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Research Paper: The Relationships between Parent-child Interaction and Critical Thinking Disposition: Mediating Role of Cognitive Flexibility

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Abstract

Objective: Critical thinking is considered a vital life skill for learning especially among students. The current research aims to determine a causal model of the relationship between parent-child interaction and the disposition towards critical thinking, with cognitive flexibility playing an intermediary role.

Methods: The research design was descriptive-correlational, utilizing structural equation modeling. The population included male and female middle school students from the city of Lahijan during the 2023-2024 academic year. A sample of 200 students was selected through convenience sampling. For data collection in this research, the Parent-Child Relationship Scale (PCRS), The California Critical Thinking Disposition Inventory (CCTDI), and the Cognitive Flexibility Inventory (CFI) were used. The data were then analyzed using Pearson's correlation test and structural equation modeling, with the help of SPSS 26 and LISREL 10.2 software.

Results: The results indicated that the proposed model was a good fit. Additionally, parent-child interaction and cognitive flexibility had a direct effect on the disposition toward critical thinking ($P > 0.05$). Parent-child interaction had a significant and positive indirect impact on the disposition toward critical thinking through cognitive flexibility ($P > 0.05$).

Conclusion: Therefore, it can be concluded that parent-child interaction and cognitive flexibility can predict critical thinking skills in students. School authorities and parents should pay special attention to these variables.

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1. Introduction

What kind of parents wouldn't want their offspring to become proficient in wise decision-making skills and effective problem-solving?

The significance of critical thinking is undeniably magnified in today's world, where misinformation, fraud, and deceit are commonplace. Reflecting on one's thought processes is one of the crucial aspects of critical thinking (Pulatova, 2023). Students engage in critical thinking when they analyze, evaluate, interpret, or synthesize information, and employ creative thinking to guide discussions, resolve dilemmas, and formulate conclusions. Critical thinking is vital for cultivating independence and motivating students to make choices and establish personal beliefs. It is essential not only for educational purposes but also for life's broader spectrum. Some experts assert it to be the paramount skill of the 21st century (Akbar, 2023), even though some research in Iran rates students' critical thinking as moderate.

Thinking, a core component of cognition is the mental action invoked during problem solving. It is a crucial mental operation that aids in defining and structuring experiences, strategizing, assimilating knowledge, reflecting, and innovating (Baron, 2023). Critical thinking, a specific type of thinking, is indispensable for progress in our times. With the surge of information, the need for an inquisitive mind becomes more pressing. Critical thinking contributes to developing long-term strategies and methods that support youth in selecting and pursuing their ambitions. It is an invaluable tool for young individuals to interpret and evaluate a plethora of information they encounter (Rasmussen et al., 2016).

Critical thinking stands at the vanguard of education, assisting students in reflecting upon and comprehending their perspectives. This skill enables students to understand the world through observations and interpretations (Gafurova, 2023). Furthermore, critical thinking provides individuals with the means to approach decision-making and problem-solving with clarity, logic, and an organized methodology. Consequently, it leads to more enlightened decisions, inventive solutions, and improved outcomes (Liao et al., 2022). Critical thinking is the scrutiny of facts, observations, evidence, and arguments to inform judgment. It is a sophisticated subject, involving self-corrective, self-monitoring, disciplined, and autonomous thought (Clark et al., 2019). Therefore, a critical thinker is a person who either actively applies critical thinking skills or has been trained in its practices. Critical thinking shields people from deception and manipulation and enables them to address problems with greater creativity, autonomy, and efficiency (Sternberg & Halpern, 2020).

The inclination toward critical thinking is associated with factors such as the parent-child interaction. The parent-child relationship is a distinct and impactful connection essential for the adolescents' physical and mental development (Zwiers & Crawford, 2023). Research has shown that the parent-child relationship is a crucial element for the psychological health of children, and aggressive behavior in children is often a consequence of troubled families

with dysfunctional structures and inadequate parent-child communication. In such families, ranges of stressors are commonly observed. These include marital strife, lack of parental acceptance (evidenced by an absence of intimacy and support), parental rejection (characterized by a lack of positive emotions and harmful behaviors), inconsistent parental behaviors, psychological control over children, and challenging temperaments (Shigeto et al., 2014; Akcinar & Baydar, 2014; Rohner et al, 2012; Gulay & Onder, 2011). Consequently, the family dynamics, the nature of relationships among family members, the quality of parent-child communication, and the child's temperament play a pivotal role in the emergence of behavioral disorders.

Given that parents spend a considerable amount of time with their children, their relationship with their offspring and parenting approaches significantly influence the children's behavioral development. Factors such as leniency, inadequate supervision, hostile interactions, punitive measures, criminality, depression, personality disorders, inconsistent upbringing, contradictory behaviors, frequent failures, threats, humiliation, discrimination, and insufficient parental support can be primary contributors to behavioral issues (Matthys & Lochman, 2010).

Additionally, studies have demonstrated a correlation between cognitive flexibility and critical thinking (Ionescu, 2012). While critical thinking assists individuals in dissecting problems, cognitive flexibility is crucial in the quest for solutions. Information and data inform us of past occurrences, yet the past is not always a reliable predictor of the future, particularly in swiftly evolving situations. Hence, it is imperative to practice flexible and critical thinking (Scheibling-Sève et al., 2022). Cognitive flexibility, known as cognitive shifting, pertains to the brain's capacity to adjust to novel, evolving, or unexpected events. Essentially, cognitive flexibility is the ability to transition from one thought process to another (Ionescu, 2012). Individuals with flexible thinking employ alternative rationales, positively reframe their cognitive schemas, embrace stressful or challenging circumstances, and demonstrate greater psychological resilience than those without flexibility (Burton et al., 2010). Some researchers regard cognitive flexibility as an individual's evaluation of the controllability of situations, which varies across different contexts (Zong et al., 2010).

Karimi and Fatemi (2019) studied the relationship between parent-child interaction quality and the tendency towards critical thinking in adolescent female students considering mental health components; they concluded that the quality of the relationship with the father significantly predicts mental health and the inclination towards critical thinking in adolescent female students. However, the quality of the mother's relationship did not significantly predict these outcomes. In their research involving 319 female high school students from Chalus City's public schools, Neymvari et al. (2023) found a positive and significant relationship between family communication patterns and the tendency towards critical thinking ((r=0.34, p<0.05)). They also reported a

positive and significant relationship between cognitive flexibility and the tendency towards critical thinking ((r=0.73, p<0.01)). The role of cognitive flexibility in children's learning power under dynamic experimental conditions was explored by Stad et al. (2019) who discovered that cognitive flexibility positively correlates with children's reasoning and conclusion abilities. Daks and Rogge (2020), investigated the correlations of psychological flexibility in romantic relationships and family dynamics in a meta-analysis and concluded that psychological flexibility and inflexibility were crucial in shaping interactions within couples and families. This finding underscored the link between psychological flexibility and family communication. Güner and Gökçe (2021) explored the reciprocal effects between the tendency toward critical thinking, cognitive flexibility, math anxiety as well as math achievement in 1628 students across 4, 8, and 12 grades using structural equation modeling. The results indicated a direct and reciprocal influence between the tendency towards critical thinking and cognitive flexibility. Zwiers and Crawford (2023) demonstrated that establishing a two-way dialogue in the classroom is an effective method for enhancing critical thinking, suggesting that a similar dialogue-based relationship between parents and children could be beneficial. Campo et al. (2023) conducted a study with 263 Spanish students, revealing that the students perceived a relationship with teachers and parents as influential on critical thinking.

Upon examination of existing literature and reports, it is apparent that systematic investigations into cognitive flexibility within the dynamics of parent-child interactions, particularly about the propensity for critical thinking among students, are lacking. In light of the significance of these topics, the researcher has studied these variables to improve the caliber of critical thinking and elevate the educational standards of students. The question arises: Does cognitive flexibility serve as an intermediary factor in the nexus between parent-child interactions and the tendency of the students for critical thinking?

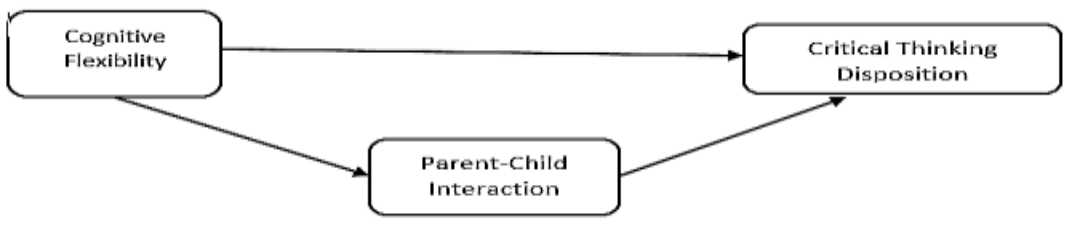

Figure 1
Conceptual model of research

2. Methods

This study was applied in nature and employed a descriptive-correlational approach through structural equation modeling. It encompassed a diverse group of middle school students, both girls and boys, from Lahijan city in the academic year 2021-2022. According to Habibi and Kolahi (2022), the minimum sample size for correlational research that utilizes structural equation modeling is 200.

2.1. Instruments

Parent-Child Relationship Scale (PCRS)**:** The PCRS, developed by Fine et al. (1983), consists of 24 items used to assess the quality of parent-child relationships. It has two forms, one for evaluating the child's relationship with the mother and the other with the father. Both forms are identical except for the interchangeable terms "father" and "mother." The scale measures four dimensions: positive feelings, father's involvement as well as enmeshment, communication, and anger for the father's version; and positive feelings, role confusion/disgust, and communication determination for the mother's version. It is scored on a 7-point Likert scale, with the total score being the average of the subscales. The score range is 24 (low), 96 (medium), and 168 (high). In Iraqi's research (2008), the alpha coefficients ranged from 0.89 to 0.94 for the father-related subscales and 0.96 overall, and from 0.61 (identification) to 0.94 for the mother-related subscales, with an overall alpha of 0.96, indicating excellent internal consistency. The scale's creators obtained these alpha coefficients by administering the questionnaire to 241 students.

The California Critical Thinking Disposition Inventory (CCTDI): Facione (1992) created this instrument comprising 34 questions to measure an individual's critical thinking skills (analysis, evaluation, inference, inductive reasoning, and deductive reasoning). Each item has four or five options, and since there is only one correct answer, the test-taker scores 0 or 1 per item. The total individual score ranges from 0 to 34. In Khalili and Soleymani's study (2003), the test reliability was 0.62 using the Kuder-Richardson method, and factor analysis for construct validity indicated that the test consists of five factors (analysis, inference, evaluation, deductive reasoning, and inductive reasoning), all of which correlated positively and significantly with the total test score. The test also distinguished the level of critical thinking skills between nursing and philosophy students. Facione (1997) reported the test reliability as 0.68-0.70 using the Kuder-Richardson method.

The Cognitive Flexibility Inventory (CFI)**:** Introduced by Dennis and VanderWal (2010), the CFI is a brief 20-item self-report tool used to measure the cognitive flexibility necessary for an individual's success in challenging and replacing inefficient thoughts with more efficient ones. This tool is used to evaluate an individual's progress in clinical and non-clinical trails and in developing flexible thinking in cognitive-behavioral therapy for depression and other mental illnesses. It is scored on a 7-point Likert scale, with 1 for (strongly disagree,) 2

for (disagree), 3 for (somewhat disagree), 4 for (neutral), 5 for (somewhat agree), 6 for (agree), and 7 for (strongly agree). The lowest and highest possible scores are 20 and 140, respectively. In Soltani et al.'s research (2013), the concurrent validity of this inventory with Beck's Depression Inventory (BDI-II) was 0.39, and its convergent validity with Martin and Rubin's Cognitive Flexibility Scale was 0.75. The test-retest reliability of the entire scale was reported as 0.71, and Cronbach's alpha coefficients for the scale were reported as 0.90.

2.2. Procedure

Within the defined statistical population, a sample of 200 individuals was selected through a convenience sampling method implemented in educational institutions. Then, the research instruments were printed and disseminated within the designated demographic. Precautionary measures were taken to ensure the distribution of 260 questionnaires since the inherent playfulness and potential restlessness of the student participants could lead to incomplete or compromised questionnaires. This approach was taken to ensure the collection of 200 fully completed questionnaires, which were rigorously analyzed statistically. The analytical methodology employed in this study included Pearson correlation tests and structural equation modeling techniques. The statistical analysis was conducted using the advanced capabilities of SPSS 26 and LISREL 10.2 software.

3. Results

The study's demographic breakdown included 81 girls and 119 boys, constituting 40.5% and 59.5% of the sample, respectively. The participants' ages averaged 14.34 years, with a standard deviation of 2.08 years. Specifically, girls had an average age of 14.07, while boys were slightly older, averaging 14.61 years. Grade-wise distribution revealed 57 seventh graders (28.5%), 45 eighth graders (22.5%), and 98 ninth graders (49%), indicating a predominant representation of ninth graders in the sample. Table 1 presents the mean and standard deviation of the research variables, categorized accordingly.

Table 1
Mean and standard deviation of research variables

Variable Source		Mean	Standard Deviation
Critical Thinking (total)		91.88	12.29
Critical Thinking	Truth-Seeking	12.65	2.97
	Consistency	10.21	2.71
	Self-Control	7.51	1.79
	Analytical Mindset	12.68	1.83
	Problem-solving Orientation	13.43	3.17
	Curiosity	14.95	2.98
	Self-Confidence	10.31	1.85
	Perfection and Maturity	10.17	1.66
Parent-Child Interaction		93.78	13.15
Cognitive Flexibility (total)		80.67	12.06
Cognitive Flexibility-Control	Control	37.36	5.85
	Justification	21.11	4.16
	Perception of Different Options	22.20	3.45

The Kolmogorov-Smirnov test was utilized to assess the normal distribution of the research variables. The results for critical thinking (P = 0.10, Z = 0.09) and its sub-scales, such as truth-seeking (P = 0.37, Z = 0.91), organized action (P = 0.20, Z = 0.03), self-control (P = 0.49, Z = 0.83), analytical thinking (P = 0.09, Z = 0.07), inclination towards problem situations (P = 0.19, Z = 1.07), curiosity (P = 0.51, Z = 0.81), self-confidence (P = 0.06, Z = 1.33), perfection and maturity (P = 0.10, Z = 1.21), and parent-child interaction (P = 0.85, Z = 0.41), along with the sub-scales of cognitive flexibility including control (P = 0.26, Z = 0.71), justification (P = 0.25, Z = 1.01), and perception of different options (P = 0.09, Z = 0.07), were not statistically significant. This indicated a normal distribution of data.

Furthermore, the tolerance index and variance inflation factor for dependent variables of the study were greater than 0.1 (parent-child interaction and cognitive flexibility at 0.837 and 0.724, respectively) and less than 10 (parent-child interaction and cognitive flexibility at 1.145 and 1.381), respectively. This suggests that multicollinearity is not present among the research variables.

Table 2

Correlation matrix of research variables

Research variables	1	2	3
1. Parent-Child Interaction	1		
2. Critical Thinking	0.25**	1	
3. Cognitive Flexibility	0.33**	0.31**	1

*p < 0.05 **p < 0.01

It was noted that a positive correlation existed among parent-child interaction, cognitive flexibility, and critical thinking.

A specialized model fitting program was employed in assessing the proposed model's fit. This program is advantageous as it generates indices that gauge the model's compatibility with the empirical data. Essentially, these indices reveal the model's capacity accurately to represent the data. Thompson suggests that the most critical indices for evaluating model fit are the Chi-Square Test ($\chi 2$), Comparative Fit Index (CFI), and Incremental Fit Index (IFI), as corroborated by Meyers et al. (2006).

Table 3

Model fit indices

Index	Estimated Model	Saturated Model	Independent Model	Criteria	Result
NPAR	35	120	15	-	-
X^2	366.108	0	1167.969	-	-
Df	85	0	105	-	-
X^2/df	0.0000	-	11.124	< 3	Unacceptable
IFI	0.740	1	0	> 0.8	Unacceptable
CFI	0.736	1	0	> 0.8	Unacceptable
RMSEA	0.129	0	0.229	< 0.07	Unacceptable

Table 3 revealed that the estimated model's Chi-square to degrees of freedom ratio stands at 11.124, surpassing the acceptable threshold of 3, as per Kline (2011), thus deeming it unsatisfactory. The model's RMSEA value was measured at 0.129, exceeding the upper limit of 0.07, which further signified a poor fit. Moreover, the IFI and CFI values, which should exceed 0.8, fall short at 0.74 and 0.736, respectively, rendering them inadequate. These indicators collectively suggested a significant discrepancy between the current model and the theoretical framework. The model underwent revisions to address this, with the enhanced fit indices detailed in Table 4.

Table 4

Improved Model Fit Indices

Index	Modified Model	Result
NPAR	43	-
X^2	148.366	-
Df	77	-
X^2/df	1.927	Acceptable
IFI	0.935	Acceptable
CFI	0.933	Acceptable
RMSEA	0.068	Acceptable

Table 4 illustrated that for the updated model, the Chi-square to degrees of freedom ratio stood at 1.927. With an RMSEA value of 0.068, the model achieves an acceptable level of fit. Furthermore, the NFI and CFI values exceed the 0.8 benchmark, confirming the model's satisfactory alignment with the data.

Table 5

Overview of the Revised Model's Direct Coefficients

Path	Standardized Effect Coefficient	Significance Level	Significance at 95% Level	
			Lower Bound	Upper Bound
Parent-Child Interaction on Critical Thinking Disposition	0.215*	0.006	0.078	0.354
Cognitive Flexibility on Critical Thinking Disposition	0.195*	0.037	0.043	0.374

*p< 0.05

Table 5 showed that parent-child interaction had a direct positive effect on the variance of the criterion variable, namely the inclination towards critical thinking, by 0.22 units ($p < 0.05$). Considering the estimation error, these coefficients can range from 0.08 to 0.4 in the population. Therefore, parent-child interaction had a direct impact on the inclination toward critical thinking ($p < 0.05$). Additionally, Table 5 indicates that cognitive flexibility has a direct positive effect on the variance of the criterion variable, namely the inclination towards critical thinking, by 0.195 units ($p < 0.05$). Considering the estimation error, these coefficients can range from 0.04 to 0.4 in the population. Consequently, cognitive flexibility has a direct effect on the inclination toward critical thinking ($p < 0.05$).

Table 6
Indirect Coefficients Summary in the Revised Model of Parent-Child Interaction via Cognitive Flexibility and Its Impact on Critical Thinking Disposition

Indirect Path	Total Standard Effect	Significance Level	Indirect Effect Standard	Significance Level
Parent-Child Interaction on Critical Thinking Disposition	0.270**	0.004	0.056*	0.037

*p < 0.05 **p < 0.01

The results of Table 6 demonstrated that through cognitive flexibility, parent-child interaction had a positive and significant indirect effect on the inclination towards critical thinking by 0.07 units ($p < 0.05$). Therefore, parent-child interaction indirectly influences the tendency towards critical thinking via cognitive flexibility.

4. Discussion

The results underscored that the interaction between parents and children positively and directly influences the propensity for critical thinking. This concurs with the findings of Fouladchang and Ghodoumi Zadeh (2015). Kouroshnia and Latifian (2012) also demonstrated that the various interactive scenarios families encounter throughout life can cultivate critical thinking in offspring. Ennis (1996) posited that the higher the parent-child relationship quality, the more pronounced the emergence and enhancement of critical thinking in adolescents. Critical thinking comprises at least two fundamental elements: the analysis and evaluation of arguments, necessitating the acquisition of skills for accurate comprehension and appraisal of reasons and assertions; and a critical spirit, encompassing attitudes towards the family, as well as mental attributes and personality traits. A family's environment is conducive to the development of critical thinking. Indeed, children who maintain a positive and robust relationship with their parents are more inclined to utilize various thinking styles, particularly critical thinking; however, this is contingent upon the approach adopted by the parents. Parents who exhibit greater flexibility can significantly contribute to the intellectual growth of their progeny. In essence, parents who engage in positive interactions tend to nurture children who are critical thinkers. From the discourse, it is evident that the interactions between parents and children have a direct bearing on the inclination toward critical thinking. Thus, the research hypothesis is validated.

Moreover, the present study revealed that cognitive flexibility had a positive direct impact on critical thinking. These findings are in harmony with those of Güner and Gökçe (2021). To elucidate this hypothesis further, it was noted that in 1985, Ennis identified several characteristics integral to successful critical thinking, including the pursuit of diverse and flexible approaches devoid of bias, and the formulation of conclusions from different observations that

are thoughtfully and reasonably subject to judgment. This aspect of critical thinking is also discernible within the facets of cognitive flexibility. An individual endowed with critical thinking, who internalizes the competencies associated with critical thinking in posing essential questions and issues, collating and evaluating pertinent information, articulating results and substantiated solutions, and subjecting them to scrutiny, fortifies their intellectual frameworks. Such an individual is adept at identifying assumptions, rationales, and consequences, and forging effective connections to unearth solutions to intricate dilemmas. As Paul and Elder (2000) have articulated, critical thinking is a mode of contemplation about any topic or problem wherein the thinker augments the caliber and method of their thought process through the adept application of cognitive constructs, grounding it in rational standards. Engaging in this process necessitates cognitive flexibility traits, culminating in the cultivation of a critical thinker. Consequently, the research hypothesis was corroborated.

A recent study has revealed that the dynamics of parent-child interaction indirectly foster critical thinking through the lens of cognitive flexibility. Nowadays, there is a lack of comparative research on this specific topic, yet the outcomes of this investigation seem to resonate with the work of Karimi and Fatemi. (2019). The bond between adolescents and children in general, with their parents is instrumental in shaping their critical thinking abilities. The greater the flexibility parents exhibit in their everyday interactions with their adolescents, particularly in fostering open dialogue and opinion exchange, the more they aid in cultivating their children's critical thinking skills. Parents who adopt a democratic approach in child rearing and respond flexibly to their children's viewpoints and critiques are exceptionally effective in nurturing critically minded offspring. It is acknowledged that cognitive flexibility evolves throughout an individual's life. Researchers define cognitive flexibility as the ability to adapt one's focus and thought process across various tasks or functions, particularly in adapting to new demands and changing rules. Consequently, it is inferred that parents who practice flexibility in their interactions are likely to develop critical thinking skills in their children, and cognitive flexibility, along with an understanding of cognitive components; this serves as a mediating factor in the relationship between parent-child interactions and critical thinking. In essence, adaptable parents indirectly mold their children's critical thinking capabilities. Hence, the research hypothesis stands validated.

A notable limitation of this study is its reliance on convenience sampling. The research, conducted among high school students in Lahijan city, is cross-sectional and correlational, limiting its applicability to other educational stages and locales. Being cross-sectional, it fails to capture the temporal evolution of variable relationships. Using self-reported questionnaires for data collection might introduce biases in the findings. The investigation was confined to two variables affecting critical thinking,

notwithstanding the potential influence of other psychological factors.

5. Conclusion

In light of these considerations, it is proposed that future research should expand to different educational levels and cities, employing varied data-gathering techniques like observation and interviews, and examining additional variables that may affect critical thinking, in a longitudinal format. Experimental methods should be utilized to explore causal connections. Based on the insights gained, it is advised that educational institutions and families emphasize enhancing parent-child interactions and cognitive flexibility among students, thereby fostering individuals with heightened critical faculties. Given the established direct impact of cognitive flexibility on critical thinking, it is recommended to organize workshops in schools to educate students on strategies to augment cognitive flexibility.

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Conflict of interest

The Authors declare that there is no conflict of interest with any organization. Also, this research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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