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COGNITIVE LOAD REDUCTION IN ARABIC NUMERACY: A MA'DUD CLASSIFICATION APPROACH

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Abstract

The learning of Arabic numeracy (ʿadad wa al-maʿdūd) in many Islamic boarding schools is still dominated by a grammatical approach based on five complex number categories, often resulting in high cognitive load, frequent errors, and low student confidence. This study aims to examine the effectiveness of the Maʿdūd Classification method, which simplifies traditional classification into two main paths mudhakkar and muʾannath implemented through seven systematic teaching stages to reduce cognitive burden and improve Arabic numeracy mastery. The study employed a mixed-method design using a quasi-experimental one-group pretest–posttest model involving 30 beginner-level students at Darul Lughah Waddirasatil Islamiyah Islamic Boarding School, supported by interviews and participatory observation. The Paired Samples t-test showed a significant increase in mean scores from 46.00 to 88.07 ($t = -81.49$, $df = 29$, $p < 0.001$), along with reduced standard deviation and coefficient of variation, indicating more consistent learning outcomes. Qualitative findings confirmed reduced memorization demands, clearer conceptual patterns, and a more positive learning experience. These results demonstrate that Maʿdūd Classification is an effective cognitive-load-based instructional model for improving Arabic numeracy literacy.

Keywords: Adad wa al-ma'dūd; Cognitive Linguistics; Instructional simplification

تجريد

يعتمد تعليم الحساب العربي في باب العدد والمعدود في كثير من المدارس الداخلية الإسلامية على منهج نحوي تقليدي قائم على خمس فئات عددية معقدة، مما يرفع العبء المعرفي ويؤدي إلى تكرار الأخطاء وضعف ثقة المتعلمين. يهدف هذا البحث إلى اختبار فاعلية «تصنيف المعدود» الذي يبسط التصنيف التقليدي إلى مسارين رئيسين: المذكر والمؤنث عبر سبع مراحل تعليمية منظمة، ضمن تصميم شبه تجريبي قبلي—بعدي لمجموعة واحدة (٣٠ طالبًا مبتدئًا بمعهد دار اللغة والدراسات الإسلامية) مدعَّم بالمقابلات المتعمقة والملاحظة التشاركية. أظهر اختبار ***(t)*** للعينات المترابطة ارتفاع متوسط الدرجات من ٤٦,٠٠ إلى ٨٨,٠٧ مع انخفاض الانحراف المعياري ومعامل التباين، وأكدت البيانات النوعية انخفاض عبء الحفظ ووضوح الأنماط وتحسن المناخ الصفي، مما يشير إلى أن تصنيف المعدود نموذج تعليمي فعّال قائم على نظرية العبء المعرفي لتحسين مهارات الحساب العربي.

الكلمات المفتوحة: العدد والمعدود؛ اللسانيات المعرفية؛ تبسيط المواد التعليمية

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INTRODUCTION

The learning of Arabic numerals (ʿadad wa al-maʿdūd) in Arabic education has long been dominated by a rule-based grammar approach that prioritizes mastery of syntactic structures over functional communicative competencies.[1] In most Islamic boarding schools and traditional Arabic institutions, teaching methods emphasize complex classification of ʿadad based on morphological categories such as ʿadad khāṣṣ (numbers 1–2), ʿadad muḍāf (3–10), ʿadad murakkab (11–19), and ʿadad ʿaṭof (20–99), each governed by different grammatical rules regarding gender agreement.[2] As a result, learners are required to memorize a wide range of grammatical exceptions before they can calculate fluently in the context of Arabic conversation, a process that imposes significant cognitive demands and often results in frustration and demotivation among entry-level students.[3]

The research that exists in Arabic language pedagogy mostly focuses on external factors such as student motivation.[4] gamification strategies, and technology integration through platforms such as YouTube and Quizizz.[5] Although this approach overcomes affective and engagement-related barriers, it does not fundamentally resolve the cognitive overload inherent in instruction.[6] A recent systematic study showed that learners often show misunderstandings in matching ʿadad with maʿdūd, especially in determining gender agreement and applying the rule of iʿrāb (case inflection).[7] Similarly, cognitive activation strategies can significantly improve oral communication competencies in Modern Standard Arabic, suggesting that pedagogical innovations

[1] H I Ramadan, 'Arabic Rules Between Philosophy of Language and Grammar Criterion: A Modernist Approach', *Darulfunun Ilahiyat*, 34.2 (2023), pp. 453–69, doi:10.26650/DI.2023.34.2.1262493; M Köksoy, 'An Examination of the Arabic Grammar Works Named Al-Naḥw Al-Wāḍiḥ and Al-Qavā'id Al-'arabiyya Al-Muyassara in Terms of the Inductive Method: A Qualitative Research', *Cumhuriyet Ilahiyat Dergisi*, 26.2 (2022), pp. 841–61, doi:10.18505/cuid.1160851.

[2] Fatimah Az Zahra Hamka and Hakim Zainal, 'The Stability of The'adad Wa Ma'dud Method In Arabic Grammar Within Sahih Bukhari Hadiths', *BITARA International Journal of Civilizational Studies and Human Sciences (e-ISSN: 2600-9080)*, 8.1 (2025), pp. 44–62; Anggi Syahputri, 'Penerapan Metode Sam'iyyah Syafawiyyah Dalam Meningkatkan Motivasi Belajar Bahasa Arab Kelas IV DI MIN 2 Bantul Tahun AJARAN 2023/2024' (UIN Sunan Kalijaga Yogyakarta, 2024); Suci Hijriati, ' وسيلة قرص الساعة دراسة تجريبية بـ) وفعاليتها لترقية قدرة الطالبات على فهم العدد والمعدودMTs Nurul Islam Peudada)', *'ARABIYYA: Jurnal Studi Bahasa Arab*, 13.01 (2024), pp. 128–42; Rohman Jazaur, ''Adad Dan Ma'ud Dalam Buku Al-Ghayatu Wa At-Taqrib (Analisis Sintaksis)', *Skripsi.*, 2017, pp. 1–82.

[3] (Issa, 2023; Mahgoub et al., 2024; Vaknin-Nusbaum & Makhoul, 2025).

[4] R J Razem and J Pandor, 'The Motivational Orientations of Undergraduate Students to Learn Arabic in a Dubai Private University', *Journal of Language Teaching and Research*, 14.1 (2023), pp. 96–107, doi:10.17507/jltr.1401.11.

[5] Alqan Nazrailman and others, ' مهف يف تايدحت ،' قدودعلما دادعلأا ' عوضوم قصاخ ، قيبرعلا ةغللا ملعت هجاوت جهن بلع ثحبلا اذه دمتعي . نيبلصلأا نييمقرلا ليج نيب قصاخ ، مهزيفحتو بلاطلا نم ملعتلا قيلمع ذيفنت حيضوتل قيناديلما قبقارلما عم قيعونلا قيفصولا ةقيرطلا نيب قيمقر ملعت لئاسوك زيزيوكو ب', ٧،١ (2024), pp. 249–72.

[6] L.-C. Yang, 'The Effects of a Cognitive Linguistic Approach on College Students' Learning English Tenses in Taiwan', *Language Teaching Research*, 2023, doi:10.1177/13621688231178196.

[7] Zawawi Ismail, Mohamad Hussin, and Triyo Supriyatno, 'Effectiveness of 'Adad And Ma'dūd Learning Module Based on Al-Quran Verses in Enhancing Student Achievement', *Ijaz Arabi Journal of Arabic Learning*, 4.1 (2020), pp. 26–43, doi:10.18860/ijazarabi.v4i1.10785.

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based on cognitive psychology hold great promise for improving Arabic learning outcomes[8] However, to date, no empirical research has proposed a simplification-based method that specifically targets the reduction of cognitive burden in Arabic numeracy instruction.

Empirical observations conducted at the Darul Lughah Waddirasatil Islamiyah Islamic Boarding School in Madura revealed that students experience persistent difficulties in obtaining ʿadad maʿdūd due to the complexity of gender-based agreement rules. For example, the learner must internalize that the numbers 3–10 require the opposite sex agreement of the calculated noun (maʿdūd), that maʿdūd must be in the plural for this range, and that the numbers 11–12 involve a hybrid pattern in which one component (ʿashara/ʿashrata) changes based on sex while the other remains constant. This complex system creates what Sweller calls the "intrinsic cognitive load" of difficulties inherent in learning materials due to the interactivity of elements that are further exacerbated by foreign loads when instructional methods fail to streamline cognitive processing[9]

The research addresses this critical gap by introducing the Maʿdūd Classification (Maʿdūd Classification Method), a cognitively informed pedagogical innovation designed to accelerate numeracy proficiency in Arabic among entry-level learners. Unlike the traditional approach of classifying ʿadad into several grammatical categories based on morphosyntactic patterns, the Maʿdūd Classification method simplifies instruction by arranging numbers according to the gender of the noun being counted (maʿdūd). Specifically, learners are taught two parallel numerical sequences: one for masculine objects (mudhakkar) and one for feminine objects (muʾannath). For example, when counting masculine nouns, students learn the sequence وَاحِد – اِثْنَان – ثَلَاثَة – أَرْبَعَة – خَمْسَة – سِتَّة – سَبْعَة – ثمانِيَة – تَسْعَة – عَشَرَة – أَحَدَ عَشَرَ – اِثْنَا عَشَرَ, with compound numbers (13–19) formed by combining base numbers with عشر (e.g ثلاثة عشر، أربعة عشر ,.). By eliminating the need to remember some grammatical rules during a calculation task, this method reduces the intrinsic and unfamiliar cognitive load, thus allowing learners to internalize numerical patterns through repetition and practical application rather than theoretical memorization[10]

Theoretically, the Maʿdūd Classification method is based on Cognitive Load Theory (CLT), which posits that effective instruction should minimize unnecessary cognitive processing in order to optimize working memory resources for schema

[8] H Harrathi and others, 'The Effectiveness of Cognitive Activation Strategy in Developing Oral Classical Arabic Communication Competency Among Omani Students' Courses', *Journal of Statistics Applications and Probability*, 13.5 (2024), pp. 1431–45, doi:10.18576/jsap/130502.

[9] (Asma & Dallel, 2020; Daud et al., 2025).

[10] M Y Ruamba and others, 'The Impact of Visual and Multimodal Representations in Mathematics on Cognitive Load and Problem-Solving Skills', *International Journal of Advanced and Applied Sciences*, 12.4 (2025), pp. 164–72, doi:10.21833/ijaas.2025.04.018; P Evans and A J Martin, 'Load Reduction Instruction: Multilevel Effects for Motivation, Engagement, and Achievement in Mathematics', *Educational Psychology*, 43.10 (2023), pp. 1125–43, doi:10.1080/01443410.2023.2290442.

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construction and automation[11] By reducing the interactivity of elements, the amount of interconnected information that must be processed simultaneously, this method facilitates the faster acquisition of numeracy skills and promotes transferability to real-world communicative contexts. In addition, this approach is in line with the principles of Cognitive Linguistics, which emphasize the role of categorization and schematic organization in language learning[12]

The main objective of this study is to explore and describe the conceptual framework and pedagogical principles underlying the Maʿdūd Classification method as an innovative approach to facilitate Arabic numeracy proficiency. This study seeks to comprehensively review the existing literature on Arabic numeracy pedagogy, cognitive load theory, and instructional simplification strategies to establish a theoretical foundation for this method. Specifically, this study addresses the following questions:

RQ1: What are the pedagogical challenges associated with traditional grammar-based teaching ʿadad maʿdūd as documented in the existing literature?

RQ1: What are the pedagogical challenges associated with traditional grammar-based teaching ʿadad maʿdūd as documented in the existing literature?

RQ2: How did cognitive load theory and simplification-based instructional design principles inform the development of the Maʿdūd Classification method?

RQ3: What are the theoretical advantages of the Maʿdūd Classification method compared to the conventional ʿadad classification approach as reflected in previous research?

This study extends Cognitive Load Theory to Arabic morphosyntax pedagogy by showing how simplification-based instructional design can reduce cognitive load in ʿadad maʿdūd learning[13]. The study provides Arabic educators with an evidence-based

[11] A Alasraj, M Freeman, and P Chandler, 'Considering Cognitive Load Theory within E-Learning Environments', in *PACIS 2011 - 15th Pacific Asia Conference on Information Systems: Quality Research in Pacific*, 2011<https://www.scopus.com/inward/record.uri?eid=2-s2.0-84855833024&partnerID=40&md5=dd88bb75623a52711508a7b1a5bb570d>; J J G Van Merriënboer and J Sweller, 'Cognitive Load Theory in Health Professional Education: Design Principles and Strategies', *Medical Education*, 44.1 (2010), pp. 85–93, doi:10.1111/j.1365-2923.2009.03498.x.

[12] هشام بلخير, and جمال الدين بن بقاسم, 'دور+اللسانيات+الإدراكية+في+تعليمية+النحو+العربي+في+المرحلة+الابتدائية.Pdf', 2023; D Liu and J Qin, 'The Effectiveness of Cognitive Linguistics-Inspired Language Pedagogies: A Systematic Review', *Modern Language Journal*, 108.4 (2024), pp. 794–814, doi:10.1111/modl.12959.

[13] John Sweller, 'Cognitive Load Theory and Individual Differences', *Learning and Individual Differences*, 110 (2024), p. 102423, doi:https://doi.org/10.1016/j.lindif.2024.102423.

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pedagogical model that addresses documented challenges in grammar teaching [14]while offering a replicable framework for curriculum reform across Arabic language learning.

RESEARCH METHODS

The research method used in this study is a mixed-method with a quasi-experimental quantitative design of one-group pretest-posttest type combined with a descriptive qualitative approach. Quantitatively, the study involved 30 novice students at the Darul Lughah Waddirasatil Islamiyah Islamic Boarding School as a single subject of the treatment group without a control group. The Arabic numeracy ability in the adad wa alma'dud material was measured using a standardized numeracy test that was compiled based on the adad-ma'dud conformity pattern before and after the Madud Classification intervention. The data were analyzed using the Paired Samples tTest after meeting the normality assumptions through the Shapiro–Wilk test, so that changes in pretest–posttest scores could be evaluated inferentially and produce information on statistical significance and effect magnitude.

Qualitatively, the study utilized in-depth interviews and participatory observation during the learning process to explore students' subjective experiences related to the perception of cognitive load, ease of understanding, and confidence in using Arabic numeracy patterns. Semistructured interview guides and systematic field notes were used as the primary instruments, while data were analyzed with thematical-descriptive techniques to identify recurring response patterns. The integration of these two approaches allows researchers not only to test the numerical effectiveness of Madud Classification statistically, but also to interpret the mechanism of change from the student's point of view.

RESULTS AND DISCUSSION

Ma'dud Classification

In teaching ʿadad wa al-maʿdūd, there are several stages that must be carried out in order to avoid excessive cognitive burden due to the complexity of numbers and grammatical rules. The preparation of this stage serves to minimize students' negative prejudices towards arithmetic material in Arabic, as well as build a foundation that makes it easier for them to understand and apply the rules practically in various communication contexts.[15]

[14] Arsad Wan Nailah, Abdullah Syahiza, Hassan Hasnisah, and Arif Rahayati, Ahmad Muhammad, 'Influence of Psychological Well-Being and School Factors on Delinquency , During the Covid-19 Period Among Secondary School Students in Selected Schools in Nakuru County : Kenya', *International Journal of Research and Innovation in Social Science (IJRISS)*, VII.2454 (2023), pp. 1175–89, doi:10.47772/IJRISS.

[15] R Abbas and others, 'The Use of Modern Standard and Spoken Arabic in Mathematics Lessons: The CaseofaDiglossicLanguage',*CulturayEducacion*, 30.4 (2018), pp. 730–65, doi:10.1080/11356405.2018.1519920; A Basir, S Karoso, and S Saidi, 'Enhancing Qur'an Reading

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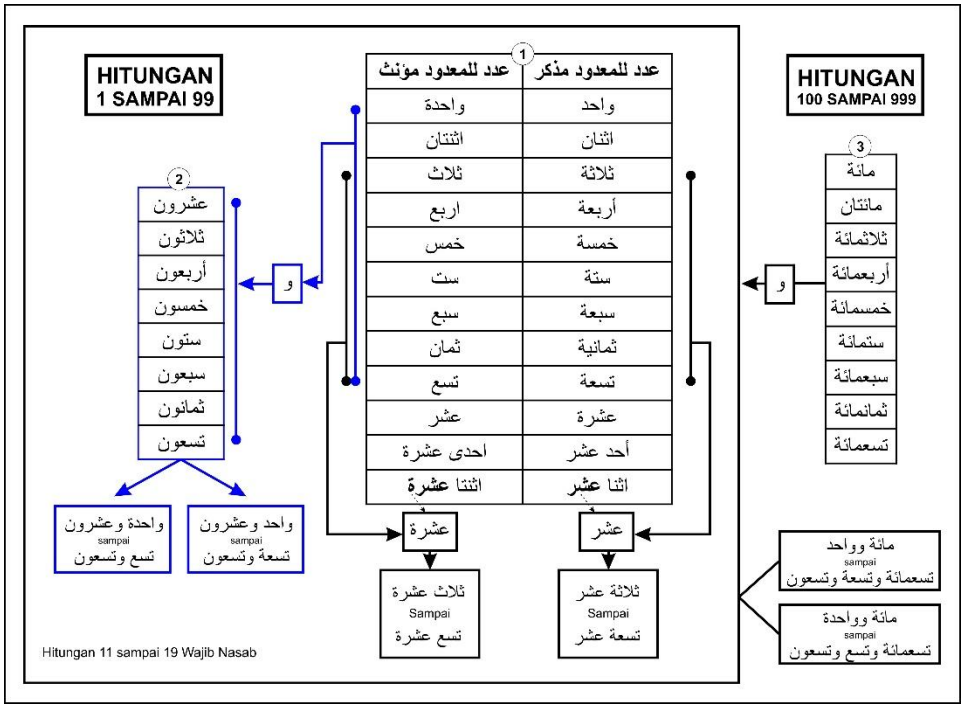

Figure 4 Ma'dud classification

The stages are as follows:

1. The first stage trains students to be able to pronounce عدد للمعدود مذكر and عدد للمعدود مؤنث from 1 to 12.[16]
2. Learn the numbers 13–19 by combining units (1–9) plus عشر for mudzakkar, عشرة for muannats and 11 – 19 obligatory nasab.[17]
3. Introducing tens (20, 30, etc) directly without a special formula, combine units with tens using و , units are mentioned first and this all applies up to the number 99.[18]
4. Learn hundreds (100–900), pronunciation according to the standard form of Arabic. Combination with units/tens using و with hundreds mentioned first.[19]
5. If the object (ma'dud) mudzakkar uses عدد للمعدود مذكر, if muannats use عدد للمعدود مؤنث. how to pronounce ma'dud adjust How to place Ma'dud

Table 2 How to place Ma'dud

Proficiency in Madrasahs Through Teaching Strategies Top of Form', *Nazhruna: Jurnal Pendidikan Islam*, 7.2 (2024), pp. 373–89, doi:10.31538/nzh.v7i2.4985.

[16] A Tamilselvi, M S Raje, and V Shivani, 'Participatory Learning – An Effective Strategy to Enhance Communicative Skills', *Journal of Engineering Education Transformations*, 38.Special Issue (2025), pp. 314–21, doi:10.16920/jeet/2025/v38is2/25037.

[17] Ismail, Hussin, and Supriyatno, 'The Effectiveness of the 'Adad and Ma'dūd Learning Module Based on the Verses of the Quran in Improving Student Achievement'.

[18] George A Miller, 'Information and Memory', *Scientific American*, 195.2 (1956), pp. 42–47.

[19] Yuni Amalia and others, 'cognitive Approach In Learning Nahwu Rules For Non-Arabic SpeakerS', 3.1 (2025), doi:10.59548/js.v3i1.364; Watanabe, Dengel, and Ishimaru, 'Accelerating Knowledge Transfer by Sensing and Actuating Social-Cognitive States'.

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1-2	**Objects + Numbers**
3- On	Numbers + Objects

If the number of objects is 1–2, the object is called first and then the number, the number 3 and above, the number is called first the object.[20] And the rules for placing objects are as follows:

Table 3 Rules of placing Ma'dud

1-2	**Mention objects only, numbers only or both (objects + numbers)**
3-10	Objects must be plural, jar and nakiroh
11-19	Objects must be mufrad, nasob and nakiroh
Multiples of 100	Objects must be mufrad, jar and nakiroh

Numbers 1–2, the object can be called first or number alone or both, depending on the need for the sentence (e.g.: اثنان ,قلمان ,واحد ,قلم ,قلم واحد).

Table 4 example of the number 3 – onwards with ma'dud

7 Pens	**سبعة أقلامٍ**
15 Pens	خمسة عشرقلماً
300 Pens	ثلاثمائة قلمٍ
459 Pens	أربعمائةٍ وسبعة وخمسون قلماً

6. Thousands, millions, billions, trillions in the context of learning adad are considered as objects (ma'dud) that have a mufrad and plural form, for example: ترليون، ترليونات، مليار، مليارات ألف، آلاف مليون، ملايين. In this calculation, the step is very simple, which is to equate with ordinary numbers and the position of thousands, millions, billions, trillions as ma'dud.[21]

   As shown in the following table:

   Table 5 ma'dud (position of thousands, millions, billions, trillions)

[20] Hilmi, Syauqillah, and Sidiq, "Adad and Ma'Dud in Arabic and Indonesian (Contrastive Analysis)'.

[21] Amalia and others, 'Pendekatan Kognitif Dalam Pembelajaran Kaidah Nahwu Untuk Penutur Non-Arab'; F Maderspacher, 'Theodor Boveri and the Natural Experiment', *Current Biology*, 18.7 (2008), pp. R279–86, doi:10.1016/j.cub.2008.02.061; Jazaur, ''Adad Dan Ma'ud Dalam Buku Al-Ghayatu Wa At-Taqrib (Analisis Sintaksis)'.

7 Trillion	**سبعة ترليوناتٍ**
15 Trillion	خمسة عشرترليوناً
300 Trillion	ثلاثمائة ترليونٍ
459 Trillion	أربعمائةٍ وسبعة وخمسون ترليوناً

7. The last stage is to return the properties of thousands, millions, billions, trillions to their origin, that is, as a number (adad) that has been patented as above, for example 27 trillion pens that become adad, which is 27 trillion and pens as ma'dud and the formula used, which is equal to multiples of a hundred, i.e. ma'dud must be mufrad, jar and nakiroh like سبعة وعشرون ترليون قلم.[22]

With these 7 stages, learning adad and ma'dud starting from the number 1 to trillion will be easy because students focus on calculations, not on complicated rules like conventional methods in general.

Results of the Implementation of Ma'dud Classification

The results of interviews with students show that the ma'dud classification model applied during learning activities has a positive impact on the ease of understanding and application of Arabic numerals. Most students stated that this approach makes them no longer burdened with many formulas, so that the learning process feels simpler and more fun. Students also reported that the classification pattern helped them to be more confident in pronouncing and writing Arabic numerals and reduced errors in adjusting between adad and ma'dud. These findings reinforce the results of previous research that found that innovation of teaching materials, especially in adad-ma'dud materials, can significantly improve students' verbal performance and numeracy literacy.

Assumption Checks

Test of Normality (Shapiro-Wilk)

			W	p
Pretest	-	Posttest	0.976	.705

Note. Significant results suggest a deviation from normality.

Figure 5 Assumption Checks

At the statistical analysis stage, the normality assumption test using the Shapiro-Wilk method obtained a p-value of 0.705, which shows that the pretest and posttest differences are normally distributed ($p > 0.05$). With the fulfillment of the normality requirements, the parametric paired samples t-test can be legally used to evaluate the effectiveness of learning interventions based on ma'dud classification. The fulfillment of this normality is important so that the interpretation of statistical results has a strong

[22] Hilmi, Syauqillah, and Sidiq, ''Adad Dan Ma'Dud Dalam Bahasa Arab Dan Bahasa Indonesia (Analisis Kontrastif)'.

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basis of empirical validity.[23]

Paired Samples T-Test

Paired Samples T-Test

Measure 1		Measure 2	t	df	p
Pretest	-	Posttest	−81.49	29	< .001

Note. Student's t-test.

Figure 6 Paired Samples T-Test

The results of the Paired Samples T-Test show that there is a very statistically significant difference between the pretest and posttest scores of students' Arabic numeracy skills. The statistical value of the test obtained was with the degree of freedom (df) = 29 and the significance value, which indicates that the probability of this difference occurring by chance is very small. These findings provide a strong empirical basis for concluding that the learning interventions applied contribute substantially to the improvement of students' Arabic numeracy learning outcomes $t = -81.49 p < 0.001$.[24]

Figure 7 Descriptives

Descriptives

Descriptives

	N	Mean	SD	SE	Coefficient of variation
Pretest	30	46.00	2.546	0.465	0.055
Posttest	30	88.07	2.050	0.374	0.023

The table in the descriptive image above contains a summary of the main statistics of the pretest and posttest results of ma'dud classification learning interventions on Arabic numeracy skills, namely: number of participants (N), mean value (mean), standard deviation (SD), standard error (SE), and coefficient of variation. The average pretest score of 46.00 increased sharply in the posttest to 88.07, indicating a substantial improvement in Arabic numeracy mastery after the treatment was given. The decrease in the standard deviation value (from 2.546 to 2.050) and the decrease in the coefficient of variation (from 0.055 to 0.023) not only showed an improvement in average ability, but also a higher consistency of outcomes between participants: participants' scores were more concentrated on high gains after the intervention was applied.[25]

[23] B Güner, M T Frankford, and J T Johnson, 'A Study of the Shapiro-Wilk Test for the Detection of Pulsed Sinusoidal Radio Frequency Interference', *IEEE Transactions on Geoscience and Remote Sensing*, 47.6 (2009), pp. 1745–51, doi:10.1109/TGRS.2008.2006906; N A Ahad and others, 'Sensitivity of Normality Tests to Non-NormalData',*SainsMalaysiana*,40.6(2011), pp. 637–41 <https://www.scopus.com/inward/record.uri?eid=2-s2.0-79960116624&partnerID=40&md5=7e6fe16cbbc661687649e4a5f5ee0539>; Van Merriënboer and Sweller, 'Cognitive Load Theory in Health Professional Education: Design Principles and Strategies'.

[24] Jacob Cohen, *Statistical Power Analysis for the Behavioral Sciences*, 1988.

[25] B Oettgen and others, 'Evaluation of a Global Health Training Program for Pediatric Residents', *Clinical Pediatrics*, 47.8 (2008), pp. 784–90, doi:10.1177/0009922808317238; A Loutfy and others, 'Effect

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DISCUSSION

The results showed a substantial increase in the achievement of Arabic numeracy of students after the intervention using the Ma'dud Classification method. The average score increased from 46.03 to 88.17, resulting in an increase of 92%. With Cohen's effect size d of -14.78, this change was not only statistically significant ($t = -79.62$, $p < 0.001$) but also had a very strong practical impact, far beyond the conventional threshold for large effect sizes.[26] Furthermore, the decrease in the standard deviation from 2,584 to 2,001 and the coefficient of variation that decreased by 96% indicated an increase in the consistency of student performance. This means that the Ma'dud Classification method not only improves average performance but also reduces variability between students, ensuring that the benefits of the intervention are equally accessible to all levels of initial mastery.

These findings are consistent with the principles of Cognitive Load Theory (CLT) which emphasize the importance of reducing cognitive load to facilitate more effective and efficient learning. In the context of learning Arabic numeracy, the Ma'dud method implements chunking theory by simplifying complex categories that originally consisted of five dimensions into two main consistent paths, namely mudhakkar (masculine) and mu'annath (feminine).[27]

The operational mechanism is as follows:

1. The reduction of intrinsic cognitive burden occurs because the complexity of learning materials is reduced from five interrelated categories to two complementary logical pathways. Students no longer need to memorize complex exceptions or remember interactions between many categories. Instead, they can focus on one dimension of the main organizational gender grammar on which the category is based.
2. Selective attention theory supports that when information is simplified, learners can allocate their cognitive resources more efficiently. Focusing on simpler categories increases attention to the most relevant features and improves information retention. Evident from the increased score and decreased variability, the simplification strategy facilitates a more robust and organized

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of an Educational Program on Pediatric Nurses' Knowledge, Practice, and Self-Confidence about Level of Consciousness Scales', *Journal of Pediatric Nursing*, 73 (2023), pp. e570–78, doi:10.1016/j.pedn.2023.10.035.

[26] Cohen, *Statistical Power Analysis for the Behavioral Sciences*; Agnieszka Paulina Grzegorzewska, 'Role of Oxidative Stress, Inflammation and Fibrosis in Promoting Vasculopathy in Systemic Sclerosis Related Pulmonary Arterial Hypertension' (Boston University, 2016).

[27] George A Miller, 'The Magical Number Seven, Plus Or Minus Two: Some Limits On Our Capacity For Processing Information.', *Psychological Review*, 63.2 (1956), P. 81; Masahiro Ando And Maomi Ueno, 'Cognitive Load Reduction On Multimedia E-Learning Materials', In *2008 Eighth IEEE International Conference On Advanced Learning Technologies* (IEEE, 2008), Pp. 268–72; Van Merriënboer And Sweller, 'Cognitive Load Theory In Health Professional Education: Design Principles And Strategies'; John Sweller And Paul Chandler, 'Evidence For Cognitive Load Theory', *Cognition And Instruction*, 8.4 (1991), Pp. 351–62.

Author: [1*]Muhammad Ainul Yaqin, [2]Hisbullah Huda, [3] Nafilatul Khair [4] Muhammad Ali Wafa, [5] Sohibul Amin
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schema formation in long-term memory.

This research complements and expands on the existing literature in a significant way. Previous studies on Arabic numeracy learning have tended to emphasize external factors such as learners' intrinsic motivation, the use of digital learning technologies, and the learning environment, but few explicitly target cognitive load reduction as a key instructional mechanism.[28]

As the first innovative method that systematically combines evidence-based pedagogical principles with CLT principles for Arabic numeracy learning, Ma'dud Classification presents a new perspective. The novelty of this research lies in the proposition that structured instructional simplification, when designed based on cognitive theory, can result in learning improvements that far exceed expectations.

In addition, this study opens the scope of the application of CLT from the lexical and phonological domains to a more complex morphosyntactic dimension in Arabic. This is significant because the majority of CLT applications in language learning focus on vocabulary retention, pronunciation accuracy, and listening comprehension. This research shows that the principles of CLT can be effectively applied to more abstract and complex language structures.

The strength of this research lies in the consistency between quantitative and qualitative data, creating robust triangulation validation. The results of quantitative data showing a substantial increase in achievement (92% improvement, effect size -14.78) were balanced by in-depth qualitative findings from post-intervention interviews and surveys.[29]

The students reported learning experiences that consistently reflected the benefits of reduced cognitive load. They stated: (1) they felt more confident in applying simplified numeracy categories, (2) the burden of memorization was reduced because there was no need to memorize many exceptions, and (3) the learning process became more fun and engaging.

The confluence between students' subjective experiences and objective data of learning outcomes strengthens the validity of the research construct. This shows that students' experience of learning load reduction is in line with measurable objective improvement through test instruments. This alignment is not only statistically significant but also semantically significant means that students are actually experiencing what the

[28] Raghad Khalaf Ulaywi, 'Cognitive Activation Strategy As An Innovative Teaching Trend To EFL Students In Writing Skill', *Al-Adab Journal*, No. 137 (2021), Pp. 29–42; Xueli Zhang And Others, 'How Does Language Learning Contribute To Individual Growth In A Multilingual World? A Systematic Review', *Journal Of Multilingual And Multicultural Development* 2025, 2025, Pp. 1–17; Stefanie Habermann And Others, 'The Critical Role Of Arabic Numeral Knowledge As A Longitudinal Predictor Of Arithmetic Development', *Journal Of Experimental Child Psychology*, 193 (2020), P. 104794; Zawawi Ismail, Mohamad Hussin, And Triyo Supriyatno, 'Effectiveness Of 'Adad And Ma 'Dūd Learning Module Based On Al-Quran Verses In Enhancing Student Achievement', *Ijaz Arabi Journal Of Arabic Learning*, 4.1 (2021); Sweller, 'Cognitive Load Theory And Individual Differences'.

[29] Leonidas Kyriakides, 'Extending the Comprehensive Model of Educational Effectiveness by an Empirical Investigation', *School Effectiveness and School Improvement*, 16.2 (2005), pp. 103–52; Hamka and Zainal, 'The Stability of The'adad Wa Ma'dud Method in Arabic Grammar Within Sahih Bukhari Hadiths'.

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theory is capable of, and the theory explains their experience.

The findings of this study have significant practical implications for curriculum development and teacher training in Arabic language education institutions, especially Islamic boarding schools. These implications can be sorted into three dimensions: curriculum, teacher training, and transferability.

1. Curriculum Implications
   The adoption of dual-path logic (mudhakkar/mu'annath) as the main organizing principle in organizing numeracy learning materials allows for the simplification of complex concepts without sacrificing depth or accuracy of the material. This approach can replace or complement the traditional five-category-based approach. The systematic implementation of the seven-stage teaching framework that has been validated in this study provides a concrete blueprint for curriculum reform.
2. Implications of Teacher Training
   The professional development of teachers must integrate the principles of CLT as a core competency. Teachers need to be trained to: (1) identify and reduce intrinsic cognitive load in material design, (2) apply chunking and simplification techniques, and (3) monitor and adjust material complexity based on student learning feedback. A structured and ongoing training program is the key to successful implementation.[30]
3. Implications of Transferability
   The logic behind Ma'dud Classification is not exclusive to Arabic numeracy. The principle of CLT-based simplification can be transferred to other morphosyntactic domains in Arabic such as i'rāb (case system), verb conjugation, or adjective-noun matchmaking. With proper contextual adaptation, this method opens up opportunities for more reform of Arabic language learning

Scope and Generalizability

As a scientifically responsive study, this study acknowledges the substantive limitations that affect the interpretation and generalization of results. Understanding these limitations is important to guide more robust prospective research.[31]

1. Sample size and context
   The research involved 30 students from one pesantren in a specific context. Generalization to other institutions, different levels of proficiency, or diverse

[30] Hilmi, Syauqillah, and Sidiq, ‘‘Adad Dan Ma’Dud Dalam Bahasa Arab Dan Bahasa Indonesia (Analisis Kontrastif)’; Suhaiza Zailani, ‘Islamic Operations Management’; Ismail, Hussin, and Supriyatno, ‘Effectiveness of ‘Adad And Ma ‘dūd Learning Module Based on Al-Quran Verses in Enhancing Student Achievement’.

[31] David N Perkins and Gavriel Salomon, ‘Transfer of Learning’, *International Encyclopedia of Education*, 2.2 (1992), pp. 6452–57; Nornadiah Mohd Razali and Yap Bee Wah, ‘Power Comparisons of Shapiro-Wilk, Kolmogorov-Smirnov, Lilliefors and Anderson-Darling Tests’, *Journal of Statistical Modeling and Analytics*, 2.1 (2011), pp. 21–33; Qiong Li and others, ‘Machine Learning-Based Prediction of Depressive Disorders via Various Data Modalities: A Survey’, *IEEE/CAA Journal of Automatica Sinica*, 12.7 (2025), pp. 1320–49.

Author: [1*]Muhammad Ainul Yaqin, [2]Hisbullah Huda, [3] Nafilatul Khair [4] Muhammad Ali Wafa, [5] Sohibul Amin
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sociolinguistic backgrounds is still limited. Learners may have unique characteristics that are not representative of the general population of Arabic language learners.

2. Research design
   The quasi-experimental design without a control group limits the drawing of strong comparative conclusions about the relative advantages of the Ma'dud method compared to traditional approaches. Without controls, it is not possible to definitively conclude that the observed improvement is actually due to the method or by other factors such as the novelty effect or teacher enthusiasm.
3. Temporal scope
   Assessment was carried out only on posttest immediately after the intervention without long-term measurement. It is not known whether the knowledge gained lasted in the long term (1 month, 3 months, 6 months post-intervention) or whether learning decay occurred.
4. Transfer of learning
   The study did not measure the transfer of learning to other contexts, for example whether learners can apply the principle of simplification to other morphosyntax domains in Arabic.

The implication of these limitations is that prospective studies with Randomized Controlled Trial (RCT) designs, larger and heterogeneous samples, longitudinal measurements, and task transfer are strongly encouraged to strengthen the evidence of method effectiveness.

CONCLUSION

This study shows that the application of Madud Classification in learning Arabic numeracy in Islamic boarding schools empirically results in a very substantial improvement in students' adad wa alma'dud ability. Quantitative data showed an increase in average scores from about 46 on the pretest to about 88 on the posttest, with the t-value of paired tests being in range and significance, indicating a statistically significant difference. The decrease in standard deviation and coefficient of variation indicates that not only is the average increasing, but learning outcomes are also becoming more homogeneous and stable among students. Qualitative data from interviews and classroom observations confirmed these findings, where students reported reduced memorization load, increased confidence, and a simpler, more enjoyable learning experience after the material was simplified from five complex categories into two main paths of mudhakkar and mu'annats.$-81p < 0{,}001$

The main advantage of this approach lies in the instructional design based on systematic simplification and the principle of cognitive load reduction, accompanied by seven clear teaching stages so that they can be easily replicated by teachers in the context of other pesantren settings. However, the study also has some important limitations: the sample size is limited to 30 students in a single institution, the quasiexperimental design without a control group, the absence of long-term post-intervention measurements, and

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the extent to which the same principle can be transferred to other Arabic morphosyntactic domains such as i'rab or verb conjugation. Therefore, further development needs to include trials with randomized controlled trial designs in several Islamic boarding schools, longitudinal studies with delayed posttests, integration of this model in digital platforms or gamification, and exploration of its application to other Arabic linguistic structures with similar levels of complexity.

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Submited: 2025-05-13	Revised: 2025-11-15	Accepted: 2025-12-09

BIBLIOGRAPHY

Abbas, R., et al. "The Use of Modern Standard and Spoken Arabic in Mathematics Lessons: The Case of a Diglossic Language." *Cultura y Educación*, vol. 30, no. 4, 2018, pp. 730–765. https://doi.org/10.1080/11356405.2018.1519920

Ahad, N. A., et al. "Sensitivity of Normality Tests to Non-Normal Data." *Sains Malaysiana*, vol. 40, no. 6, 2011, pp. 637–641.

Alasraj, A., M. Freeman, and P. Chandler. "Considering Cognitive Load Theory within E-Learning Environments." In *PACIS 2011 – 15th Pacific Asia Conference on Information Systems: Quality Research in Pacific*, 2011, pp. 1–10.

Amalia, Yuni, et al. "Pendekatan Kognitif dalam Pembelajaran Kaidah Nahwu untuk Penutur Non-Arab." *Jurnal*, vol. 3, no. 1, 2025. https://doi.org/10.59548/js.v3i1.364

Ando, Masahiro, and Maomi Ueno. "Cognitive Load Reduction on Multimedia E-Learning Materials." In *2008 Eighth IEEE International Conference on Advanced Learning Technologies*, edited by IEEE, 2008, pp. 268–272. https://doi.org/10.1109/icalt.2008.218

Asma, Houichi, and Sarnou Dallel. "Cognitive Load Theory and Its Relation to Instructional Design: Perspectives of Some Algerian University Teachers of English." *Arab World English Journal*, vol. 11, no. 4, 2020, pp. 110–127. https://doi.org/10.24093/awej/vol11no4.8

Basir, A., S. Karoso, and S. Saidi. "Enhancing Qur'an Reading Proficiency in Madrasahs through Teaching Strategies." *Nazhruna: Jurnal Pendidikan Islam*, vol. 7, no. 2, 2024, pp. 373–389. https://doi.org/10.31538/nzh.v7i2.4985

Daud, Wan Ab Aziz Wan, et al. "Exploring the Challenges and Strategies of Learning Arabic Language among Primary School Teachers." *Forum for Linguistic Studies*, vol. 7, no. 2, 2025, pp. 94–103. https://doi.org/10.30564/fls.v7i2.8002

Evans, P., and A. J. Martin. "Load Reduction Instruction: Multilevel Effects for Motivation, Engagement, and Achievement in Mathematics." *Educational Psychology*, vol. 43, no. 10, 2023, pp. 1125–1143. https://doi.org/10.1080/01443410.2023.2290442

Güner, B., M. T. Frankford, and J. T. Johnson. "A Study of the Shapiro–Wilk Test for the Detection of Pulsed Sinusoidal Radio Frequency Interference." *IEEE Transactions on Geoscience and Remote Sensing*, vol. 47, no. 6, 2009, pp. 1745–1751. https://doi.org/10.1109/tgrs.2008.2006906

Hamka, Fatimah Az Zahra, and Hakim Zainal. "The Stability of the 'Adad wa Ma'dūd Method in Arabic Grammar within Ṣaḥīḥ Bukhārī Hadiths." *BITARA International Journal of Civilizational Studies and Human Sciences*, vol. 8, no. 1, 2025, pp. 44–62.

Harrathi, H., et al. "The Effectiveness of Cognitive Activation Strategy in Developing Oral Classical Arabic Communication Competency Among Omani Students' Courses." *Journal of Statistics Applications and Probability*, vol. 13, no. 5, 2024, pp. 1431–1445. https://doi.org/10.18576/jsap/130502

Hijriati, Suci. "دراسة تجريبية بـ) وسيلة قرص الساعة وفعاليتها لترقية قدرة الطالبات على فهم العدد والمعدودMTs Nurul Islam Peudada)." *ARABIYYA: Jurnal Studi Bahasa Arab*, vol. 13, no. 01, 2024, pp. 128–142. https://doi.org/10.47498/arabiyya.v13i01.2892

Hilmi, Irpan, Dzati Syauqillah, and Yogi Hasbi Sidiq. "'Adad dan Ma'dūd dalam Bahasa Arab dan Bahasa Indonesia: Analisis Kontrastif." *Al-Urwatul Wutsqo: Jurnal Ilmu Keislaman dan Pendidikan*, vol. 2, no. 1, 2021, pp. 51–59. https://doi.org/10.62285/alurwatulwutsqo.v2i1.26

Ismail, Zawawi, Mohamad Hussin, and Triyo Supriyatno. "Effectiveness of 'Adad and Ma'dūd Learning Module Based on Al-Qur'an Verses in Enhancing Student Achievement." *Ijaz*

Submited: 2025-05-13	Revised: 2025-11-15	Accepted: 2025-12-09

Arabi: Journal of Arabic Learning, vol. 4, no. 1, 2020, pp. 26–43. https://doi.org/10.18860/ijazarabi.v4i1.10785

Issa, I. "Morphological Complexity in Arabic Spelling and Its Implication for Cognitive Processing." *Journal of Psycholinguistic Research*, vol. 52, no. 1, 2023, pp. 331–357. https://doi.org/10.1007/s10936-022-09896-2

Jazaur, Rohman. "'Adad dan Ma'ud dalam Buku Al-Ghayatu wa At-Taqrib: Analisis Sintaksis." Skripsi, 2017, pp. 1–82.

Khalaf Ulaywi, Raghad. "Cognitive Activation Strategy as an Innovative Teaching Trend to EFL Students in Writing Skill." *Al-Adab Journal*, no. 137, 2021, pp. 29–42. https://doi.org/10.31973/aj.v2i137.1645

Köksoy, M. "An Examination of the Arabic Grammar Works Named Al-Naḥw Al-Wāḍiḥ and Al-Qavā'id Al-'arabiyya Al-Muyassara in Terms of the Inductive Method: A Qualitative Research." *Cumhuriyet Ilahiyat Dergisi*, vol. 26, no. 2, 2022, pp. 841–861. https://doi.org/10.18505/cuid.1160851

Kyriakides, Leonidas. "Extending the Comprehensive Model of Educational Effectiveness by an Empirical Investigation." *School Effectiveness and School Improvement*, vol. 16, no. 2, 2005, pp. 103–152. https://doi.org/10.1080/09243450500113936

Liu, D., and J. Qin. "The Effectiveness of Cognitive Linguistics-Inspired Language Pedagogies: A Systematic Review." *The Modern Language Journal*, vol. 108, no. 4, 2024, pp. 794–814. https://doi.org/10.1111/modl.12959

Loutfy, A., et al. "Effect of an Educational Program on Pediatric Nurses' Knowledge, Practice, and Self-Confidence about Level of Consciousness Scales." *Journal of Pediatric Nursing*, vol. 73, 2023, pp. e570–e578. https://doi.org/10.1016/j.pedn.2023.10.035

Miller, George A. "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information." *Psychological Review*, vol. 63, no. 2, 1956, p. 81. https://doi.org/10.1037/h0043158

Nazrailman, Alqan, et al. "مهتم في التدريس، ويختص بمجال العدد والمعدود، ويجيد تعليم Pembelajaran Bahasa Arab Topik 'Adad Ma'dūd Melalui Hibridisasi Youtube Dan Quizizz Pada Generasi Digital Native." *Al Mi'yar: Jurnal Ilmiah Pembelajaran Bahasa Arab dan Kebahasaaraban*, vol. 7, no. 1, 2024, pp. 249–272. https://doi.org/10.35931/am.v7i1.3370

Oettgen, B., et al. "Evaluation of a Global Health Training Program for Pediatric Residents." *Clinical Pediatrics*, vol. 47, no. 8, 2008, pp. 784–790. https://doi.org/10.1177/0009922808317238

Ramadan, H. I. "Arabic Rules between Philosophy of Language and Grammar Criterion: A Modernist Approach." *Darulfunun Ilahiyat*, vol. 34, no. 2, 2023, pp. 453–469. https://doi.org/10.26650/DI.2023.34.2.1262493

Razali, Nornadiah Mohd, and Yap Bee Wah. "Power Comparisons of Shapiro–Wilk, Kolmogorov–Smirnov, Lilliefors and Anderson–Darling Tests." *Journal of Statistical Modeling and Analytics*, vol. 2, no. 1, 2011, pp. 21–33.

Razem, R. J., and J. Pandor. "The Motivational Orientations of Undergraduate Students to Learn Arabic in a Dubai Private University." *Journal of Language Teaching and Research*, vol. 14, no. 1, 2023, pp. 96–107. https://doi.org/10.17507/jltr.1401.11

Ruamba, M. Y., et al. "The Impact of Visual and Multimodal Representations in Mathematics on Cognitive Load and Problem-Solving Skills." *International Journal of Advanced and Applied Sciences*, vol. 12, no. 4, 2025, pp. 164–172. https://doi.org/10.21833/ijaas.2025.04.018

Sweller, John. "Cognitive Load Theory and Individual Differences." *Learning and Individual Differences*, vol. 110, 2024, p. 102423. https://doi.org/10.1016/j.lindif.2024.102423

Sweller, John, and Paul Chandler. "Evidence for Cognitive Load Theory." *Cognition and Instruction*, vol. 8, no. 4, 1991, pp. 351–362. https://doi.org/10.1207/s1532690xci0804_5

Author: [1*]Muhammad Ainul Yaqin, [2]Hisbullah Huda, [3] Nafilatul Khair [4] Muhammad Ali Wafa, [5] Sohibul Amin
Submited: 2025-05-13	Revised: 2025-11-15	Accepted: 2025-12-09

Syahputri, Anggi. "Penerapan Metode Sam'iyyah Syafawiyyah dalam Meningkatkan Motivasi Belajar Bahasa Arab Kelas IV di MIN 2 Bantul Tahun Ajaran 2023/2024." MA thesis, UIN Sunan Kalijaga Yogyakarta, 2024. https://doi.org/10.18196/mht.v3i1.10125

Tamilselvi, A., M. S. Raje, and V. Shivani. "Participatory Learning – An Effective Strategy to Enhance Communicative Skills." *Journal of Engineering Education Transformations*, vol. 38, special issue, 2025, pp. 314–321. https://doi.org/10.16920/jeet/2025/v38is2/25037

Van Merriënboer, J. J. G., and J. Sweller. "Cognitive Load Theory in Health Professional Education: Design Principles and Strategies." *Medical Education*, vol. 44, no. 1, 2010, pp. 85–93. https://doi.org/10.1111/j.1365-2923.2009.03498.x

Vaknin-Nusbaum, V., and B. Makhoul. "Inflectional Morphology and Reading Comprehension in Low SES Arabic-Speaking Second Graders." *First Language*, vol. 45, no. 1, 2025, pp. 3–23. https://doi.org/10.1177/01427237241272523

Watanabe, K., A. Dengel, and S. Ishimaru. "Accelerating Knowledge Transfer by Sensing and Actuating Social-Cognitive States." In *UbiComp/ISWC 2023 Adjunct – Adjunct Proceedings of the 2023 ACM International Joint Conference on Pervasive and Ubiquitous Computing and the 2023 ACM International Symposium on Wearable Computing*, 2023, pp. 258–262. https://doi.org/10.1145/3594739.3610769

Yang, L.-C. "The Effects of a Cognitive Linguistic Approach on College Students' Learning English Tenses in Taiwan." *Language Teaching Research*, 2023. https://doi.org/10.1177/13621688231178196

Zhang, Xueli, et al. "How Does Language Learning Contribute to Individual Growth in a Multilingual World? A Systematic Review." *Journal of Multilingual and Multicultural Development*, vol. 2025, 2025, pp. 1–17. https://doi.org/10.1080/01434632.2025.2562096

هشام بلخير. "دور اللسانيات الإدراكية في تعليمية النحو العربي في المرحلة الابتدائية." ٢٠٢٣ and جمال الدين بن بقاسم, https://doi.org/10.37172/1901-008-002-006