

The Relationship Between Brain Hemisphere Dominance and Arabic Grammar and Vocabulary Mastery Among MTs Students: A Neurolinguistic Study

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Article History	ABSTRACT
Received: 26-12-2025	Background: Arabic language learning at the Madrasah Tsanawiyah (MTs) level demonstrates considerable variation in students' mastery of grammar and vocabulary. Some learners perform better in grammatical analysis, whereas others achieve stronger vocabulary mastery. From a neurolinguistic perspective, these variations may be associated with differences in brain hemisphere dominance during language processing. Purpose: This study aimed to examine the relationship between brain hemisphere dominance and the mastery of Arabic grammar and vocabulary among students at MTs Al-Islam Telaga Biru. Method: This study employed a quantitative correlational design involving 60 female students from Class IX-6 and Class IX-7 selected through total sampling. Data were collected using a 20-item brain hemisphere dominance questionnaire and achievement tests measuring Arabic grammar and vocabulary mastery. Data were analyzed using descriptive statistics and Pearson's product-moment correlation with IBM SPSS Statistics Version 29. Results and Discussion: Based on the questionnaire scores, 20 students were classified as left-brain dominant and 40 as right-brain dominant. Students classified as left-brain dominant tended to obtain higher grammar scores, whereas those classified as right-brain dominant tended to achieve higher vocabulary scores. Pearson's correlation analysis revealed a very strong negative relationship between brain dominance scores and grammar mastery ($r = -0.927$, $p < 0.01$) and a very strong positive relationship between brain dominance scores and vocabulary mastery ($r = 0.963$, $p < 0.01$). Conclusions and Implications: The findings indicate a significant relationship between brain hemisphere dominance and Arabic grammar and vocabulary mastery. These findings suggest that Arabic language teachers should consider students' hemispheric learning tendencies when designing differentiated instructional strategies that accommodate diverse learning characteristics.
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	ABSTRAK

Latar Belakang: Pembelajaran bahasa Arab di tingkat Madrasah Tsanawiyah (MTs) menunjukkan variasi dalam penguasaan kaidah dan mufradat. Sebagian peserta didik lebih unggul dalam memahami kaidah bahasa Arab, sedangkan sebagian lainnya lebih baik dalam penguasaan mufradat. Perspektif neurolinguistik menunjukkan bahwa variasi tersebut kemungkinan berkaitan dengan perbedaan kecenderungan dominasi fungsi hemisfer otak dalam memproses informasi bahasa.

Tujuan: Penelitian ini bertujuan untuk menganalisis hubungan antara dominasi fungsi hemisfer otak dengan penguasaan kaidah dan mufradat bahasa Arab pada peserta didik MTs Al-Islam Telaga Biru.

Metode: Penelitian ini menggunakan pendekatan kuantitatif dengan desain korelasional yang melibatkan 60 santriwati kelas IX-6 dan IX-7 yang dipilih menggunakan teknik total sampling. Data dikumpulkan melalui angket dominasi fungsi hemisfer otak yang terdiri atas 20 butir pernyataan serta tes penguasaan kaidah dan mufradat bahasa Arab. Data dianalisis menggunakan statistik deskriptif dan korelasi Pearson Product-Moment dengan bantuan IBM SPSS Statistics Version 29.

Hasil dan Pembahasan: Berdasarkan skor angket, sebanyak 20 peserta diklasifikasikan memiliki kecenderungan dominasi hemisfer kiri dan 40 peserta memiliki kecenderungan dominasi hemisfer kanan. Peserta yang diklasifikasikan memiliki kecenderungan dominasi hemisfer kiri cenderung memperoleh skor yang lebih tinggi pada penguasaan kaidah, sedangkan peserta dengan kecenderungan dominasi hemisfer kanan cenderung memperoleh skor yang lebih tinggi pada penguasaan mufradat. Analisis korelasi Pearson menunjukkan hubungan negatif yang sangat kuat antara skor dominasi hemisfer dengan penguasaan kaidah ($r = -0,927$; $p < 0,01$) serta hubungan positif yang sangat kuat antara skor dominasi hemisfer dengan penguasaan mufradat ($r = 0,963$; $p < 0,01$).

Kesimpulan dan Implikasi: Penelitian ini menunjukkan adanya hubungan yang signifikan antara dominasi fungsi hemisfer otak dengan penguasaan kaidah dan mufradat bahasa Arab. Temuan ini mengindikasikan bahwa guru bahasa Arab perlu mempertimbangkan kecenderungan pemrosesan informasi peserta didik dalam merancang strategi pembelajaran yang berdiferensiasi dan sesuai dengan karakteristik belajar mereka.

Kata Kunci

Dominasi Hemisfer Otak; Neurolinguistik; Kaidah Bahasa Arab; Mufradat; Pembelajaran Bahasa Arab.



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INTRODUCTION

Arabic language learning plays a strategic role in Islamic education, particularly at the Madrasah Tsanawiyah (MTs) level, where Arabic serves not only as a foreign language but also as the primary medium for understanding the Qur'an, Hadith, classical Islamic texts, and other religious sciences.[1][2] Successful Arabic language acquisition depends on mastery of two fundamental linguistic components: **kaidah** (grammar) and **mufrodad** (vocabulary). Grammar provides the structural system that enables learners to understand sentence patterns and linguistic rules, whereas vocabulary supplies the lexical resources necessary for comprehension and communication. Both components are complementary and indispensable for achieving communicative competence in Arabic.

In classroom practice, considerable variation is observed in students' mastery of these two linguistic components. Some learners demonstrate strong analytical abilities that facilitate grammatical understanding but encounter difficulties in vocabulary acquisition. Conversely, other learners readily acquire vocabulary through contextual or visual cues while experiencing challenges

in applying grammatical rules consistently.[3][4] These differences suggest that language learning performance may be associated with variations in learners' cognitive processing characteristics rather than being determined solely by instructional methods or learning environments.

Neurolinguistics provides one theoretical perspective for explaining individual differences in language processing. Previous studies have suggested that differences in hemispheric processing tendencies may be associated with variations in language performance, particularly in grammatical analysis and vocabulary learning.[5][6][7] However, contemporary neuroscience emphasizes that language processing results from the integrated functioning of both cerebral hemispheres rather than strict left–right hemispheric dominance. Therefore, the concept of brain hemisphere dominance adopted in this study should be understood as a **heuristic framework** for describing differences in cognitive processing preferences rather than as evidence of fixed biological dominance.

Previous research has primarily examined the relationship between hemispheric processing and English or other foreign-language learning.[8] Studies focusing on Arabic language learning remain limited, particularly within Indonesian Islamic secondary schools (Madrasah Tsanawiyah).[9][10][11] Furthermore, previous investigations generally examined only one linguistic component, either grammar or vocabulary, whereas the interaction between these two essential components has received relatively little attention.

Accordingly, this study seeks to address these gaps by examining the relationship between brain hemisphere processing tendencies and students' mastery of both Arabic grammar and vocabulary simultaneously. The study also employs a brain hemisphere questionnaire adapted from the theoretical perspectives of Sperry, Herrmann, and McCarthy and contextualized for Arabic language learning in Indonesian madrasahs. Consequently, this research is expected to contribute both theoretically to the development of neurolinguistic studies in Arabic language education and practically by providing empirical evidence that may assist teachers in designing more differentiated instructional strategies based on learners' cognitive characteristics.

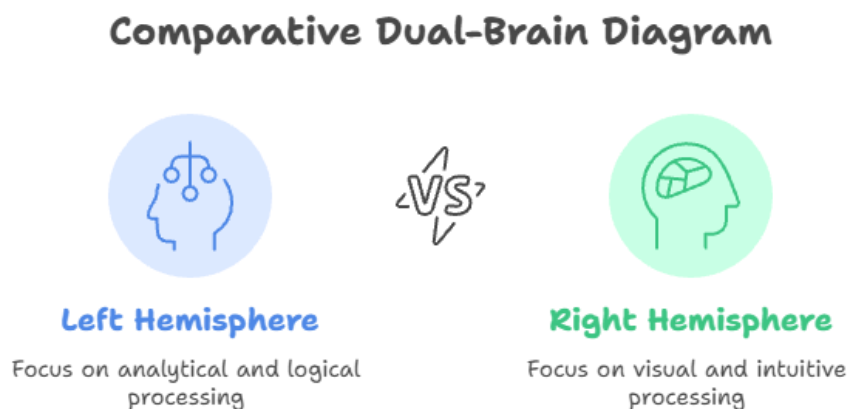
LITERATURE REVIEW

Neurolinguistic studies in Arabic language learning have become increasingly relevant in uncovering internal factors that influence learners' ability to master specific linguistic components. In the context of Arabic education, two fundamental elements that determine learning success are grammar (kaidah) and vocabulary (mufrodāt). Grammar serves as the structural system of the language, while vocabulary functions as the basic carrier of meaning. Variations in learners' ability to master these components indicate the presence of distinct cognitive processes at work within individuals, one of which is the tendency toward hemispheric brain dominance.

It is important to note that while the theoretical framework of left–right brain dominance has been subject to critical evaluation in neuroscientific literature as a simplification of complex hemispheric functions [12][15], its application in this study is situated within an educational and pedagogical context. The left–right brain dominance model is employed here as a heuristic framework for understanding individual differences in learning style tendencies, rather than as an absolute neurological claim. This position is consistent with its established use in applied linguistics and language education research.[5][20]

Neurolinguistics, as a field that investigates the relationship between the brain and language, provides a theoretical foundation for understanding such variations.[13][14][15] Neurolinguistic findings indicate that the left hemisphere is dominant in analytical, logical, and sequential processing, whereas the right hemisphere plays a major role in visual, spatial, associative, and intuitive language processing. This concept was introduced by Sperry (1961) through studies on hemispheric specialization, further developed by Herrmann (1976) through the Herrmann Brain Dominance Instrument (HBDI), and expanded by McCarthy (1987) through the Left–Right Brain Inventory widely used in educational settings [28].

In Arabic language learning, mastery of grammar and vocabulary requires distinct cognitive processes. Grammar mastery demands analytical skills and structural understanding, which neurolinguistically align with left-brain processing. Conversely, vocabulary mastery relies on associative ability, visual memory, and contextual interpretation—core strengths of the right hemisphere.[16][17] These divergent characteristics explain why some students excel in grammar but struggle with vocabulary, and vice versa.



Picture 1. Left and Right Brain Functions in Arabic Language Learning

The concept of hemispheric brain dominance has been widely discussed in research on language learning. Soyoof (2014) found that left-brain-dominant learners perform better in grammatical aspects, whereas right-brain-dominant learners excel in vocabulary acquisition.[18][19][20][21][22] Dülger (2012) demonstrated the influence of hemispheric dominance on foreign language learning strategies. Moreover, Li et al. (2022) emphasized that hemispheric dominance affects second language acquisition, particularly in linguistic skills requiring symbolic and visual processing.

A review of the literature indicates that research on brain dominance in Arabic language learning remains limited, especially at the MTs level. Most previous studies focus on English or other foreign languages, or are conducted at the university level.[23][24][25][26][27] This creates a significant research gap: the absence of studies integrating neurolinguistic theory with the simultaneous mastery of both grammar and vocabulary in the context of Arabic learning at the MTs level. No previous research has utilized brain dominance instruments derived from the Sperry–Herrmann–McCarthy frameworks in the context of Arabic learning using the Al-‘Arabiyyah Bayna Yadayk textbook.[28][29][30][31][32]

The Synergy of Grammar and Vocabulary in Arabic Fluency



Picture 2. Interconnection Between Grammar and Vocabulary Mastery

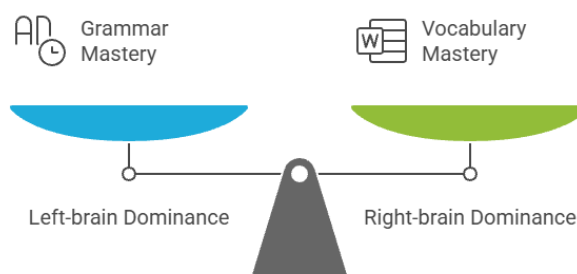
METHOD

This study employed a quantitative correlational design to examine the relationship between brain hemisphere dominance and students' mastery of Arabic grammar and vocabulary. Brain dominance was measured as a continuous score derived from the Brain Dominance Questionnaire. Pearson's correlation analysis was selected because both the brain dominance score and learning achievement scores were continuous variables. The classification of participants into left-brain dominant ($n = 20$) and right-brain dominant ($n = 40$) was performed only for descriptive purposes and was not used as the primary inferential analysis.^[33]

1. Research Design

This study used a quantitative correlational design. The independent variable was left–right brain dominance, while the dependent variables were the mastery of Arabic grammar and vocabulary. The correlational design facilitated comparison of linguistic performance between left-brain-dominant and right-brain-dominant learners.^[34]

Balance Brain Dominance for Language Mastery



Picture 3. Correlational Research Framework

2. Population and Samples

The population consisted of all 60 female students of Class IX-6 and Class IX-7 at MTs Al-Islam Telaga Biru in the 2024/2025 academic year. Given the relatively small and accessible population size, total sampling was employed, meaning that all members of the population were included as research participants.[35] Following the administration of the brain dominance questionnaire, each participant obtained a brain dominance score. Based on the questionnaire scoring, participants were descriptively classified into left-brain dominant ($n = 20$) and right-brain dominant ($n = 40$) to describe the distribution of the sample.

3. Instruments

The research employed three main instruments: a left–right brain dominance questionnaire, a grammar test, and a vocabulary test.

a. Brain Dominance Questionnaire (20 items)

The brain dominance questionnaire was developed based on Sperry's (1961) hemispheric theory, Herrmann's (1976) Brain Dominance Model, and McCarthy's (1987) Left–Right Brain Inventory. The questionnaire consisted of 20 statements reflecting left-brain tendencies (10 items) and right-brain tendencies (10 items). Respondents answered using a four-point Likert scale. Total scores determined the dominant hemisphere. The instrument underwent content validation through expert judgment and reliability testing using Cronbach's Alpha, producing a reliability coefficient of $\alpha \geq 0.80$, indicating high reliability.

4. Procedures

The research procedures consisted of four major stages: preparation, implementation, data management, and data analysis.

a. Preparation Stage

The researcher developed the instruments, conducted expert validation, performed a limited pilot test, obtained formal research permission from MTs Al-Islam Telaga Biru, and briefed the Arabic language teacher regarding the research objectives.

b. Implementation Stage

The research was conducted in two meetings. In the first meeting, the brain dominance questionnaire was administered. In the second meeting, the grammar and vocabulary tests were administered. All instruments were completed in written form under supervised conditions.

c. Data Management

Data were compiled and organized into tables. Each participant was assigned an anonymous code to maintain confidentiality.

d. Data Analysis

Data analysis consisted of descriptive and inferential statistical procedures. Descriptive statistics were used to summarize the characteristics of the data, including the minimum and maximum scores, mean, standard deviation, and the distribution of participants based on brain hemisphere dominance classification. Inferential analysis was conducted using Pearson's product–moment correlation to examine the relationships between brain hemisphere dominance scores and Arabic grammar mastery, brain hemisphere dominance scores and Arabic vocabulary mastery, as well as the relationship between grammar and vocabulary mastery. Pearson's product–moment correlation was selected because the study aimed to examine the relationships among continuous variables obtained from the brain hemisphere dominance questionnaire and the Arabic grammar and vocabulary achievement tests.

All statistical analyses were performed using IBM SPSS Statistics Version 29 with a significance level of 0.05.

RESULT AND DISCUSSION

Result

Data were analyzed to examine the relationship between brain hemisphere dominance and students' mastery of Arabic grammar and vocabulary among 60 female students at MTs Al-Islam Telaga Biru. Descriptive statistics were first calculated to summarize the characteristics of the research variables. As presented in Table 1, the brain hemisphere dominance scores ranged from 30 to 99, with a mean of 68.58 (SD = 22.529). The Arabic grammar test scores ranged from 67 to 95, with a mean of 77.20 (SD = 10.035), whereas the vocabulary test scores ranged from 65 to 96, with a mean of 84.63 (SD = 11.317). These descriptive statistics provide an overview of the distribution and central tendency of each research variable prior to the correlation analysis

Table 1: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Left-Right Brain Dominance Score	60	30	99	68.58	22.529
Grammar Test Score	60	67	95	77.20	10.035
Vocabulary Test Score	60	65	96	84.63	11.317

The descriptive statistics presented in Table 1 summarize the characteristics of the research variables. Brain hemisphere dominance scores ranged from 30 to 99, with a mean of 68.58 (SD = 22.529). The Arabic grammar test scores ranged from 67 to 95, with a mean of 77.20 (SD = 10.035), whereas the vocabulary test scores ranged from 65 to 96, with a mean of 84.63 (SD = 11.317). These results provide an overview of the distribution and central tendency of each variable prior to the correlation analysis.

Table 2. Pearson Correlation Matrix among Brain Dominance Score, Grammar Test Score, and Vocabulary Test Score

Variables	1	2	3
1. Brain Dominance Score	1		
2. Grammar Test Score	-0.927**	1	
3. Vocabulary Test Score	0.963**	-0.988**	1

Note. $p < 0.01$ (2-tailed).

The results of the Pearson product-moment correlation analysis are presented in Table 2. The analysis revealed a very strong negative correlation between brain hemisphere dominance scores and Arabic grammar mastery ($r = -0.927$, $p < 0.01$), indicating that the two variables were significantly associated. In contrast, a very strong positive correlation was found between brain hemisphere dominance scores and Arabic vocabulary mastery ($r = 0.963$, $p < 0.01$), indicating a significant positive association between the variables. Furthermore, Arabic grammar and vocabulary mastery were also significantly correlated ($r = -0.988$, $p < 0.01$). Overall, these findings demonstrate statistically significant relationships among the three research variables.

Discussion

The present study identified statistically significant relationships between brain hemisphere dominance scores and students' mastery of Arabic grammar and vocabulary. Pearson's correlation analysis revealed a very strong negative relationship between brain hemisphere dominance scores and grammar mastery ($r = -0.927$, $p < 0.01$), as well as a very strong positive relationship between brain hemisphere dominance scores and vocabulary mastery ($r = 0.963$, $p < 0.01$). In addition, grammar and vocabulary mastery were significantly correlated ($r = -0.988$, $p < 0.01$). These findings indicate that variations in brain hemisphere dominance scores were associated with differences in students' Arabic language achievement.

The negative association between brain hemisphere dominance scores and grammar mastery may reflect differences in cognitive processing tendencies rather than fixed hemispheric specialization. From a neurolinguistic perspective, grammatical learning requires analytical reasoning, sequential processing, and rule-based thinking. These cognitive characteristics have traditionally been associated with left-hemispheric processing; however, contemporary neuroscience emphasizes that language processing results from the integrated activity of both cerebral hemispheres. Therefore, the present findings should be interpreted as supporting a heuristic explanation of cognitive processing preferences rather than confirming exclusive left–right brain functions.

The positive association between brain hemisphere dominance scores and vocabulary mastery suggests that students with stronger holistic and contextual processing tendencies may demonstrate advantages in learning vocabulary. Vocabulary acquisition frequently involves semantic association, contextual understanding, and visual representation, which have been linked to broader cognitive processing strategies. Nevertheless, these findings should not be interpreted as evidence that vocabulary learning is exclusively controlled by the right hemisphere, but rather as indicating an association between cognitive processing preferences and language learning performance.

The observed relationship between grammar and vocabulary mastery indicates that the two language components demonstrated different achievement patterns within the present sample. Because this study employed a correlational design, these findings should be interpreted as statistical associations rather than causal relationships. Further studies involving larger samples and more comprehensive cognitive assessments are recommended to clarify the nature of this relationship.

From an educational perspective, these findings suggest that Arabic language teachers may benefit from implementing differentiated instructional strategies that accommodate students' diverse cognitive processing tendencies. Analytical activities, such as grammar exercises and sentence analysis, may support learners with stronger analytical preferences, whereas contextual and visual learning activities may facilitate vocabulary development. However, these instructional implications should be understood as pedagogical recommendations rather than deterministic consequences of brain hemisphere dominance.

CONCLUSION AND IMPLICATIONS

This study examined the relationship between brain hemisphere dominance and students' mastery of Arabic grammar and vocabulary at MTs Al-Islam Telaga Biru. The findings revealed statistically significant relationships between brain hemisphere dominance scores and both components of Arabic language learning. Brain hemisphere dominance scores were negatively associated with grammar mastery and positively associated with vocabulary mastery, indicating that differences in cognitive processing tendencies may be related to variations in students' language learning performance. These findings contribute to the growing body of research in

neurolinguistics by providing empirical evidence within the context of Arabic language education. Nevertheless, the results should be interpreted within the limitations of a correlational design and should not be regarded as evidence of fixed hemispheric specialization or causal relationships. From a practical perspective, Arabic language teachers are encouraged to implement differentiated instructional strategies that accommodate students' diverse cognitive processing tendencies while maintaining balanced learning experiences that integrate grammar and vocabulary development. Future research is recommended to involve larger and more diverse samples, employ additional cognitive assessment instruments, and investigate other linguistic skills to further explore the relationship between cognitive processing tendencies and Arabic language learning.

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