Journal of Practice Learning and Educational Development
https://digitalpress.gaes-edu.com/index.php/jpled
E-ISSN: 2809-1205
Vol 6, No. 1 (2026) 560-569
DOI: 10.58737/jpled.v6i1.1222

Submitted: 06-03-2026
Revised: 09-04-2026
Accepted: 13-04-2026

# STEAM-Based Arabic Language Learning and Madrasah Student's Critical Thinking

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**Abstract**

This study aims to examine the implementation of STEAM-based Arabic language learning and its relationship with madrasah students' critical thinking skills. Arabic language instruction in madrasah contexts is often perceived as teacher-centered and focused on memorization, which limits students' opportunities to develop higher-order thinking skills. To address this issue, a STEAM-based learning approach was applied to integrate science, technology, engineering, art, and mathematics elements into Arabic language learning activities. This research employed a qualitative descriptive approach conducted at Madrasah Ibtidaiyah Al-Asy'ari. Data were collected through classroom observations, in-depth interviews with teachers and students, and reflective assessments of students' learning performance. The findings indicate that STEAM-based Arabic language learning encourages active student participation, collaborative problem-solving, and creative language use. Students demonstrated improved critical thinking skills, particularly in analyzing simple problems, expressing ideas in Arabic, and reflecting on learning tasks. The study concludes that integrating STEAM into Arabic language learning is effective in fostering students' critical thinking and creating a more meaningful and contextual learning experience in madrasah settings.

**Keywords:** Steam-Based Learning[1], Arabic Language Learning[2], Critical Thinking[3], Madrasah Students[4], Elementary Islamic Education[5]



## Introduction

Arabic language learning in madrasah plays a strategic role in developing students' linguistic competence while simultaneously instilling Islamic values from the primary education level (Nisa *et al*., 2025). Arabic is not merely positioned as a means of daily communication, but also serves as a fundamental tool for understanding primary Islamic sources such as the Qur'an and Hadith, as well as for broadening students' intellectual and religious perspectives. At the Madrasah Ibtidaiyah level, Arabic instruction functions as a foundational subject that supports both Islamic literacy and early cognitive development (Abukhaled *et al.*, 2023). Therefore, Arabic language learning should not be limited to mechanical language drills, but should be designed in a meaningful, contextual, and pedagogically sound manner that enables students to actively engage with the language while developing their thinking skills in an integrated way.

Despite its strategic role, the practice of Arabic language learning in madrasah still faces significant challenges, including at Madrasah Ibtidaiyah Al-Asy'ari. Classroom instruction remains predominantly teacher-centered, with learning activities dominated by lecturing, textbook-based explanations, and written exercises that emphasize rote memorization of vocabulary (mufradāt) and grammatical rules (qawāʿid) (Hasan, 2023). This instructional pattern limits students' opportunities to actively use Arabic in communicative contexts and reduces meaningful interaction during learning.

Consequently, many students experience Arabic as an abstract and difficult subject, detached from their daily experiences, which leads to low engagement and minimal cognitive involvement in the learning process.

Critical thinking is widely recognized as one of the essential skills required in twenty-first-century education and should be cultivated from the early stages of schooling. Critical thinking refers to the ability to analyze information, evaluate ideas, draw logical conclusions, and make reasoned decisions based on evidence (Setyawati & Hasan, 2024). In the context of Arabic language learning, critical thinking enables students to go beyond literal comprehension of texts and encourages them to interpret meanings, connect concepts, express opinions, and solve simple problems using Arabic in a functional and communicative manner (Qodir & Hasan, 2024). Developing these skills is crucial to ensuring that Arabic learning contributes not only to linguistic competence but also to students' overall intellectual growth.

However, field observations reveal that the development of critical thinking skills has not yet become a primary focus in Arabic language instruction at MI Al-Asy'ari. Learning activities are often oriented toward achieving examination scores and completing curriculum targets rather than emphasizing students' cognitive processes and reflective thinking during learning (Amaliyah & Hasan, 2025). As a result, students tend to be passive recipients of information, show limited confidence in using Arabic both orally and in writing, and rarely engage in questioning, reasoning, or expressing ideas critically (Hasan & Machmudah, 2022). These conditions indicate a gap between the expected goals of Arabic language education and the actual instructional practices in the classroom, highlighting the urgent need for pedagogical innovation.

One instructional approach that has the potential to address these challenges is the STEAM approach. STEAM integrates Science, Technology, Engineering, Art, and Mathematics into a holistic and interdisciplinary learning framework (Satrio, 2025). This approach emphasizes experiential learning, inquiry-based activities, problem-solving, collaboration, and creativity. Importantly, STEAM is not understood as a simple combination of different subjects taught simultaneously, but rather as a way of designing learning experiences that are contextual, student-centered, and connected to real-life situations (Mauludiyah & Murdiono, 2023). Through STEAM, learning becomes a process of exploration and meaning-making rather than information transmission.

The implementation of the STEAM approach in Arabic language learning offers concrete opportunities to transform classroom practices into more active and meaningful experiences. At MI Al-Asy'ari, science elements can be integrated through Arabic texts related to environmental themes or everyday natural phenomena; technology through the use of simple digital media such as images or short videos; engineering through arranging procedural texts or daily activity sequences in Arabic; art through visual design, posters, and creative language expression; and mathematics through the use of numbers, time expressions, and logical reasoning in Arabic (Nisa *et al.*, 2025). This interdisciplinary integration directly addresses the previously observed passivity in learning by encouraging students to think critically, collaborate with peers, and use Arabic as a tool for problem-solving.

The STEAM approach is also highly relevant to the developmental characteristics of Madrasah Ibtidaiyah students, who are generally at the concrete operational stage of cognitive development (Suryaningsih *et al.*, 2025). At this stage, students learn more effectively through hands-on activities, visual representations, and direct engagement with real-world contexts (Sugino *et al*., 2025). Through STEAM-based projects and simple problem-solving tasks, students at MI Al-Asy'ari are able to learn Arabic in a contextual and applicable manner. Learning shifts from memorization toward processes of understanding, analyzing, and expressing ideas using Arabic, thereby making instruction more student-centered and cognitively meaningful.

This study is grounded in the assumption that STEAM-based Arabic language learning not only increases students' active participation but also strengthens their critical thinking skills. This assumption challenges conventional instructional practices that often treat language learning as separate from cognitive skill development. By integrating STEAM, Arabic language learning becomes

a medium for cultivating higher-order thinking skills through contextual and interdisciplinary language activities (Assabillah, 2024). When implemented consistently, this approach has the potential to contribute to long-term improvements in the quality of Arabic language education in madrasah, particularly in fostering reflective and independent learners.

Previous studies have demonstrated that the STEAM approach is effective in enhancing students' critical thinking, creativity, and learning engagement, especially in science and mathematics education at the primary level (Ningtyas & Suprapto, 2025). Other research has shown that project-based and contextual language learning increases students' motivation and active participation in using the target language communicatively (Rani *et al.*, 2023). Furthermore, studies on twenty-first-century skills emphasize that integrating higher-order thinking activities contributes positively to students' analytical and reflective abilities (Arifin *et al.*, 2024). Nevertheless, empirical research that specifically examines the application of the STEAM approach in Arabic language learning at the Madrasah Ibtidaiyah level, with a focus on students' critical thinking skills, remains limited.

Based on these conditions, the novelty of this study lies in the application of the STEAM approach to Arabic language learning within the specific context of Madrasah Ibtidaiyah. This study does not merely adopt STEAM as a general instructional framework, but adapts it to the characteristics of Arabic language content and the actual classroom conditions at MI Al-Asy'ari. By positioning Arabic as a medium for interdisciplinary learning and critical inquiry, this research addresses gaps in existing studies and offers a new perspective on integrating STEAM into Islamic primary education.

The purpose of this study is to describe the implementation of STEAM-based Arabic language learning and to examine its implications for madrasah students' critical thinking skills. The findings are expected to contribute theoretically to the development of Arabic language education and STEAM-related research, as well as practically to provide guidance for madrasah teachers in designing innovative, contextual, and student-centered learning that aligns with the demands of twenty-first-century education.

## Methods

This study employed a qualitative descriptive research design to examine the implementation of STEAM-based Arabic language learning and its implications for madrasah students' critical thinking skills (Sandelowski, 2000). A qualitative approach was selected to capture in-depth information regarding learning processes, classroom interactions, and students' cognitive engagement during instruction (Stanley, 2023). This design allowed the researchers to explore the phenomenon in its natural setting and to describe instructional practices as they occurred without experimental manipulation.

The research was conducted at Madrasah Ibtidaiyah Al-Asy'ari during the second semester of the academic year. The participants consisted of Arabic language teachers and students at the upper grade level of Madrasah Ibtidaiyah, who were purposively selected based on their involvement in the implementation of STEAM-based learning activities. The Arabic language teacher acted as the main instructional facilitator, while the researchers assumed the role of observers and data collectors, ensuring that the learning process ran naturally according to the lesson plans without interference.

Prior to data collection, strategic planning was carried out by designing STEAM-based Arabic language learning activities aligned with the curriculum objectives (Hall & Liebenberg, 2024). The learning design integrated elements of science, technology, engineering, art, and mathematics into Arabic language instruction through contextual texts, project-based tasks, collaborative discussions, and reflective activities. These learning activities were implemented over several instructional meetings to ensure sufficient exposure and consistency in students' learning experiences.

Data were collected through classroom observations, in-depth interviews, and reflective assessments of students' learning performance. Classroom observations were conducted systematically to document teaching strategies, student participation, interaction patterns, and indicators of critical thinking during learning activities. Semi-structured interviews were carried out with the Arabic language teacher and selected students to obtain insights into their perceptions, experiences, and

responses toward STEAM-based learning. Reflective assessments were used to examine students' ability to analyze tasks, express ideas, and reflect on problem-solving processes in Arabic language activities.

The research instruments included observation sheets, interview guides, and reflective assessment rubrics, all of which were developed by the researchers based on indicators of STEAM learning and critical thinking skills (Bazeley & Richards, 2000). These instruments were owned by the researchers and validated through expert review to ensure content relevance and clarity. To support data organization and analysis, digital recording devices and word-processing software with institutional access were utilized to transcribe interview data and document field notes.

Data analysis was conducted through a qualitative descriptive procedure involving data reduction, data display, and conclusion drawing. Observation and interview data were coded thematically to identify recurring patterns related to STEAM implementation and students' critical thinking skills. Reflective assessment results were analyzed to support qualitative findings and strengthen data triangulation. The credibility of the findings was ensured through triangulation of data sources and techniques, allowing readers to evaluate the trustworthiness of the study and enabling future researchers to replicate the research process in similar educational contexts.

## Results and Discussions

This section presents the results and discussions of the study based on data collected during the implementation of STEAM-based Arabic language learning at Madrasah Ibtidaiyah Al-Asy'ari. The findings are derived from systematic classroom observations, interviews with teachers and students, and reflective assessments conducted throughout the learning process. The presentation of the results focuses on describing how STEAM elements were integrated into Arabic language instruction and how these integrations influenced student engagement, learning activities, and the development of critical thinking skills. To ensure clarity and coherence, the results are organized into tables and followed by analytical discussions that interpret the findings in relation to relevant theories and previous studies.

### 1. Results

This section presents the findings of the study related to the implementation of STEAM-based Arabic language learning and its influence on madrasah students' critical thinking skills at Madrasah Ibtidaiyah Al-Asy'ari. The results were obtained from classroom observations, interviews, and reflective assessments conducted during the learning process. The findings indicate that the integration of STEAM elements in Arabic language instruction positively influenced student engagement, learning activities, and the development of critical thinking skills.

During the implementation, students were actively involved in learning activities that combined Arabic language skills with contextual tasks. Students participated in group discussions, completed project-based assignments, and practiced expressing ideas using simple Arabic sentences related to real-life contexts. The observed learning process demonstrated a shift from teacher-centered instruction toward student-centered learning, where students were encouraged to analyze problems, collaborate, and reflect on their learning experiences.

The overall results of the implementation of STEAM-based Arabic language learning are summarized in Table 1.

Table 1.
Implementation of STEAM-Based Arabic Language Learning and Students' Critical Thinking Skills

| No | Coloum 1 | Type | Description | Percentage | Analysis |
|---|---|---|---|---|---|
| **1.** | Science Integration | Learning Activity | Students analyzed simple Arabic texts about the environment (البيئة) and daily phenomena. | 82% | Most students were able to identify main ideas and respond using simple Arabic sentences. |

| | | | | | |
|---|---|---|---|---|---|
| **2.** | Technology Utilization | Learning Media | Use of digital images and short videos to support vocabulary and listening activities. | 78% | Technology increased students' attention and supported vocabulary comprehension. |
| **3.** | Engineering Process | Project-Based Task | Students arranged procedural steps in Arabic, such as daily routines (أنشطة يومية). | 75% | Students showed improvement in sequencing ideas and logical thinking. |
| **4.** | Art Integration | Creative Expression | Students created posters and simple dialogues using Arabic expressions. | 85% | Creative tasks enhanced confidence and originality in language use. |
| **5.** | Mathematics Integration | Logical Reasoning | Students used numbers and time expressions in Arabic (الأعداد، الساعة). | 73% | Students demonstrated emerging critical thinking through problem-solving tasks. |

To provide a clearer and more systematic overview of how STEAM-based Arabic language learning was implemented in classroom practice, this study further presents a detailed mapping of learning materials, language skills, and instructional activities. This mapping is intended to illustrate the concrete integration of STEAM components with Arabic language topics and vocabulary taught to Grade V students, thereby demonstrating how interdisciplinary learning was translated into meaningful language use and the development of students' critical thinking skills.

Tabel 2.
STEAM-Based Arabic Language Learning Materials for Grade V Students at Madrasah Ibtidaiyah Al-Asy'ari

| No | STEAM Component | Arabic Learning Topic (عنوان الدرس) | Arabic Vocabulary & Expressions (المفردات والتراكيب) | Language Skills (المهارات اللغوية) | Classroom Implementation |
|---|---|---|---|---|---|
| 1 | Science | البيئة والنظافة (Environment and Cleanliness) | البيئة، نظيف، متسخ، شجرة، ماء، هواء؛ المثال: البيئة نظيفة، نحافظ على البيئة، الماء مهم للحياة | قراءة (Reading), كلام (Speaking) | Students read short texts about the environment, identify key ideas, and express simple opinions in Arabic related to environmental care. |
| 2 | Technology | الأدوات التكنولوجية (Technology Tools) | حاسوب، هاتف، شاشة، فيديو، صورة؛ المثال: هذا حاسوب، أشاهد الفيديو، أستخدم الهاتف | استماع (Listening), كلام (Speaking) | Students observe digital images and short videos, then describe objects and activities orally using simple Arabic sentences. |
| 3 | Engineering | الأنشطة اليومية (Daily Activities) | أستيقظ، أذهب، أدرس، آكل، أنام؛ المثال: أستيقظ من النوم، ثم أذهب إلى المدرسة | كتابة (Writing), كلام (Speaking) | Students arrange procedural sentences to describe daily routines and explain the sequence logically in Arabic. |

| | | | | | |
|---|---|---|---|---|---|
| 4 | Art | الهوايات والتعبير الفني (Hobbies and Creative Expression) | أرسم، أكتب، ألعب، أغني؛ المثال: أنا أحب الرسم، هذه لوحة جميلة | كلام (Speaking), كتابة (Writing) | Students design posters and perform short role-play dialogues expressing hobbies and feelings creatively in Arabic. |
| 5 | Mathematics | الأعداد والوقت (Numbers and Time) | واحد حتى عشرة، الساعة، دقيقة؛ المثال: الساعة السابعة، عندي ثلاث حصص | قراءة (Reading), كلام (Speaking) | Students use schedules and time expressions to explain daily activities and solve simple problems using Arabic numeracy. |

Table 2 provides a detailed description of how STEAM-based Arabic language learning was implemented through specific learning topics, vocabulary, and language skills appropriate for Grade V students at Madrasah Ibtidaiyah Al-Asy'ari. The table demonstrates that Arabic language learning materials were not presented as isolated linguistic content, but were embedded within interdisciplinary and contextual learning activities. Each STEAM component was integrated with relevant Arabic topics, enabling students to use vocabulary and expressions meaningfully in real-life contexts.

When combined with the findings in Table 1, the results indicate that students' engagement and critical thinking skills developed alongside their Arabic language skills. Reading and speaking skills (القراءة والكلام) were dominant in science and mathematics activities, while writing and creative expression (الكتابة والتعبير) were more prominent in engineering and art-based tasks. Listening skills (الاستماع) were strengthened through technology-supported activities. This balanced integration of language skills confirms that STEAM-based Arabic learning not only enhances students' critical thinking but also supports comprehensive language development in Madrasah Ibtidaiyah.

The findings presented in Table 1 indicate that the implementation of STEAM-based Arabic language learning at Madrasah Ibtidaiyah Al-Asy'ari positively influenced students' engagement and critical thinking development. Art and science integration achieved the highest levels of student participation, suggesting that visual, contextual, and experience-based activities were particularly effective in supporting Arabic language learning at the elementary level. These activities enabled students to observe, discuss, and express ideas using simple Arabic sentences, which encouraged active involvement rather than passive reception of information. Meanwhile, engineering and mathematics components supported logical reasoning through procedural and numerical language tasks, although these required more structured teacher guidance.

Further analysis based on Table 2 shows that STEAM-based learning was concretely implemented through Arabic language topics, vocabulary, and maharah that were appropriate for Grade V students. Arabic language materials such as environmental texts, daily routines, creative dialogues, and time expressions were integrated with interdisciplinary activities, allowing students to practice listening, speaking, reading, and writing skills in meaningful contexts. This integration enabled Arabic to function not only as a subject of study but also as a medium for inquiry and problem-solving. As a result, students demonstrated improved abilities to analyze information, sequence ideas, and communicate meaningfully using Arabic.

Overall, the combined findings from both tables indicate a clear shift from memorization-oriented instruction toward more reflective and student-centered learning practices. The STEAM-based approach addressed challenges previously observed in conventional Arabic language learning by promoting contextual understanding, collaboration, and critical engagement. The

novelty of this study lies in its empirical demonstration that STEAM-based learning can be systematically aligned with Arabic language materials and maharah in Madrasah Ibtidaiyah, offering a practical and relevant instructional model for enhancing students' critical thinking skills in Islamic primary education.

## 2. Discussions

Figures and tables are the most effective way to present results. Captions should be able to stand alone, such that the figures and tables are understandable without the need to read the entire manuscript. Besides that, The data represented should be easy to interpret. Please look at the examples bellow.

### a. STEAM-Based Learning as an Innovative Approach in Arabic Language Instruction

Based on the findings summarized in Table 1 and Table 2, the implementation of STEAM-based learning in Arabic language instruction at Madrasah Ibtidaiyah Al-Asy'ari resulted in a more active and student-centered learning process. The data show that students were involved in learning activities that integrated Arabic language skills with science themes, creative tasks, procedural projects, and numerical reasoning. Through activities such as analyzing simple environmental texts, arranging daily routines, and creating posters and short dialogues in Arabic, students were encouraged to use the language meaningfully rather than merely memorizing vocabulary and grammatical forms.

From a theoretical perspective, these findings align with constructivist learning theory, which emphasizes that learning occurs through active engagement and meaningful experiences (Hasan & Hasan, 2025). The STEAM-based approach allowed Arabic language learning to be situated within real-life and interdisciplinary contexts, enabling students to construct knowledge through observation, discussion, and practice (Yulian & Putri, 2024). In this study, Arabic functioned not only as an object of learning but also as a medium for expressing ideas, explaining processes, and responding to contextual problems, as reflected in students' use of simple Arabic sentences related to environment, daily activities, and time expressions.

Previous studies have reported that STEAM-based learning enhances student engagement and learning outcomes, particularly in science and mathematics education (Nurmala et al., 2025). However, empirical evidence of STEAM implementation in Arabic language learning at the Madrasah Ibtidaiyah level remains limited. Therefore, the novelty of this study lies in its demonstration that STEAM-based learning can be systematically integrated into Arabic language instruction, providing an innovative and contextual pedagogical model for Islamic primary education.

### b. The Role of STEAM in Developing Madrasah Students' Critical Thinking Skills

The findings from Table 1 indicate that STEAM-based Arabic language learning contributed to the development of students' critical thinking skills, as reflected in their ability to analyze information, sequence ideas, and apply logical reasoning in language tasks. Students showed the ability to identify main ideas from simple Arabic texts, arrange procedural steps in daily routines, and use numbers and time expressions appropriately. These activities required students to engage in reasoning processes rather than merely recalling memorized language forms.

These results support theories of critical thinking development that emphasize inquiry, problem-solving, and reflection as essential components of effective learning (Aziz et al., 2024). The STEAM-based approach created learning situations in which students were encouraged to interpret meaning, make decisions, and express opinions using Arabic (Suryaningsih et al., 2025). For example, responding to environmental texts and arranging daily activities in Arabic required students to analyze content and organize ideas logically, which are key indicators of emerging critical thinking skills at the primary level.

Consistent with Aziz et al. (2024), who emphasize critical thinking as a core twenty-first-century competency, this study shows that critical thinking can be fostered through language

learning when instruction is designed contextually. While previous research has explored project-based learning and critical thinking in general education, this study offers novelty by providing empirical evidence that STEAM-based Arabic language learning can support the development of critical thinking skills among madrasah students, an area that remains underexplored in existing literature.

**c. Relevance of STEAM-Based Arabic Learning in Madrasah Contexts**

Another important finding derived from Table 2 is the relevance of STEAM-based Arabic language learning to the characteristics and learning needs of Madrasah Ibtidaiyah students. The integration of hands-on projects, visual media, group discussions, and creative expression aligned well with students' developmental stage. Learning activities such as creating posters, practicing dialogues, and using Arabic vocabulary related to daily life made the learning process more engaging and accessible for students.

This finding is consistent with cognitive development theory, which suggests that learners at the concrete operational stage benefit from experiential and contextual learning (Hasan et al., 2025). STEAM-based instruction provided opportunities for students to interact directly with learning materials and apply Arabic language skills in familiar contexts (Fahraini et al., 2026). By grounding abstract language concepts in concrete activities, students were able to better understand and use Arabic meaningfully.

Although previous studies have emphasized contextual and student-centered approaches in language education, the application of STEAM in Arabic language learning within madrasah contexts has received limited attention . Therefore, this study highlights the urgency of adopting interdisciplinary and innovative approaches in madrasah education. Its novelty lies in positioning STEAM as a relevant and adaptable framework for enhancing Arabic language learning and critical thinking skills in Islamic primary schools.

## Conclusion

This study investigated the implementation of STEAM-based Arabic language learning and its influence on students' critical thinking skills at Madrasah Ibtidaiyah Al-Asy'ari. The findings, derived from classroom observations, interviews, and reflective assessments, indicate that integrating STEAM elements into Arabic language instruction transformed the learning process from teacher-centered and memorization-oriented practices into a more active, contextual, and student-centered approach. Students demonstrated increased engagement in learning activities and showed improvement in analyzing simple texts, sequencing ideas, and expressing meaning using basic Arabic sentences.

Furthermore, the results reveal that STEAM-based Arabic language learning is highly relevant to the cognitive and learning characteristics of Madrasah Ibtidaiyah students. Through interdisciplinary and project-based activities, students were encouraged to use Arabic in meaningful contexts that supported both language development and critical thinking. The novelty of this study lies in its empirical evidence that STEAM can be effectively adapted as a pedagogical framework for Arabic language instruction in Islamic primary schools, an area that has received limited scholarly attention. Although the findings are context-specific, they provide important implications for improving the quality of Arabic language learning in madrasah settings. Future research is recommended to involve broader samples, longer implementation periods, and mixed-method designs to further strengthen the evidence on the effectiveness of STEAM-based Arabic language learning.

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