ISSN 2964-4291
https://proceeding.unnes.ac.id/index.php/iset

An Implementation of STEAM Approach: Junior High School Mathematics and Science Teachers' Perceptions and Obstacles

Isti Hidayah*, Arif Widiyatmoko, Nazzun Sholikha Nurin, Agung Laksono

Universitas Negeri Semarang, Indonesia
*Corresponding Author: isti.hidayah@mail.unnes.ac.id

Abstract. STEAM approach is part of mathematics, science, and other teaching policies to facilitate students' higher-order thinking skills, including Critical Thinking, Collaboration, Communication, and Creativity. This research aims to examine both math and science teachers' perceptions and obstacles in implementing the STEAM approach, formulating teacher's preparation model in applying it. This descriptive research was conducted using survey methods by Google Form. The research subjects were 68 mathematics teachers and 42 science teachers in Semarang City. The results showed that both the perceptions of math and science teachers tend to have a positive attitude to apply the STEAM approach to science/math in the classroom with the highest average score (4.13) and the lowest average score occurs in the knowledge indicator of STEAM learning steps based on the science and math integration project (3.31). Meanwhile, the obstacle with the highest score in applying the STEAM approach for both math and science teachers is still required more knowledge about STEAM. Based on the study of perceptions and obstacles, and the existing preparation models, it is concluded that the modification of the hypothetical model can be done by strengthening the knowledge and skills of STEAM, as well as preparation practices in the Teacher Working Group/MGMP (Musyawarah Guru Mata Pelajaran) forum.

Key words: Perceptions and obstacles; JHS mathematics and science teachers; STEAM

How to Cite: Hidayah, I., Widiyatmoko, A., Nurin, N.S., and Laksono, A. (2022). An Implementation of STEAM Approach: Junior High School Mathematics and Science Teachers' Perceptions and Obstacles. ISET: International Conference on Science, Education and Technology (2022), 92-95.

INTRODUCTION

Higher order thinking skills (HOTS) and 4C (Critical Thinking, Collaboration, Communication, and Creativity) are the targets for achieving 21st century learning outcomes. These skills are part of the characteristics of competence in preparing students to be able to face the challenges of the global community in the era of 4.0 and Society 5.0. Curriculum demands which are one of the policies in education require that each learning facilitate attitudes formation, cognitive understanding, and the development of students' thinking skills. Various innovative learning with various approaches, models, and learning media make facilities for the achievement of student competencies. One approach related it is the STEAM learning approach (Science, Technology, Engineering, Art, Mathematics). Many studies have been conducted on the effectiveness of the STEAM approach implementation with various media-assisted learning models, as well as for the development of various skills and attitudes from kindergarten (pre-school) to college (early age, elementary, junior high, high school, college) (Najamuddin et al, 2022; Sari et al, 2021; Wulandar, 2020; Suryaningsih, S., & Ainun, 2021; Trivena, & Langi', 2021; Atmojo, 2020; Patresia, I., Silitonga, M. & Ginting, A, 2020). In fact, not only variations in education levels, the effectiveness of the STEAM approach is also shown not only in exact and science learning, but also social studies including thematic (kindergarten and elementary school) (Najamuddin et al, 2022; Sari et al, 2021; Fitriyah A & Ramadan, 2021).

However, there are many schools or teachers who have not implemented the STEAM approach in learning, because it is difficult to implement it. Even the results of research by Diana & Turmudi (2021) showed that the majority of the participants in this survey who were teachers lacked sufficient knowledge. about STEM, so that teachers had difficulties in developing STEM-based modules. The results of the study on teacher perceptions of the STEAM approach focused on Mathematics teachers, showed that there were 3 obstacles, the first was the absence of relevant literature. Second, there are teachers who have not received training. The third is the limited amount of mathematical material that can be applied in STEAM learning. In addition, the teacher stated that rather than being the core focus in STEAM instruction, mathematics is better suited as a supplementary material

(Rosikhoh, et al., 2019). Based on the description above, it is important to obtain more complete data on teachers' perceptions and constraints in designing and implementing the STEAM approach. This research aims to examine both math and science teachers' perceptions and obstacles in implementing the STEAM approach, formulating teacher's preparation model in applying it.

METHODS

Data from a sample of the target population is collected for this study using a descriptive method with a cross-sectional survey design model, and various variables are then used to evaluate the data (Creswell, 2012). The respondents of this study were mathematics teachers (68) and science teachers (42) in Semarang City. The survey used can report respondents' understanding of perceptions and obstacles on STEAM. The adopted and adapted STEAM questionnaire administered by Google Form consisting of Likert scale items used as a research tool. The instrument to measure teachers' perceptions and obstacle on STEAM was developed from the STEAM concept grid which serves as a guide in the preparation and implemenattion of STEAM in learning.

RESULTS AND DISCUSSION

Respondents are Junior High School Mathematics and Science Teachers in Semarang City. Based on their education level, out of 68 respondents 84% are bachelor degree (S1) and 16% are master degree (S2) for mathematics teacher. Meanwhile, for science teachers, out of 42 respondents based on their education level, 90% were bachelor degree (S1) and 10% were master degree (S2).

Mathematics and Science Teachers' Perceptions

The indicators of mathematics and science teachers' perception in implementing STEAM approaches are presented in Table 1.

Tabel 1. Variable dan Indicators of Mathematics and Science Teachers' Perception

Variable	Indicator	
STEAM Attitude	SA1	I implement STEAM because it's related to my subject and knowledge
	SA2	In order to teach my students using STEAM activities, I am continually enhancing my teaching techniques
	SA3	I agree STEAM education prepares students' careers and changes their thinking and learning
	SA4	I agree to apply the STEAM approach in teaching science/mathematics in the classroom
STEAM Knowledge	SK1	I know the term of STEAM
	SK2	I know that STEAM learning fits my context and I can teach science effectively and I feel confident in my ability to guide students to have an awareness of sources of evidence as a scientist
	SK3	I know the steps needed to teach science using STEAM learning related to science projects, project-based learning, and integrated science and math
	SK4	I believe in and able to use various approaches or teaching strategies to develop math/science/technology/engineering concepts in STEAM teaching and learning

Based on the study results of mathematics and science teachers' perception in Semarang City on STEAM in preparing and implementing its application in learning, a comparison of perceptions between both of them will be studied. The highest average for mathematics teachers is found in the SA 4 indicator with a score of 4.132. As for science teachers, the highest average is found in the SA 3 indicator. Both indicators are found in the STEAM Attitude variable. This shows that both mathematics and science teachers support the implementation of the STEAM approach in learning because it will have a positive impact, including preparing students' future careers.

On the other hand, the lowest average of both mathematics and science teachers is found in the SK 3 indicator which is included in the STEAM Knowledge variable with an average of 3.471 and 3.310 respectively. This means that on average,

respondents do not really know the steps needed to teach science using STEAM learning related to science projects, project-based learning, and integrated science and mathematics. So it can be concluded that overall respondents agree and support the application of the STEAM approach to learning, but there is a need for implementation preparation that can provide knowledge for teachers related to the steps for its application in learning.

Mathematics and Science Teachers' Obstacles

The indicators of mathematics and science teachers' obstacles in implementing STEAM approaches are presented in Table 2.

Tabel 2. Variable dan Indicators of Mathematics and Science Teachers' Obstacles

Variable	Indicator	
Teachers' Difficulty	TD1	Because of the erroneous information that children have gained from their parents, the media, and other sources, I find it challenging to teach them about technology
	TD2	I don't know STEAM and I don't have teaching experience because I don't understand teaching about STEAM
	TD3	I have never been to STEAM training and STEAM activities but I have read and know about STEAM learning and teaching
	TD4	Sometimes I feel unsure of my ability to guide my students to select useful information to support STEAM learning
	TD5	I want to know more about STEAM that's why I want to learn about STEAM education

The results of the teachers' obstacles showed that the highest average was the same for both Mathematics and Science teachers, that is on the TD5 indicator with a score of 4.132 and 4.119, respectively. This means that respondents want to know more about STEAM which is the reason they want to learn about STEAM education.

Likewise, the lowest average refers to the same indicators for both Mathematics and Science teachers, namely TD 2 with scores of 2.326 and 2.548, respectively. This means that in general, respondents are familiar with the term STEAM. However, if it is related to perception, respondents only know the term STEAM but do not know more about the learning steps.

CONCLUSION

Based on the results of Mathematics and Science teachers' perceptions, respondents agree and support the implementation of the STEAM approach to learning, but there was a need for implementation preparations that could provide knowledge for teachers related to the steps for implementing it in learning. In general, the obstacles from the two groups of respondents indicated that the difficulties for teachers were due to a lack of knowledge about STEAM. So, it is concluded that the modification of the hypothetical model can be done by strengthening the knowledge and skills of STEAM, as well as preparation practices in the Teacher Working Group/MGMP (Musyawarah Guru Mata Pelajaran) forum.

REFERENCES

Atmojo, I. R. W. (2020). Implementasi Pembelajaran Berbasis Science, Technology, Engenering, Art And Mathematich (STEAM) untuk Meningkatkan Kompetensi Paedagogik dan Professional Guru SD Melalui Metode Lesson Study. Jurnal Pendidikan Dasar, 8(2).

Creswell, J. W. (2012). Qualitative enquiry and research design: Choosing among five approaches. 2nd ed. Thousand Oaks, CA: Sage.

Diana, N dan Turmudi, T. 2021. Teachers' Readiness in Developing STEM-based Module to Support Teaching and Learning in the 21st Century . Vol. 11 No. 02 (2021): *Edumatica: Jurnal Pendidikan Matematika*. https://doi.org/10.22437/edumatica.v11i02.11720

Fitriyah A & Ramadan S D. 2021. Pengaruh Pembelajaran STEAM Berbasis PJBL (Project-Based Learning) Terhadap Keterampilan Berpikir Kreatif dan Berpikir Kritis . *Jurnal Inspiratif Pendidikan (JIP).* Volume X, Nomor 1, Januari – Juni 2021 DOI: https://doi.org/10.24252/ip.v10i1.17642

Laila Wulandar. 2020. Penerapan Pendekatan

STEAM Berbasis Projek "Pendopo Joglo" untuk Meningkatkan Keterampilan 4c Kelas VIII. *Jurnal Profesi Kependidikan*. Vol 6, No 2 (2020).

Najamuddin, Fitriani, R. Puspandini, M. 2022. Pengembangan Bahan Ajar Science, Technology, Engineering, Art, and Mathematics (STEM) Berbasis Loose Partuntuk Meningkatkan Kemampuan Pemecahan Masalah Anak Usia Dini–. *Jurnal Basicedu* Vol 6 No 1 (2022). DOI: https://doi.org/10.31004/basicedu.v6i1.2097

Patresia, I., Silitonga, M.& Ginting, A.(2020). Developing biology students' worksheet based on STEAM to empower science process skills.*JPBI (Jurnal Pendidikan Biologi Indonesia)*, 6(1), 147-156. doi: https://doi.org/10.2229/jpbi.v6i1.10225

Rosikhoh, et al. 2019. Experienced teachers' perceptions: Math-focused STEAM Learning. *Abjadia: International Journal of Education*, 4 (2). pp. 118-128. ISSN 24430587

Sari, P. N., Jumadi, & Ekayanti, A. (2021). Penerapan Model Pembelajaran STEAM (Science, Technology, Engineering, Art, and Math) untuk Penguatan Literasi-Numerasi Siswa. *Jurnal Abdimas Indonesia*, 1(2), 89-96. https://doi.org/10.53769/jai.v1i2.90

Suryaningsih, S., & Ainun Nisa, F. . (2021). Kontribusi STEAM Project Based Learning dalam Mengukur Keterampilan Proses Sains dan Berpikir Kreatif Siswa. *Jurnal Pendidikan Indonesia*, 2(6), 1097–1111. https://doi.org/10.36418/japendi.v2i6.198

Trivena, T., & Langi', W. (2021). Persepsi Mahasiswa PGSD UKI Toraja terkait STEAM. *Edumaspul: Jurnal Pendidikan*, 5(2), 381-388. https://doi.org/10.33487/edumaspul.v5i2.2109