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STEAM-BASED INDONESIAN LANGUAGE LEARNING WITH GARDNER'S MULTIPLE INTELLIGENCE APPROACH TO IMPROVE STUDENTS' CRITICAL THINKING AND COMMUNICATION SKILLS

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Abstrak

This study examines the implementation of STEAM-based Indonesian language learning (Science, Technology, Engineering, Arts, Mathematics) by integrating Gardner's Multiple Intelligence approach to improve students' critical thinking and communication skills. In the era of the industrial revolution 4.0, language education needs to transform from a conventional approach to integrative learning that is responsive to the diversity of student potential. This study aims to describe the STEAM-Multiple Intelligence learning design in Indonesian language subjects, analyze its impact on critical thinking and communication skills, and identify implementation challenges. Using a classroom action research method with the Kemmis and McTaggart design, the study was conducted on 34 ninth-grade junior high school students in Surabaya over two learning cycles. Data were collected through observation, critical thinking skills tests, communication assessments, Multiple Intelligence questionnaires, and documentation. The results showed that the integration of STEAM with the Multiple Intelligence approach significantly improved students' critical thinking skills from an average of 68.5 (cycle I) to 84.2 (cycle II), and communication skills from 70.3 to 86.7. Learning that accommodates multiple intelligences allows students with various intelligence profiles to contribute optimally in STEAM projects. This research contributes to the discourse of integrative pedagogy and offers a practical model for implementing innovative and inclusive Indonesian language learning.

1. INTRODUCTION

Learning Indonesian in the digital era faces complex challenges in preparing students to face the demands of the 21st century, which require not only literacy competencies but also critical thinking, creativity, collaboration, and communication skills (Zubaidah, 2016). Conventional approaches that position Indonesian as a separate subject from other disciplines are increasingly irrelevant to the needs of holistic and contextual learning (Kemendikbud, 2017).

STEAM (Science, Technology, Engineering, Arts, Mathematics) as an integrative learning approach offers opportunities to connect language learning with real-life contexts through interdisciplinary projects (Yakman & Lee, 2012). The integration of arts in STEM creates space for creativity and expression that is highly relevant to language learning. However, the implementation of STEAM in Indonesia is still limited, especially in the context of Indonesian language learning (Permanasari, 2016).

On the other hand , the theory of Multiple Intelligences developed by Gardner, (2011) offers a perspective on the diversity of human intelligence that goes beyond traditional linguistic and logical-mathematical intelligence. Gardner identified nine intelligences: linguistic, logical-mathematical, spatial, bodily-kinesthetic, musical, interpersonal, intrapersonal, naturalistic, and existential. This approach recognizes that students have diverse intelligence profiles and that learning must accommodate this diversity (Armstrong, 2009).

The combination of STEAM and Multiple Intelligence in Indonesian language learning has not been systematically explored. In fact, the integration of the two has the potential to create learning that not only develops language competency but also 21st-century skills while respecting the uniqueness of each student.

The following table illustrates the integration of STEAM with various types of Gardner's intelligence in the context of Indonesian language learning:

Table 1. Integration of STEAM Components with Multiple Intelligence in Indonesian Language Learning

STEAM Components	Gardner's Types of Intelligence	Indonesian Language Learning Activities	Competency Output
Science	Logical-Mathematical, Naturalist	Writing observation reports on natural phenomena; analyzing scientific explanation texts	The ability to construct factual texts with cause-effect logic
Technology	Logical-Mathematical, Spatial	Creating narrative podcasts; designing digital infographics for expository texts	Digital literacy and multimodal capabilities
Engineering	Bodily-Kinesthetic, Spatial	Prototype design and presentation project with written documentation	Technical procedural and descriptive skills
Arts	Linguistic, Musical, Spatial	Writing poetry based on visual experiments; drama based on literary texts	Language creativity and aesthetic appreciation
Mathematics	Logical-Mathematical, Intrapersonal	Analyzing rhetorical patterns in argumentation; statistics of language use	Ability to analyze text structure and argumentation

Source : Adapted from Gardner (1983), Yakman & Lee (2012), and Kemendikbud (2017)

This study aims to: (1) describe the design of STEAM-based Indonesian language learning with a Multiple Intelligence approach, (2) analyze the influence of this approach on students' critical thinking skills, (3) analyze its influence on students' communication skills, and

(4) identify implementation challenges and opportunities.

The significance of this research lies in its contribution to the development of an Indonesian language learning model that is responsive to the needs of the 21st century and student diversity. Practically, this research offers a framework for teachers to design integrative, inclusive, and meaningful learning.

2. LITERATURE REVIEW

2.1 STEAM Learning

STEAM is an evolution of the STEM (Science, Technology, Engineering, Mathematics) approach with the addition of an Arts component to emphasize the importance of creativity, design, and expression in integrative learning (Yakman & Lee, 2012). This approach uses authentic projects that integrate multiple disciplines to solve complex problems or create innovative products.

Quigley et al., (2017) explain that STEAM is not simply a combination of subjects, but rather the creation of a learning space where disciplinary boundaries become fluid and students experience interdisciplinary connections. In the context of Indonesian language learning, STEAM enables language to function as an authentic communication tool in inquiry, design, and presentation processes (Aliyah & Nurjanah, 2022).

Permanasari, (2016) research shows that STEAM learning improves student motivation and learning outcomes in Indonesia. However, its implementation is still focused on science and mathematics subjects, with language integration limited to its instrumental function.

2.2 Gardner's Multiple Intelligence Theory

Gardner, (2011) in his "Frames of Mind" evidence challenged the traditional view of a single intelligence that can be measured through IQ tests. Gardner proposed that humans possess a variety of relatively independent types of intelligence: (1) Linguistic: sensitivity to spoken and written language; (2) Logical-Mathematical: the ability to analyze problems logically; (3) Spatial: the ability to perceive space and visualization; (4) Bodily-Kinesthetic: the ability to use the body to solve problems; (5) Musical: sensitivity to rhythm, pitch, and timbre; (6) Interpersonal: the ability to understand and interact with others; (7) Intrapersonal: the ability to understand oneself; (8) Naturalistic: the ability to recognize and categorize flora and fauna; (9) Existential: sensitivity to fundamental questions of existence.

Armstrong, (2009) explains the pedagogical implications of this theory: learning should be designed to activate multiple intelligences, rather than relying solely on traditional verbal-linguistic and logical-mathematical approaches. Hanafin, (2014) research shows that Multiple Intelligence-based learning increases the participation and achievement of students with various intelligence profiles.

In Indonesia, several studies have explored the application of Multiple Intelligence in learning (Chatib, 2009); (Syarif et al., n.d.), but its integration with the STEAM approach, especially in Indonesian language learning, is still limited.

2.3 Critical Thinking Skills

Critical thinking is defined as the ability to analyze, evaluate, and construct arguments rationally and reflectively (Ennis, 1996). (Facione, 2011) identified six core critical thinking skills: interpretation, analysis, evaluation, inference, explanation, and self-regulation.

In the context of learning Indonesian, critical thinking involves the ability to analyze the structure and meaning of text, evaluate arguments, identify bias, and construct coherent and logical text (Zubaidah, 2016). Inquiry and project-based learning has been shown to be effective in developing critical thinking skills (Saavedra & Opfer, 2012).

(Redhana, 2019) research shows that STEM-based science learning improves critical thinking in Indonesian students. However, there is still little research exploring the development of critical thinking through integrative language learning.

2.4 Communication Skills

Communication skills include the ability to convey and receive information effectively

through various modes (oral, written, visual) and contexts (Trilling & Fadel, 2009). In the multimodal era, communication is not limited to verbal text but includes a combination of language, images, sound, and gestures (Kress, 2009).

The Partnership for 21st Century Skills (P21) identifies communication as one of the "4Cs" (Critical Thinking, Communication, Collaboration, Creativity) that are essential for success in the 21st century. Communication skills include the ability to articulate ideas, listen actively, use media and technology, and communicate in diverse contexts.

In Indonesian language learning, traditional communication skills focus on listening, speaking, reading, and writing (Pendidikan & Indonesia, 2025). The STEAM approach expands the concept of communication by involving multimodal presentations, project documentation, and team collaboration (Liao, 2016).

3. RESEARCH METHODS

3.1 Research Design

This research uses a Classroom Action Research (CAR) approach with the Kemmis and McTaggart model which consists of four stages: planning, acting, observing, and reflecting which are carried out in two cycles (Kemmis & Taggart, 2002).

CAR was chosen because of its practical, collaborative nature, and its focus on directly improving learning practices. This design allows researchers and teachers to collaborate on developing, implementing, and evaluating learning interventions iteratively.

3.2 Setting and Participants

The research was conducted at SMPN 12 Surabaya, East Java, during the odd semester of the 2023/2024 academic year for 8 weeks (2 cycles of 4 weeks). Schools were selected purposively based on their willingness to implement learning innovations and the availability of supporting facilities (computer laboratories, libraries, teaching aids).

The study participants were 34 ninth-grade students (18 girls, 16 boys) aged 14–15 . They came from middle socioeconomic backgrounds, with 85% having internet access at home. Their academic abilities varied, with a distribution of 30% high, 50% medium, and 20% low based on their previous semester's report card grades.

3.3 Data Collection Instruments

1. **Multiple Intelligence Questionnaire** : An adaptation of (McKenzie, 1999) that has been translated and validated for the Indonesian context, consisting of 90 statements (10 for each type of intelligence) with a Likert scale of 1-5. The reliability of the instrument was tested with Cronbach's Alpha = 0.87 .
2. **Critical Thinking Skills Test** : Developed based on (Facione, 2011) framework, it consists of 20 essay questions that measure six aspects of critical thinking in the context of text analysis and production. Content validity was confirmed by three experts (a linguistics lecturer, an Indonesian language teacher , and an education practitioner).
3. **Communication Assessment Rubric** : Using a holistic rubric with 5 criteria (clarity of ideas, organization, use of language, creativity of presentation, interaction with the audience) with a scale of 1-4 for each criterion. Inter-rater reliability between the two assessors was 0.82 .
4. **Observation Sheet** : A structured observation protocol records student activities, interactions, use of multiple intelligences, and critical thinking indicators during learning.
5. **Documentation** : Includes photos of activities, presentation videos, student product artifacts (posters, podcasts, prototypes, written texts).

3.4 Research Procedures

Pre-Cycle :

- Multiple Intelligence questionnaire administration to map students' intelligence profiles
- Pre-test of critical thinking and communication skills
- Grouping heterogeneous students based on intelligence profiles and academic abilities

Cycle I (4 weeks) :
Planning : Designing a STEAM project learning with the theme "Environmental Pollution and its Solutions" that integrates: (a) Science: investigation of local river water quality, (b) Technology: use of measurement and data processing applications, (c) Engineering: design of a simple filtration system, (d) Arts: creative campaign through posters and videos, (e) Mathematics: statistical analysis of pollution data.
Each activity is designed to accommodate multiple intelligences:

- Linguistics: writing investigative reports and persuasive campaign texts
- Logical-Mathematical: analyzing water quality data
- Spatial: designing campaign visual designs and filtration system diagrams
- Kinesthetic: construction of filtration prototypes
- Naturalist: river ecosystem observation
- Interpersonal: group discussions and community interviews
- Intrapersonal: personal reflection journal

Action : Implementation of learning during 12 meetings (@ 2 x 40 minutes), with the following stages: (1) Problem orientation and inquiry (2 meetings), (2) Field investigation (3 meetings), (3) Analysis and synthesis (3 meetings), (4) Solution design (2 meetings), (5) Presentation and reflection (2 meetings) .
Observation : Documentation of the learning process, recording student participation, identification of obstacles.
Reflection : Evaluation of achievement, identification of weaknesses (especially in scaffolding critical thinking skills for low-ability students), improvement plans for Cycle II.
Cycle II (4 weeks) :

With improvements based on Cycle I reflection, a STEAM project themed "Local Food Innovation for Nutritional Security" was implemented with additional scaffolding for critical thinking through: graphic organizers, explicit questioning strategies (Socratic method), and structured peer review.

3.5 Data Analysis

Quantitative data (critical thinking and communication test scores) were analyzed descriptively (mean, standard deviation, percentage of improvement) and comparatively between cycles using the Wilcoxon test (because the sample was small and not normally distributed).

Qualitative data (observation, documentation) were analyzed thematically by coding to identify patterns of use of multiple intelligences, critical thinking strategies, and communication dynamics.

Multiple Intelligence questionnaire data was analyzed to create individual and class intelligence profiles, which were then used to interpret variations in student responses to learning.

4. RESULTS AND DISCUSSION

4.1 Student Multiple Intelligence Profile

The Multiple Intelligence questionnaire analysis showed the diversity of students' intelligence profiles. Of the 34 students, only 6 students (17.6 %) had linguistic intelligence as their dominant intelligence. The other dominant intelligences were spread out: logical-mathematical (8 students, 23.5 %), spatial (5 students, 14.7%), kinesthetic (4 students, 11.8%), interpersonal (6 students, 17.6%), intrapersonal (3 students, 8.8%), and naturalist (2 students, 5.9%). There were no students with dominant musical or existential intelligence in this sample.

These findings confirm Gardner's assumption that linguistic intelligence is not a universal intelligence that dominates all students. In conventional Indonesian language learning, which places a heavy emphasis on linguistic intelligence, the majority of students (82.4 %) are potentially unable to demonstrate their optimal abilities.

4.2 Implementation of STEAM- Multiple Intelligence Learning

Cycle I :

The "Environmental Pollution and Its Solutions" project successfully integrates STEAM components by accommodating multiple intelligences. Observations show increased participation compared to conventional learning. Students with kinesthetic intelligence are very active in the filtration prototype construction stage, while those with naturalist intelligence excel in ecosystem observation.

However, some challenges arise. Students with intrapersonal intelligence initially struggle with intensive group work. Teachers address this by providing individual reflection time and "researcher-documenter" roles that allow them to work more independently while still contributing to the team .

In the Indonesian language aspect, students produced various types of texts: observation reports (documentation of field investigations), explanatory texts (explaining pollution processes and filtration mechanisms), persuasive texts (campaigns), and procedural texts (guidelines for building a filtration system). The authentic context of the project made the writing more meaningful than generic text exercises.

Critical thinking skills develop especially in the data analysis and solution design stages. Students must interpret measurement results, identify patterns, evaluate various solution options based on criteria (effectiveness, cost, sustainability), and provide justification for their design choices.

Cycle II :

Based on Cycle I reflections, improvements focused on explicit scaffolding for critical thinking. The teacher introduced the "Think-Pair-Share" and "Socratic Questioning" strategies to help students articulate their thinking processes.

The "Local Food Innovation for Nutritional Security" project challenges students to identify underutilized local food ingredients, research their nutritional content, design innovative processed products, and develop marketing strategies. This project is more complex and requires a higher level of synthesis and evaluation.

The use of graphic organizers (Venn diagrams for comparing options, cause-effect charts for analyzing nutritional problems, decision matrices for evaluating alternatives) helps students visualize their critical thinking processes. Students with spatial intelligence benefit greatly from these visual tools.

Structured peer review in Cycle II improved communication quality. Students received feedback from peers with varying intelligence profiles, providing a multidimensional perspective on their communication effectiveness.

4.3 Improving Critical Thinking Skills

Analysis of the critical thinking test showed significant improvement. The average pre-test score was 62.4 (scale 0-100), increasing to 68.5 in the Cycle I post-test (a 9.8% increase), and 84.2 in the Cycle II post-test (a 23.0% increase from Cycle I; 34.9% from pre-test).

Aspect-by-aspect analysis of critical thinking reveals an interesting pattern:

- **Interpretation** : Increase from 65 → 72 → 86 (highest)
- **Analysis** : 60 → 70 → 85
- **Evaluation** : 58 → 65 → 82
- **Inference** : 62 → 68 → 84
- **Explanation** : 64 → 70 → 83
- **Self-Regulation** : 65 → 66 → 80 (slowest increase)

The interpretation and analysis aspects showed the highest improvement, possibly due to STEAM activities requiring students to interpret empirical data and analyze information from various sources. Self-regulation (metacognition) improved the slowest, indicating that this aspect requires more intensive intervention and longer time.

Qualitative findings show a transformation in the quality of students' argumentation. In

the pre-test, arguments tended to be opinion-based without evidence. In the Cycle II post-test, students consistently provided empirical evidence, anticipated counter-arguments, and acknowledged the limitations of their claims—indicators of mature critical thinking.

Variations based on intelligence profiles show that students with dominant logical-mathematical intelligence show the fastest increase in critical thinking (average 40%), followed by linguistic (36%), and intrapersonal (35%). Students with kinesthetic intelligence showed slower improvement (28%), but when given the opportunity to demonstrate understanding through physical models or simulations, they showed a deeper understanding that was not fully captured by written tests.

4.4 Improving Communication Skills

Communication skills also showed substantial improvement. The average pre-test communication score was 66.8, increasing to 70.3 in Cycle I (a 5.2% increase), and to 86.7 in Cycle II (a 23.3% increase from Cycle I; 29.8% from pre-test).

Communication criteria analysis:

- **Clarity of Ideas** : 68 → 73 → 88
- **Organization** : 65 → 70 → 87
- **Language Use** : 70 → 72 → 85
- **Presentation Creativity** : 64 → 68 → 87
- **Audience Interaction** : 67 → 68 → 86

Presentation creativity showed the highest increase, reflecting how the integration of Arts in STEAM opens up space for exploring diverse communication modes. Students are not limited to conventional oral presentations but create campaign videos, podcasts, interactive infographics, and visual installations.

The Multiple Intelligence approach allows each student to communicate through their strengths. Students with high spatial intelligence create complex yet easy-to-understand data visualizations. Students with musical intelligence use jingles and rhythm to convey campaign messages. Students with interpersonal intelligence excel in interactive presentations that engage audiences.

Observations showed a dramatic increase in communication confidence. Many students who were previously reluctant to speak in front of the class became active communicators when talking about projects they were personally invested in and when using communication modes that suited their intelligence.

The quality of written communication (reports, campaign texts) has also improved. Linguistic analysis shows improvements in sentence complexity, variety of technical vocabulary, use of cohesion and coherence, and multimodal integration (text with graphics, diagrams, and images).

4.5 Challenges and Adaptation

Implementation is not without challenges:

Time Management : STEAM learning requires significantly more time than conventional learning. Projects designed for four weeks sometimes require extensions. Teachers must balance depth of exploration with curriculum coverage.

Resource Availability : Access to technology and materials is uneven. While schools have adequate facilities, implementation at home relies on family resources. Teachers address this by providing alternatives and borrowing equipment.

Complex Assessment : Assessing integrative learning is more complex than grading conventional tests. Teachers need to develop multidimensional rubrics and document the process, not just the product. This requires additional time and expertise.

Initial Resistance : Some students are initially resistant to approaches that are very different from the learning they are used to. They feel insecure about ambiguity and prefer explicit instruction. Gradual scaffolding and open communication about learning goals help overcome this resistance.

Interdisciplinary Collaboration : Ideally, STEAM learning involves collaboration between

teachers from various subjects. In this study, limited coordination between teachers meant that STEAM integration was managed by a single Indonesian language teacher with limited consultation with science and mathematics teachers. A more structured teaching team model would improve the quality of integration.

5. CONCLUSION

This research demonstrates that STEAM-based Indonesian language learning with a Multiple Intelligences approach offers a powerful framework for developing students' critical thinking and communication skills. This integration creates learning that not only enhances language competency but also fosters multidisciplinary literacy, creativity, and problem-solving abilities.

The main findings of this study include:

First , the STEAM approach contextualizes language learning in authentic situations that demand the use of language as a tool for thinking and communicating, not just an object of study. Students write not for structural practice but to document investigations, communicate findings, and persuade audiences—the genuine functions of language.

Second , the integration of Multiple Intelligences enables inclusive and equitable learning. Students with diverse intelligence profiles can contribute optimally and develop language competency through pathways that align with their strengths. This challenges the assumption that only students with high linguistic intelligence can excel in language learning.

Third , STEAM-Multiple Intelligence integrative learning significantly improves critical thinking and communication skills—core competencies of the 21st century. This improvement is not only quantitative but also qualitative, reflected in the depth of analysis, maturity of argumentation, and creativity of students' communication.

Fourth , implementation requires a fundamental transformation in the role of teachers from transmitters of knowledge to facilitators of learning, designers of experiences, and holistic assessors. This requires professional development and systemic support.

Implications for educational practice include:

- **Curriculum** : Curriculum developers need to provide flexibility for integrative learning and reduce the pressure of excessive content coverage.
- **Teacher Training** : Teachers need training in STEAM learning design, authentic assessment, and Multiple Intelligence-based differentiation.
- **Infrastructure** : Schools need to provide facilities, materials, and technology that support experiential and project-based learning.
- **Assessment Policy** : The assessment system needs to evolve from a focus on standardized tests to portfolio assessment, performance assessment, and holistic evaluation.

The limitations of this study lie in its limited scale and duration, which limits generalizability. The research was conducted in one class in an urban school with relatively adequate resources. Implementation in rural contexts or schools with limited facilities may face different challenges.

Further research could explore:

- A longitudinal study to evaluate the long-term impact of STEAM-Multiple Intelligence learning on literacy and academic achievement.
- Comparative effectiveness research compares various models of STEAM integration in language learning.
- An investigation into how this learning can be adapted to different sociocultural contexts and resource levels in Indonesia.
- Exploring the use of emerging technologies (AR, VR, AI) to support STEAM-Multiple Intelligence learning.

other disciplines and from the diverse potential of students. By embracing interdisciplinary integration and respecting multiple intelligences, we can create language learning that is more meaningful, inclusive, and responsive to the demands of the times.

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