LANGUAGE CIRCLE: Journal of Language and Literature 20 (1) October 2025 p-ISSN 1858-0165
Available online at https://journal.unnes.ac.id/journals/LC e-ISSN 2460-853X

TEACHERS' PERSPECTIVES ON USING STEM IN ENGLISH LANGUAGE TEACHING IN ELEMENTARY SCHOOL

Teguh Budiarto
PGRI Kanjuruhan University of Malang
paktebe85@gmail.com

Wahyuningsih Usadiati
PGRI Kanjuruhan University of Malang
wahyuningsih@unikama.ac.id

Agus Sholeh
PGRI Kanjuruhan University of Malang
agussholeh@unikama.ac.id

Abstract

STEM education incorporates Science, Technology, Engineering, and Mathematics into a single learning paradigm. Through investigation, experimentation, and design-based problem solving, this method helps students develop critical, creative, and collaborative thinking. STEM principles can be used in English Language Teaching as well as other fields. STEM can make language learning more relevant and practical while developing 21st-century abilities. This study examines the perspectives of teachers in public primary school of *Dadapan*, Malang, Indonesia on integrating STEM into their English language teaching. It also analyzed their readiness to implement this approach. This study used qualitative descriptive design, where the researcher used a questionnaire, interview, and observation as the instruments to collect the data, and employed thematic analysis and triangulation for analysing the data. This study reveals that (1). The teachers have a strong understanding of the concept of STEM and believe that it is a valuable and effective method for teaching English. Moreover, it has a favorable impact on students' ground, engagement, and overall academic performance. (2). The majority of teachers demonstrate preparedness for this integration. However, they clearly indicated a significant need for increased cooperation among colleagues, more accessible resources and instructional materials, and continuous professional training. The findings of this study provide practical guidance for curriculum developers and teachers on how to effectively integrate STEM into English language lessons, especially in the elementary education level.

Keywords: Elementary Education, English Language Teaching, STEM Integration, Teachers' perspectives.

INTRODUCTION

Today, technological developments greatly influence the world of education, including the way teachers teach and students learn. In the 21st century, teachers are expected to make classroom learning activities more interesting and encourage students to be more active, rather than just delivering lectures. Teachers are expected to create various learning methods and strategies to actively raise students' awareness and engagement, including in English language teaching and learning at school. Unfortunately, the English language skills of students are still low, even in elementary school. In this case, teachers' teaching methods and appropriate strategies need to be varied to overcome this.

One of the methods that has been agreed upon as effective for students is through STEM-based learning. It is an approach combining four disciplines: Science, Technology, Engineering, and Mathematics into one integrated whole. In practice, STEM either teach concepts from each field of

science separately or emphasizes more on how these concepts are interconnected and can be applied to solve real problems. Students are motivated to think critically, creatively, and collaboratively in inventing solutions through the process of investigation, experimentation, and design, as proclaimed by Bybee (2010).

Then, how is it integrated into language learning? Experts are progressively recognizing that the potential of STEM integration is no longer limited to science subjects but broaden to other disciplines, including language. Integrating STEM makes language learning more appealing and relevant, while also thriving important skills in students. For example, through CLIL (Content and Language Integrated Learning), STEM topics are used as appealing learning materials to learn vocabulary, grammar, and speaking/ writing skills in real contexts.

STEM-based projects motivate active language use for collaboration and presentations. In addition, teachers can engage in STEM games and simulations, hands-on experiments, technology integration, data analysis, and subsequent instructions in the target language. This approach could help reinforce language understanding in a STEM context. This integration is seen as a way to contextualize language learning, make it more relevant to the real world, and improve students' 21st-century skills. An article by Vosniadou, S., & Skopeliti, I. (2023) discusses how inquiry-based learning (often part of a STEM approach) can improve students' conceptual and language understanding in science.

The integration of STEM into the curriculum, particularly in English language teaching, presents both opportunities and challenges. Susanto, Miyono, & Affini (2020) underlined that in Central Java, the use of social media, vlogs, and nature observations presents chances for STEM application in English classes. However, they also identified defiance, including low teacher technology skills, insufficcient school facilities, and a lack of socialization of this approach. Similarly, Sultana, Kahwaji, & Kurup (2021) showed remarkable challenges for English as a Second Language (ESL) learners in STEM education, such as strains with technical vocabulary, insufficient teacher training, and psychological fences. These findings suggest a need for a pedagogical shift toward integrated and practice-oriented approaches to overcome these hurdles.

Additionally, several studies highlight challenges faced by teachers, such as ESL (English as a Second Language) students' difficulties with technical vocabulary (Sultana et al., 2021) and the lack of face-to-face interaction in online learning (Sultana et al., 2021). Furthermore, Borreguero et al. (2022) found that prospective elementary school teachers exhibited negative emotions and low self-efficacy toward STEM learning. On the other hand, numerous studies highlight the benefits and positive outcomes of this approach. Teachers who have implemented STEM stated that the method is relevant, increases student success and confidence, makes learning more accessible, and connects lessons to everyday life (Bal & Bedir, 2021). Other studies also highlight the significant of practical cases, real-life examples, and projects in encouraging students notice in science and thriving problem-solving skills (Birzina et al., 2021).

Related to teacher preparedness, research shows that intended early childhood education (ECE) teachers in Latvia are aware of numerous STEM teaching strategies and the significance of cognitive engagement (Cedere et al., 2022). Nevertheless, overall, there is a clear need for professional training, as practical STEM

activities can increase teachers' professional development (Borreguero et al., 2022), and other research proposes the need for specific training in STEM concepts and pedagogy, especially for ECE teachers (Aleksieva et al., 2021).

Some studies prove that numerous pedagogical approaches and products can be effectively used to apply STEM. Yuana, Fitriyati, & Suwandi (2022) found that teachers have a positive perspective of STEM integration, applying it through project-based and problem-based learning to improve students' critical thinking and problem-solving skills. In the same way, Sitorus et al., 2020) found that STEM-PjBL (Project-Based Learning) is effective in increasing critical thinking, creativity, and overall learning results. Furthermore, Naufal & Asdar (2022) showed that tangible STEAM products, like catapults, can be used in schools to improve 21st-century skills. The use of e-modules within a STEM learning model has also been proven effective in developing problem-solving skills (Arina Fauziyah & Rica Wijayanti, 2024), and digital learning in general has a positive impact on student outcomes (Izzatullina Liyana Khalid, Mohd Nordin Sarif Abdullah, & Hanani Mohd Fadzil, 2024).

The other studies constantly show that the STEM approach has a notable and positive impact on a variety of student skills and learning results. Saputri & Herman (2022) found that using a STEM approach in mathematics positively impacts 21st-century competencies, especially critical thinking and problem-solving skills. Davidi, Sennen, & Supardi (2021) upholded this, finding that the STEM approach increases elementary school students' critical thinking. In addition to critical thinking, the STEM approach has been shown to improve creativity (Sitorus, Pasaribu, & Hutajulu, 2020) and mathematical creative thinking skills (Syarifah Ayu Angela & Wardani Rahayu, 2025). Ozturk (2021) found that integrating STEM into English lessons increases students' interest, knowledge, and enjoyment. Finally, Sari, Nurdianti, & Maulana (2022) concluded that the STEM approach has a significant impact on student learning outcomes, outperforming collaborative learning alone.

The studies mentioned above have mostly explored the integration of STEM concepts into teaching practices related to science and mathematics learning, and most of them are related to secondary or higher education, not primary education. By exploring primary school teachers' perceptions of the integration of STEM concepts into English language teaching, the present study is expected to provide a novel contribution to the field of education, the results of which can be very helpful in developing more collaborative and skill-oriented English lessons, especially in primary schools.

This study could contribute to at least three main areas. First, academically, this study deepens the understanding of teachers' perspectives, adds insight into STEM integration in English language teaching, and lays the foundation for further research on effective STEM-based learning methods. Second, for teachers, this study offers an innovative approach to integrating STEM into language learning that improves the quality of teaching. Third, for students, those who receive STEM-based instruction will be better prepared for critical thinking and active and more engaging learning.

Based on the explanation above, the objectives of the current study are to identify the perspectives of five teachers from Dadapan 3 Elementary School on STEM integration into English language teaching and analyzes their readiness to implement this approach. Practically, this study's discoveries will suggest direct guidelines for

elementary school curriculum developers and teachers on how to effectively integrate STEM into English language lessons, leading to more appealing and impactful learning experiences. It will underline specific areas where teachers need support, materials, and training, enabling schools to provide interests more strategically. Scientifically, this study contributes to the growth body of knowledge on interdisciplinary teaching approaches, particularly at the primary level and within the context of language acquisition. It presents empirical proof supporting the advantages of STEM-integrated ELT, providing as a foundational reference for upcoming studies exploring pedagogical innovations and their effects on student learning results and teacher professional growth.

METHODOLOGY

The research method used in this study is qualitative descriptive. Qualitative research, including descriptive research, emphasizes data depth rather than breadth. This means the focus is on a deep understanding of a phenomenon, rather than generalizing from numbers or statistics (Kriyantono, 2020). This research was held at SD Negeri 3 Dadapan, Wajak District, Malang Regency. The school has 6 classroom teachers, an Islamic religion teacher, a physical education teacher, and a principal. English lesson was given as local content with 2 hours per week. It was taught by the classroom teachers who became the subjects of the present study. Their profiles are as presented in table 1.

Table 1. Profile of the research subjects

No	Research Subject	Teacher Of	Work Period
1	IN (1a)	Grade 2	10 years
2	HW (1b)	Grade 3	20 years
3	SN (1c)	Grade 6	6 years
4	NF (1d)	Grade 5	4 years
5	RP (1e)	Grade 1	5 years

Source: Data of Dadapan 3 Public Elementary School in 2024

The instruments used in this study are a questionnaire, an interview, and an observation. The questionnaire is to ask various questions to obtain information from the subjects. Suharsimi Arikunto (2019) defines it as a series of written questions given to respondents to obtain information about them. In addition, Sujarweni (2020) shares a similar opinion, stating that a questionnaire is a data collection instrument that involves providing respondents with a series of written questions or statements.

Furthermore, it's important to understand that the quality of the data generated is highly dependent on the instrument itself. As Nuryani (2021) points out, the validity and reliability of a questionnaire are crucial factors in determining the accuracy of the data obtained.

In this study, the researcher used a Likert scale to assess the agreement or disagreement of research participants with certain statements. Taherdoost (2021), in his work on questionnaire design, reinforces the scale's primary function, stating that the Likert scale is the most common instrument for measuring attitudes or behaviors in social science and market research, providing an effective way to quantify subjective feelings and facilitate statistical analysis. Furthermore, it is defined by Vagias (2022) in Likert Scale & Survey Design: Understanding the Nuances of Survey Design, as a psychometric response scale used to obtain individual opinions or attitudes by asking participants to indicate their level of agreement or disagreement to a series of statements, typically using an odd number of response categories (e.g., 5 or 7 points) to ensure a neutral midpoint. In this case, the researcher asks participants about the integration of STEM in English language teaching related to their understanding and readiness to implement it. The four options

displayed are (a) Strongly Agree, (b) Agree, (c) Disagree, and (d) Strongly Disagree. To facilitate finding patterns and trends, the questionnaire data is displayed in a table that summarizes the frequency of responses for each item, table 1 shows teachers' opinions on the value and benefits of integrating STEM into English language teaching, while table 2 looks at teachers' preparedness to implement a STEM approach, which suggests information about their resources, dependence, and preparedness to frame a STEM-integrated curriculum.

Then, to explore data verbally and in-depth to obtain valid and detailed data gained from questionnaires, the researcher used an interview with open-ended questions. Unlike static questionnaires, interviews allow for direct interaction between researchers and participants. John W. Creswell and J. David Creswell (2024), in the latest edition of their book, Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, emphasize that interviews are a key way for researchers to describe participants' experiences, perspectives, or characteristics in depth. They emphasize the importance of interviews as a tool for obtaining rich, contextual, and personal data that is often difficult to obtain through questionnaires. Demirci (2024) and Bayuo et al. (2024) note that there is a growing emphasis on more complex interview formats, such as dyadic/triadic interviews (involving two or three participants simultaneously). This devotion to capturing in-depth perceptions requires carefully formulated, open-ended questions that inspect resources and needs, such as " Do you have any sufficient access to tools and resources to support STEM-based learning? If not, what do you need? " . These questions were asked to determine the readiness of teachers in using the STEM approach in English teaching in the classroom.

Then, the data collected from the interview were analyzed by using thematic coding, to make certain that key patterns and trends were recognized to come up with to wide - ranging discussions specifically about the role of STEM in level of elementary education. This approach arrange in line directly with modern qualitative research applications, where thematic analysis is recognized as a essential and flexible method for interpreting narrative data. Braun and Clarke (2022), in their work focusing on the evolution of thematic analysis, declare that this method is very essential for systematically identifying, organizing, and reporting design of meaning (themes) within a data set. Moreover, in qualitative analysis, Creswell and Creswell (2024) highlight that researchers captivate in the coding recurrent process to aggregate text portions into a small number of themes, thereby building a compound image of the experience under study.

Afterwards, it will be the observation stage. Observation allows the researcher to record phenomena that cannot be expressed verbally and dig deeper, especially regarding things that may not be covered in questionnaire questions, as well as to capture additional details that may be overlooked or not mentioned in the interview. This step is crucial for achieving methodological completeness. Flick (2022) highlights that observation is crucial for studying the "doing" of social life, authorizing researchers to range over the "unsaid and the unwritten" and check for divergence between what participants say and what they actually do. Furthermore, Saldaña (2021), in The Coding Manual for Qualitative Researchers, highlights the practical purpose of observation by stating that researchers should use field notes not just to document behavior, but to capture the "gestalt"—the overall context and atmosphere of the setting—

which is necessary for thick description and for properly contextualizing the verbal data gathered from interviews.

In the present research, the researcher observes how teachers adapted teaching materials to include STEM elements through lesson plans, how they did teaching practices involving STEM integration into English language teaching, as well as how teachers and students interacted with this learning method in the classroom. Then, to ensure whether research was credible and the findings and interpretations were accurate, the researcher used triangulation, that is, a process of corroborating evidence from different individuals, types of data, or methods of data collection (Creswell, 2012).

Therewith, Morse and Cheek (2020), in a discussion on qualitative awkwardness, define triangulation as a means to obtain convergence and wholeness. They proclaim that when findings from different data sources (e.g., interview transcripts and observation notes) intersect, the confidence in the finding is soared; when they show divergence, triangulation assists the researcher fully explore the complexity and variation of the phenomenon. Furthermore, Noble and Smith (2022), writing on the criteria for rigor in qualitative research, highlight that effective triangulation—particularly data triangulation (using data from interviews, observations, and documents)—significantly increases the trustworthiness of the study by confirming that the emerging themes are not artifacts of a single method or data source.

After the data are collected, to analyse them, the scallng down stage involves selecting and sifting the information that is most relevant to the research questions. According to Miles, Huberman, and Saldaña (2020), in the updated edition of Qualitative Data Analysis: A Methods Sourcebook, data reduction is not just about abandoning data; it is an analytical process that involves selecting, focusing, simplifying, abstracting, and transforming the data that appear in field notes or transcripts. This step is essential because it sharpens, sorts, focuses, discards, and organizes the material in a way that allows the researcher to draw final conclusions. The questionnaire data were grouped according to themes. Interview results were transcribed and coded to find coming up patterns or themes. In the meantime, inspection notes were analyzed to see the fit between theory and practice in the application of STEM in English teaching.

The following stage will be data presentation. To facilitate further analysis, the refined data is presented in the study results in various formats, such as diagrams, tables, graphs, or thematic summaries. According to Miles, Huberman, and Saldaña (2020), in Qualitative Data Analysis: A Methods Sourcebook, data presentation is the second major component of analysis, defining it as "an organized, compressed assembly of information that permits conclusion drawing and action". To explore the relationship between teachers' perspectives and their classroom practices, key themes emerging from questionnaires, interviews, and observations were carefully compared. Additionally, relevant quotes from interviews were included as supporting evidence to illustrate teachers' real experiences in integrating STEM into English language instruction.

The last stage is conclusion drawing and verification. After the data were presented, the researcher concluded how teachers understand, adapt, and apply the STEM approach in English language teaching.

According to Miles, Huberman, and Saldaña (2020), in Qualitative Data Analysis: A Methods Sourcebook, conclusion drawing is the final analytical step, which involves the researcher stepping back to judge what the displayed data mean and to assess their implications for the research questions. To ensure data consistency obtained from the three techniques above, the researcher conducted data triangulation, which is the combination of various data collection techniques and data sources based on Sugiyono (2020:125). This view is echoed by Noble and Smith (2022), who emphasize that effective data triangulation significantly increases the trustworthiness of the study by confirming that the emerging themes are not artifacts of a single method or data source.

Furthermore, according to Flick (2022), in An Introduction to Qualitative Research, triangulation moves beyond mere consistency; it is a critical strategy for enhancing credibility by providing "multiple angles of vision" on the same phenomenon, thereby enabling a richer, more comprehensive, and less biased interpretation. Then, the results of this study are compared to the previous theories and research to see the contribution to existing literature.

RESULT AND DISCUSSION

1). RESULT

From the results of data analysis, in accordance with the research's focus and objectives, two main themes related to thematic learning were identified: teachers' perspectives on STEM Integration and teachers' readiness in adopting the STEM approach. The results of research subject replies, teachers' answering questionnaires which employ a Likert scale, are shown in the following tables:

Table 2. Teachers' Perspectives on STEM Integration

Statement	Totally agree	Agree	Disagree	Totally disagree
1a	1	5	-	-
1b	2	3	-	-
1c	1	5	-	-

1a. Understanding of STEM concepts and their relation to English language learning in elementary school.
1b Believing that STEM integration can help students better understand English.
1c Believing that STEM approaches are relevant to English language learning.

Table 3. Teacher readiness in implementing the STEM approach

Statement	Totally agree	Agree	Disagree	Totally disagree
2a	1	3	1	-
2b	1	1	3	-
2c	-	3	2	-
2d	4	1	-	-

2a. Feeling confident in using STEM approaches to teach English.
2b. Having previous experience or training in STEM integration in English language teaching.
2c. Having adequate access to tools/ resources to support STEM-based learning.
2d. Being prepared to develop curriculum or teaching materials that integrate STEM with English language learning.

The analysis of the teacher questionnaire above shows the understanding as well as their implementation readiness of the STEM approach. In line with this, the interview conducted afterwards further strengthened this perspective, highlighting the extent of teachers' understanding and their readiness to integrate STEM into English language learning. For validation and deepening, the interview revealed richer narratives and contexts where

the integration of questionnaire and interview data provided a comprehensive and verified picture of both. The following are the excerpts from the interview with 5 teachers as respondents.

Question topic 1: "How do you understand the concept of STEM? Do you feel that this concept is relevant to English learning in elementary school?", and what makes you believe that the STEM approach can help students understand English material better?

Teacher 1 (RP) understands STEM as an approach that connects science, technology, engineering, and mathematics into learning, and she feels that this concept is very relevant to English learning because children can learn language through exploring real objects around them. She also believes that through direct experience, children will learn better, for example when they touch objects and describe them in English, they can remember vocabulary and meaning more easily than just memorizing words delivered by teachers or from books. In line with that, teacher 2 (IN) believes that STEM as a learning approach that integrates multiple disciplines such as science, technology, engineering, and mathematics in the learning process, and believes in its relevance in English learning because students can learn, not just theory, but through experiments and direct practice. She also believes that by using STEM, students will memorize vocabulary and understand its use in real contexts. Such as, when learning about the weather, they can observe weather changes directly and describe them in English.

On the other hand, teacher 3 (PR) looks at STEM as an approach that triggers students to be more active and creative in creatively thinking and solving problems. In the context of English, this is an effective way to introduce new vocabulary in a more interesting way. According to her, students not only hear or read new words, but also see and experience the concepts they learn directly, which strengthens their memory. Meanwhile, teacher 4 (NF) has the same interpretation as the prior opinions that sees STEM to be very useful in learning English, where students actively apply it in various situations involving science and technology. She also believes that because STEM allows students to directly apply what they learn, when they build or observe something, they can describe the process in English, so they better understand and remember new vocabulary.

Meanwhile, Teacher 5 (SN) understands STEM as an approach that combines science, technology, engineering, and mathematics, which is very relevant because it helps students understand real-world contexts through interdisciplinary projects and offers a practical and contextual approach that helps natural language acquisition. She also believes that STEM offers a practical and contextual approach. For example, students should read instructions in English when creating simple technology projects, then discuss them and write reports. This will help them naturally master the language.

The answers for question topic 2: "How confident are you in using a STEM approach to teaching English?" are shown in Figure 1.

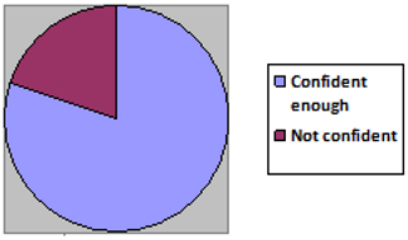

Figure 1. Teachers' confidence in STEM implementation

It shows that 4 teachers feel confident, while 1 teacher does not.

The answers for question topic 3: "Do you have any previous experience or training in STEM integration in English teaching? If so, how has that experience helped you?" are presented in Figure 2.

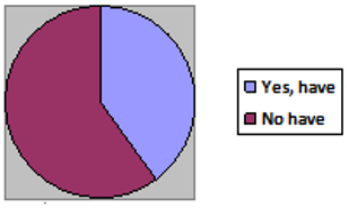

Figure 2. Teachers' experience in STEM

It shows that 3 teachers have any previous experience of that, while others did not.
The answers for the next question: "Do you have any adequate access to tools and resources to support STEM-based learning? If not, what do you need?" are given in Figure 3.

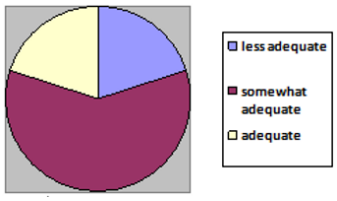

Figure 3. Access to support STEM

It shows that most teachers do not have prepared are you to develop curriculum or teaching materials that integrate STEM" is shown in Figure 4.

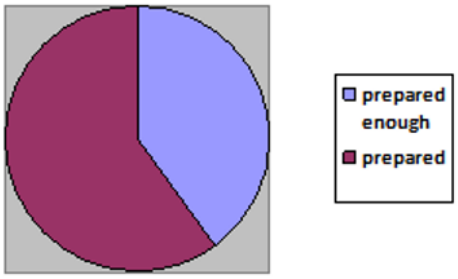

Figure 4. Preparedness to develop material

It shows that 3 teachers are well prepared in adopting STEM.
After the data results are shown, they will be grouped according to themes. Interview results will be transcribed and coded to find emerging patterns or themes, as shown in the following table.

Table 4: Interview Transcript and Thematic Coding (Summarized)

Questions	Transcript Responses	hematic Codes
1. Researcher: How is your understanding of STEM concepts? Do you feel this concept is relevant to learning English in elementary school?	* Connecting Science, Technology, Engineering and mathematics in learning. * Learn language through exploration of real objects. * Learn languages through experimentation and hands-on practice. * Students are active and creative in finding solutions. * Introduce new vocabulary interestingly. * Understand real-world contexts through interdisciplinary projects	STEM concept & relevance
2. Researcher: What makes you believe that STEM approaches can help students understand English materials better?	Learn better with hands-on experience. * * Understand the use of vocabulary in real contexts. * Describe the process when building or observing. * Practical and contextual approach. * Mastering the language naturally through technology projects.	Impact & effectiveness of STEM
3.Researchers: do you any have adequate access to tools and resources to support STEM-based learning? If not, what do you need?	* Have some tools, but it is better if there are more teaching materials and experimental tools. * Access to some basic tools, but need additional resources for complex experiments. * Requires interactive technology devices or structured teaching materials. * Access is quite sufficient, but requires more props and materials for experiments. * Requires digital resources such as videos and interactive learning apps.	Implementation and needs of teachers

2). DISCUSSION

STEM concept & relevance

This study focuses on revealing teachers' perceptions about STEM integration into English language teaching and analyzing their readiness in implementing the STEM approach in elementary education. Based on the questionnaire result and findings from the phenomenological interview, the analysis revealed three main themes: teachers' perceptions of the concept and relevance of STEM, their beliefs about the effectiveness and impact of STEM in English language teaching, and teachers' implementation & needs regarding the applying of this approach.

The following discussion will interpret the interview findings within the framework of the codes. STEM concept & this show how the teachers try to understand the implementation of STEM in education and how it relates to English language teaching. Based on them, STEM is an educational

approach that attaches science, technology, engineering, and mathematics. The teachers highlighted that students can be provided to solve problems, think creatively, and apply information in practical settings by using it. Based on the questionnaires and interview outcomes, the teachers' sights of SD Negeri 3 Dadapan are quite optimistic about STEM integration into English language learning. This positive view is strongly supported by Table 2 (Teacher Perspectives), where all respondents stated 'Agree' or 'Strongly Agree' regarding the relevance and understanding of STEM concepts (Statements 1a, 1b, and 1c). Furthermore, the interview results confirmed teachers' understanding that STEM is an effective approach and a successful way to help students understand language and make it more relevant through practical projects and studies.

Impact and effectiveness of STEM

Teachers' perceptions of how STEM assists students in grasping English-language materials are included in this study. Based on teachers' views, STEM can increase language acquisition through practical experiences, which will increase vocabulary retention and foster a deeper understandings. STEM, they also think, makes learning more interesting and relevant by showing children how language is used in real-world situations, offers a purposeful environment for language acquisition, and allows students to pick up language through real activities, learning, projects, experiments, and investigations, as well as helps students understand abstract ideas, improve communication skills, and teach language.

This belief in efficacy is reinforced by qualitative data (interview results) indicating that teachers believe hands-on experiences through STEM it is effective to improve vocabulary retention and contextual understanding, as well as students' speech and grammar. For example, Teacher 5 explicitly stated that simple technology projects help students "naturally acquire the language" because they have to read instructions and write reports in English.

Implementation and needs of teachers

This reveals how most teachers feel more prepared to implement a STEM approach and what kind of help they would require to put it into practice. Their confidence levels in utilizing STEM varied. Based on interviews, this perceived readiness is reflected in the data in Figure 1, where 4 out of 5 teachers feel confident in using the STEM approach, and 3 teachers stated that they are ready to develop a curriculum or teaching materials that integrate STEM, as shown in Figure 4.Due to their excellent experiences with STEM, while some teachers felt secure, others needed further assistance and training.They still need significant support for increased collaboration, better access to resources and teaching materials, and ongoing professional training, as evidenced by Table 3 (Statement 2c), where 3 out of 5 teachers explicitly stated 'Disagree' that they have adequate access to tools/resources. This point is reinforced by Figure 3, which shows that the majority of teachers (3/5) do not have adequate access, and is made clear in interviews detailing the need for experimental equipment and interactive digital resources.

Theoretical Implication

This study is very much in line with the existing theory of constructivist learning, which states that students actively construct their own knowledge. This idea, supported by Jean Piaget (who emphasized direct interaction) and John Dewey (who advocated "learning by doing" through real-life experiences), is still very relevant today. Primarni et al. (2024) and Subarjo et al. (2023), in their recent studies, further

emphasize that constructivist strategies enhance critical thinking, problem solving, engagement, and knowledge retention. Thus, the finding that teachers view STEM as providing a "purposeful environment for language acquisition" through "real activities, projects, experiments, and investigations" directly supports this view and notion.

CONCLUSSION

Based on the results of this study, the majority of teachers at SD Negeri 3 Dadapan generally have a strong understanding and positive opinions about English language teaching that integrates STEM methods in it. They consider it an effective strategy for making language learning relevant through real-world projects and research. While most teachers feel ready to use this strategy, others see the need for improved teamwork, easier access to resources and teaching materials, and ongoing professional development. The idea that language acquisition is a meaningful process in which students actively construct linguistic information through authentic and collaborative experiences, rather than simply memorizing, is supported by these findings, which align directly with constructivist learning theory.

Meanwhile, to address this issue, policymakers must act appropriately and strategically to ensure successful STEM integration, particularly at the elementary school level. Possible efforts include providing sufficient funding for necessary STEM-based equipment and resources, ensuring educators receive ongoing, hands-on support and training to boost their confidence, and encouraging the development of cooperative learning communities to exchange best practices.

REFERENCES

Aleksieva, E., Cedere, D., & Birzina, R. (2021). *Research on preschool teachers' readiness for STEM education implementation.*

Arina Fauziyah & Rica Wijayanti. (2024). *E-modules and problem-solving skills.*

Bal, M., & Bedir, H. (2021). *Teachers' views on STEM education: A qualitative study.*

Bayuo, R. K., Aziato, L., & Wong, A. S. L. (2024). *Complex interview formats.*

Birzina, R., Cedere, D., & Aleksieva, E. (2021). *The importance of practical cases, real-world examples, and projects to increase students' interest in science and develop problem-solving skills.*

Borreguero, C., Gonzlez-Geraldo, J. L., & Garca-Martnez, J. A. (2022). *Pre-service elementary teachers' emotions and self-efficacy towards STEM learning and teaching.*

Braun, V., & Clarke, V. (2022). *[Title about thematic analysis*

Bybee, R. W. (2010). *Advancing STEM Education: A 2020 Vision. Science Education, 94*(1), 1–13.

Cedere, D., Aleksieva, E., & Birzina, R. (2022). *Preschool pre-service teachers' awareness of different STEM teaching methods and the importance of cognitive engagement.*

Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Pearson Education.

Creswell, J. W., & Creswell, J. D. (2024). *Research design: Qualitative, quantitative, and mixed methods approaches.*

Davidi, M. S., Sennen, L., & Supardi, Z. (2021). *[Title about critical thinking]*

Demirci, A. (2024). *[Title about dyadic/triadic interviews]*

Flick, U. (2022). *An introduction to qualitative research.*

Izzatullina Liyana Khalid, Mohd Nordin Sarif Abdullah, & Hanani Mohd Fadzil. (2024). *Digital learning impact]*

Kriyantono, R. (2020). *Qualitative research*

Miles, M. B., Huberman, A. M., & Saldaña, J. (2020). *Qualitative data analysis: A methods sourcebook.*

Morse, J. M., & Cheek, J. (2020). *Triangulation: convergence and completeness*

Naufal, T. S., & Asdar. (2022). *Tangible STEAM products.*

Noble, H., & Smith, J. (2022). *Criteria for rigor/trustworthiness.*

Nuryani. (2021). *The validity and reliability of questionnaire.*

Ozturk, G. (2021). *STEM integration in English lessons.*

Primarni, A., Subarjo, A., & Sari, N. (2024). *The effectiveness of constructivist learning in improving critical thinking skills.*

Saldaña, J. (2021). *The coding manual for qualitative researchers.*

Saputri, E., & Herman. (2022). *STEM approach in mathematics.*

Sari, N., Nurdianti, R., & Maulana, R. (2022). *STEM approach impact on student learning outcomes.*

Sitorus, S., Pasaribu, A., & Hutajulu, M. (2020). *STEM-PjBL.*

Simplyeducate.me. (2023). *Qualitative descriptive method.*

Subarjo, A., Primarni, A., & Sari, N. (2023). *Constructivist strategies enhance critical thinking, problem solving, engagement, and knowledge retention.*

Su, Y. (2024). *The effectiveness of STEM learning environments and assessment instruments.*

Sugiyono. (2020). *Data triangulation.*

Suharsimi Arikunto. (2019). Q*uestionnaire definition.*

Sujarweni. (2020). *Questionnaire definition*

Sultana, N., Islam, M. R., & Rahman, M. M. (2021). *Challenges in teaching English to ESL students in a STEM context.*

Susanto, A., Miyono, N., & Affini, L. N. (2020). *STEM opportunities and challenges in Central Java.*

Syarifah Ayu Angela & Wardani Rahayu. (2025). *Mathematical creative thinking skill.*

Taherdoost. (2021). *Likert scale primary function.*

Vagias, W. M. (2022). *Likert Scale & Survey Design: Understanding the Nuances of Survey Design.*

Vosniadou, S., & Skopeliti, I. (2023). *Inquiry-based learning and conceptual change in science education. Science Education, 107*(2), 245–263.

Yuana, R. B., Fitriyati, W. T., & Suwandi, R. (2022). *Positive perception of STEM integration.*