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The Analysis of S.T.E.M Education Lesson Plan in Curriculum 2013

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Abstract

The integration of STEM (Science, Technology, Engineering, and Mathematics) Education is essential to develop students' abilities, such as creativity, critical thinking, collaboration, and communication. Teachers should create a lesson plan that integrates STEM education to implement STEM Education into the learning process. The purpose of this research is to analyze the lesson plans from preservice teachers in science education programs and establish a standardized lesson plan that integrates STEM Education. The method used descriptive analysis that describes the characteristics of STEM Education lesson plans using a rubric, adapted from another journal. The rubric has 20 indicators to analyze the lesson plans, with four levels - no evidence of, inadequate, needs improvement, and adequate. Most of the lesson plans met the standard but still require improvement and development. For the identity section, 50% of the lesson plans needed improvement. For the learning process, more than 50% of the lesson plans required improvement, but they were adequate for scientific activities. For the assessment and resources section, there was an equal distribution of lesson plans that needed improvement and adequate level. However, up to 70% of the lesson plans were on an adequate level for using a different media in the learning process.

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INTRODUCTION

21st-century learning is essential for the current generation Z. Learning should revolve around the students with a strong emphasis on technology integration. Moreover, students must acquire 21st-century skills, commonly called the 4Cs: critical thinking, creativity, collaboration, and communication. Recent PISA results in 2022 have revealed a significant decline in the performance of mathematics, reading, and science compared to 2018 (OECD, 2023). Therefore, learning that can increase those skills is needed. Then, it can be developed as an integrated STEM education learning process.

STEM education integrates four disciplines: science, technology, engineering, and mathematics (Rahmaniar, 2020). Multidisciplinary integration enhances students' critical thinking skills, which is evident in problem-solving, decision-making, assumption analysis, and research evaluation (Davidi et al., 2021). In research, STEM-based learning has been shown to significantly improve students' creative thinking abilities (Karmila & Putra, 2022). STEM education can enhance collaborative skills through discussions and problem-solving (Nurwidodo et al., 2022). In other words, integrating STEM education into science learning inclines students' abilities that are necessary for them. In addition, it also can develop attitude, cognitive, and skills to create logical thinking in each discipline (Sartika, 2019)

To ensure effective learning, it is essential to have pre-planned designs. The 2013 Curriculum lays down a detailed learning design, known as RPP (Lesson Plan). This design encompasses several aspects, including the school's identity, subjects to be taught, teaching methods to be used, learning models, approaches, learning media, learning steps, and assessment (Susanto, 2019). The RPP design is crucial in providing a structured and organized approach to teaching and learning. It helps teachers plan their lessons effectively and prepares them to deliver content in a way that ensures maximum student engagement and understanding. The design also supports the use of varied teaching methods and learning models, which cater to the diverse learning needs of students. By incorporating these elements into the design, the RPP ensures that the learning process is comprehensive, sustainable, and effective. It is crucial that the RPP is in line with the applied curriculum and addresses the needs of students. STEM-based learning is essential to meet the needs of 21st-century students. Therefore, the RPP should integrate STEM education. A study was conducted at a community service to assist science teachers in developing the RPP for PBL-STEM. The findings revealed that the teachers were competent and equipped to create STEM-based science lessons (Parno et al., 2023).

The Science Education department of FPIK UNIGA recently organized a training and workshop program for science teachers in Garut. The program aimed to teach the participants how to integrate STEM Education into science learning by creating a lesson plan that incorporates STEM education and the Engineering Design Process. The participants were highly enthusiastic and eager to learn more about the STEM education program, requesting additional training programs (Latip et al., 2023).

Mulawarman University has performed community service to encourage elementary teachers to integrate STEM education into their lesson plans. Although most of the participants were able to create a lesson plan after the activities, they still faced difficulties in using technology, appropriate assessment, and developing scenarios of learning that are suitable for the learning process (Isnaini et al., 2021).

Lesson plans are demanded to implement STEM Education in the learning process. However, it needs a rubric or standardized lesson plans to ensure consistency. For this reason, this research focused on analyzing six types of STEM Education lesson plans in science learning for junior high school students. The study aims to create a standardized lesson plan integrating STEM Education.

RESEARCH METHOD

The research used descriptive analysis to examine the criteria for designing STEM-integrated learning based on the standards specified in Circular No. 14 of 2019 (Indonesia, 2019). However, the focus of the research is on the lesson plans (RPP) developed by students, which are collected in groups. The research methodology involves several stages of science learning for junior high school. Then, the study aims to establish a standard lesson plan incorporating STEM Education (Loeb et al., 2017).

Identify a phenomenon: During the initial phase, the researcher conducts field observations and a literature review to gather information about the challenges encountered in developing STEM-integrated science lesson plans. The 2013 Curriculum for junior high school serves as a reference point, with modifications in lesson plan creation as per Circular No. 14 of 2019, which comprises Learning Objectives, Learning Activities, and Assessment. Upon analysis of the gathered data, it is observed that the existing lesson plans do not incorporate STEM Education.

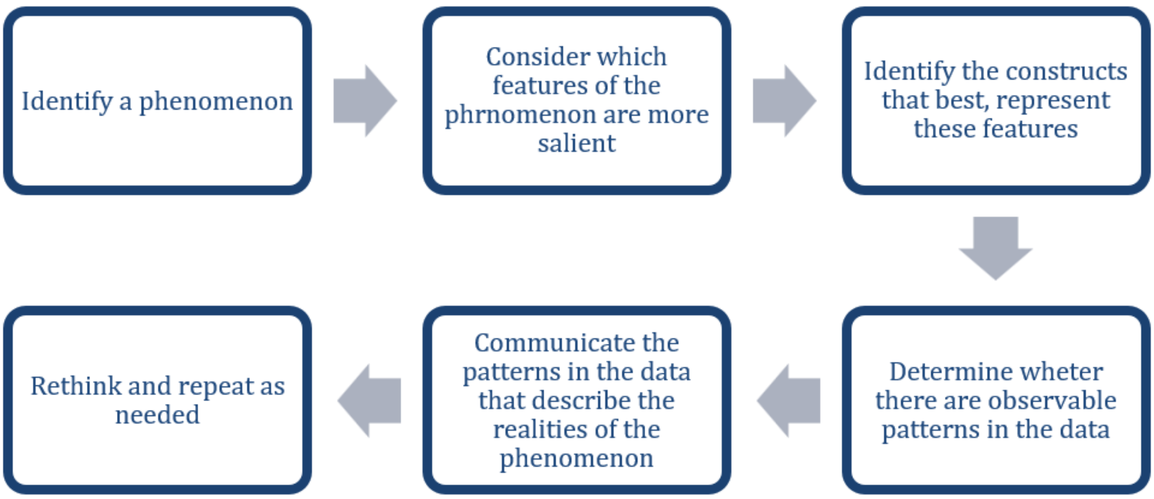

Figure 1. The research process

Consider which features of the phenomenon are most salient: To effectively integrate STEM Education into the learning process, it is recommended to offer an applied STEM Education course that spans one semester. During this course, students will learn how to design science lessons for junior high school that incorporate STEM concepts. Following eight sessions of instruction, students will have the opportunity to simulate teaching in a classroom setting.

Identify the constructs that best represent these features: During the third stage, student-created lesson plans are collected for analysis and categorized into six groups: Science and Technology (ST), Science and Engineering (SE), Science and Mathematics (SM), Science, Technology, and Engineering (STE), Science, Technology and Mathematics (STM), and Science, Technology, Engineering, and Mathematics (STEM). A rubric has been developed to assess the lesson plans, which consist of twenty standardized criteria.

Determine whether there are observable patterns in the data: In the fourth stage of the analysis process, the collected data was subjected to thorough scrutiny to identify any discernible patterns or trends that may have emerged from the data. To achieve this, a rigorous approach was employed that involved using rubrics to conduct a comprehensive assessment of each lesson plan. The rubrics were designed to evaluate the quality of the lesson plans based on specific criteria, and a Likert Scale was used to classify each plan into one of four categories. The categories used in the rubrics were no evidence, inadequate, in need of improvement, or adequate, which allowed for a nuanced and detailed evaluation of each lesson plan. This stage aimed to ensure that the lesson plans were of the highest quality and met the desired standards, which would facilitate effective teaching and learning outcomes.

Communicate the patterns in the data that describe the realities of the phenomenon: After the analysis was completed, the findings were compared with the theoretical principles of STEM Education. The data was interpreted using a rubric consisting of twenty criteria and four scales. It is important to emphasize that further research is required to design an efficient learning methodology incorporating STEM Education, complete with a comprehensive lesson plan.

RESULT AND DISCUSSION

Based on the findings, the lesson plans have been identified using the rubric containing 20 characteristics of a Lesson Plan, adapted (Winaya, 2015). The rubric used to assess lesson plans comprises four levels for each characteristic. These levels include no evidence, inadequate, needs improvement, and adequate. The rubric was developed based on the STEM Education learning process, which is designed to facilitate effective teaching and learning through Science, Engineering, Technology, and Mathematics. By using this rubric, educators can evaluate their lesson plans and identify areas that may require more attention or improvement to support their students' learning outcomes.

Table 1. The Rubric of STEM Education Integrated Lesson Plan
(Identity Section)

No.	Characteristics	Type of Lesson Plan						
		ST	**SE**	**SM**	**STE**	**STM**	**STEM**	**STEM**
1.	Contains identification in the lesson plan, such as the school's name, subject, theme/subtheme, semester, and time allocation.	3	3	3	4	4	3	4
2.	Contains Core Competencies (KI-1, KI-2, KI-3, KI-4) that align with the syllabus.	3	2	3	2	2	1	2
3.	Contains Fundamental Competencies according to the syllabus.	3	3	4	3	4	3	4
4.	Contains a STEM Education analysis consisting of Science, Technology, Engineering, and Mathematics depending on the selected aspects.	3	3	4	4	4	3	4
5	Alignment of the desired indicators with Fundamental Competencies.	3	4	3	4	3	3	3
6.	Indicators use operational verbs and align with the achieved competencies.	4	3	3	3	3	3	3
7.	Includes a suitable learning model for the teaching material.	4	4	3	4	4	4	4
8.	Contains an appropiate teaching approach for the teaching material.	1	2	2	4	4	4	1

No.	Characteristics	Type of Lesson Plan						
		ST	SE	SM	STE	STM	STEM	STEM
9.	Contains an appropiate teaching method for the teaching material.	4	3	3	4	3	4	4
10.	Includes time allocation (number of sessions and hours) following the syllabus.	4	4	4	3	3	4	3

In the lesson plan, there is an identity section that outlines ten distinct characteristics. These characteristics include the overall identity of the lesson plan, the core competencies, and fundamental competencies, playing as the learning goal. Additionally, the identity section includes indicators that can be used to measure the success of the lesson plan, as well as an analysis of how the lesson plan relates to STEM education. The section also outlines the learning method, approach, and model that will be used to deliver the lesson, as well as the time allocation for each component of the lesson. Overall, the identity section provides a comprehensive overview of the lesson plan and its key components. The lesson plan should not have the same template ,but it should have the core components (Fauziaturromah et al., 2021).

Most lesson plans have a comprehensive set of criteria that covers all the important aspects of the subject matter. Based on these criteria, the essential competencies are identified and included in the lesson plan. However, in some cases, not all the core competencies are included, resulting in deficiencies in the lesson plan. Nurtanto et al., (2021) assessed that most lesson plans contain comprehensive criteria that cover important aspects of the subject, and that essential competencies are identified and included in the lesson plan based on these criteria. However, it points out that in some cases, all core competencies are not included, which can lead to flaws in the lesson plan. Moreover, identifying essential competencies and including them in lesson plans is an important factor in achieving learning objectives. Essential competencies refer to the knowledge, skills, and attitudes that students must acquire in the course of their studies. It will allow students to develop an in-depth understanding of the subject matter and the ability to apply it to real-world situations.

The following standards are determined by the instructional approach employed in the lesson plan, such as Science and Technology, Science and Engineering, Science and Mathematics, Science, Technology, and Engineering, Science, Technology, and Mathematics, and Science, Technology, Engineering, and Mathematics. Each lesson plan scrutinizes the subject it employs. Based on the evaluation of STEM topics, 71% of the lesson plans require improvement, as indicated by the foundational competencies, and 86% utilized operational verbs to attain these competencies at the needs improvement level. Suwarma & Kumano, (2019) did a workshop for science teacher to integrate STEM education but they started with two subjects up to four subjects that were collaborated.

Additionally, the following attributes include the learning model, method, approach, and allocation time. Nearly 90% of established types of learning models based on competencies. Furthermore, half of the lesson plans outline the method and approach, with an allocation time of more than fifty percent of the time. The model approach and method follow the subject matter at hand. For instance, the Project-Based Learning model is utilized when teaching Engineering subjects, while Problem-Based Learning and Discovery Learning are utilized without integrating engineering. The PjBL model was used to increase the student's creativity, which has been researched and can be used as an alternative learning strategy (Hanif et al., 2019). According to this study, the PjBL approach is effective in helping students improve their creative thinking skills through the process of solving real-world problems. For example, in engineering classes, students can apply theoretical knowledge to real-world situations, develop problem-solving skills, and develop teamwork and collaboration skills while working on real-world projects.

In Table 2, the learning process spans from the introductory to the closing section. However, over 80 percent of the lesson plans require improvement as they lack detailed explanations of activities and assessments used at the start of learning. Additionally, the EDP elements in the learning process have inadequate implementation and require improvement. The Engineering Design Process (EDP) plays an important role in developing engineering thinking and problem-solving skills. However, if the implementation of these elements in many lesson plans is insufficient, students may struggle to develop engineering thinking. It needs to enhance the EDP elements in improving students' problem-solving skills. There is research about including EDP in STEM learning, they propose to utilize deductive pedagogical and professional development models to support competency development and to integrate engineering into existing standards, especially in less integrated areas, such as mathematics (Carr & Strobel, 2011).

Table 2. The Rubric of STEM Education Integrated Lesson Plan
(Learning process)

No.	Characteristics	Type of Lesson Plan						
		ST	**SE**	**SM**	**STE**	**STM**	**STEM**	**STEM**
1	Clearly outlines introductory activities: a) greeting and prayer, b) perception, c) creating a pleasant learning atmosphere, d) linking previous material to the next, e) stating the competencies to be achieved, f) outlining the material, g) explaining the scope of assessment techniques.	3	2	3	3	3	3	3
2	Depicts Engineering Design Process (EDP) activities in the learning process for SE, STE, and STEM.	1	3	2	3	3	2	2
3	Clearly illustrates the integration of each scientific discipline in learning activities (Mathematics/Technology/Engineering).	3	3	4	4	4	3	3
4	Clearly illustrates core activities depicting scientific activities (observing, questioning, trying, reasoning, and communicating).	4	4	4	4	4	4	4
5	Clearly outlines closing activities depicting a) summarizing/summarizing learning, b) reflecting on the activities carried out, c) providing feedback on the learning process and results, d) planning follow-up actions in the form of remedial, enrichment, e) presenting the material to be studied in the next meeting, f) greetings and prayers to end the lesson.	3	3	2	2	3	2	2

Furthermore, the integration of each subject into the learning process shows that students need improvement and adequacy at a 50/50 ratio. It is worth noting that all lesson plans demonstrate scientific activities at an adequate level. On the other hand, over half of the lesson plans lack detailed explanations of the closing session, including remedial activities.

Table 3. The Rubric of STEM Education Integrated Lesson Plan
(Assessment, Resources, Media)

No.	Characteristics	Type of Lesson Plan						
		ST	**SE**	**SM**	**STE**	**STM**	**STEM**	**STEM**
1	Alignment of the assessment prepared in the lesson plan with the syllabus.	3	3	3	3	4	3	3
2	Includes authentic assessments covering attitudes, knowledge, and skills.	2	3	3	3	4	4	3
3	Each assessment for each Core Competency has a rubric/answer key.	3	4	3	3	4	4	3
4	Includes the compatibility of learning resources with the material in the lesson plan.	3	3	3	4	4	4	3

5	The learning resources and media listed in the lesson plan support the achievement of learning indicators.	4	4	4	4	3	4	3

According to Table 3, the learning process utilizes assessments, sources, and media. The table indicates that over 90% of students require improvement in assessments mentioned in the syllabus. Additionally, more than half of the assessments need improvement to cover all aspects, including attitudes, knowledge, and skills. The students also incorporate portfolio rubrics, such as projects, presentations, and writing tests. Interestingly, 57% of students prepare a lesson plan to improve their rubric-making skills for each assessment. As for resources and media, up to 80% of students use media adequately, while there is room for improvement in resources. Media is primarily used as a tool for demonstrating and visualizing science concepts through videos.

From an academic perspective, these statistics provide an urgent insights for analyzing the effectiveness of assessment and learning tools. The need to improve student assessment suggests that the assessment methods in the curriculum do not accurately reflect students' learning outcomes. This highlights the need to rethink the reliability and validity of assessment tools. In particular, students' overall competency development can be hampered when assessments do not encompass attitudes, knowledge, and skills. Therefore, a multidimensional approach to assessment tools is required.

The use of portfolio rubrics provides an opportunity for students to reinforce self-directed learning through various forms of assessment. Whether it's for projects, presentations, or writing tests, using a variety of rubrics promotes students' creativity and critical thinking. However, the fact that only 57% of students prepare lesson plans to improve their rubric writing skills indicates that students lack clear guidelines and training in rubric writing. It suggests that educators need specific teaching strategies to strengthen their ability to write rubrics. The applied rubricsfor assessing students portfolio must be valid and based on the learning outcome (Rahmaniar, 2021).

Finally, the use of media serves as an important tool to facilitate the visual understanding of scientific concepts. However, the fact that there is room for improvement in the material means that students need better support in terms of the quality of the learning material. In particular, media should be used in a way that promotes students' critical thinking and problem-solving skills beyond mere visual tools. This highlights the need for educators to explore ways to maximize the educational impact of media utilization. Hoban et al. (2013) emphasize that media should be used to promote students' critical thinking and problem-solving skills, not just visual tools. One of the studies of learning media is exploring the use of slow motion. And, the result helps students understand concepts and promote creative thinking and problem-solving. Research highlights the need for educators to explore and adopt more innovative teaching methods such as Slowmation (Brown, 2011).

The STEM education plan begins with the formation of a STEM team formed by the principal. And, it is the implementation of STEM education in science learning based on four elements: setting learning goals, writing learning materials, choosing learning strategies, and writing learning assessments (Winangun & Fauziah, 2019). In proportion to the results, most of the lesson plans were standardized and contained all the criteria, even though a few were inadequate (Pendidikan et al., 2016). The integration of Science, Technology, Engineering, and Mathematics (S.T.E.M) subjects into the learning process has been observed in many lesson plans. However, the Engineering Design Process (EDP) stages for the three types of lesson plans that consist of engineering elements do not clearly describe the integration of S.T.E.M subjects. As a result, students require more training to develop a lesson plan that effectively integrates S.T.E.M subjects. Furthermore, an effective S.T.E.M-integrated lesson plan should be developed based on the implemented curriculum, as the standard is based on government regulations. This will ensure that students are well-equipped with the necessary skills and knowledge to succeed in the future.

CONCLUSION

It has been observed that S.T.E.M (Science, Technology, Engineering, and Mathematics) subjects have been introduced into the curriculum of educational institutions. However, it has been noticed that the EDP (Engineering Design Process) stages for lesson plans that involve engineering elements fail to clearly describe the integration of these subjects. As a result, additional training is required for students to develop effective lesson plans that incorporate S.T.E.M subjects meaningfully. It is worth noting that these lesson plans must align with the government regulations and standards set by the curriculum. Aiming to ensure students receive a comprehensive education in these subjects, it needs to create lesson plans that are well-structured and well-thought-out. This way, students can develop a deeper understanding of these subjects and be better equipped to use this knowledge in practical applications.

REFERENCES

Brown, J. (2011). *The Impact of Student Created Slowmation On The Teaching And Learning Of Primary Science*. 1–146. http://ro.ecu.edu.au/cgi/viewcontent.cgi?article=1437&context=theses

Carr, R. L., & Strobel, J. (2011). Integrating Engineering Design Challenges into Secondary STEM Education. *White Papers: Building a Framework for Engineering Design Experiences in STEM*, 14–20.

Davidi, E. I. N., Sennen, E., & Supardi, K. (2021). Integrasi Pendekatan STEM (Science, Technology, Enggeenering and Mathematic) Untuk Peningkatan Keterampilan Berpikir Kritis Siswa Sekolah Dasar. *Scholaria: Jurnal Pendidikan Dan Kebudayaan*, *11*(1), 11–22. https://doi.org/10.24246/j.js.2021.v11.i1.p11-22

Dewi Sartika. (2019). Jurnal Ilmu Sosail dan Pendidikan. *Jurnal Ilmu Sosial Dan Pendidikan*, *3*(3), 89–93.

Edy Susanto, M. (2019). Permendikbud No 22 Tahun 2016. *Journal of Chemical Information and Modeling*, *53*(9), 1689–1699.

Fauziaturromah, Y., Rahman, T., & Mulyana, E. H. (2021). Fauziaturromah, Y., Rahman, T., & Mulyana, E. H. (2021). Pengembangan Rencana Pembelajaran Model Pembelajaran STEM Untuk Kelompok B Sub Tema Benda-Benda Alam. Jurnal PAUD Agapedia, 5(2), 176–183. *Desember*, *5*(2), 176–183.

Hanif, S., Wijaya, A. F. C., & Winarno, N. (2019). Enhancing Students' Creativity through STEM Project-Based Learning. *Journal of Science Learning*, *2*(2), 50. https://doi.org/10.17509/jsl.v2i2.13271

Indonesia, K. P. dan K. R. (2019). *Surat Edaran Nomor 14 tahun 2019 tentang Penyederhanaan Rencana Pelaksanaan Pembelajaran*.

Isnaini, M., Farwati, R., & Metafisika, K. (2021). CATUR STEM: Buku Panduan bagi Guru Kimia untuk Menyusun RPP Berbasis STEM Muhammad. *Orbital: Jurnal Pendidikan Kimia*, *5*(1), 1–12. file:///D:/Sri Mulyanti/riset/artkel orbital.pdf

Karmila, K., & Putra, D. P. (2022). Pengaruh Pembelajaran STEM (Science, Technology, Engineering And Mathematics) Pada Materi Fluida Terhadap Keterampilan Berpikir Kreatif Peserta Didik. *Jurnal Literasi Digital*, *2*(1), 11–20. https://doi.org/10.54065/jld.2.1.2022.115

Latip, A., Abdurrahman, D., Rahmaniar, A., Purnamasari, S., Lestari, W. Y., Nurfadilah, V. A., & Fauziah, S. R. (2023). Training on the Development of Science Learning Tools with STEM Approach for Science Teachers in Garut Regency [Pelatihan Pengembangan Perangkat Pembelajaran IPA Dengan Pendekatan STEM Untuk Guru IPA di Kabupaten Garut]. *J. Pengabdian Isola*, *2*(1), 1–7. http://ejournal.upi.edu/jpi

Loeb, S., Dynarski, S., McFarland, D., Morris, P., Reardon, S., & Reber, S. (2017). Descriptive analysis in education: A guide for researchers. *U.S. Department of Education, Institute of Education Sciences. National Center for Education Evaluation and Regional Assistance*, *March*, 1–40. https://eric.ed.gov/?id=ED573325

Nurtanto, M., Kholifah, N., Masek, A., Sudira, P., & Samsudin, A. (2021). Crucial problems in arranged the lesson plan of vocational teacher. *International Journal of Evaluation and Research in Education*, *10*(1), 345–354. https://doi.org/10.11591/ijere.v10i1.20604

Nurwidodo, N., Romdaniyah, S. W., Sudarmanto, S., & Husamah, H. (2022). Pembinaan Guru dalam Melaksanakan Pembelajaran STEM dengan Kemampuan Berfikir Kreatif dan Keterampilan Kolaboratif pada Siswa SMP Coaching Teachers in Implementing STEM Learning with Creative Thinking and Collaborative Skills for Junior High School Studen. *Jurnal Abdimas (Journal of Community Service): Sasambo*, *4*(1), 1–12.

OECD. (2023). *2.4.3 PISA 2022 Results (Volume II): Learning During - and From - Disruption: Vol. II*. https://www.oecd-ilibrary.org/education/pisa-2022-results-volume-ii_a97db61c-en

Parno, P., Edi Supriana, Arif Hidayat, Bakhrul Rizky Kurniawan, Try Nada Fis, & Farah Rafidah6. (2023). Pelatihan Pengembangan Rpp Untuk Pjbl-Stem-Asesmen Formatif Berorientasi Literasi Sains Bagi Guru Ipa Smpn Se-Kota Malang. *J-ABDI: Jurnal Pengabdian Kepada Masyarakat*, *3*(6), 1045–1054. https://doi.org/10.53625/jabdi.v3i6.6756

Pendidikan, M., Kebudayaan, D. A. N., & Indonesia, R. (2016). *Peraturan Menteri Pendidikan Dan Kebudayaan Nomor 22 Tahun 2016 Tentang Standar Proses Pendidikan Dasar Dan Menengah*.

Rahmaniar, A. (2020). *Perceptions of the Indonesia National Curriculum in Relation To Integrated Stem Education At the High School Level*. 1–99.

Rahmaniar, A. (2021). *The Utilization of the Valid Rubric to Improve High School Students' Real-world Problem-solving Skills in STEM Education*. *Icaess 2020*, 379–385. https://doi.org/10.5220/0010357203790385

Suwarma, I. R., & Kumano, Y. (2019). Implementation of STEM education in Indonesia: Teachers' perception of STEM integration into curriculum. *Journal of Physics: Conference Series*, *1280*(5). https://doi.org/10.1088/1742-6596/1280/5/052052

Winangun, M. M., & Fauziah, D. (2019). Designing lesson plan of Science, Technology, Engineering, Mathematics (STEM) education in science learning. *Journal of Physics: Conference Series, 1318*(1). https://doi.org/10.1088/1742-6596/1318/1/012024

Winaya. (2015). *Analisis Rencana Pelaksanaan Pembelajaran Menurut Kurikulum 2013 kelas IV SD No. 4 Banyuasri. MIMBAR PGSD Undiksha, 3(1). https://doi.org/10.23887/jjpgsd.v3i1.5730.*