ideas in their future profession. It is important to note that these results represent only one aspect of the pre-service teachers' critical thinking abilities and should be interpreted in conjunction with other assessments and observations. For this purpose, evaluation of the results received from various constructs of critical thinking disposition are analysed based on the high school academic background and type of school of the pre-service teachers.

Table 2. Critical Thinking Disposition Assessment Based on Constructs and Academic Background of Pre-service Teachers

Academic Background of Pre-Service Teachers	Critical Thinking Disposition Construct						
	Engagement Construct		Innovativeness Construct		Cognitive Maturity Construct		Grand Total
	Sum	Percentage	Sum	Percentage	Sum	Percentage	Sum
Commerce	2918	42.51	1872	27.27	2075	30.23	6865
Humanities/Arts	3368	42.95	2133	27.20	2341	29.85	7842
Science (Medical/Non-Medical)	797	43.15	506	27.40	544	29.45	1847

The results presented in the table show the sums and percentages of pre-service teachers' scores in three constructs: Engagement, Innovativeness, and Cognitive Maturity. The data presented is based on the academic background of the pre-service teachers, namely Commerce, Humanities/Arts, and Science (Medical/Non-Medical).

In terms of Engagement construct, pre-service teachers with a Science (43.15%) background have a slightly higher percentage, indicating that they are more engaged in their learning than those with a Commerce (42.51%) or Humanities/Arts (42.95%) background. This may be because Science courses tend to be more discussion-based and require more participation, whereas Commerce or Humanities/Arts courses may be more lecture-based.

In terms of Innovativeness construct, pre-service teachers with all academic backgrounds have a similar percentage revolving around 27%. It is possible since all courses require creative problem-solving, and innovation and this skill is inevitably an equitable part of the academic backgrounds.

In terms of Cognitive Maturity construct, pre-service teachers with a Commerce (30.23%) background have a slightly higher percentage, indicating that they have slightly higher levels of cognitive maturity than those with a Humanities/Arts (29.85%) or Science (29.45%) background. This may be because Commerce courses require more critical thinking and analysis in terms of business and economic contexts and may therefore foster greater cognitive maturity.

It is important to note that while there are differences in the results based on academic background, the differences are relatively small. Overall, pre-service teachers in all academic backgrounds have moderate levels of the constructs measured. Therefore, it is important for teacher education programs to provide opportunities and support for pre-service teachers to develop these skills and dispositions further, regardless of their academic background.

The results suggest that pre-service teachers with a Science background may have a slight advantage in terms of

engagement construct, but they may face a slight disadvantage in terms of cognitive maturity construct. However, all pre-service teachers have moderate levels of these constructs, indicating that there is room for further development and growth. Teacher education programs should aim to provide opportunities and support for all pre-service teachers to develop these skills and dispositions to become effective and innovative educators.

Table 3. Critical Thinking Disposition Assessment Based on Constructs and Type of School of Pre-service Teachers

Type of School of Pre-Service Teachers	Critical Thinking Disposition Construct						
	Engagement Construct		Innovativeness Construct		Cognitive Maturity Construct		Grand Total
	Sum	Percentage	Sum	Percentage	Sum	Percentage	Sum
Government School	1435	42.82	937	27.96	979	29.22	3351
Private School	5648	42.78	3574	27.07	3981	30.15	13203

Table 3 provides data on the critical thinking disposition assessment of pre-service teachers based on the constructs of engagement, innovativeness, and cognitive maturity, and the type of school they attended, i.e., government or private.

Analysing the results in terms of type of school, private school teachers have much higher absolute scores in each construct and the overall total, which could indicate greater overall critical thinking disposition in pre-service teachers who attended private schools in comparison to pre-service teachers who attended government schools. Private schools often have flexibility in curriculum design and teaching methods, potentially incorporating more modern, student-centred, and inquiry-based approaches. These methods foster innovation and critical engagement, which may not be as readily emphasized in government school settings.

Analysing the results in terms of construct, we can see that both government and private school pre-service teachers scored highest in the engagement construct, with private school pre-service teachers scoring 5648 (42.78%) and government school pre-service teachers scoring 1435 (42.82%). This suggests that pre-service teachers from both types of schools actively participate and invest in the thinking process.

The cognitive maturity construct was the second highest score for both groups, with private school pre-service teachers scoring 3,981 (30.15%) and government school pre-service teachers scoring 979 (29.22%). This suggests that pre-service teachers from both types of schools have a relatively high level of cognitive maturity, which is a crucial component of critical thinking.

The innovativeness construct had the lowest score for both groups, with private school pre-service teachers scoring 3,574 (27.07%) and government school pre-service teachers scoring 937 (27.96%). This indicates that pre-service teachers from both types of schools may have room for improvement in terms of their innovative thinking. This requisite is important as the pre-service teachers are the builders of our future generation, and they need to be creative innovative thinkers to infuse the seed of creativity in the young learners. Teacher education institutes should foster an environment that encourages and supports innovation. This can be achieved by organizing events, workshops, and seminars that focus on innovative teaching practices and methodologies. The institute can also invite guest speakers who are experts in innovative teaching to inspire pre-service teachers. Teacher education institutes can encourage pre-service teachers to think outside the box and come up with innovative solutions to problems. This can be achieved through creative assignments, projects, and group activities that promote brainstorming and idea generation. They can collaborate with other institutes to share best practices and promote innovation in teaching. This can be achieved through joint research projects, student exchanges, and collaborative teaching initiatives. By implementing these strategies, teacher education institutes can help pre-service teachers develop the innovativeness they need to become effective and creative teachers.

Looking at Table 4 and comparing the results by academic background, we can see that the scores for the innovativeness and cognitive maturity constructs are relatively similar across all academic backgrounds in both government and private schools. However, the scores for the engagement construct vary slightly across different academic backgrounds. Pre-service teachers from the science (43.38%) background in private schools scored slightly higher compared to other academic backgrounds.

Comparing the results by type of school, we can see that the scores for the engagement and innovativeness constructs are relatively similar between government and private schools. However, for the cognitive maturity construct, pre-service teachers from private schools (30.15%) scored slightly higher compared to those from government

schools (29.22%).

Table 4. Critical Thinking Disposition Assessment based on Constructs, Type of School and Academic Background of Pre-service Teachers

Type of School of Pre-Service Teachers and their Academic Background	Critical Thinking Disposition Construct						
	Engagement Construct		Innovativeness Construct		Cognitive Maturity Construct		Grand Total
	Sum	Percentage	Sum	Percentage	Sum	Percentage	Sum
Government School	**1435**	**42.82**	**937**	**27.96**	**979**	**29.22**	**3351**
Commerce	497	42.48	329	28.12	344	29.40	1170
Humanities/Arts	639	43.12	413	27.87	430	29.01	1482
Science (Medical/Non-Medical)	299	42.78	195	27.90	205	29.33	699
Private School	**5648**	**42.78**	**3574**	**27.07**	**3981**	**30.15**	**13203**
Commerce	2421	42.51	1543	27.09	1731	30.40	5695
Humanities/Arts	2729	42.91	1720	27.04	1911	30.05	6360
Science (Medical/Non-Medical)	498	43.38	311	27.09	339	29.53	1148

Overall, these results suggest that there are some minor variations in critical thinking disposition among pre-service teachers from different academic backgrounds and types of schools. These differences could be explored further to determine if there are any specific interventions that could be targeted to improve critical thinking disposition among pre-service teachers from different backgrounds and schools.

3.2 Objective 2:

To investigate whether there is a significant difference in the critical thinking disposition of pre-service teachers based on their academic background.

The table provides information on the mean, standard deviation, and standard error of the mean of critical thinking disposition scores of pre-service teachers based on their academic background. The pre-service teachers are categorized into three groups: Humanities/Arts, Commerce, and Science (Medical/Non-Medical), and the total number of pre-service teachers included in the analysis is 170.

Table 5. Group Statistics of Critical Thinking Disposition Scores Based on the Academic Background of Pre-service Teachers

Academic Background	N	Mean	Std. Deviation	Std. Error
Humanities/Arts	80	97.6250	14.30621	1.5995
Commerce	71	96.2958	12.98174	1.5407
Science (Medical/Non-Medical)	19	96.8421	11.80990	2.7094
Total	170	96.9824	13.44349	1.0311

According to Table 5, the mean critical thinking disposition score for pre-service teachers with an academic background in Humanities/Arts is 97.6250, which is the highest among the three groups. The mean score for pre-service teachers with an academic background in Commerce is 96.2958, and for those with an academic background in Science it is 96.8421. The overall mean score for all the pre-service teachers is 96.9824.

The standard deviation of critical thinking disposition scores is highest for pre-service teachers with an academic background in Humanities/Arts (14.30621), followed by Commerce (12.98174) and Science (11.80990). The standard error of the mean is lowest for pre-service teachers with an academic background in Humanities/Arts (1.5995), followed by Commerce (1.5407), and Science (2.7094).

Overall, the table suggests that pre-service teachers with an academic background in Humanities/Arts have a higher mean critical thinking disposition score than those with an academic background in Commerce or Science. However, the standard deviation of scores for pre-service teachers with an academic background in Humanities/Arts is also the highest, indicating a greater variability in scores within this group. The standard error of the mean is lowest for

pre-service teachers with an academic background in Humanities/Arts, indicating that the mean score for this group is more reliable than the mean scores for the other two groups.

To determine if the differences in mean critical thinking disposition scores between the three groups of pre-service teachers are statistically significant, an ANOVA test is performed to determine if there is a significant difference in mean scores between the three groups.

Table 6. ANOVA of Critical Thinking Disposition Scores Based on Academic Background of Pre-service Teachers

Stream in High School	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	66.882	2	33.441	.183	.833
Within Groups	30476.07	167	182.491		
Total	30542.95	169			

Based on the ANOVA table (Table 6) provided, the F-statistic for the between groups effect is .183, with a p-value of .833. This suggests that there is no significant difference in the critical thinking disposition of pre-service teachers based on their academic background, as the p-value is greater than the commonly used significance level of .05.

The sum of squares for the between-groups component is 66.882, which represents the amount of variability in critical thinking disposition scores that is explained by the academic background of pre-service teachers. The degrees of freedom for the between-groups component are 2, which indicates that there were three groups being compared (based on academic background). The mean square for the between-groups component is 33.441.

The sum of squares for the within-groups component is 30476.07, which represents the amount of variability in critical thinking disposition scores that is not explained by differences in academic background. The degrees of freedom for the within-groups component are 167. The mean square for the within-groups component is 182.491.

The total sum of squares is 30542.95, and the total degrees of freedom are 169.

To determine if the F-statistic of .183 is statistically significant, we need to compare it to the critical value from the F-distribution table for the degrees of freedom associated with the between-groups and within-groups components. In this case, the degrees of freedom for the between-groups component are 2 and the degrees of freedom for the within-groups component are 167, resulting in an F-critical value of approximately 3.01 for a significance level of .05.

Since the calculated F-statistic of .183 is much smaller than the critical F-value of 3.01, we can conclude that the difference in critical thinking disposition scores based on academic background is not statistically significant at the .05 level.

Overall, based on these results, we cannot reject the null hypothesis that there is no significant difference in critical thinking disposition scores based on academic background. However, it is important to consider potential limitations of the study, such as sample size, selection bias, or measurement limitations, that may have influenced the findings. Additionally, it is possible that there are other factors that may influence critical thinking disposition scores that were not measured in this study.

3.3 Objective 3:

To determine whether there is a significant difference in the critical thinking disposition of pre-service teachers based on the type of high school they attended.

Table 7. Group Statistics of Critical Thinking Disposition Scores Based on the Type of high School Attended by Pre-service Teachers

	Type of School	N	Mean	Std. Deviation	Std. Error Mean
Critical Thinking Disposition Scores	Private School	136	96.8175	13.9733	1.1938
	Government School	34	98.5588	12.1386	2.0817

Table 7 presents group statistics for a measure of critical thinking disposition scores among two groups of pre-service teachers based on the type of high school they attended. The two groups are pre-service teachers who attended private schools and pre-service teachers who attended government schools. The table reports the number of

participants in each group (N), as well as the mean, standard deviation, and standard error of the mean for the critical thinking disposition scores.

The mean critical thinking disposition score for pre-service teachers who attended private schools is 96.8175, with a standard deviation of 13.9733 and a standard error of the mean of 1.1938. The mean critical thinking disposition score for pre-service teachers who attended government schools is 98.5588, with a standard deviation of 12.1385 and a standard error of the mean of 2.0817.

Analysing the table, we can see that the mean critical thinking disposition score is slightly higher for pre-service teachers who attended government schools (98.5588) than for those who attended private schools (96.8175). However, the difference in means is relatively small and may not be statistically significant, given the large standard errors of the means. Additionally, the standard deviations for both groups are quite large, indicating that there is considerable variability in the critical thinking disposition scores within each group.

The table provides some basic descriptive information about the distribution of critical thinking disposition scores of pre-service teachers who attended private schools and government schools, but it is difficult to draw strong conclusions about the differences between the two groups based solely on the information presented in the table. Further statistical analysis, such as t-tests is necessary to determine whether the observed difference in mean scores is statistically significant or not.

Table 8. Independent Sample t-test of Critical Thinking Disposition Scores according to Type of High School Attended by Pre-Service Teachers

t value	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
					Lower	Upper
-.667	169	.506	-1.7413	2.61238	-6.8984	3.4157

The table reports the results of a t-test that was conducted to determine whether there is a significant difference in critical thinking disposition scores between pre-service teachers who attended private schools and those who attended government schools. The table reports the t-value, degrees of freedom (df), significance level (Sig.), mean difference, standard error of the difference, and the 95% confidence interval of the difference.

The calculated t-value is -0.667, and the df is 169. Using a t-table at a significance level of 0.05 (two-tailed) and df of 169, the critical value of t is approximately ±1.977. Since the absolute value of the calculated t-value is less than the critical value of t, we fail to reject the null hypothesis.

The significance level (Sig.) is 0.506, which indicates that the difference in critical thinking disposition scores between pre-service teachers who attended private schools and government schools is not statistically significant at the conventional alpha level of 0.05.

The mean difference between the two groups is -1.7413, which indicates that pre-service teachers who attended government schools had slightly higher critical thinking disposition scores than those who attended private schools. However, the standard error of the difference is relatively large at 2.61238, indicating that the difference in means is not precise.

The 95% confidence interval of the difference (-6.8984 to 3.4157) indicates that with 95% confidence, the true mean difference in critical thinking disposition scores between pre-service teachers who attended private schools and government schools lies somewhere between -6.8984 and 3.4157. Since the interval includes zero, we can conclude that the difference in critical thinking disposition scores between the two groups is not statistically significant.

Overall, the table provides evidence that there is no significant difference in critical thinking disposition scores between pre-service teachers who attended private schools and those who attended government schools.

3.4 Objective 4:

To examine whether there is a significant difference in the critical thinking disposition of pre-service teachers based on the employment status of their parent(s).

Table 9. Group Statistics of Critical Thinking Disposition Scores based on the Employment Status of Parent(s) of Pre-service Teachers

	Parental Employment Status	N	Mean	Std. Deviation	Std. Error Mean
Critical Thinking Disposition Scores	Single Parent Employed	122	96.6557	13.5810	1.2295
	Both Parents Employed	49	98.4286	13.7477	1.9639

Table 9 presents group statistics for critical thinking disposition scores based on parental employment status. The two categories of parental employment status are "Single Parent Employed" and "Both Parents Employed".

For the "Single Parent Employed" group, there were 122 participants, and the mean critical thinking disposition score was 96.6557, with a standard deviation of 13.5810 and a standard error mean of 1.2295.

For the "Both Parents Employed" group, there were 49 participants, and the mean critical thinking disposition score was 98.4286, with a standard deviation of 13.7477 and a standard error mean of 1.9639.

From this table, we can see that the mean critical thinking disposition score is slightly higher for the "Both Parents Employed" group than for the "Single Parent Employed" group. However, the difference in means may not be statistically significant given the overlap in standard error means between the two groups.

Overall, the table provides a basic summary of the data and allows for a quick comparison between the two groups in terms of their mean scores and variability. However, to draw more definitive conclusions about the relationship between parental employment status and critical thinking disposition scores, a t-test is applied.

Table 10. T-test of Critical Thinking Disposition Scores Based on Parent(s) Employment Status of Pre-service Teachers

t value	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
					Lower	Upper
-.769	169	.443	-1.7728	2.3045	-6.3231	2.7774

Based on the statistical data provided, a t-test for equality of means was conducted (Table 10) to determine if there is a significant difference in the critical thinking disposition scores of pre-service teachers based on the employment status of their parent(s).

To determine the table value of t, we need to know the degrees of freedom (df) for the t-distribution. In this case the df is 169.The calculated value of t is -0.769. Using a t-table at a significance level of 0.05 (two-tailed) and df of 169, the table value of t is approximately ±1.974.

Since the calculated t-value is less than the table value of t, we fail to reject the null hypothesis. This indicates that there is no significant difference in the critical thinking disposition of pre-service teachers based on the employment status of their parent(s).

Therefore, we fail to reject the null hypothesis, which suggests that there is no significant difference in the critical thinking disposition of pre-service teachers based on the employment status of their parent(s).

Before we move on to the analysis of Objective 5,6 & 7, it is important to note that the variables among which the researcher is attempting to analyse the relationship are categorical and numerical variables. Pearson correlation is typically used when both variables are continuous and have a linear relationship. Therefore, it may not be appropriate to use Pearson correlation when one variable is categorical and the other is numerical.

If the categorical variable is dichotomous (i.e., only two categories), then we can use a point-biserial correlation coefficient to measure the relationship between the dichotomous and continuous variables. The point-biserial correlation is a variant of the Pearson correlation coefficient that allows us to measure the strength and direction of the relationship between a dichotomous variable (coded as 0 or 1) and a continuous variable.

3.5 Objective 5:

To examine the relationship between critical thinking disposition and academic background (science vs non-science) of pre-service teachers.

Table 11. Correlation Matrix between Critical Thinking Disposition Scores and Demographic Variables

	Academic Background (Science Vs Non-Science)	Type of High School (Private Vs Government)	Parental Employment Status (Single Parent Employed Vs Both Parents Employed)
Critical Thinking Disposition	-0.004	0.044	0.050

The point biserial correlation coefficient (r_{pb}) is a statistical measure used to determine the relationship between a dichotomous variable (such as private vs government high school) and a continuous variable (such as critical thinking disposition). The value of (r_{pb}) ranges from -1 to +1, where -1 indicates a perfect negative correlation, +1 indicates a perfect positive correlation, and 0 indicates no correlation.

The result of the point biserial correlation analysis between critical thinking disposition and academic background (science vs non-science) of pre-service teachers is a correlation coefficient of -0.004 (Refer Table 11). The result suggests that there is a very weak negative linear relationship between these two variables. This means that as the academic background (science vs non-science) of pre-service teachers changes, there is a very small change in their critical thinking disposition scores, but the direction of the relationship is negative, meaning that as academic background shifts from science to non-science, critical thinking disposition scores tend to decrease slightly.

However, it is important to note that this relationship is so weak that it is not practically significant. This means that even if the relationship were found to be statistically significant, it would not have much practical value or impact. This indicates that academic background (science vs non-science) is not a strong predictor of critical thinking disposition scores for pre-service teachers.

It is important to interpret the result of a statistical analysis in the context of the research question and the larger body of literature. While this particular result suggests that academic background (science vs non-science) is not a strong predictor of critical thinking disposition scores, other factors may have a stronger influence on critical thinking disposition scores for pre-service teachers. Further research may be needed to explore these factors in more detail.

3.6 Objective 6:

To examine the relationship between critical thinking disposition and type of high school of pre-service teachers.

The r_{pb} value showing a relationship between critical thinking disposition and type of high school attended by pre-service teachers is -0.044 (Refer Table 11). This value indicates a weak negative correlation between these two variables. This means that as the type of high school changes from private to government, there is a slight decrease in critical thinking disposition scores. However, the strength of the correlation is very weak, which suggests that the relationship is not significant.

It is important to note that a weak correlation does not necessarily mean that there is no relationship between the variables. There may be other factors that influence critical thinking disposition scores, such as individual differences, teaching experience, and educational background. These factors may have a greater impact on critical thinking disposition scores than the type of high school attended. Therefore, it is important to consider multiple factors when analysing the relationship between critical thinking disposition scores and type of high school attended by pre-service teachers.

Furthermore, the point biserial correlation coefficient (r_{pb}) is a statistical measure that only examines the linear relationship between two variables. It is possible that there may be a non-linear relationship between critical thinking disposition scores and the type of high school attended that is not captured by the r_{pb} value.

3.7 Objective 7:

To examine the relationship between critical thinking disposition and parent(s) employment status of pre-service teachers.

According to Table 11, the calculated value of r_{pb} (signifying a relationship between parents' employment status and critical thinking disposition) is 0.050 which is slightly positive. This suggests that there is a weak, positive relationship between the employment status of pre-service teachers' parents (single parent employed or both parents employed) and their critical thinking disposition scores. A positive correlation between two variables means that as one variable increases, the other variable tends to increase as well. In this case, the positive r_{pb} value of 0.050 suggests that there is a slight tendency for pre-service teachers' critical thinking disposition scores to increase slightly as the employment status of their parents' changes from single parent employed to both parents employed.

It is important to note that a weak positive correlation between two variables does not imply that the presence of one variable causes an increase in the other variable. In other words, we cannot conclude that having both parents employed causes pre-service teachers to have higher critical thinking disposition scores, or that having a single employed parent causes pre-service teachers to have lower critical thinking disposition scores. The correlation only shows that there is a weak relationship between these two variables.

Therefore, based on this result, we cannot conclude that the employment status of pre-service teachers' parents has a significant impact on their critical thinking disposition scores. There may be other factors that influence critical thinking disposition scores, such as personal motivation, self-discipline, and exposure to diverse perspectives. These factors may have a greater impact on critical thinking disposition scores than the employment status of pre-service teachers' parents. A researcher must consider multiple factors when analysing the relationship between critical thinking disposition scores and employment status of pre-service teachers' parents.

4. Discussion

Individuals who possess a natural inclination towards critical thinking exhibit notable distinctions in various aspects such as academic achievement, proficiency in scientific methodologies, problem-solving acumen, and their approach to challenges. Conversely, those lacking such a disposition differ significantly. Additionally, it can be inferred that individuals inclined towards critical thinking tend to adopt a more rational perspective towards superstitious beliefs, a prevalent issue in underdeveloped nations, while also displaying heightened sensitivity towards societal matters. Given these insights, fostering critical thinking among pre-service teachers becomes of paramount importance, as they are poised to play a pivotal role in shaping future generations and steering the course of society (Bakir, 2015). According to research, for university faculty to effectively cultivate the next generation of leaders, it is imperative to assess the extent to which our pedagogical methods and university experiences are equipping students with enhanced critical thinking abilities. This involves fostering intellectual curiosity, promoting an understanding of the intricate nature of real-world issues, and encouraging an openness to diverse perspectives and inherent biases. Furthermore, educators must adopt a deliberate approach to guide students in fortifying their inclination towards critical thinking. Studies have demonstrated that leaders within various industries anticipate higher education institutions to enhance their efforts in preparing graduates to confidently navigate the challenges posed by a global economy characterized by uncertainty and continual transformation (Crawford et al., 2011).

The extensive investigation into the critical thinking disposition of pre-service teachers with respect to their academic background, graduated school, and the employment status of their parents has yielded consistent and compelling findings. The comprehensive analysis of these variables has revealed that there exists no significant relationship between these factors and the critical thinking disposition of pre-service teachers.

The outcome of the current study highlights a lack of substantial correlation between the critical thinking disposition of pre-service teachers and their academic background. When examining related research on this topic, it is evident that the influence of academic background on critical thinking disposition has been investigated by various scholars. Research conducted by Walsh and Hardy (1999) explored the critical thinking dispositions of students from both applied (nursing, education, economy) and non-applied (English, history, psychology) fields. Their findings indicated that students in departments such as English, psychology, and nursing displayed higher scores in critical thinking. Additionally, Eigenberger et al. (2001) conducted a study encompassing 486 students, revealing that those within the Art and Sciences and Traditional Social Science faculties exhibited a stronger inclination towards critical thinking when compared to peers in the Education and Applied Social and Health Science faculties. The disparity between our research outcomes and the findings of the cited studies could stem from the distinct educational context of pre-service teacher training, wherein the cultivation of critical thinking skills might exhibit greater uniformity across various academic disciplines. Furthermore, the specific nature of pre-service teacher education could introduce a unique set of influences and experiences that set this group apart from the broader student populace scrutinized in earlier research endeavours.

The findings of our study reveal no significant relationship between the critical thinking disposition of pre-service teachers and the type of high school they attended, whether private or government-run. This result aligns with certain other research endeavours in this area. For example, Karakaya and Yılmaz's 2022 study on ninth-grade students in science high schools found that the type of graduated school did not yield a statistically significant difference in their critical thinking dispositions and related scores. Similar perspectives emerged from the studies conducted by Zayif (2008), Gülveren (2007), and Akar (2007), which indicated no substantial correlation between pre-service teachers' critical thinking dispositions and the type of high school they attended. Conversely, when considering pre-service

science teachers, Yenice's 2011 research exhibited a significant difference in critical thinking disposition total scores based on high school type. Similar findings were reported by Kürüm (2002), emphasizing higher critical thinking dispositions among pre-service teachers who graduated from Anatolian high schools.

5. Conclusion

The outcomes of our study indicate that the critical thinking disposition of pre-service teachers does not significantly hinge on their academic background, the type of school they graduated from, or their parents' employment status. This suggests that factors beyond these realms exert more considerable influence in shaping and nurturing critical thinking disposition capabilities among prospective educators. As educational institutions and educators persist in their endeavours to foster critical thinking skills, an escalated focus on investigating supplementary factors becomes increasingly imperative. With the educational landscape undergoing a metamorphosis as envisaged by the National Education Policy 2020 of India, the insights offered by this research serve as a compass guiding the development of educators primed to create dynamic and interactive learning environments, thereby concretizing the broader goals of the policy.

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Acknowledgments

We thank Amity University for approving this study and extend our gratitude to the deans, faculty, and students from various universities for their valuable time and participation.

Authors contributions

Ms. Pallavi Jain contributed to the study design, data collection, and drafting of the manuscript. Prof. Harish and Prof. Anup provided guidance and support during the revision process. All authors reviewed and approved the final manuscript.

Funding

This study did not receive financial support from any government or private funding agency.

Competing interests

The authors declare no conflict of interest related to this study.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Sciedu Press.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.