Analysis of Thinking and Language in the Cognitive Development of Santri Islamic Boarding School

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ABSTRACT. This qualitative field study investigated cognitive development among third-grade Madrasah Tsanawiyah students at Rumah Sajada Orphanage and Islamic Boarding School, Yogyakarta. Over five weeks the researcher observed seven pupils two selected purposively for detailed analysis during a one-hour formal lesson each week. Unstructured field notes were thematically analysed using Piaget's Formal Operational Stage and the Islamic educational constructs of tadabbur, faqiha, and tadhakkur. Findings reveal a spectrum of formal-operational maturity: several students exhibited consistent abstract, deductive, and hypothetico-deductive reasoning, whereas others remained in transition. Routine tadabbur acted as a catalyst for executive-function growth, while adolescent egocentrism, manifested as an "imaginary audience," occasionally constrained classroom discourse. Supportive teacher feedback and verse-based collaborative tasks reduced these barriers and promoted deeper reasoning. The study demonstrates that an integrated spiritual-academic environment can accelerate attainment of formal-operational competencies and enrich reflective language ability, providing empirically grounded recommendations for curriculum design in faith-based schools and similar educational contexts.

Keywords: formal operational stage; cognitive development; tadabbur; Islamic boarding school; qualitative research

INTRODUCTION

MTS adolescents undergo a significant cognitive transformation, in which their thinking abilities shift from concrete to abstract and multidimensional thinking, allowing for hypothetical reasoning and deeper self-reflection (S. Brown, Jernigan, and Dowling 2023; Debby Irola and Anna Dina Kalifia 2024; Dumontheil 2016; Irvin 2016). In the Formal Operational Stage according to Piaget, adolescents begin to be able to think about concepts that are not physically present and explore hypothetical scenarios with intellectual flexibility (Maulana 2024; Rabindran 2020). They also develop logical and deductive reasoning able to draw conclusions from existing premises as well as formulate and test hypotheses systematically (Day 1981; Rabindran 2020). Their problem-solving skills are maturing by considering many variables and potential outcomes (Hale 1980; Oogarah-Pratap, Bholoa, and Ramma 2020), although adolescent egocentrism such as the belief that they are the center of attention also emerges as part of complex self-reflection (Rabindran 2020).

Field observations at the Rumah Sajada Islamic Boarding School, using observation sheets based on Piaget's theory, revealed variations in the implementation of the Formal Operational Stage between students. In the aspect of abstract thinking, researchers found various levels of maturation: some students were already able to explain the concept of value such as *sincerity* and *tawakkal* without concrete examples, while others still needed additional stimulus to connect abstract concepts with daily experiences. Hypothetical reasoning seems to be quite developed in some students, while the ability of propositional logic and grouping-serialization

shows room for improvement. The variation in oral and written expressions also reflects that the maturity of executive functions interacts closely with spiritual-educational practices such as tadabbur, *faqiha*, and *tadhakkur* which are routinely carried out based on the teachings of the Qur'an (Hafizallah, Zayadi, and Zamzami n.d.; Rohimah et al. 2024).

Most research on adolescent cognitive development still focuses on the general population without considering the context of Islamic values and practices typical of pesantren (Benda et al. 2024; Irvin 1995), while the study of Islamic Educational Psychology is often normative and rarely directly measures the dynamics of adolescent executive functions in religious activities (Caro 2013; Dumontheil 2016). This gap begs the question: to what extent do the characteristics of adolescent cognitive development affect the integration of thinking and language according to the framework of Islamic Educational Psychology? The literature review underscores the role of social and environmental experiences in the formation of abstract and multidimensional thinking (S. A. Brown, Jernigan, and Dowling 2023; Irvin 2016), as well as the maturation of the prefrontal cortex which improves impulse control and planning (Caro 2013; Dumontheil 2016). On the other hand, Islamic Educational Psychology emphasizes the importance of effective communication and problem-solving based on Islamic principles to support the holistic development of students (Arlina et al. 2023; Napitupulu, Lubis, and Siregar 2022; Rokhimah et al. 2024). However, few studies have empirically synthesized the two to explain how students combine cognitive processes and spiritual-verbal practices in pesantren learning (Aswanda, Hulawa, and Dewi 2023; Kurniyadi, Amin, and Rohimah 2024).

Although a number of international studies have shown that dorm patterns can provide certain cognitive advantages, these findings are still ambiguous when viewed holistically especially in the context of Indonesian Islamic boarding schools. A meta-analysis of 49 studies by Zhong et al. (Zhong, Feng, and Xu 2024) reported a measure of moderate positive effects (g = 0.25) of boarding schools on students' general cognitive development, and the study of Chang et al. (Chang et al. 2023) in rural junior high schools in China found improvements in memory and attention. However, the same evidence confirms that the dormitory environment does not consistently improve reasoning skills, transcription speed, or non-cognitive abilities; Even significant negative effects were recorded on the affective aspects and attitudes of students (Chang et al. 2023; Zhong et al. 2024). In addition, the meta-analysis showed that junior high school students in rural areas felt greater negative impacts than their urban counterparts, suggesting that socio-cultural context is decisive (Zhong et al. 2024). In Piaget's perspective, environmental stimuli are indeed crucial to formal operational maturity, but their quality must be adapted to the stage of development and the needs of learners (Anggraeni et al. 2024; Marinda 2020). These findings mark an important gap: there has not been a study that has in-depth assessed how the Qur'anic value-based dormitory system such as at the Rumah Sajada Islamic Boarding School affects the spectrum of students' cognitive and affective development. This study, therefore, is directed to contextually examine whether structured *tadabbur* and *tadhakkur* routines are able to optimize adolescent executive functions without sacrificing emotional well-being, thereby enriching the discourse on the effectiveness of Islamic boarding education.

The urgency of this research lies in the empirical evidence about how the Qur'anic value-based dormitory system with the routine of *tadabbur*, *faqiha*, and *tadhakkur* affects adolescents' cognitive development as well as their affective well-being in the pesantren environment. International findings on boarding schools do show improved memory and attention, but they also mark risks to students' social-emotional development; Until now, there has been no study that assesses this balance in the context of Indonesian Islamic boarding schools. Therefore, this study aims to investigate in depth the interaction between cognitive executive function and Islamic spiritual practices in 3rd grade MTS students at the Rumah Sajada Islamic Boarding School, with the hope of producing contextual and holistic curriculum recommendations. The research argues that synchronizing high-level cognitive activities such as hypothetical-deductive reasoning with

structured spiritual discipline will not only strengthen religious learning, but also nurture affective development and enrich students' reflective language skills.

METHOD

This research uses a qualitative approach with a field research design at the Rumah Sajada Islamic Boarding School, Yogyakarta. The researcher positioned himself as a non-interventional observer and each week attended one hour of formal class lessons for five consecutive weeks. Observation is focused on the process of thinking and speaking the language of the students during the learning of nahwu and interpretation of the Qur'an; No interviews or extracurricular activities were recorded, so all data was sourced from classroom interactions.

Table 1. Operational Definition and Observation Indicators

Key Terms	Operational Definition	Observation Indicators in the Classroom
Abstract Thinking	The ability to process concepts that are not physically present and relate them to new situations.	• Explaining *sincerity / tawakkal* without concrete examples. • Using general terms (e.g. "internal motivation") to describe behavior.
Hypothetical-Deductive Reasoning	The process of formulating "what if" questions and systematically testing possible answers.	•Propose alternative scenarios. • Mention ≥2 variables that affect the outcome.
Propositional Logic	The ability to draw "if–then" conclusions from two or more premises in sequence.	• Constructing an argument: "If X is true and Y occurs, then Z must be done."
Classification–Serialization	Skill of grouping and sorting concepts/objects according to hierarchical criteria.	• Classify the pillars of zakat or distinguish the *obligation of fardu* vs *sunnah* correctly.
Executive Functions	High-level cognitive processes: planning, impulse control, cognitive flexibility.	• Changing the strategy of arguments when challenged. • Holding back impulsive comments and waiting for their turn.
Tadabbur	Activity to reflect on the meaning of the verse before class discussion.	• Write a reflection of ≥3 sentences before the presentation.
Tadhakkur	Repetition of the core points of verses/hadith after worship or learning as a memory booster.	• Quoting verses/hadiths without being directed by the teacher and mentioning their practical applications.
Faqiha	Deepening of fiqh terminology so that it is understood conceptually and practically.	• Provide a definition of the term fiqh and examples of its application in one sentence.

The table above summarizes the key terms used in the research ranging from cognitive constructs (abstract thinking, hypothetical-deductive reasoning, propositional logic, classification-serialization, and executive functions) to spiritual practices (*tadabbur, tadhakkur,* and *faqiha*). Each term is defined operationally according to the context of pesantren learning, then followed by behavioral indicators that are observed directly in the classroom. This indicator is the basis for coding field data and determining maturity categories (high, medium, low) in the research results. The subjects of the study were seven 3rd grade students of Madrasah Tsanawiyah; From this

population, two people were purposively selected representing the high and medium ranges of cognitive maturity to be observed in more depth. The selection of two "small n" cases allowed researchers to document variations in abstract thinking processes and spiritual reflection without losing focus on the details of individual behavior (Creswell et al. 2007).

Because the entire population of 3rd grade MTS at the Rumah Sajada Islamic Boarding School only amounts to seven students, this study deliberately includes them in full. The small group size makes it easy for researchers to record each individual's behavior in detail from the way they formulate hypotheses to reflective responses to *tadabbur* so that variations in high, medium, and early levels of cognitive maturity are captured without losing the social context of the class. The uniform 24-hour dormitory environment reinforces the argument that the differences in findings are due more to the dynamics of cognitive development than to external factors. Thus, these seven students serve as a solid example (small N) to build a theoretical proposition about the synchronization of executive functions and spiritual practices, which can later be tested in similar pesantren This narrative is placed at the end of the Research Methods section, after an explanation of the selection of two focus participants, in order to confirm the logic of the selection of "mini-populations" and the relevance of the transferability of the findings.

Data were collected through non-structured observation with narrative field notes, including question and answer dialogues, hypothetical scenarios that appeared spontaneously, and verbal and non-verbal expressions of students when responding to the material. The analysis follows the steps of thematic analysis: (1) transcription of field notes, (2) open coding based on the framework of Piaget's Formal Operational Stages and the concept of tadabbur–tadhakkur in Islamic Educational Psychology, (3) the preparation of themes about reasoning patterns, and (4) interpretation to explain the synchronization of cognitive executive functions with spiritual practices in the classroom (Creswell et al. 2007).

The first step is the *transcription of field notes*, where all the results of daily observationsincluding class dialogues, non-verbal gestures, and student reflection quotes are typed verbatim to ensure a complete data trace. Next, the transcript underwent *open encoding*; the researchers labeled sentences or phrases that represent the indicators in Table 1, such as "what-if" questions for hypothetical reasoning or "definitions without concrete examples" for abstract thinking. Similar codes are then *grouped into themes* for example, the themes of "Stable Formal Reasoning" and "Abstract Transitions" for cognitive aspects, or "Reflective Rituals" for *tadabbur–tadhakkur practices*. In the final stage, the themes are analyzed comparatively with the theory (Piaget) and the literature of Islamic Educational Psychology; this stage is called *interpretation and literature*. The researcher examined how each theme reflects the synchronization of executive functions and spiritual activitiesfor example, the theme "Reflective Rituals" is associated with the findings of Zhong et al. (2024) on the benefits of a structured dormitory environment, as well as explaining the differences in the context of Islamic boarding schools. This four-step flow maintains data traceability from field notes to conclusion drawn, increasing the credibility and transparency of qualitative analysis.

RESULT AND DISCUSSION

Result

This research was conducted at the Rumah Sajada Islamic Boarding School, an orphanage and Islamic boarding school for orphans and poor people established on February 1, 2009 in Wirokraman Hamlet RT 04/RW 13 Sidokarto, Godean, Sleman, Yogyakarta, with the vision of "Building a Quranic and Independent Generation." This institution provides integrated education—early childhood, general knowledge, and life-skills such as swimming, archery, and gardening—which are fully scheduled in the dormitory environment, so that foster children are

fostered 24 hours a day to instill the values of the Qur'an and Sunnah as well as entrepreneurial independence. After dawn, students are accustomed to reading and memorizing the Qur'an; At night they are routinely trained to pray tahajud. In addition to the men's complex in Wirokraman, the pesantren has 2001 m² of land in Sorolaten for women's dormitory and office, including an area of 100 m² that functions as a PAUD for the local community. Through this integrated parenting, Rumah Sajada seeks to improve the standard of living of orphans and poor people so that they grow as quality Muslims who will later benefit the people.

Table 2. *Variations in Cognitive Abilities of Grade 3 MTS Students (S1–S7)*

Students	Abstract Thinking	Hypothetical-Deductive Reasoning	Propositional Logic	Classification–Serialization	Oral-Written Expression
S1	Tall	Tall	Tall	Keep	Keep
S2	Tall	Keep	Keep	Keep	Low
S3	Keep	Keep	Keep	Low	Keep
S4	Keep	Low	Keep	Low	Low
S5	Keep	Keep	Keep	Keep	Keep
S6	Low	Low	Low	Low	Low
S7	Tall	Tall	Tall	Keep	Tall

Category description
- **High**   : the indicator appears consistent and independent.
- **Medium**   : indicators appear but still need teachers' stimulus.
- **Low**   : the indicator is rare/not appearing or only appears after intensive briefing.

This table shows the spectrum of maturity of the Formal Operational Stage within one class: three students (S1, S2, S7) show strong abstract capacity; two students (S3, S5) are at the transition level; and two other students (S4, S6) are still in the early stages, especially in classification-serials and written expressions.

The results of five weeks of observation in the 3rd grade of Madrasah Tsanawiyah Pondok Pesantren Rumah Sajada showed that all seven students were within the range of the Piaget Formal Operational Stage, but with varying depths. Two participants who were intensively observed described the spectrum: one student displayed a steady abstract reasoning pattern, while the other was still in the transition phase. Both are able to recognize the concept of value *sincerity* and *tawakkal*—as non-concrete ideas, in line with the characteristics of abstract thinking in adolescents (Dumontheil 2016; Irvin 2016). However, only students at the other end of the maturation spectrum consistently associate the concept with conditional logic for example, "if the intention changes, the quality of charity declines" an example of propositional reasoning that marks formal operational maturity (Maulana 2024; Rabindran 2020).
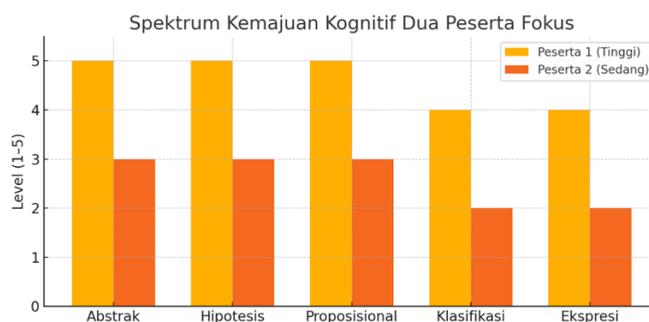
Figure 2. *Spectrum of Cognitive Progress of Two Samples of Students*

The bar chart above shows the contrast of the cognitive maturity levels of the two participants focusing on five main indicators: abstract thinking, hypothetical reasoning, propositional logic, classification–serialization, and oral-written expression (scale 1–5). Participant 1 (yellow) was consistently at a high level, while Participant 2 (orange) was in the medium-low range, confirming the formal operational spectrum found through field observation. The tadabbur practice carried out at the beginning of each meeting seems to be the main trigger for the emergence of hypothetical ideas; Students with high maturity routinely write down the question "What if...?" and test the variation of answers, while their developing colleagues often stop at mentioning scenarios without elaborating on variables. This fact supports the findings of Oogarah-Pratap et al. (Oogarah-Pratap et al. 2020) that free exploration opportunities are a catalyst for the development of problem-solving strategies, but also corroborate Hale's record (Hale 1980) about the need for explicit guidance so that adolescents systematically map variables.

Observations also reveal the negative influence of egocentrisman "imaginary audience" that makes some students reluctant to speak in open forumsa phenomenon that Piaget predicted would emerge in mid-adolescence (Rabindran 2020). Teachers who provide supportive feedback, instead of reprimanding mistakes directly, succeed in lowering those barriers and opening up space for collective deductive reasoning. These findings underscore the urgency of dialogical communication raised by Napitupulu et al. (Napitupulu et al. 2022) and Rokhimah et al. (Rokhimah et al. 2024) within the framework of Islamic Educational Psychology. Overall, the pattern of cognitive–spiritual integration in the classroom suggests that ritual practicestadabbur, *faqiha*, and *tadhakku*not only enrich religious vocabulary, but also serve as "training tools" for executive function. The context of pesantren that combines secular learning and worship creates a repetitive reflective-cognitive rhythm; this process is in line with the ideas of Rohimah et al. (Rohimah et al. 2024) on the importance of *tadhakkur* for long-term memory consolidation and supporting the neurocognitive outcomes reported by Brown et al. (S. A. Brown et al. 2023).

The findings of this study also fill the gap highlighted by Benda et al. (Benda et al. 2024): Studies of adolescent cognitive development rarely consider Islamic contexts. Field results show that religious values can accelerate the emergence of abstract reasoning, but full maturity demands pedagogical interventions such as graded classification tasks and small group discussions that adjust students' readiness levels. Thus, the synchronization of cognitive executive functions and spiritual activities has been shown to increase the effectiveness of religious learning as well as enrich reflective language skills, supporting the integrative argument put forward by Kurniyadi et al. (Kurniyadi et al. 2024) and Aswanda et al. (Aswanda et al. 2023).

Discussion

The discussion section aims to: (1) answer the problem formulation and research or study questions; (2) shows how the findings were obtained or found; (3) interpret the findings; (4) linking research findings or studies with established knowledge structures; and (5) bring up new

theories or modifications to existing theories, by comparing the results of previous studies that have been published in reputable journals.The results in Table 2 indicate clear variations in the cognitive abilities of Grade 3 MTS students, even though all of them fall within the range of the Formal Operational Stage. The levels of reasoning and abstraction differ significantly, showing that cognitive maturity develops at different speeds among students. Some students demonstrate consistent abstract thinking and logical reasoning, while others are still dependent on teacher guidance or show limited ability to classify and express ideas clearly. This variety suggests that the development of formal reasoning is influenced by the learning environment and teaching strategies, not only by age or biological factors.

The learning atmosphere at Rumah Sajada Islamic Boarding School provides a unique environment that supports both intellectual and spiritual growth. The combination of academic study and daily religious routines such as Qur'an recitation, reflection, and night prayers forms a pattern of discipline that strengthens students' focus and reasoning. Students who are active in reflective practices tend to show stronger hypothetical and abstract reasoning skills, especially when interpreting moral values such as sincerity and trust. However, those who are less engaged still struggle to connect abstract ideas with logical conditions, indicating the need for structured support from teachers to help them reach higher levels of cognitive maturity.The comparison between two observed participants clearly illustrates the cognitive spectrum that exists in the class. One student demonstrates high consistency in abstract reasoning and logical relationships, while the other remains in the middle range, showing good potential but requiring guidance to analyze problems systematically. This difference highlights the importance of active engagement and teacher facilitation. Students who are encouraged to ask questions, explore alternatives, and explain their reasoning develop stronger analytical skills than those who are only passive listeners.

Emotional and social factors also play an important role in the development of reasoning. Some students show hesitation to speak in front of their peers because of a sense of self-consciousness, which limits their opportunities to practice logical communication. Teachers who create a supportive and respectful environment help reduce this barrier, allowing students to express opinions more freely. Encouraging open discussion and providing constructive feedback strengthen not only students' confidence but also their ability to think critically and cooperatively. Overall, the integration of spiritual practice and cognitive training in the pesantren classroom creates a balanced form of education. Activities such as reflection, discussion, and self-evaluation serve as exercises for developing reasoning and memory. This integration produces students who can connect faith-based values with rational thinking, leading to a more comprehensive form of learning. In this context, cognitive growth is not seen merely as an academic goal but as part of the holistic formation of character, intellect, and faith.

CONCLUSION

This study, which was carried out at the Rumah Sajada Islamic Boarding School, confirmed that the 3rd grade students of MTS although there were only seven displayed the maturity spectrum of the Piaget Formal Operational Stage. Through observation of one hour per week for five weeks, it was found that some students had mastered abstract, logical, and hypothetical-deductive reasoning, while others were still in the transition phase. Such variation is directly proportional to the courage to participate in class dialogue and the deep habit of tadabbur ; Students who actively ask questions and are used to writing reflections on the Qur'an show a more coherent argument structure and the use of well-established conditional logic.These qualitative findings affirm the added value of the pesantren context: the routine practice of tadabbur, *faqiha*, and *tadhakkur* is not just a religious activity, but a vehicle for executive function training—working memory, problem-solving, and self-reflection that enriches the path of adolescent cognitive development. However, egocentrism, typical of teenagers according to Piaget, still appears in the form of an "imaginary audience" that inhibits some students from

speaking; Supportive teacher strategies and small group discussions have proven effective in reducing these barriers.Theoretically, this study expands the cognitive development literature by showing that a structured religious environment can facilitate, even accelerate, formal operational achievement. Practically, the pesantren curriculum needs to include verse-based case study assignments and collaborative projects to train hypothesis reasoning, as well as provide gradual guidance for students who are still weak in classification-serialization and written expression. By synchronizing cognitive executive functions and Islamic spiritual activities, pesantren have a strong potential to form a generation of Quranic adolescents who are reflective, logical, and independent.

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