

**STUDENTS' CREATIVITY AND COMMUNICATION SKILLS IN
LEARNING ABOUT SOUND AND WAVES BY IMPLEMENTING STEAM
LEARNING APPROACH**

RESEARCH PAPER

Submitted as Requirement to Obtain Degree of *Sarjana Pendidikan* in
International Program on Science Education (IPSE) Study Program



Arranged by:

Kamila Putri Nursyahbani (1704417)

**INTERNATIONAL PROGRAM ON SCIENCE EDUCATION
FACULTY OF MATHEMATICS AND SCIENCE EDUCATION
UNIVERSITAS PENDIDIKAN INDONESIA**

2021

STUDENTS' CREATIVITY AND COMMUNICATION SKILLS IN LEARNING
ABOUT SOUND AND WAVES BY IMPLEMENTING STEAM LEARNING
APPROACH

Arranged by:
Kamila Putri Nursyahbani

Submitted as Requirement to Obtain Degree of *Sarjana Pendidikan* in
International Program on Science Education

© Kamila Putri Nursyahbani
Universitas Pendidikan Indonesia
August 2021

Copyright reserved

This thesis may not be reproduced in whole or in part, reprinted, copied, or any other
means without the permission of the author

APPROVAL SHEET
STUDENTS' CREATIVITY AND COMMUNICATION SKILLS IN LEARNING
ABOUT SOUND AND WAVES BY IMPLEMENTING STEAM LEARNING
APPROACH

By:

Kamila Putri Nursyahbani

1704417

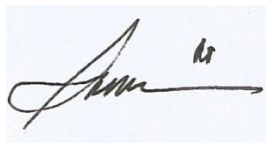
Approved and Authorized by,
Supervisor I



Dr. Diana Rochintaniawati, M.Ed.

NIP. 196709191991032001

Supervisor II



Irma Rahma Suwarma, M.Pd., Ph.D

NIP. 198105032008012015

Perceived by,
Head of International Program on Science Education Study Program



Dr. Eka Cahya

Prima

2021.08.17

13:15:07 +07'00'

Dr. Eka Cahya Prima, S.Pd., M.T.

NIP. 199006262014041001

DECLARATION

I hereby declare that this research paper with the title “Students' Creativity and Communication Skills in Learning about Sound and Waves by Implementing STEAM Learning Approach” and all its contents are genuinely my own work. I do not plagiarize or quote in ways that do not follow the scientific ethics in the scientific community. For this statement, I am ready to bear the risk or sanction if in the future there is a violation of scientific ethics or there is a claim from another party against the authenticity of my work.

Sukabumi, 16 August 2021

Declarant,

A 10,000 Indonesian postage stamp (METERAN TEMPORER) with a signature over it. The stamp features the Garuda Pancasila emblem and the text "METERAN TEMPORER" and "10000". The signature is in black ink and appears to be "Kamila Putri Nursyahbani".

Kamila Putri Nursyahbani

1704417

STUDENTS' CREATIVITY AND COMMUNICATION SKILLS IN LEARNING ABOUT SOUND AND WAVES BY IMPLEMENTING STEAM LEARNING APPROACH

Kamila Putri Nursyahbani
International Program on Science Education
Universitas Pendidikan Indonesia
kamilaputri03@gmail.com

ABSTRACT

Education in the 21st century features the enhancement of students' knowledge, skills, and attitudes. Some of the important skills in the 21st century are creativity and communication skills, which are the focuses of this study. To address the demands of the important skills in the 21st century, STEAM (Science, Technology, Engineering, Art, and Mathematic) is one of the approaches that can be used. The purpose of this study is to investigate students' creativity and communication skills in learning about sound and waves by the STEAM learning approach. The method is descriptive research with convenience sampling of the participants. The research participants are 11 eight-graders from one of the junior high schools in Bandung. This research was implemented in online learning. The result showed that in the implementation of the STEAM learning approach, almost all of the learning experiences were carried out as some of the learning phases (e.g. problem statement, verification, and generalization phases) were not implemented completely due to the time constraints. In the implementation of the STEAM learning approach, students' creativity has a percentage of 77.61% which is categorized as good. Students' communication skill has a total average score of 2.77 out of 4.00 which is interpreted as basic. STEAM can be used as an alternative innovative learning approach that supports students' creativity and communication skills.

Keywords: Creativity, Communication Skills, STEAM Learning Approach

KREATIVITAS DAN KEMAMPUAN KOMUNIKASI SISWA PADA PEMBELAJARAN BUNYI DAN GELOMBANG DENGAN PENDEKATAN PEMBELAJARAN STEAM

Kamila Putri Nursyahbani
International Program on Science Education
Universitas Pendidikan Indonesia
kamilaputri03@gmail.com

ABSTRAK

Pendidikan di abad 21 mengutamakan peningkatan pengetahuan, keterampilan, dan sikap siswa. Beberapa keterampilan penting untuk siswa di abad 21 adalah kreativitas dan kemampuan komunikasi yang kemudian menjadi fokus penelitian ini. Untuk menjawab tuntutan keterampilan di abad 21, STEAM (*Science, Technology, Engineering, Art, dan Mathematic*) dianggap sebagai salah satu pendekatan pembelajaran yang dapat digunakan. Penelitian ini bertujuan untuk mengetahui kreativitas dan kemampuan komunikasi siswa dalam pembelajaran bunyi dan gelombang dengan menerapkan pendekatan pembelajaran STEAM. Metode yang digunakan dalam penelitian ini adalah metode deskriptif dengan metode *convenience sampling* untuk mengumpulkan partisipan penelitian. Partisipan penelitian ini berjumlah 11 siswa kelas delapan dari salah satu SMP di Kota Bandung. Penelitian ini dilaksanakan dalam pembelajaran daring. Hasil penelitian menunjukkan bahwa pada penerapan pendekatan pembelajaran STEAM dalam mempelajari topik bunyi dan gelombang, hampir seluruh aktivitas pembelajaran terlaksana. Beberapa fase pembelajaran yaitu fase *problem statement*, fase *verification*, dan fase *generalization* tidak sepenuhnya terlaksana karena waktu yang terbatas. Pada penerapan pendekatan pembelajaran STEAM, kreativitas siswa memiliki persentase sebesar 77,61% yang masuk ke dalam kategori baik. Selain itu, keterampilan komunikasi siswa memiliki skor rata-rata total 2,77 dari 4,00 yang diartikan sebagai *basic* atau dasar. Oleh karena itu, STEAM dapat menjadi pendekatan pembelajaran inovatif yang mendukung kreativitas dan keterampilan komunikasi siswa.

Kata Kunci: Kreativitas, Kemampuan Komunikasi, Pendekatan Pembelajaran STEAM

PREFACE

Bismillahirrahmanirrahim,

All praises and gratitude are given to the Most Merciful, Allah SWT, so that the author is able to complete the research paper entitled “Students' Creativity and Communication Skills in Learning about Sound and waves by Implementing STEAM Learning Approach”, which is a requirement in order to accomplish the degree of *Sarjana Pendidikan* in International Program on Science Education, FPMIPA, Universitas Pendidikan Indonesia. Blessings and greetings may always be expressed to the Prophet Muhammad SAW, who has always been the best source of inspiration and role model for humankind.

The author realizes that writing the research paper is still far from perfect and has limitations and shortcomings. Therefore, constructive criticism and suggestions are welcomed so that the quality of this research paper can be improved. Hopefully, this research paper can be useful, make a positive contribution to the development of science education, and can provide inspiration for all readers.

Sukabumi, August 2021

Author

ACKNOWLEDGMENT

In the process of completing this research paper, the author has received many lessons, motivational support, and assistance in the form of invaluable guidance from various parties starting from the preparation, the implementation, to the completion of this research paper. Therefore, the author would like to express her gratitude and appreciation to the people who have helped her:

- 1) Dr. Eka Cahya Prima, M.T., as the Head of International Program on Science Education Study Program
- 2) The first supervisor, Dr. Diana Rochintaniawati, M.Ed. who has guided and enlightened the author with her knowledge and has given endless supports to the author during the completion of the research paper
- 3) The second supervisor, Irma Rahma Suwarma, M.Pd., Ph.D. who has also given meaningful guidance and insights to the author during the process of completing the research paper
- 4) All the lecturers in IPSE Study Program, who have given a lot of meaningful knowledge, experiences, and motivation, especially in preparing the author to be a good educator
- 5) The author's beloved parents and family, who have always been the best supporters of all time
- 6) Ar Rafi Drajat Middle School's teachers, especially Adinda Nur Wulandari, S.Pd. and Suwarno, S.Si., who have assisted the author in completing her teaching practice and conducting the research in the school
- 7) Diana Ayu Latifah, the author's favorite partner in everything during her college life, including during the process of finishing this research paper that put a lot of effort and time spent together
- 8) Miftah Ummi Hanifa and Tiara Syifanida, the author's other partners in completing the research together from the beginning until the end
- 9) The author's classmates who will become the friends she will have for life, IPSE 2017 that involve Nadira Renata Putri, Tashya Alfiah Yasin,

Diana Ayu Latifah, Shafa Rihadatul Aisy, Arsanti Satriani Salim, Miftah Ummi Hanifa, Annisa Fadhila, Dhika Andraresti, Mia Wulansani, Sofi Alfiani, Rossy Andini, Xavierina Dewi, Naufal Rabah, Syahida Ainaya, Nur Shinta Ratna Wulan, Raisha Nur Kanina, Salma Khoirotunnisa, Erika Octaviani, Mohamad Yusril Aldiana Mahendra, Sulistinayah Suwaka Putri, Novi Nursafitri, Putri Sekar Imel, and Tiara Syifanida who have been sharing beautiful memories and supporting each other at all costs

10) Viskha and Reni, the author's little friends who have been growing and fighting together to achieve their dreams since 14 years ago.

11) The author's best friends since junior high school, Amel, Tamy, Ziva, Rasya, Rafifah, Syahla, Fal-Q, and Wildan who have always been there for the author through the ups and downs.

The author expresses the most profound gratitude to all the parties mentioned above and to many other people who cannot be mentioned for all the help and support in any way, especially when completing this research paper.

LIST OF CONTENTS

APPROVAL SHEET.....	i
DECLARATION	ii
ABSTRACT.....	iii
PREFACE.....	v
ACKNOWLEDGEMENT	vi
LIST OF CONTENTS	viii
LIST OF TABLES	x
LIST OF FIGURES	xi
LIST OF APPENDIXES.....	xii
CHAPTER I INTRODUCTION.....	1
1.1 Background.....	1
1.2 Research Problem.....	4
1.3 Research Objective	4
1.4 Research Benefit	4
1.5 Limitation of Problem.....	5
1.6 Organization of the Paper	6
CHAPTER II LITERATURE REVIEW.....	8
2.1 STEAM Learning Approach	8
2.2 Students' Creativity	11
2.3 Students' Communication Skill.....	13
2.4 Sound and waves Topic	17
2.5 Relevant Research.....	20
CHAPTER III RESEARCH METHODOLOGY.....	23
3.1 Research Method.....	23
3.2 Participants	23
3.3 Research Instrument	24
3.3.1 The Implementation of STEAM Learning Approach.....	24
3.3.2 Students' Creativity	27
3.3.3 Students' Communication Skill.....	32

3.4 Operational Definition	36
3.5 Research Procedure	37
CHAPTER IV RESULT AND DISCUSSION.....	40
4.1 Implementation of STEAM Learning Approach in Sound and waves Topic ..	40
4.2 Students' Creativity in Learning about Sound and waves by Implementing STEAM Approach	52
4.2.1 The Result of Students' Creativity Based on Each Dimension	55
4.2.2 The Result of Students' Creativity Based on Each Student	58
4.3 Students' Communication Skills in Learning about Sound and waves by Implementing STEAM Approach	62
4.3.1 Students' Communication Skills Based on Each Indicator	64
4.3.2 Students' Communication Skills Based on Each Student	69
CHAPTER V CLOSING.....	73
5.1 Conclusion	73
5.2 Recommendation.....	74
REFERENCES.....	75
APPENDIX.....	86
AUTOBIOGRAPHY.....	120

LIST OF TABLES

Table 2.1 Competencies for the Topic of Sound and Waves	17
Table 3.1 STEAM Learning Approach Observation Sheet.....	25
Table 3.2 Interpretation of Learning Experiences Implementation	27
Table 3.3 Creative Product Analysis Matrix (CPAM) Rubric Indicator	28
Table 3.4 Creative Product Analysis Matrix (CPAM) Rubric Design.....	31
Table 3.5 Interpretation of Score Percentage Criteria	32
Table 3.6 Communication Skills Rubric	32
Table 3.7 Communication Skill Rubric Design	35
Table 3.8 Interpretation of Communication Skill Score	35
Table 4.1 STEAM Learning Approach Observation Sheet.....	43
Table 4.2 STEAM Aspects Implication	51
Table 4.3 Result of Students' Creativity	53
Table 4.4 Students' Creativity for Each Dimension	56
Table 4.5 Students' Creativity for Each Student	58
Table 4.6 Average Score of Students' Communication Skill.....	63
Table 4.7 Students' Communication Skill for Each Indicator.....	65
Table 4.8 Students' Communication Skill for Each Student.....	69

LIST OF FIGURES

Figure 2.1 The Illustration of Longitudinal and Transverse Waves	19
Figure 2.2 Sound Wave Components	20
Figure 3.1 Flowchart of Research Procedures	39
Figure 4.1 Thinking Step in Students' Worksheet	46
Figure 4.2 Students' Answer in the Thinking Step of Students' Worksheet	47
Figure 4.3 Designing Step in Students' Worksheet.....	47
Figure 4.4 Students' Answer in the Designing Step of Students' Worksheet	48
Figure 4.5 Creating Step in Students' Worksheet	48
Figure 4.6 Students' Answer in the Creating Step of Students' Worksheet.....	49
Figure 4.7 Testing Step in Students' Worksheet.....	49
Figure 4.8 Students' Answer in the Testing Step of Students' Worksheet	50
Figure 4.9 An Example of Student's Product	53
Figure 4.10 Result of Students' Creativity for Each Dimension	56
Figure 4.11 The Proportion of the Students for Each Creativity Category	59
Figure 4.12 The Student's Presentation About the Product	63
Figure 4.13 Result of Students' Communication Skills for Each Indicator	65
Figure 4.14 An Example of the Addition of Text in the Students' Video	68
Figure 4.15 The Proportion of the Students for Each Communication Skills Category	70

LIST OF APPENDIXES

APPENDIX A Research Instrument	87
Appendix A.1 STEAM Learning Approach Observation Sheet	88
Appendix A.2 Students' Creativity Rubric	92
Appendix A.3 Students' Communication Skills Rubric	96
Appendix A.4 Instrument Judgment Form	99
APPENDIX B Instructional Tools	103
Appendix B.1 Lesson Plan	104
Appendix B.2 Students' STEAM Worksheet	110
APPENDIX C Research Data Result	115
Appendix C.1 Students' Creativity Result.....	116
Appendix C.2 Students' Communication Skills Result	117
APPENDIX D Research Documentation	118

REFERENCES

- Adistiana, K. D. (2018). Memahami Perbedaan Getaran dan Gelombang. Retrieved from Ruang Guru website: <https://www.ruangguru.com/blog/perbedaan-getaran-dan-gelombang>
- Adriyawati, Utomo, E., Rahmawati, Y., & Mardiah, A. (2020). STEAM-Project-Based Learning Integration to Improve Elementary School Students' Scientific Literacy on Alternative Energy Learning. *Universal Journal of Educational Research*, 8(5), 1863–1873. <https://doi.org/10.13189/ujer.2020.080523>
- Aguilera, D., & Ortiz-Revilla, J. (2021). STEM vs. STEAM Education and Student Creativity: A Systematic Literature Review. *Education Sciences*, 11(7), 331. <https://doi.org/10.3390/educsci11070331>
- Ahmad, D. N., Astriani, M. M., Alfahnum, M., & Setyowati, L. (2021). Increasing Creative Thinking of Students by Learning Organization with STEAM Education. *Jurnal Pendidikan IPA Indonesia*, 10(1), 103–110. <https://doi.org/10.15294/jpii.v10i1.27146>
- Akyurt, N. (2018). Determination of the Communication Skills of University Students by Sociodemographic Features. *SHS Web of Conferences*, 48(01056), 1–15.
- Al-Issa, A. S., & Al-Qubtan, R. (2010). Taking the Floor : Oral Presentations in EFL Classrooms. *TESOL Journal*, 1(2), 227–246. <https://doi.org/10.5054/tj.2010.220425>
- Alhaddad, I., Kusumah, Y. S., Sabandar, J., & Dahlan, J. A. (2015). Enhancing Students ' Communication Skills through Treffinger Teaching Model. *IndoMS-JME*, 6(1), 31–39.
- Allen, D., Freeland, T., Neuwirth, M., Hennings, J., & Schauer, L. (2008). Creatively Speaking: Some Strategies for the Preparation and Delivery of Oral Presentations. *Speaking of Teaching*, 18(1), 1–8.
- Altun, H., & Serin, O. (2019). Determination of learning styles and achievements of talented students in the fields of Science and Mathematics. *Cypriot Journal of Educational Sciences*, 14(1), 80–89. <https://doi.org/10.18844/cjes.v14i1.3441>

- Angraini, Y. (2016). Rules of Three Analysis in Persuasive Public Speaking Presentation. *ANGLO-SAXON: Jurnal Ilmiah Program Studi Pendidikan Bahasa Inggris*, 7(1), 3. <https://doi.org/10.33373/anglo.v7i1.542>
- Annisa, R., Effendi, M. H., & Damris, D. (2019). Peningkatan Kemampuan Berpikir Kreatif Siswa dengan Menggunakan Model Project Based Learning Berbasis STEAM (Science, Technology, Engineering, Arts dan Mathematic) pada Materi Asam dan Basa di SMAN 11 Kota Jambi. *Journal of The Indonesian Society of Integrated Chemistry*, 10(2), 14–22. <https://doi.org/10.22437/jisic.v10i2.6517>
- Askfelt, E. (2012). Combining Ideas. Retrieved from Project of How website: <https://projectofhow.com/methods/combining-ideas/>
- Astutik, S., Sudarti, Bektiarso, S., & Nuraini, L. (2017). Developing Scientific Creativity Test to Improve Scientific Creativity Skills for Secondary School Students. *The International Journal of Social Sciences and Humanities Invention*, 4(9), 3970–3974. <https://doi.org/10.18535/ijsshi/v4i9.12>
- Atmowardoyo, H. (2018). Research Methods in TEFL Studies: Descriptive Research, Case Study, Error Analysis, and R & D. *Journal of Language Teaching and Research*, 9(1), 197. <https://doi.org/10.17507/jltr.0901.25>
- Badmus, O. T., & Omosewo, E. O. (2020). Evolution of STEM, STEAM and STREAM Education in Africa: The Implication of the Knowledge Gap. *International Journal on Research in STEM Education*, 2(2), 99–106.
- Badriyah, N. L., Anekawati, A., & Azizah, L. F. (2020). Application of PjBL with Brain-Based STEAM Approach to Improve Learning Achievement of Students. *Jurnal Inovasi Pendidikan IPA*, 6(1), 88–100. <https://doi.org/10.21831/jipi.v6i1.29884>
- Bahrum, S., Wahid, N., & Ibrahim, N. (2017). Integration of STEM Education in Malaysia and Why to STEAM. *International Journal of Academic Research in Business and Social Sciences*, 7(6), 645–654. <https://doi.org/10.6007/ijarbss/v7-i6/3027>
- Ball, A., Joyce, H. D., & Anderson-Butcher, D. (2016). Exploring 21st Century Skills and Learning Environments for Middle School Youth. *International Journal of*

- School Social Work*, 1(1), 1–15. <https://doi.org/10.4148/2161-4148.1012>
- Ben. (2021). What Are the 3 Guidelines for Using Statistics in A Speech? Retrieved from Mvorganizing website: <https://www.mvorganizing.org/what-are-the-3-guidelines-for-using-statistics-in-a-speech/>
- Besemer, S., & O’quin, K. (1986). Analyzing Creative Products: Refinement and Test of a Judging Instrument. *The Journal of Creative Behavior*, 20(2), 115–126. <https://doi.org/10.1002/j.2162-6057.1986.tb00426.x>
- Boholano, H. (2017). Smart Social Networking: 21st Century Teaching and Learning Skills. *Research in Pedagogy*, 7(1), 21–29. <https://doi.org/10.17810/2015.45>
- Brand, B. R. (2020). Integrating Science and Engineering Practices: Outcomes from A Collaborative Professional Development. *International Journal of STEM Education*, 7(1), 1–13. <https://doi.org/10.1186/s40594-020-00210-x>
- Brooks, G., & Wilson, J. (2014). Using Oral Presentations to Improve Students ’ English Language Skills. *Kwansei Gakuin University Humanities Review*, 19(1), 199–212.
- Brown, B. (2020). Why Vocal Variety Is So Valuable. Retrieved from Toastmasters International website: <https://www.toastmasters.org/magazine/magazine-issues/2020/sept/toolbox-why-vocal-variety-is-so-valuable>
- Bybee, R. W. (2011). Scientific and Engineering Practices in K-12 Classrooms: Understanding A Framework for K-12 Science Education. *Science and Children*, 49(4), 10.
- Bybee, R. W. (2013). *Translating the NGSS for Classroom Instruction*. Arlington: the National Science Teachers Association (NSTA).
- Conradty, C., Sotiriou, S. A., & Bogner, F. X. (2020). How Creativity in STEAM Modules Intervenes with Self-Efficacy and Motivation. *Education Sciences*, 10(3), 70.
- Diloyan, A. (2017). *The Importance of Communication in the Classroom: The Impact of Effective Communication Skills on Student Enthusiasm*. American University of Armenia.
- Dunbar, N. E., Brooks, C. F., & Kubicka-Miller, T. (2006). Oral Communication

- Skills in Higher Education: Using A Performance-Based Evaluation Rubric to Assess Communication Skills. *Innovative Higher Education*, 31(2), 115–128. <https://doi.org/10.1007/s10755-006-9012-x>
- Erdogan, V. (2019). Integrating 4C Skills of 21st Century into 4 Language Skills in EFL Classes. *International Journal of Education and Research*, 7(11), 113–124. Retrieved from www.ijern.com
- Erhabor, N. I., & Don, J. U. (2016). Impact of environmental education on the knowledge and attitude of students towards the environment. *International Journal of Environmental and Science Education*, 11(12), 5367–5375. <https://doi.org/10.25073/0866-773x/68>
- Etikan, I. (2016). Comparison of Convenience Sampling and Purposive Sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), 1. <https://doi.org/10.11648/j.ajtas.20160501.11>
- Georgia Tech. (2014). Writing and Communication - WOVEN. Retrieved from Georgia Institute of Technology website: <https://wcprogram.lmc.gatech.edu/guiding-principles/woven>
- Gilakjani, A. P. (2016). English Pronunciation Instruction: A Literature Review. *International Journal of Research in English Education*, 1(1), 1–6.
- Gruszka, A., & Tang, M. (2017). The 4P's Creativity Model and its Application in Different Fields. In M. Tang & C. H. Werner (Eds.), *Handbook of the Management of Creativity and Innovation* (pp. 51–71). https://doi.org/10.1142/9789813141889_0003
- Gunawan, Harjono, A., Sahidu, H., & Nisrina, N. (2018). Improving Students' Creativity Using Cooperative Learning with Virtual Media on Static Fluida Concept. *Journal of Physics: Conference Series*, 1006(1), 012016. <https://doi.org/10.1088/1742-6596/1006/1/012016>
- Hanif, S., Wijaya, A. F. C., & Winarno, N. (2019). Enhancing Students' Creativity through STEM Project-Based Learning. *Journal of Science Learning*, 2(2), 50–57. <https://doi.org/10.17509/jsl.v2i2.13271>
- Hanifa, R., & Yusra, S. R. (2018). Insight on Delivering Oral Presentation:

- Preparations, Problems, and Solutions. *International Journal of Learning and Teaching*, 4(4), 318–325. <https://doi.org/10.18178/ijlt.4.4.318-325>
- Henriksen, D. (2014). Full STEAM Ahead: Creativity in Excellent STEM Teaching Practices. *The STEAM Journal*, 1(2), 1–9. <https://doi.org/10.5642/steam.20140102.15>
- Herana, Patahuddin, & Jumadi. (2020). Peningkatan Motivasi Belajar Sejarah Melalui Metode Listening Group Berbantuan Video Pada Pembelajaran Sejarah Kelas XI IIS A SMA Negeri 5 Soppeng Tahun Ajaran 2019/2020. *Attoriolog Jurnal Pemikiran Kesejarahan Dan Pendidikan Sejarah*, 18(1), 76–87.
- Information Commissioner's Office (ICO). (2018). Guide to the Privacy and Electronic Communications Regulations. In *Open Government Licence (OGL) V3.0*.
- Kang, N. (2019). A Review of the Effect of Integrated STEM or STEAM (Science, Technology, Engineering, Arts, and Mathematics) Education in South Korea. *Asia-Pacific Science Education*, 5(1), 1–22.
- Kartini, D., & Widodo, A. (2020). Exploring Elementary Teachers', Students' Beliefs and Readiness toward STEAM Education. *Mimbar Sekolah Dasar*, 7(1), 54–65. <https://doi.org/10.17509/mimbar-sd.v7i1.22453>
- Kasmaienezhadfar, S., Talebloo, B., Roustae, R., & Pourrajab, M. (2015). Students' Learning Through Teaching Creativity: Teachers' Perception. *Journal of Educational, Health and Community Psychology*, 4(1), 1–13. <https://doi.org/10.12928/jehcp.v4i1.3699>
- Kementerian Pendidikan dan Kebudayaan Republik Indonesia. (2017). Ilmu Pengetahuan Alam SMP/MTs Kelas VIII Semester 2. In *Kementerian Pendidikan dan Kebudayaan*. Jakarta: Kementerian Pendidikan dan Kebudayaan.
- Kementerian Pendidikan dan Kebudayaan Republik Indonesia. *Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 37 Tahun 2018*. , (2018).
- Kementerian Pendidikan dan Kebudayaan Republik Indonesia. *Surat Edaran Nomor 3636Z/MPK.A/HK/2020 tentang Pembelajaran Secara Daring dan Bekerja dari*

- Rumah dalam Rangka Pencegahan Penyebaran Corona Virus Disease (COVID-19)*. , (2020).
- Khambayat, S. R. (2017). Developing Effective Communication Skills in Students. *Scholarly Research Journal for Interdisciplinary Studies*, 4(37), 8799–8817. <https://doi.org/10.21922/srjis.v4i37.10829>
- Kim, H., & Chae, D. H. (2016). The development and application of a STEAM program based on traditional Korean culture. *Eurasia Journal of Mathematics, Science and Technology Education*, 12(7), 1925–1936. <https://doi.org/10.12973/eurasia.2016.1539a>
- Kim, P. W. (2016). The wheel model of STEAM education based on traditional Korean scientific contents. *Eurasia Journal of Mathematics, Science and Technology Education*, 12(9), 2353–2371. <https://doi.org/10.12973/eurasia.2016.1263a>
- Liliawati, W., Rusnayati, H., Purwanto, & Aristantia, G. (2018). Implementation of STEAM Education to Improve Mastery Concept. *IOP Conference Series: Materials Science and Engineering*, 288(1), 012148. <https://doi.org/10.1088/1757-899X/288/1/012148>
- Majid, S. N. A., Kassim, H., & Razak, M. A. (2015). Evaluating the Creativity of a Product Using Creativity Measurement Tool (CMET). *E-Proceeding of the International Conference on Social Science Research*, 257–263.
- Mardikawati, R. A., & Mundilarto. (2020). Development of Physics Communication Skill Instruments Based on Local Wisdom for Senior High School Students. *Jurnal Pendidikan Indonesia (JPI)*, 9(2), 236–243. <https://doi.org/10.23887/jpi-undiksha.v9i2.23333>
- Marfuah. (2017). Meningkatkan Keterampilan Komunikasi Peserta Didik. *Jurnal Pendidikan Ilmu Sosial*, 26(2), 148–160.
- Marmon, M. (2019). The Emergence of the Creativity in STEM: Fostering an Alternative Approach for Science, Technology, Engineering, and Mathematics Instruction Through the Use of the Arts. *STEAM Education*, 101–115. <https://doi.org/10.1007/978-3-030-04003-1>

- Meita, L., Furi, I., Handayani, S., & Maharani, S. (2018). Eksperimen Model Pembelajaran Project Based Learning Dan Project Based Learning Terintegrasi Stem Untuk Meningkatkan Hasil Belajar Dan Kreativitas Siswa Pada Kompetensi Dasar Teknologi Pengolahan Susu. *Jurnal Penelitian Pendidikan*, 35(1), 49–60. <https://doi.org/10.15294/jpp.v35i1.13886>
- Mukti, N. I., & Wahyudi, R. (2015). EFL Students' Uses of Um as Fillers in Classroom Presentations. *Journal of Language and Communication*, 2(1), 1–14.
- Munawar, M., Roshayanti, F., & Sugiyanti, S. (2019). Implementation of STEAM (Science, Technology, Engineering, Art, Mathematics) - Based Early Childhood Education Learning in Semarang City. *CERIA (Cerdas Energik Responsif Inovatif Adaptif)*, 2(5), 276. <https://doi.org/10.22460/ceria.v2i5.p276-285>
- Mushtozza, D. A. (2016). Discovery Learning in Teaching Report Writing for Junior High School Students Based on 2013 Curriculum. *IJET (Indonesian Journal of English Teaching)*, 5(1), 55–77. <https://doi.org/10.15642/ijet2.2016.5.1.55-77>
- National Research Council. (2012). Distinguishing Practices in Science from those in Engineering. In *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. San Francisco.
- Novita, C. (2021). Apa itu Getaran, Gelombang, dan Bunyi: Perbedaan, Jenis & Contohnya. Retrieved from <https://tirto.id/apa-itu-getaran-gelombang-dan-bunyi-perbedaan-jenis-contohnya-gbre>
- Nurmaliah, C., Syukriah, Abdullah, Khairil, Safrida, Artika, W., & Huda, I. (2020). Enhancing Student's Creativity by Implementing Project-based Learning (PjBL) in Biodiversity Concept. *Journal of Physics: Conference Series*, 1460(1). <https://doi.org/10.1088/1742-6596/1460/1/012065>
- 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. <https://doi.org/10.22219/jpbi.v6i1.10225>
- Pattiwael, A. (2016). Addressing 21st Century Communication Skills: Some Emerging Issues from Eil Pedagogy & Intercultural Communicative

- Competence. *IJEE (Indonesian Journal of English Education)*, 3(2), 158–170.
<https://doi.org/10.15408/ijee.v3i2.3164>
- Piirto, J. (2014). *Creativity for 21st Century Skills: How to Embed Creativity Into the Curriculum*. Rotterdam: Sense Publishers.
- Prabavathi, R., & Nagasubramani, P. C. (2018). Effective oral and written communication. *Journal of Applied and Advanced Research*, 3(1), 29–32.
<https://doi.org/10.21839/jaar.2018.v3is1.164>
- Radhakrishnan, G. (2013). Non-Experimental Research Designs: Amenable to Nursing Contexts. *Asian Journal of Nursing Education and Research*, 3(1), 25–28. Retrieved from <https://ajner.com/HTMLPaper.aspx?Journal=Asian Journal of Nursing Education and Research;PID=2013-3-1-7>
- Rahmawati, Y., Ridwan, A., Hadinugrahaningsih, T., & Soeprijanto. (2019a). Developing Critical and Creative Thinking Skills through STEAM Integration in Chemistry Learning. *Journal of Physics: Conference Series*, 1156(1).
<https://doi.org/10.1088/1742-6596/1156/1/012033>
- Rahmawati, Y., Ridwan, A., Hadinugrahaningsih, T., & Soeprijanto. (2019b). Developing Critical and Creative Thinking Skills through STEAM Integration in Chemistry Learning. *Journal of Physics: Conference Series*, 1156(1), 012033.
<https://doi.org/10.1088/1742-6596/1156/1/012033>
- Rahmawati, Yuli, Ramadhani, S. F., & Afrizal. (2020). Developing Students' Critical Thinking: A STEAM Project for Chemistry Learning. *Universal Journal of Educational Research*, 8(1), 72–82. <https://doi.org/10.13189/ujer.2020.080108>
- Reisman, F. K. (2013). Creativity: Process, Product, Personality, Environment, & Technology. In *Knowledge, Innovation and Enterprose Conference*. Riga: International Conference on Knowledge, Innovation & Enterprise.
- Ridwan, A., Rahmawati, Y., & Hadinugrahaningsih, T. (2017). STEAM Integration in Chemistry Learning for Developing 21st Century Skills. *MIER Journal of Educational Studies, Trends & Practices*, 7(2), 184–194.
- Rizkha Heryansyah, T. (2017). Konsep Gelombang Bunyi. Retrieved from Ruang Guru website: <https://blog.ruangguru.com/konsep-gelombang-bunyi>

- Rosyida, U. N., Sukarmin, & Sunarno, W. (2020). 7th Grade Student's Creativity Analysis on Science Learning. *Journal of Physics: Conference Series*, 1567(4), 042024. <https://doi.org/10.1088/1742-6596/1567/4/042024>
- Rukoyah, S. O. (2020). *Pembelajaran Berbasis STEM untuk Membangun Keterampilan Rekayasa dan Kemampuan Engineering Productivity Siswa*. Universitas Pendidikan Indonesia.
- Sabbah, S., Hallabieh, F., & Hussein, O. (2020). Communication Skills among Undergraduate Students at Al-Quds. *World Journal of Education*, 10(6), 136–142. <https://doi.org/10.5430/wje.v10n6p136>
- Sahputra, N. W., & Aminatun, T. (2018). Instrument Test Design of Scientific Creativity in Ecosystem Topics based on Hu & Adey. *5th ICRIEMS Proceedings*, 73–80.
- Salikha, U. A. (2020). *The Effect of STEM Project-Based Learning on Students' Creativity and Motivation in Learning Heat Transfer*. Universitas Pendidikan Indonesia.
- Schreiber, L. M., Paul, G. D., & Shibley, L. R. (2012). The Development and Test of the Public Speaking Competence Rubric. *Communication Education*, 61(3), 205–233. <https://doi.org/10.1080/03634523.2012.670709>
- Suciari, N. K. D., Ibrohim, & Suwono, H. (2021). The Impact of PjBL Integrated STEAM on Students' Communication Skills and Concept Mastery in High School Biology Learning. *AIP Conference Proceedings*, 2330(1), 030060–030068.
- Suganda, E., Latifah, S., & Sari, P. M. (2021). STEAM and Environment on Students' Creative-Thinking Skills: A Meta-Analysis Study STEAM and Environment on Students' Creative-Thinking Skills: A Meta-Analysis Study. *Journal of Physics: Conference Series*, 1796(1), 012101. <https://doi.org/10.1088/1742-6596/1796/1/012101>
- Sugito, Mulyani, S., Hartono, & Supartono. (2017). Enhancing Students' Communication Skills through Problem Posing and Presentation. *International Journal of Evaluation and Research in Education (IJERE)*, 6(1), 17–22.

- Suminar, S. O., & Meilani, R. I. (2016). The Influence of Discovery Learning and Problem Based Learning Models on Students ' Learning Achievement. *Jurnal Pendidikan Manajemen Perkantoran*, 1(1), 80–89.
- Taherdoost, H. (2018). Sampling Methods in Research Methodology; How to Choose a Sampling Technique for Research. *SSRN Electronic Journal*, 22. <https://doi.org/10.2139/ssrn.3205035>
- Toastmasters International. (2011). *Selecting Your Topic*. Mission Vejo: Toastmasters International.
- Tonc, A. (2002). Developing Skills of NGOs Presentation and Communication. In *The Regional Environmental Center for Central and Eastern Europe*. <https://doi.org/10.4324/9780203974681>
- Trygstad, P. J., Banilower, E. R., & Pasley, J. D. (2016). Operationalizing the Science and Engineering Practices. *Horizon Research, Inc*.
- Tsai, K. C. (2016). Fostering Creativity in Design Education: Using the Creative Product Analysis Matrix with Chinese Undergraduates in Macau. *Journal of Education and Training Studies*, 4(4), 1–8. <https://doi.org/10.11114/jets.v4i4.1247>
- Wahyudi, R., Rukmini, D., & Bharati, D. A. L. (2019). Developing discovery learning-based assessment module to stimulate critical thinking and creativity of students' speaking performance. *English Education Journal*, 9(2), 2019–2172. Retrieved from <http://journal.unnes.ac.id/sju/index.php/eej>
- Wahyuni, A. (2018). The Power of Verbal and Nonverbal Communication in Learning. *Advances in Social Science, Education and Humanities Research (ASSEHR)*, 125, 81. <https://doi.org/10.2991/icigr-17.2018.19>
- Wandari, G. A., Wijaya, A. F. C., & Agustin, R. R. (2018). The Effect of STEAM-based Learning on Students' Concept Mastery and Creativity in Learning Light And Optics. *Journal of Science Learning*, 2(1), 26. <https://doi.org/10.17509/jsl.v2i1.12878>
- Yuan, X., & Lee, J. H. (2014). A Quantitative Approach for Assessment of Creativity in Product Design. *Advanced Engineering Informatics*, 28(4), 528–541.

<https://doi.org/10.1016/j.aei.2014.07.007>

Živković, S. (2014). The Importance of Oral Presentations for University Students.

Mediterranean Journal of Social Sciences, 5(19), 468–475.

<https://doi.org/10.5901/mjss.2014.v5n19p468>