

The Bilingualism Effect: The Impact of Arabic Proficiency on The Cognitive Executive Functions of Islamic Boarding School Students

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Abstract

This study examines the phenomenon of bilingualism in the context of Arabic language proficiency and its impact on the cognitive executive functions of Islamic boarding school students, using a descriptive qualitative approach. The boarding school environment, which requires the simultaneous use of Arabic and Indonesian, creates a unique setting of natural bilingualism. The focus of this study is on three main components of cognitive executive functions: inhibitory control, working memory, and cognitive flexibility. Data were collected through participant observation, in-depth interviews, and documentation over the course of one academic semester within the pesantren environment. The results indicate that students who actively use Arabic in their daily lives demonstrate better inhibitory control, higher working memory capacity, and greater cognitive flexibility compared to students who use Arabic passively. This study supports the bilingual advantage hypothesis and enriches psycholinguistic research within the context of Islamic education in Indonesia.

Keywords: Arabic, Bilingualism, Cognitive Executive Functions, Inhibitory Control, Working Memory

INTRODUCTION

The phenomenon of bilingualism a person's ability to actively use two languages has become one of the most dynamic research topics in the fields of psycholinguistics and cognitive neuroscience over the past two decades. Researchers have focused significant attention on a fundamental question: does the routine use of two languages have a positive, negative, or even neutral effect on the functioning of the human cognitive system? This question is not merely academic but has broad practical implications, particularly for educational institutions operating in multilingual environments, including Islamic boarding schools in Indonesia.

Islamic boarding schools are the oldest and most distinctive Islamic educational institutions in Indonesia, having made a significant contribution to producing generations of Muslims who possess both a deep understanding of religious knowledge and strong intellectual abilities (Bialystok, 2022). One of the unique features of the pesantren educational system that distinguishes it from other educational institutions is the mandatory active use of Arabic the language of the Qur'an and classical Islamic texts in both the academic and daily lives of the students. In various modern pesantren and mahad (*dormitories*) at Islamic universities,

Arabic has even become a mandatory language of communication alongside Indonesian, thereby creating a structured and monitored environment of bilingualism (Manurung, 2021).

In the context of Islamic higher education, this phenomenon is increasingly relevant given that many State Islamic universities (UIN), State Islamic religious institutes (IAIN), and State Islamic religious colleges (STAIN) offer mahad programs as an integral part of their curriculum. Mahad al-Jami'ah, often referred to as a campus pesantren, requires its students to use Arabic in various communication contexts, ranging from daily conversations and muhadharah (*practice lectures*) to the study of classical Islamic texts. Thus, pesantren students are in a state of active and intense bilingualism, processing and using two language systems alternately every day (Arifa, 2022).

Cognitive executive functions refer to a set of higher-order mental processes that regulate, direct, and integrate human cognition in the pursuit of goals (Mujib, 2021). The three main components of executive functions that have been most extensively studied in relation to bilingualism are: (1) inhibitory control, which is the ability to suppress responses that are irrelevant or interfere with cognitive processes; (2) working memory, which is the active system for storing and manipulating short-term information; and (3) cognitive flexibility, which is the ability to switch between tasks, perspectives, or rules efficiently (Sharaan & Shereen, 2022).

The bilingual advantage hypothesis, pioneered by Ellen Bialystok and her colleagues, posits that bilinguals who actively use two languages on a regular basis develop stronger cognitive executive functions than monolinguals. The mechanism underlying this advantage is that when a bilingual person uses one of their languages, the other language remains indirectly active in the cognitive system, so that the brain consistently practices monitoring, inhibiting, and switching between the two language systems. This intense and continuous mental exercise is assumed to strengthen the cognitive circuits responsible for executive control (Alrwaita et al., 2024).

However, recent studies suggest that the relationship between bilingualism and executive function is not as straightforward as previously thought. Several studies have found that not all types of bilingualism yield the same cognitive benefits. Variables such as the age of second-language acquisition, proficiency levels in both languages, frequency of use, and the context of language use significantly determine whether the benefits of bilingualism actually emerge and in which aspects of executive function these benefits are strongest (Istiqomah, 2022). In the context of Arabic, which has the unique characteristic of diglossia the distinction between Standard Arabic (*fusha*) and Arabic dialects (*ammiyah*) this complexity becomes even more layered (Khoerunisa & Hilda, 2024).

The urgency of this research is at least based on three main reasons. First, until now, there has not been much research specifically examining the effects of Arabic bilingualism on the cognitive executive functions of students in Indonesian pesantren environments. Most existing studies on Arabic bilingualism focus on the Arab-English context in the Middle East or the study of diglossia among native Arabic speakers, creating a significant research gap related to the context of Arabic-Indonesian bilingualism. Second, pesantren as an educational institution with structured language environment characteristics offer an ideal natural laboratory to study the dynamics of bilingualism in well-documented conditions. Third, a deeper understanding of the relationship between Arabic language proficiency and cognitive executive functions can provide an empirical basis for developing Arabic language learning strategies that not only enhance linguistic competence but also optimize the cognitive potential of pesantren students (Saleh, 2023).

Based on this background, this research aims to: (1) describe the patterns of Arabic-Indonesian bilingualism that develop in the student pesantren environment; (2) analyze the relationship between the level of proficiency and the intensity of Arabic use with students' cognitive executive functions, including inhibitory

control, working memory, and cognitive flexibility; (3) identify contextual factors of the pesantren that mediate or moderate the relationship between bilingualism and these executive functions; and (4) produce a holistic description of the cognitive experiences of Arabic-Indonesian bilingual students in the pesantren environment. This research is theoretically grounded in the Adaptive Control Hypothesis (ACH) proposed by Green and Abutalebi, Bialystok's inhibitory control theory, and the neuroplasticity framework in the context of second language learning (Diamond, 2013).

METHOD

Research Approaches and Types

This research uses a qualitative approach with a case study design. The qualitative approach was chosen because this research aims to deeply understand the phenomenon of bilingualism and its impact on the cognitive executive functions of pesantren students in their natural context, rather than merely measuring or quantifying the relationships between variables. As stated by Moleong, qualitative research aims to understand phenomena about what the research subjects experience holistically and descriptively in the form of words and language, within a specific natural context and by utilizing various scientific methods (Moleong, 2021).

The case study design was chosen because it allows researchers to conduct an in-depth and comprehensive investigation of a specific case, namely the phenomenon of Arab-Indonesian bilingualism and its relationship with cognitive executive functions in a pesantren environment with unique characteristics. Case studies are suitable when researchers want to answer questions of 'how' and 'why' a phenomenon occurs, and when the boundary between the phenomenon and the context cannot be clearly separated. In this research, the context of the pesantren is not treated as a variable to be controlled or separated from the phenomenon being studied, but rather becomes an integral part of the object of study itself (Sukmadinata, 2022).

Although this research uses a qualitative approach as the main design, epistemologically, this research is also open to the possibility of further development with a quantitative or mixed methods approach. Because the topic being studied the effects of bilingualism on cognitive executive functions can essentially also be researched using quantitative methods thru standardized neuropsychological test instruments such as the Stroop Color-Word Test for inhibition control, the N-Back Task for working memory, and the Trail Making Test for cognitive flexibility. The combination of these two approaches will result in a more comprehensive understanding, where qualitative data provides depth and context, while quantitative data offers greater generalization power and stronger empirical validity (Sugiyono, 2023).

Research Subjects and Locations

The subjects of this study are students living in the mahad al-jami'ah (*student Islamic boarding school*) at one of Indonesia's Islamic universities. Subjects were selected using purposive sampling, which involves selection based on specific criteria relevant to the research objectives. The established inclusion criteria include: (1) active students who have resided in the mahad for at least one full semester; (2) students enrolled in the mandatory Arabic language program established by the mahad; (3) students with a formal educational background in Arabic ranging from elementary to college level; and (4) students willing to serve as research informants by signing an informed consent form (Rijali, 2018).

Based on these criteria, twelve key informants were selected and divided into two groups according to the level of their Arabic language usage. The first group consisted of six students identified as active Arabic users that is, students who use Arabic not only in formal academic contexts but also in everyday conversations,

keep a daily journal in Arabic, and actively participate in Arabic-language discussion groups. The second group consists of six students categorized as passive Arabic users that is, students who use Arabic only in required formal contexts but predominantly use Indonesian or a regional language in their daily lives.

In addition to the primary informants, this study also involved supporting informants, consisting of two language instructors (*musyrif lughah*) from the mahad, two Arabic language instructors directly involved in the mahad's language program, and one educational psychologist specializing in executive functions and language neurocognition. These supporting informants provided professional and academic perspectives that enriched the analysis of the research data (Miles, Matthew B., 2020).

Data Collection Techniques

This study employed three complementary data collection techniques. The first technique is participatory observation. The researcher was directly involved in the daily activities of the mahad for a full semester, including participating in muhadharah, halaqah (*group discussions*), mahkamah lughah (*language court as a sanction for language violations*), ta'lim ba'da subuh, as well as students' informal activities within the mahad environment. The observation focused on how students switch between the two languages (*code-switching*), how they respond to situations requiring the use of a specific language, and how the mahad's linguistic environment shapes their language habits.

The second method was the in-depth interview. The interviews were conducted in a semi-structured manner using an interview guide developed based on the study's theoretical framework, while still allowing informants the freedom to explore their experiences and perceptions at their own pace. Each key informant was interviewed two to three times, with each session lasting 45 to 90 minutes. The interviews were conducted in Indonesian so that informants could express their cognitive experiences without language barriers, although some parts of the interviews were also conducted in Arabic to observe the informants' metalinguistic abilities. All interview sessions were recorded with the informants' permission and later transcribed for analysis (Rajan, 2023)

The third technique is documentation. Researchers collected various relevant documents, including: students' academic records in Arabic language courses, results of Arabic proficiency assessments conducted by the mahad, records of language violations (*if any*), documents regarding the mahad's language program and curriculum, and students' written work in Arabic, such as diaries, assignments, and papers. This documentation provides objective and verifiable data to supplement the data from observations and interviews (Mahmudi, Ilham, 2023).

Data Analysis Techniques

Data analysis in this study used the Miles, Huberman, and Saldaña, which consists of four components that interact cyclically: (1) data collection, (2) data condensation, (3) data display, and (4) conclusion drawing and verification. The analysis process proceeds iteratively from the start of data collection, rather than waiting until all data has been collected. The researcher continuously compares new data with previously analyzed data, looking for recurring and meaningful patterns, themes, and categories (Moleong, 2021)

Data condensation is carried out through a coding process involving three stages. The first stage is open coding, in which the researcher assigns codes to each relevant data segment based on concepts emerging from the data itself or from the study's theoretical framework. The second stage is axial coding, in which the established codes are organized into more abstract categories based on the relationships among them. The

third stage is selective coding, in which the researcher identifies core categories that connect all other categories into a coherent and comprehensive narrative.

To ensure the validity of the data, this study applied the four criteria of credibility proposed by Lincoln and Guba: (1) credibility, which is achieved through source triangulation (*comparing data from primary informants, supporting informants, observations, and documentation*), member checking (*confirming the interpretation of findings with informants*), and extending the researcher's participation in the field; (2) transferability, which is achieved through a rich and detailed description (*thick description*) of the research context so that readers can assess the relevance of the findings to other contexts; (3) dependability, which is ensured through an audit trail documenting all of the researcher's methodological decisions; and (4) confirmability, which is ensured through the researcher's consistent reflexivity in documenting their assumptions and positionality throughout the research process (Sugiyono, 2023).

RESULTS AND DISCUSSION

A Profile of Bilingualism Among Islamic Boarding School Students

The first research finding concerns the bilingualism profiles of mahad students, which reveal a complexity and range that far exceed the simple bilingual versus monolingual dichotomy. Based on observational data and interviews compiled over the course of one semester, this study identifies three typologies of bilingualism that exist within the mahad environment. The first typology is balanced bilingualism, exhibited by four of the twelve informants. Students in this typology demonstrate relatively equal proficiency in both Arabic and Indonesian across various communicative contexts, both formal and informal. They are able to switch codes seamlessly and strategically, using Arabic not only out of institutional obligation but also as a personal choice (Chabibah, 2022).

The second typology is L1-dominant bilingualism, which is the most common typology found, observed in seven informants. Students in this typology use Indonesian as their dominant language in almost all contexts, while Arabic is used only in situations where it is required or socially expected. Nevertheless, their receptive skills in Arabic (*reading and understanding Arabic texts*) are generally better than their productive skills (*speaking and writing in Arabic*). The third typology is limited bilingualism, which was found in only one informant who came from a public school background without prior Arabic language education (Kurniawan, 2024).

The observed patterns of code-switching indicate that most code-switching occurs at the intra-sentential level that is, language shifts within a single sentence rather than at the inter-sentential level (*shifts between sentences*) or through tag-switching (*the use of tags from another language*). This phenomenon is interesting because, theoretically, intra-sentential code-switching requires higher cognitive processing abilities, as the brain must simultaneously maintain the grammatical rules of two different languages. These findings align with Putri's research, which identified similar patterns in the social interactions of students at Islamic boarding schools, and are consistent with the theoretical framework that experiences with complex bilingualism such as this train the cognitive control system more intensively (Putri, 2022).

The factors influencing the patterns of bilingualism among pesantren students are highly diverse. Based on the interview results, five main factors were identified as having the greatest influence: (1) the length of experience learning Arabic prior to entering the mahad, where students with a prior educational background in madrasah or pesantren tend to exhibit a more balanced profile of bilingualism; (2) intrinsic motivation toward Arabic, whether religious in nature (the desire to understand the Qur'an directly) or pragmatic (the desire to pursue a career in a field requiring Arabic proficiency); (3) the intensity of interaction with other active Arabic speakers, which is influenced by the composition of dorm rooms and study groups; (4) the

consistency and strictness with which the madrasah enforces language regulations; and (5) the accessibility and quality of Arabic language materials available within the madrasah environment (Saminan, Siti Chanifah, 2023).

Inhibitory Control in Bilingual (Arabic-Indonesian) College Students

The second finding of this study concerns inhibitory control, a component of executive function that refers to the ability to suppress irrelevant, impulsive, or distracting responses in order to achieve a planned goal. Data from in-depth interviews and observations reveal consistent and significant differences between students who are active Arabic speakers and those who are passive Arabic speakers in terms of this inhibitory ability, although these differences are more pronounced in certain contexts than in others (Afifuddin, Tajuddin, Muh. Amri, Nisa, 2023).

Students who actively use Arabic reported and demonstrated a greater ability to ignore distractions while concentrating on academic tasks, the ability to refrain from impulsive responses in academic discussions in order to provide more precise and structured answers, and the ability to filter out irrelevant information when reading complex Arabic texts (Bialystok, 2022). A participant in this group let's call him Participant A, a fourth-semester student who had previously spent six years studying at an Islamic boarding school reflected: "When I speak Arabic, I have to really resist the urge to use Indonesian words that come to mind more easily. Over time, this process has become a habit, and I feel more patient and careful in everything i do."

This statement phenomenologically describes the mechanism that neurocognitive researchers refer to as the "language control mechanism" namely, the ability of a bilingual brain to actively inhibit the activation of an unwanted language when using the target language. Ibrahim's research on the impact of Arabic diglossia on executive function confirms that exposure to two distinct language systems in this case, Fusha Arabic and Indonesian trains the brain to develop stronger inhibitory capacity. More specifically, the study found that speakers accustomed to switching between two varieties of Arabic (*Fusha and Ammiyah*) demonstrated superior performance on the Flanker inhibition task compared to monolinguals.

In contrast, students who are passive Arabic speakers described a different experience. They more frequently reported difficulty focusing on a single task for an extended period, a tendency to switch between various activities without completing any of them thoroughly, and difficulty resisting social or digital distractions (*cell phone notifications, invitations to chat with friends*) while studying. The researchers' observations in the mahad study rooms also support these differences: on average, students who are active Arabic speakers are able to maintain uninterrupted independent study sessions for longer periods than their peers.

The findings of this study are consistent with previous studies that have found inhibitory advantages in bilingual groups. Sharaan, MacPherson, and Fletcher-Watson (Ibrahim, 2024). in their study on the effects of Arabic-English bilingualism, concluded that bilingualism does not have a negative impact on inhibitory abilities and, in some domains, even shows significant benefits. Bialystok and Craik explain that the mechanism behind this inhibitory advantage is related to years of experience managing two competing language systems, which gradually shape a more efficient and adaptive executive control system (Bialystok, 2022)

It is interesting to note that the superior inhibitory control exhibited by students who are active Arabic speakers is manifested not only in linguistic contexts but also in non-linguistic contexts, such as the ability to control emotions in situations of conflict among students, the ability to refrain from behavior that violates madrasah rules, and the ability to delay immediate gratification for long-term benefits (for example, choosing to study rather than seek entertainment on the evening before an exam). These observations lead to

the conclusion that practicing inhibitory control through active use of Arabic appears to result in domain-general cognitive transfer, rather than merely domain-specific linguistic transfer.

Working Memory in Bilingual College Students

The third finding relates to students' working memory capacity, which is the component of executive function that has received the most attention in recent research on bilingualism. Working memory encompasses the ability not only to temporarily store information, but also to manipulate, update, and integrate that information with knowledge stored in long-term memory to complete complex cognitive tasks. A 2025 study by Sun et al. found that bilinguals demonstrated the most consistent advantage in working memory compared to other components of executive function (Tarebeh, G., 2023).

Data from the interviews revealed that students who actively use Arabic reported better abilities in both recalling and manipulating multi-level information, particularly in the context of processing grammatically complex Arabic texts. Arabic is an inflectional language with a very rich morphological system, in which a single root (*radix*) can generate dozens of derivations with different meanings through internal vowel changes (*wazan*) and the addition of affixes. Competent processing of Arabic text requires substantial working memory capacity to simultaneously track sentence context, access the appropriate morphological information, and integrate meaning coherently.

Informants who actively use Arabic describe their working memory in various interesting ways. One informant, who works as a *musyrif* (*Islamic boarding school supervisor*) and is also a graduate student, said: "Back when I first started learning Arabic, my mind felt cluttered and I would forget things easily. Now it's the opposite I find it easier to keep many things in my head at once. Even during lectures, I can take notes while still listening carefully to the professor." This statement illustrates what is cognitively referred to as an increase in working memory span capacity in tandem with intensive and long-term bilingualism practice (Sun, Zhike, Wenqi Xie, 2025).

A study by Rajan and Patil on multilingualism and executive function among college students in India found that there were significant differences in working memory capacity between bilingual and multilingual groups, with multilinguals demonstrating the greatest advantage. These findings are relevant to the context of Islamic boarding schools because many students at these schools are actually multilingual, fluent not only in Arabic and Indonesian but also in their respective regional languages. In this multilingual environment, the brain is forced to manage multiple language systems simultaneously, which, in theory, further trains working memory capacity (Pikri, 2022).

Another aspect revealed by this study is the relationship between working memory ability and the ability to understand *kitab kuning* (classical Islamic texts in Arabic without vowel marks). *Kitab kuning* is one of the most important scholarly traditions in Islamic boarding schools, and the ability to read them correctly requires the mental capacity to simultaneously (1) identify the correct morphological form of each word without the aid of vowel marks; (2) access the lexical and referential meaning of the word within its context; (3) maintain the overall syntactic structure of the sentence in working memory; and (4) integrate the meaning of each sentence into a coherent understanding of the paragraph or the text as a whole. Students who are active users of Arabic reported that these abilities developed more quickly and more solidly compared to their peers who are passive users.

Cognitive Flexibility Among Bilingual (Arabic-Indonesian) College Students

The third component of executive function that is the focus of this study is cognitive flexibility, which refers to the ability to switch efficiently between different tasks, perspectives, rules, or frames of thought

in accordance with the demands of a situation. Cognitive flexibility is crucial in both academic and social life, as it enables individuals to adapt to changing situations, consider problems from various perspectives, and find creative solutions to the challenges they face.

One of the clearest manifestations of cognitive flexibility in the context of bilingualism is the ability to switch between languages itself. Every time a bilingual person switches from one language to another whether based on the context of the conversation, the identity of the conversation partner, or the topic being discussed they perform a cognitive operation that demands a high degree of flexibility. The brain must quickly and accurately activate the grammatical, lexical, and pragmatic systems of the target language while deactivating or inhibiting the systems of the language not in use. This process, when repeated over many years, is thought to result in a general improvement in mental shifting ability.

The observational data from this study indicate that students who actively use Arabic demonstrate higher proficiency in several indicators of cognitive flexibility that were operationalized qualitatively. These indicators include: the ability to change learning strategies when the current strategy is ineffective; the ability to consider others' perspectives in academic discussions without becoming fixated on one's own opinions; the ability to shift focus from one course to another in a busy schedule without experiencing prolonged "cognitive lag"; and the ability to adapt to different teaching styles employed by instructors (Ware, Emily, 2020).

In-depth interviews reveal a richer dimension of cognitive flexibility among bilingual Arabic students. An informant from the group of active users a sixth-semester student shared his experience: "I feel like my brain is more flexible now. When I encounter a problem, I don't get stuck right away; instead, I can look for other solutions. Maybe it's because in Arabic, one thing can be expressed in many ways synonyms, idioms, proverbs so my brain has also gotten used to thinking along multiple paths." This phenomenological description remarkably reflects the concept of metalinguistic awareness studied by Ibrahim, in which Arabic speakers with strong linguistic competence naturally develop metalinguistic sensitivity, which in turn yields broader cognitive benefits.

Saminan, Zulkifli, and Supriady (Saminan, Siti Chanifah, 2023). in their study of the informal Arabic language environment in higher education, assert that a structured and consistent Arabic bilingual environment exactly like the one created in mahad provides optimal conditions for the development of cognitive flexibility because students not only learn Arabic as a linguistic system but also learn to think in Arabic, which is structurally different from thinking in Indonesian. Arabic, with its VSO (Verb-Subject-Object) word order and complex grammatical case system, forces users to construct different mental representations of propositional structures, which in turn trains flexibility in cognitive representation.

These findings on cognitive flexibility also resonate in the social context of life at the mahad. Students who actively use Arabic demonstrate greater adaptability in interacting with students from diverse regional, cultural, and educational backgrounds. They appear better able to adjust their communication style including their choice of language to different contexts and interlocutors, an ability that researchers of bilingualism refer to as "pragmatic flexibility." In their study on the role of interactive strategies and the language environment in improving students' Arabic speaking skills, Fadhlan et al. emphasize that a rich and varied bilingual environment, such as that found at mahad al-jami'ah, significantly contributes to the development of holistic communicative competence, rather than merely linguistic proficiency (Fadhlan, Ahmad, Imam Asrori, 2024).

Mediating and Moderating Factors in the Context of Islamic Boarding Schools

The fifth finding of this study relates to various contextual factors that mediate or moderate the relationship between Arabic bilingualism and cognitive executive functions among students in a pesantren

setting. This study found that the relationship between these two variables is not direct or simple, but rather is mediated by a number of factors that interact with one another in complex ways.

The first factor identified as an important mediator was the level of Arabic language proficiency. The research data show that superior cognitive executive function consistently emerged only among students with relatively high levels of Arabic language proficiency, particularly in productive skills (*speaking and writing*). Students who were still at the beginner proficiency level, even though they were formally part of a bilingual environment, did not demonstrate significant advantages in executive function. These findings are consistent with studies showing that high-proficiency bilinguals generally demonstrate stronger executive function advantages compared to low-proficiency bilinguals. Thus, the implication is that simply being in a bilingual environment is not enough; a certain level of proficiency must be attained for the cognitive benefits of bilingualism to be activated (Zaini Arifin, 2025).

The second factor is the consistency and intensity of Arabic use in daily life (*frequency and consistency of Arabic use*). Students who use Arabic only in the formal contexts of lectures and mandatory madrasah activities, but switch entirely to Indonesian outside those contexts, exhibit an executive function profile not significantly different from that of the passive user group. Conversely, students who consistently maintain the use of Arabic even in informal contexts such as conversations with roommates, taking personal notes, and recreational activities demonstrate more pronounced strengths in all three components of executive function. This indicates that the volume and consistency of language use are crucial variables in determining whether bilingualism yields cognitive benefits.

The third factor is the age of Arabic acquisition. Students who began formally learning Arabic at an early age generally those with a background in madrasah ibtidaiyah or children's pesantren exhibit a more balanced profile of bilingualism and stronger executive function compared to those who only began learning Arabic during adolescence or later. This finding is consistent with the bilingualism literature, which consistently shows that early bilinguals generally exhibit stronger cognitive advantages than late bilinguals. Arabic acquired at an early age appears to be more integrated into the cognitive system, allowing for more automatic and efficient management of both languages (Zieman, 2025).

The fourth factor is motivation for learning Arabic. This study distinguishes between instrumental motivation (*learning Arabic for pragmatic purposes such as career and academic goals*), integrative motivation (*learning Arabic to identify with the community of speakers and the values embodied in the Arabic language*), and religious motivation (*learning Arabic due to religious beliefs*). The data show that students with strong integrative and religious motivation tend to use Arabic more intensively and consistently, which in turn results in more pronounced executive function advantages. Religious motivation, in particular, appears to be very strong in the context of Islamic boarding schools, because Arabic is not merely a foreign language but is viewed as the language of worship and religious knowledge, possessing high intrinsic value.

The fifth and final factor is the quality of the madrasah's language environment (*bi'ah arabiyah*). Madrasahs with a structured and comprehensive bi'ah arabiyah program including the requirement to use Arabic in all contexts, intensive language training programs, the availability of Arabic-language media, and a consistent system of rewards and sanctions create optimal conditions for the development of balanced bilingualism. Research by Setiyadi et al. and Istiqomah & Hasanah (Setiyadi, A. Che, Naili Hidayah, 2023) confirms that the quality of the bi'ah lughawiyah created by madrasah administrators significantly determines students' level of Arabic proficiency and, indirectly, also determines the extent to which the cognitive benefits of bilingualism can be activated. In the context of this study, the quality of the Arabic-language environment

serves as a moderating variable that determines the strength of the relationship between the intensity of Arabic language use and the development of cognitive executive functions.

Discussion

Taken together, the findings show that the cognitive profile of Arabic-Indonesian bilingual students in the mahad is shaped less by the mere fact of being enrolled in a bilingual environment than by how actively, consistently, and proficiently Arabic is used. Students who use Arabic actively, particularly in productive and informal contexts, described and displayed stronger inhibitory control, working memory, and cognitive flexibility than passive users, whereas students at the beginner level or with only formal, obligatory exposure showed no clear advantage. This pattern is consistent with the Adaptive Control Hypothesis, which holds that the control demands of a particular interactional context determine how far executive control is trained, and with Bialystok's (2022) argument that cognitive change in bilinguals depends on the mechanism through which two languages are managed rather than on bilingualism as a single category. It also agrees with Alrwaita et al. (2024), who found that executive functions are modulated by the context of dual-language use, including diglossic settings such as Arabic.

The three executive function components, however, do not receive equal support from the wider literature. The working memory findings correspond to Sun et al. (2025), who identified working memory as the focus of the bilingual effect, and the cognitive flexibility findings correspond to Ware et al. (2020), whose meta-analysis reported a bilingual advantage in shifting. The inhibitory control findings are more contentious: the same meta-analysis found no advantage in inhibition, whereas Ibrahim (2024) reported better Flanker task performance among speakers accustomed to switching between Fusha and Ammiyah. The qualitative evidence on inhibitory control in this study, which includes self-reports of patience and impulse control, should therefore be read as an account of how students experience and enact self-regulation in the mahad, not as proof of superior performance on laboratory inhibition tasks. A plausible reading is that the broader self-regulation observed here is supported both by language control and by the mahad's disciplinary routines, such as the language court, fixed schedules, and communal rules.

Several alternative explanations must also be considered. Students who choose to use Arabic actively may already have stronger self-discipline, motivation, or prior schooling in a madrasah or pesantren, which would mean that part of the observed difference reflects who becomes an active user rather than the effect of using Arabic. The finding that integrative and religious motivation accompanies more intensive use, and that early acquisition is associated with a more balanced bilingual profile, points in this direction. The results are therefore best understood as an association that is conditional on proficiency, consistency of use, and the quality of the bi'ah arabiyyah, and as compatible with, but not a demonstration of, a causal bilingual advantage. This conditional reading is in line with studies showing that structured and sustained language environments determine how far the benefits of Arabic learning are realized (Setiyadi et al., 2023; Saminan et al., 2023).

IMPLICATION RESEARCH

Theoretically, this study supports a context-dependent version of the bilingual advantage hypothesis rather than a universal one. It adds evidence from an Arabic-Indonesian setting, which differs from the Arab-English and native-speaker diglossia contexts that dominate the literature, and from a religiously motivated learning environment in which Arabic is valued intrinsically. The findings suggest that proficiency, consistency of use, age of acquisition, motivation, and the quality of the language environment are conditions under which the cognitive benefits of bilingualism emerge. The appearance of stronger self-regulation in non-linguistic

situations, such as managing emotions and delaying gratification, is also consistent with the view that executive functions are domain-general resources that can be strengthened through sustained practice (Diamond, 2013).

Practically, the findings imply that mahad administrators should not rely on mandatory formal use of Arabic alone. Policies that extend Arabic into informal life, such as roommate conversations, personal journals, and Arabic discussion groups, appear more likely to produce the conditions associated with stronger executive functioning. Consistent rules with a coherent system of rewards and sanctions, good-quality Arabic media and learning materials, and room and study group compositions that place learners alongside active Arabic speakers all contribute to a stronger bi'ah arabiyyah. Beginner-level students need scaffolding so that they reach the proficiency level at which benefits become visible, and programs can strengthen religious and integrative motivation, which appears to sustain intensive use.

For Arabic language instructors and Islamic higher education institutions, the findings imply that learning designs emphasizing productive skills, such as speaking, writing, muhadharah, and the reading of kitab kuning, place the sustained demands on attention, memory, and mental shifting that may be relevant to executive functioning. Mahad programs in UIN, IAIN, and STAIN may thus be framed as contributing to academic self-regulation as well as linguistic competence. These implications remain tentative, however, because of the qualitative design and small sample, and they should not be presented as guaranteed cognitive outcomes of Arabic instruction.

LIMITATION RESEARCH

Several limitations should be acknowledged. First, this study involved twelve key informants from a single mahad al-jami'ah, selected through purposive sampling, so the findings cannot be statistically generalized to other pesantren, institutions, or age groups; transferability depends on the thick description provided. Second, executive functions were assessed qualitatively through interviews, observation, and documentation, so the evidence relies heavily on self-reports and the researcher's interpretation. Such data are open to social desirability and to differences between perceived and actual ability, and they cannot be equated with objective neuropsychological measurements such as the Stroop Color-Word Test, the N-Back Task, or the Trail Making Test. Although triangulation and member checking were used, the researcher's role as a participant observer may also have shaped what was noticed and how it was interpreted.

Third, the study compared active and passive Arabic users without a monolingual or non-mahad comparison group, and the classification of informants was based on patterns of use rather than on standardized proficiency measures. Active users may differ from passive users in prior schooling, motivation, and self-discipline, so the direction of the relationship cannot be established. Fourth, the cross-sectional design covering one academic semester prevents conclusions about causality or about how executive functions develop over time. Finally, the influence of Arabic could not be fully separated from that of other factors in the pesantren, such as regional languages, the Fusha-Ammiyah distinction, and the disciplinary routines of the mahad, and several of the supporting studies cited here concern children, older adults, or clinical populations whose findings may not transfer directly to university students.

FUTURE AND SUGGESTION RESEARCH

Future research should first address the questions of causality and development that this study could not resolve. Longitudinal studies that follow pesantren students from entry to the end of their studies, using standardized and valid instruments, would show whether executive functions change as Arabic proficiency grows. Mixed-methods designs that combine the qualitative depth of this study with tests such as the Stroop, N-Back, Flanker, and Trail Making tasks would allow self-reported experiences to be checked

against objective performance. Quasi-experimental studies that compare students before and after a structured bi'ah arabiyyah program, or that include a comparison group of non-mahad students, would help separate the effect of Arabic use from selection and from general pesantren routines.

Researchers are also encouraged to widen the scope and test the moderating factors identified here. Comparative, multi-site studies across pesantren and mahad with different language program characteristics, larger samples, and different regional backgrounds would improve generalizability. Quantitative models could estimate the relative contribution of proficiency, intensity of use, age of acquisition, motivation, and environment quality, and separate studies could examine the roles of Fusha, Ammiyah, and regional languages in multilingual students. For practitioners, the results suggest that mahad managers and Arabic instructors document and evaluate their language programs systematically, so that the link between program design and students' cognitive and academic outcomes can be examined in future work.

CONCLUSION

This study concludes that Arabic-Indonesian bilingualism in the mahad is associated with stronger inhibitory control, working memory, and cognitive flexibility among students who use Arabic actively, and that these strengths extend to non-linguistic self-regulation, which supports a domain-general interpretation of executive control. These associations are conditional: they emerged mainly where Arabic proficiency was high, use was consistent beyond formal contexts, acquisition began early, motivation was strong, and the bi'ah arabiyyah was well structured. The implications are that mahad programs should promote sustained informal use and quality language environments, and that claims about the cognitive benefits of Arabic learning should remain cautious. The study could not establish causality or the direction of the relationship, measure executive functions objectively, separate the contribution of Arabic from regional languages and mahad routines, or generalize beyond one institution with twelve informants. Future research should therefore use longitudinal and mixed-methods designs with standardized neuropsychological tests, include comparison groups, and examine multiple pesantren so that the moderating factors identified here can be tested more rigorously.

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REFERENCES

- Afifuddin, Tajuddin, Muh. Amri, & Nisa, W. (2023). Strengthening counter-terrorism religious moderation through traditional Islamic education based on *Kitab Kuning* literacy at Pesantren Ma'had Aly in South Sulawesi. *Adabiyah*, 23(2), 226–245. <https://journal.uin-alauddin.ac.id/index.php/adabiyah/article/view/41645>
- Alrwaita, N., Houston-Price, C., Meteyard, L., T. V., & C. P. (2024). Executive functions are modulated by the context of dual language use: Diglossic, bilingual and monolingual older adults. *Bilingualism: Language and Cognition*, 27(1), 178–203. <https://doi.org/10.1017/S1366728923000056>
- Arifa, Z. (2022). Pembelajaran bahasa Arab di pondok pesantren: Tinjauan sosiolinguistik. *Arabiyat: Jurnal Pendidikan Bahasa Arab dan Kebahasaaraban*, 9(2), 211–230.
- Bialystok, E., & F. I. M. C. (2022). How does bilingualism modify cognitive function? Attention to the mechanism. *Psychonomic Bulletin & Review*, 29(4), 1246–1269. <https://doi.org/10.3758/s13423-022-02057-5>

- Chabibah, S. (2022). Bilingualisme di pondok pesantren dan kaitannya dengan kecerdasan linguistik santri. *Jurnal Pendidikan Islam*, 8(1), 90–108.
- Diamond, A. (2013). Executive functions. *Annual Review of Psychology*, 64, 135–168. <https://doi.org/10.1146/annurev-psych-113011-143750>
- Fadhlan, A., Asrori, I. S., & A. C. S. (2024). The improvement of students' Arabic speaking skills: The role of interactive strategies and the establishment of a language environment. *Ta'lim al-Arabiyyah*, 8(2), 80–97.
- Ibrahim, R. (2024). The impact of diglossia on executive functions and on reading in Arabic. *Brain Sciences*, 14(10), Article 963. <https://doi.org/10.3390/brainsci14100963>
- Istiqomah, M. S., & N. H. (2022). Strategi menumbuhkan budaya berbahasa Arab dengan *bi'ah Arabiyyah* di pondok pesantren. *Dewantara: Jurnal Pendidikan Sosial Humaniora*, 1(1), 45–60.
- Khoerunisa, H., H. P. T., & M. H. F. (2024). Kemampuan kognitif mahasiswa Pendidikan Bahasa Arab pada materi nahwu berdasarkan kategori usia. *Al-Zaytun Research Journal*, 5(2), 119–136.
- Kurniawan, R., & S. S. (2024). Pengembangan lingkungan bahasa Arab (*bi'ah Arabiyyah*) di pondok pesantren modern. *Arabiyat: Jurnal Pendidikan Bahasa Arab dan Kebahasaaraban*, 11(1), 55–72.
- Mahmudi, I., S. F., & H. S. A. (2023). Evaluation of the Idhaf Lughawi program at Islamic boarding school Gontor for Girls 1 using the CIPP model. *Educan: Jurnal Pendidikan Islam*, 7(1). <https://doi.org/10.21111/educan.v7i1.8956>
- Manurung, A. H. (2021). Bilingualisme dan fungsi kognitif: Kajian psikolinguistik. *Jurnal Bahasa dan Sastra*, 10(1), 14–26.
- Miles, M. B., A. M. H., & J. S. (2020). *Qualitative data analysis: A methods sourcebook* (4th ed.). SAGE Publications.
- Moleong, L. J. (2021). *Metodologi penelitian kualitatif* (edisi revisi). Remaja Rosdakarya.
- Mujib, F., & N. R. (2021). *Metode permainan-permainan edukatif dalam belajar bahasa Arab*. Diva Press.
- Pikri, F. (2022). The role of the language environment in improving Arabic learning abilities. *International Journal of Science and Society*, 4(2), 301–312.
- Putri, D. K. (2022). Analisis bilingualisme dalam interaksi sosial santri Asrama Al-Inaroh Pondok Pesantren Darussalam Putri Utara. *Jurnal Bahasa dan Sastra Arab*, 6(2), 33–50.
- Rajan, G., & N. P. (2023). Investigating multilingualism and its association with executive functioning: An exploratory study comparing bilingual, trilingual and quadrilingual college students in India. *East European Journal of Psycholinguistics*, 10(2), 113–125. <https://doi.org/10.29038/EEJPL.2023.10.2.RAJ>
- Rijali, A. (2018). Analisis data kualitatif. *Alhadharah: Jurnal Ilmu Dakwah*, 17(33), 81–95.
- Saleh, A. A. (2023). *Pengantar psikologi*. Aksara Timur.
- Saminan, S., Chanifah, S., I. Z., & H. S. (2023). Concepts of informal Arabic language environment for higher education. *Al-Hikmah: Jurnal Agama dan Ilmu Pengetahuan*, 20(1), 28–38.
- Setiyadi, A. Che, Hidayah, N., M. W., & M. B. M. (2023). Bi'ah lughawiyah programs in Arabic language learning to improve students' Arabic speaking skills. *Ta'lim al-Arabiyyah: Jurnal Pendidikan Bahasa Arab & Kebahasaaraban*, 7(1), 29–46.
- Sharaan, S., S. E. M., & S. F.-W. (2022). The impact of bilingualism on everyday executive functions of English-Arabic autistic children: Through a parent-teacher lens. *Journal of Autism and Developmental Disorders*, 52(5), 2224–2235. <https://doi.org/10.1007/s10803-021-05114-5>
- Sugiyono. (2023). *Metode penelitian kualitatif*. Alfabeta.
- Sukmadinata, N. S. (2022). *Metode penelitian pendidikan*. Remaja Rosdakarya.

- Sun, Z., Xie, W., Y. Z., & S. M. (2025). Working memory as the focus of the bilingual effect in executive functions. *Behavioral Sciences*, 15(2), Article 134. <https://doi.org/10.3390/bs15020134>
- Tarabeh, G., H. T., & S. S. (2023). How Arabic diglossia affects the performances on phonological working memory tasks: Research evidence among first graders. *Applied Neuropsychology: Child*. <https://doi.org/10.1080/21622965.2023.2259036>
- Ware, E., M. K., & J. A. G. L. (2020). Meta-analysis reveals a bilingual advantage in shifting, but not inhibition: A systematic review and meta-analytic review. *Frontiers in Psychology*, 11, Article 1107. <https://doi.org/10.3389/fpsyg.2020.01107>
- Zaini Arifin, A. H. (2025). Tantangan dan strategi penerapan lingkungan bahasa Arab di pesantren. *Al-Hikmah: Jurnal Agama dan Ilmu Pengetahuan*, 22(1), 120–140.
- Ziermans, R., et al. (2025). Effects of bilingualism on executive function of children with neurodevelopmental disorders: A scoping review. *Children*, 12(9), Article 1247. <https://doi.org/10.3390/children12091247>