

Science Learning Accompanied By Formative Assessment: A Literature Review

Aprina maharani ZAN^{1*}, Fatni Mufit², Festiyed²

¹ Master of Physics Education, Universitas Negeri Padang, West Sumatera. Indonesia

² Department of Physics, Universitas Negeri Padang, West Sumatera. Indonesia

ARTICLE INFORMATION

Received : 2024-03-25
Revised : 2024-03-30
Accepted : 2024-03-31

Correspondence

Email :
Aprinamaharani51@gmail.com
Phone :

KEYWORDS :

Formative Assesment,
Physics, Literatur review

ABSTRACT

Learning is said to be successful seen from the learning process. For successful 21st century learning, students are expected to have critical thinking, creative, collaboration and communication skills. These 21st century skills are obtained from the learning process and assessed through formative skills assessments. Formative assessment is carried out during the learning process. Researchers conducted a literature review on the topic of formative assessment. Literature study data was taken from Google Scholar and ERIC in 2015-2023. The 20 articles obtained were then grouped based on year of publication, subject, research design and research object. The research results show that the most scientific publication articles were found in 2019-2020. This formative assessment is widely used in physics subjects. This research mostly uses quasi-experimental designs. Research objects are widely used in students' conceptual understanding abilities.



This is an open access article distributed under the Creative Commons 4.0 Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. ©2023 by author and Universitas Negeri Padang.

INTRODUCTION

Learning in the 21st century is always accompanied by developments in information and communication technology. Countless technological developments can be used in learning in student learning activities (Abdillah, 2021; Septianingrum, 2022). The goal of 21st century learning is to achieve critical, creative, collaborative and communication thinking skills (Jannah, 2022; Rosnaeni, 2021). Student learning activities cannot be separated from the curriculum, learning process, and assessment (Winaryati, 2018). These three components cannot be separated in order to achieve learning objectives.

Important components that must be considered in learning are curriculum, learning processes and assessments. Curriculum as a description and basis for learning objectives to be achieved (Bahri, 2017; Mubarok, 2021). The learning process is a process of trying to achieve the goals set in the curriculum (Lazwardi, 2017; Syam, 2017). And assessment is a series to see the results of students' abilities in achieving learning goals (Saftari, 2019). Therefore, these three things cannot be separated. Curricula and important learning processes and assessment systems must also be prepared and designed in a planned manner. This assessment includes an assessment of students' knowledge, attitudes and skills. Penilaian abad 21 menuntut adanya perubahan dari sistem penilaian yang telah digunakan sebelumnya. Perubahan dalam strategi

penilaian yang berpusat pada proses dan keterampilan peserta didik (Anggraeni, 2019). Keterampilan peserta didik dalam menghadapi dunia nyata seperti keterampilan berpikir kritis, kreatif dan mampu memecahkan masalah (Mardhiyah, 2021). Penilaian yang berpusat pada proses pembelajaran yaitu penilaian formatif.

There are two types of assessment, namely summative assessment and formative assessment. Summative assessment is an assessment carried out at the end of the learning process (Adinda, 2021). Meanwhile, formative assessment is an assessment carried out during the learning process (Nurjannah, 2017). Summative and formative assessments are very important to optimize learning to achieve learning goals. Formative assessment can support students' learning process to be meaningful (Fukuda, 2022). Formative assessments are carried out to review and improve the learning process for the better.

Previous research related to formative assessment has been carried out a lot. It was found that formative assessment is rarely used in learning because many studies only look at learning outcomes (Sari, 2019; Suryani, 2012; Zahir, 2021). This makes formative assessment quite rarely carried out in learning activities. Systematic literature review on formative assessment seen from the year of publication, subjects, research design, research objects and research integration. Therefore, this study aims to investigate science learning accompanied by formative assessment through a systematic literature review.

METHODS

This study conducted a review of formative assessment in science learning. This study uses a literature review study method. Literature review is describing research results related to certain topics in general (Siswanto, 2010; Rother, 2007; Thomas, 2020). Articles collected as many as 20 articles. The process of reviewing literature such as determining topics, searching for related articles, analyzing articles, writing review literature from the articles obtained (Ridwan, 2021). The steps for filtering literature review articles can be shown in Figure 1.

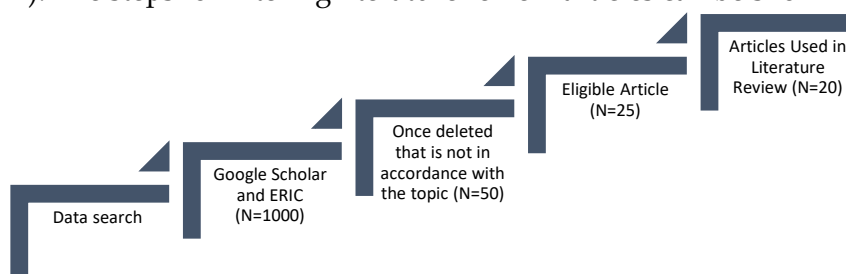


Figure 1. Screening of Literature Study Articles

Article analysis related to formative assessment is carried out by selecting and analyzing related topics. Then look for similarities and dissimilarities between articles, provide opinions, to compare research results and summarize the results into a general conclusion. This summary is the result of a literature review research. The article data to be reviewed can be shown in table 1.

Table 1. Identities of Literature Review Articles

| No | Article Source | Year | Category |
|----|------------------------|------|----------|
| 1. | Affriyenni,et. al. | 2021 | National |
| 2. | Ismail,M.I. | 2015 | National |
| 3. | Deke,O.,et. al. | 2022 | National |
| 4. | Rahmawati,I.L.,et. al. | 2015 | Naional |

| | | | |
|-----|----------------------------|------|---------------|
| 5. | Lukitawanti,S.D.,et. al. | 2020 | National |
| 6. | Rosyad,S.,et. al. | 2020 | National |
| 7. | Saptono,S.,et. al. | 2016 | National |
| 8. | Aulia, D.M.,et. al. | 2021 | National |
| 9. | Ratnasabilla, N.E.,et. al. | 2021 | National |
| 10. | Sari, I.P.,et. al. | 2019 | National |
| 11. | Alifiyah, C.N.,et. al. | 2020 | National |
| 12. | Dieni, W.E.,et. al. | 2017 | National |
| 13. | Bulunuz,N.,et. al. | 2017 | International |
| 14. | Lestari,D.,et. al. | 2020 | National |
| 15. | Ulya,H.,et. al. | 2018 | National |
| 16. | Sulistiyowati,et. al. | 2017 | National |
| 17. | Musa'dah, R.,et. al. | 2019 | National |
| 18. | Park,M. | 2020 | International |
| 19. | Harizah,Z.,et. al. | 2019 | International |
| 20. | Hadad, R.,et. al. | 2019 | International |

The identity of the articles obtained in the source search displays the year and journal category. The year the article was published ranges from 2015-2023. The articles used in the meta-analysis are articles published in national journals and international journals. There were 16 articles in national journals. There were 4 articles from international journals. The total number of articles related to this formative assessment meta-analysis was 20 articles.

RESULTS AND DISCUSSION

Result

The articles obtained for the analysis of the literature review are articles published from 2015-2023. This article presents a study of formative assessment. The articles to be analyzed are in accordance with the topic of the formative assessment, namely 20 articles from national and international journals. The results of the article analysis can be seen as follows in table 2.

Table 2. Data Analysis on Articles Published in 2015-2023

| Author | Year | Subject | Object | Integration | Design | Outcome |
|-------------------|------|---------|---------------------|------------------------------|------------|---|
| Affriyani,et. al. | 2021 | Science | Mobile applications | Augmented reality technology | | The goal has been achieved by publishing four scientific papers for training participants on the use of mobile applications through national scale seminars. |
| Ismail, M | 2015 | Science | Learning Outcome | Initial knowledge | Experiment | The results of the analysis of testing the hypothesis that the value of tcount>ttable shows that the science learning outcomes of students are given a formative assessor for each competency |

| | | | | | | |
|-----------------------------|------|---------|--|---------------------------------|---------------------------------|--|
| | | | | | | standard by controlling the initial knowledge of science which is higher than students who are given formative assessments at each face-to-face. |
| Deke, O., et al. | 2022 | Physics | Student Scientific Arguments | STEM via Authentic PBL | Embedded experimental | The results of the study on the application of EDP-Authentic PBL and Formative Assessment showed differences in the results of the pretest and posttest seen from the N-gain value which were in the moderate category. |
| Rahmawati, I. L. | 2015 | Physics | Self Regulation Ability | | Research and Development (R&D). | The use of formative assessment is proven to improve students' ability to self-regulate on learning strategies, motivation, and student achievement. |
| Lukita wanti, S. D., et al. | 2020 | Physics | | PjBL-STEM | Quasi experiment | Statistical data obtained by test value $t_{count} = 5.549 > t_{table} = 1.996$, it is stated that the problem solving abilities of students with the PjBL-STEM model accompanied by formative assessments are higher than those with the PjBL model. |
| Rosyad, S., et al. | 2020 | Physics | Problem solving skills, motivation and learning outcomes | Scientific Approach | Quasi-Eksperimental | The data from the results of hypothesis testing obtained a significant value of less than 0.05, so the scientific approach learning model was obtained with the help of formative assessment of learning motivation and learning outcomes. |
| Saptono, S., et al. | 2016 | Biology | HOT Skills | Formative Assessment Attributes | Research and Development | Attribute Integration Learning Formative assessment can develop HOT skills through the completion of relevant individual and group assignments. |

| | | | | | | |
|---------------------------|------|---------|-------------------------------------|---------------------|-------------------|---|
| Aulia, D.M.,et . al. | 2021 | Physics | Science Literacy | TPACK-STEM | Quasi-eksperiment | Hypothesis testing obtained data $t_{count} = 41.858 > t_{table} = 2.042$, so the research results showed that there was an increase in scientific literacy skills from using the TPACK-STEM-based e-module with the PBL-STEM model accompanied by formative assessment. |
| Ratnasabila, N.E.,et. al. | 2021 | Biology | Learning Outcome | | Pre-experimental | The application of concept maps as a formative assessment strategy can improve student learning outcomes seen from the results of the pretest and posttest scores and the n-gain value (0.4) which is in the medium category. |
| Sari, I. P.,et. al. | 2019 | Science | Understanding of students' concepts | Scientific learning | Quasi-eksperimen | A two-party t-test was carried out to find out the difference between the samples with $p < 0.05$. Formative assessment in science learning based on a scientific approach has a significant influence on increasing students' understanding of concepts. |
| Alifiyah, C. N.,et. al. | 2020 | Physics | scientific literacy | PjBL-STEM model | Quasi-Eksperimen | Hypothesis testing data obtained $t_{count} > t_{table} = 6.89 > 1.67$ stating that learning using PjBL-STEM-based UKBM with formative assessments has a significant increase in scientific literacy. |
| Dieni, W.E.,et. al. | 2017 | Physics | Understanding of students' concepts | Web integrated | Ex post facto | Anava test results $F_0 > F_{table} = 45.04 > 3.08$. This suggests that the provision of web-based formative feedback has a significant influence on students' understanding of concepts.. |
| Bulunuz, N.,et. al. | 2017 | Physics | Understanding of | | Experiment | The difference in values between the pretest and posttest obtained the |

| | | | | | | |
|-----------------------|------|---------|-------------------------------------|--------------------------|--|---|
| | | | students' concept | | | value of the difference between the samples <0.05 so that it was stated that formative assessment with experiments supported an increase in students' understanding of concepts. |
| Lestari, D., et. al. | 2020 | Physics | Science literacy | | ADDIE Model | Formative assessment instruments are declared valid and reliable and can measure scientific literacy and are suitable for use. |
| Ulya, H., et. al. | 2018 | Physics | Concept mastery | Web-Based Learning | Quasi eksperimen | The difference in the results of the two samples obtained a p value <0.05 so that the application of web-based formative assessment using formative Go experienced an increase in students' conceptual understanding scores. |
| Sulistiyowati | 2017 | Physics | Learning achievement | Isomorphobic Problems | Ex-post facto | The results of the average posttest scores for the 3 classes were carried out by a one-way ANOVA test until the value $f_{count} > f_{table} = 51.92 > 3.22$. this states that the provision of online formative feedback is able to influence student achievement. |
| Musa'dah, R., et. al. | 2019 | Physics | Concept mastery | Cognitive Apprenticeship | mix-method embedded experimental model | Based on the average results of the experimental class and the control class, the n-gain value of 0.477 was in the upper medium category. This suggests that cognitive apprenticeship learning accompanied by formative e-assessment can improve students' mastery of concepts. |
| Park, M. | 2020 | Physics | Understanding of students' concepts | Web based learning | | Students can connect physics concept variables to deep formative assessments |

| | | | | | | |
|---------------------------|------|---------|--------------------------------|-----------------------|--------------------------|--|
| Hariza h,Z.,et. al. | 2019 | Physics | Critical thinking skills | Web based Learning | Pre- experi mental | computer simulation to improve students' understanding of concepts Berdasarkan pembelajaran post-test serta demonstrasi interaktif dengan penilaian formatif berbasis web dapat meningkatkan keterampilan berpikir kritis siswa . |
| Hadad, R.,et. al. | 2019 | Physics | Problem solving | STEM | | Informal formative assessment is developed according to students' critical thinking skills, technology-based and to improve students' problem solving skills. |

Based on table 2, the search results for research articles were 20 studies analyzed. The research was analyzed with a period of 2015 -2023 related to the topic of formative assessment. The results of data analysis in table 2 contain information on the year of research, subjects, research objects, research integration and research design and research results. Based on these categories, articles will be grouped with similar ones.

Many formative assessment articles have been carried out by previous researchers. In this literature review, limiting the years 2015-2023 to 20 articles. The articles will be grouped into 4 groups according to the 2 years the article was published. Classification of articles based on the year of publication of the article is stated in table 3.

Table 3. Classification Based on The Year of Publication of The Article

| No | Year | Frequency | Percentage (%) |
|----|-----------|-----------|----------------|
| 1 | 2015-2016 | 3 | 15 |
| 2 | 2017-2018 | 4 | 20 |
| 3 | 2019-2020 | 9 | 45 |
| 4 | 2021-2023 | 4 | 15 |

Based on the data information in table 3 it can be stated that summative assessments always have scientific publications. It was proven that in 2015-2016 there were 3 scientific publications out of 20 total articles analyzed. The percentage of scientific article publications in 2015-2016 is 15%. In 2017-2018 there were 4 summative assessment scientific publications with a percentage of 20%. In 2019-2020 it has 9 scientific publications with a percentage of 45%. And in 2021-2023 there will be 4 scientific publications with a percentage of 20%. Judging from the total number of 20 research articles related to scientific publications, namely in 2020-2021, there were 9 scientific publications. While scientific publications related to formative assessment were the lowest in 2015-2016, namely 3 scientific publications.

The next article review literature analysis was seen from the subjects in each research article. The subjects found in the article are Science, Physics and Biology. Then the 20 articles will be grouped into 3 pieces according to the subjects shown in table 4.

Table 4. Classification Based on Subjects

| No | Subjects | Frequency | Percentage (%) |
|----|----------|-----------|----------------|
| 1 | Science | 3 | 15 |
| 2 | Physics | 15 | 75 |
| 3 | Biology | 2 | 10 |

Based on table 4 data information, it can be stated that summative assessment can be carried out in various subjects. This literature review found summative assessments in science, physics and biology subjects. In science subjects, there were 3 scientific publications with a percentage of 15%. In the Physics subject, 15 scientific publications were obtained with a percentage of 75%. In the Biology subject, there are 2 scientific publications with a percentage of 10%. Of the three subjects that use formative assessment, it is widely used in Physics subjects. Formative assessment in science learning is very important in improving 21st century skills (Lestari, 2020). This is supported by the many formative assessments used in physics learning to improve 21st century skills. The skills seen during the learning process are in the form of critical thinking, creative, collaboration, communication and problem solving skills.

Analysis of the literature review of subsequent articles is seen from the research design used. The research designs used were experimental, embedded experimental, Research and Development, Quasi-Experimental, Pre-Experimental, Ex Post Facto and ADDIE. The research design in the articles obtained is in accordance with the topic of the summative assessment stated in table 5.

Table 5. Classification Based on Research Design

| No | Research design | Frequency | Percentage (%) |
|----|--------------------------|-----------|----------------|
| 1 | Experiment | 2 | 12 |
| 2 | Embedded Experimental | 2 | 12 |
| 3 | Research and Development | 2 | 12 |
| 4 | Quasi-Eksperimen | 6 | 35 |
| 5 | Pre-Experimental | 2 | 12 |
| 6 | Ex Post Facto | 2 | 12 |
| 7 | ADDIE | 1 | 5 |

Based on table 5, it states the classification of article publications based on the research design used. Experimental, Embedded Experimental, Research and Development, Pre-Experimental and Ex Post Facto research designs have 2 article publications with a percentage of 12%. The research design using Quasi-Experiment has 6 scientific publications with a percentage of 35%. Furthermore, the ADDIE model has 1 publication with a percentage of 5%. The research design that is widely used is Quasi-experimental and the least used is the ADDIE model. Quasi-experimental, namely experimental research using an experimental group and a control group without random selection (Hastjarjo, 2019; Lestari, 2017). This research is widely used by researchers because it can save time without having to randomly select samples.

Furthermore, the literature review, looking at the research objects in formative assessment, found many different objects. The research objects found in related articles are mobile applications, learning outcomes, scientific arguments, self-regulation abilities, problem solving abilities, motivation and learning outcomes, HOT Skills, scientific literacy, conceptual

understanding, learning achievement, critical thinking skills and problem solving. The research object that is often found is students' understanding of concepts.

Discussion

The meta-analysis carried out found groups of articles related to formative assessment based on year categories. It was found that formative assessment articles were widely used in the period 2019 to 2020. Formative assessment was used to improve students' thinking skills (Mahendra, 2020). Formative assessment is also able to improve students' thinking skills in answering HOTS questions (Wiyaka, 2020). In this way, formative assessment greatly influences student learning outcomes.

Meta-analysis of formative assessments seen from subject moderator variables obtained in the 2015-2023 range is often found in physics subjects. Formative assessment is widely used in physics lessons and can help achieve student learning outcomes in good categories. Formative assessment can improve student learning outcomes (Leenknecht, 2021). Formative assessment can foster creative ideas in physics learning (Hasanah, 2023). In this way, formative assessment is very important in learning physics.

Formative assessments are found in articles with a variety of research designs. The research design that is widely used is the quasi-experimental design. This quasi-experimental design is able to see differences in learning outcomes between two times. Differences in learning outcomes can be seen from the pretest-posttest given to students (Prabawati, 2020). Quasi-experimental designs can be used in assessing control classes and experimental classes (Gopalan, 2020). Research using quasi-experiments is able to display formative assessments for students that are suitable for use.

CONCLUSION

After conducting a literature review of 20 articles from Google Scholar and ERIC in the 2015-2023 period. Literature review is reviewed from the year of publication, subjects, research design and research objects. The results of the study found that there were many scientific publications related to formative assessment in 2019-2020. Furthermore, the subjects that apply a lot of this assessment are physics subjects. The research design that is popularly used is quasi-experimental. The object of research related to formative assessment articles is found in understanding students' concepts. Formative assessment greatly influences student learning outcomes. Formative assessment is very important in learning physics. Research using quasi-experiments is able to display formative assessments for students that are suitable for use.

REFERENCES

- Abdillah, K., & Hamami, T. (2021). Pengembangan kurikulum menghadapi tuntutan kompetensi abad ke 21 di Indonesia. *Jurnal Pendidikan Islam Al-Ilmi*, 4(1).
- Adinda, A. H., Siahaan, H. E., Raihani, I. F., Aprida, N., Fitri, N., & Suryanda, A. (2021). Penilaian Sumatif dan Penilaian Formatif Pembelajaran Online. *Report Of Biology Education*, 2(1), 1-10.
- Affriyenni, Y., Mustikasari, V. R., Yulianti, E., & Hamimi, E. (2021). Workshop of mobile application use equipped with augmented reality technology in the science formative assessment. *JCES (Journal of Character Education Society)*, 4(1), 167-176.

- Alifiyah, C. N., Parno, P., & Kusairi, S. (2020). Efektivitas penggunaan ukbm terhadap literasi sains materi alat optik dalam model PjBL-STEM dengan asesmen formatif pada siswa kelas XI MIA SMA Negeri 9 Malang. *Briliant: Jurnal Riset dan Konseptual*, 5(4), 679-686.
- Anggraeni, N. E. (2019). Strategi pembelajaran dengan model pendekatan pada peserta didik agar tercapainya tujuan pendidikan di era globalisasi. *ScienceEdu*, 2(1), 72-79.
- Aulia, D. M., Parno, P., & Kusairi, S. (2021). Pengaruh e-modul berbasis TPACK-STEM terhadap literasi sains alat optik dengan model PBL-STEM disertai asesmen formatif. *Jurnal Riset Pendidikan Fisika*, 6(1), 7-12.
- Bahri, S. (2017). Pengembangan kurikulum dasar dan tujuannya. *Jurnal Ilmiah Islam Futura*, 11(1), 15-34.
- Bulunuz, N., & Bulunuz, M. (2017). Effect of Formative Assessment-Based Instruction on High School Students' Conceptual Understanding of Balance and Torque. *Online Submission*, 7(1), 21-33.
- Deke, O., Jewaru, A. A. I., & Kaleka, Y. U. (2022). Engineering design process pada STEM melalui authentic PBL dan asesmen formatif: meninjau desain argumentasi ilmiah siswa terkait termodinamika. *Borneo Journal of Science and Mathematics Education*, 2(3), 94-117.
- Dieni, W. E., Sujito, S., Sugiyanto, S., & Kusairi, S. (2017). Pengaruh formative feedback berbasis web terhadap pemahaman konsep siswa kelas X SMAN 1 Lawang tentang gravitasi Newton. In *Seminar Nasional Fisika dan Pembelajarannya* (pp. 44-50).
- Eka Mahendra, I. W. (2020). Teachers' Formative Assessment: Accessing Students' High Order Thinking Skills (HOTS)? Teachers' Formative Assessment: Accessing Students' High Order Thinking Skills (HOTS)?, 12(12), 180-202.
- Fukuda, S. T., Lander, B. W., & Pope, C. J. (2022). Formative assessment for learning how to learn: Exploring university student learning experiences. *RELC Journal*, 53(1), 118-133.
- Gopalan, M., Rosinger, K., & Ahn, J. B. (2020). Use of quasi-experimental research designs in education research: Growth, promise, and challenges. *Review of Research in Education*, 44(1), 218-243.
- Hadad, R., Thomas, K., Kachovska, M., & Yin, Y. (2020). Practicing formative assessment for computational thinking in making environments. *Journal of Science Education and Technology*, 29, 162-173.
- Harizah, Z., Kusairi, S., & Latifah, E. (2020, June). Student's critical thinking skills in interactive demonstration learning with web based formative assessment. In *Journal of Physics: Conference Series* (Vol. 1567, No. 4, p. 042038). IOP Publishing.
- Hasanah, S. U., Parno, P., Hidayat, A., Supriana, E., Yuliati, L., Latifah, E., & Ali, M. (2023, January). Building students' creative thinking ability through STEM integrated project-based learning with formative assessment on thermodynamics topics. In *AIP Conference Proceedings* (Vol. 2569, No. 1). AIP Publishing.
- Hastjarjo, T. D. (2019). Rancangan eksperimen-kuasi. *Buletin psikologi*, 27(2), 187-203.
- Ismail, M. I. (2015). Pengaruh intensitas penilaian formatif terhadap hasil belajar IPA dengan mengontrol pengetahuan awal siswa. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, 2(1).
- Jannah, D. R. N., & Atmojo, I. R. W. (2022). Media digital dalam memberdayakan kemampuan berpikir kritis abad 21 pada pembelajaran IPA di sekolah dasar. *Jurnal Basicedu*, 6(1), 1064-1074.
- Lazwardi, D. (2017). Manajemen kurikulum sebagai pengembangan tujuan pendidikan. *Al-Idarah: Jurnal Kependidikan Islam*, 7(1), 119-125.
- Leenknecht, M., Wijnia, L., Köhlen, M., Fryer, L., Rikers, R., & Loyens, S. (2021). Formative assessment as practice: The role of students' motivation. *Assessment & Evaluation in Higher Education*, 46(2), 236-255.

- Lestari, A. F., Pd, S., & Matematika, P. (2017). Meningkatkan kemampuan pemahaman matematis siswa melalui model problem based learning (penelitian quasi eksperimen terhadap siswa SMP Negeri 1 Tambakdahan). *BIORMATIKA Jurnal Ilmiah FKIP Universitas Subang*, 3(1), 1-8.
- Lestari, D., & Setyarsih, W. (2020). Kelayakan instrumen penilaian formatif berbasis literasi sains peserta didik pada materi pemanasan global. *Inovasi Pendidikan Fisika*, 9(03).
- Lukitawanti, S. D., Parno, P., & Kusairi, S. (2020). Pengaruh PJBL-STEM disertai asesmen formatif terhadap kemampuan pemecahan masalah pada materi elastisitas dan hukum hooke. *Jurnal Riset Pendidikan Fisika*, 5(2), 83-91.
- Mardhiyah, R. H., Aldriani, S. N. F., Chitta, F., & Zulfikar, M. R. (2021). Pentingnya keterampilan belajar di abad 21 sebagai tuntutan dalam pengembangan sumber daya manusia. *Lectura: Jurnal Pendidikan*, 12(1), 29-40.
- Mubarok, A. A., Aminah, S., Sukamto, S., Suherman, D., & Berlian, U. C. (2021). Landasan pengembangan kurikulum pendidikan di Indonesia. *Jurnal Dirosah Islamiyah*, 3(1), 103-125.
- Musa'adah, R., & Kusairi, S. (2020). Analisis penguasaan konsep siswa materi suhu kalor pada pembelajaran cognitive apprenticeship disertai formative e-assessment. *Jurnal Riset Pendidikan Fisika*, 4(2), 85-90.
- Nurjannah, N. (2017). Efektivitas bentuk penilaian formatif disesuaikan dengan media pembelajaran. *PARAMETER: Jurnal Pendidikan Universitas Negeri Jakarta*, 29(1), 75-90.
- Park, M. (2020). Students' problem-solving strategies in qualitative physics questions in a simulation-based formative assessment. *Disciplinary and Interdisciplinary Science Education Research*, 2(1), 1.
- Prabawati, R., Nugrahaningsih, W. H., & Alimah, S. (2020). The influence of predict observe explain (POE) learning model on student learning outcomes. *Journal of Biology Education*, 9(1), 57-63.
- Rahmawati, I. L., Hartono, H., & Nugroho, S. E. (2015). Pengembangan asesmen formatif untuk meningkatkan kemampuan self regulation siswa pada tema suhu dan perubahannya. *Unnes Science Education Journal*, 4(2).
- Ramadhani, D. P. (2021). Analisis penerapan asesmen formatif dalam pembelajaran ipa dan fisika: literature review. *LENSA (Lentera Sains): Jurnal Pendidikan IPA*, 11(2), 110-120.
- Ratanasabilla, N. E., Sriyati, S., & Hamdiyati, Y. (2021). Penerapan peta konsep sebagai strategi asesmen formatif dalam upaya meningkatkan hasil belajar siswa pada pembelajaran sistem koordinasi. *Assimilation: Indonesian Journal of Biology Education*, 4(1), 16-23.
- Ridwan, M., Suhar, A. M., Ulum, B., & Muhammad, F. (2021). Pentingnya penerapan literature review pada penelitian ilmiah. *Jurnal Masohi*, 2(1), 42-51.
- Rosnaeni, R. (2021). Karakteristik dan asesmen pembelajaran abad 21. *Jurnal Basicedu*, 5(5), 4334-4339.
- Rosyad, S., Diantoro, M., & Kusairi, S. (2021). Pengaruh scientific approach berbantuan penilaian formatif terhadap motivasi belajar dan hasil belajar fisika siswa kelas xi perempuan pada materi elastisitas. *Jurnal Pendidikan: Teori, Penelitian, dan Pengembangan*, 5(10), 1480-1484.
- Rother, E. T. (2007). Systematic literature review X narrative review. *Acta paulista de enfermagem*, 20, v-vi.
- Saftari, M., & Fajriah, N. (2019). Penilaian ranah afektif dalam bentuk penilaian skala sikap untuk menilai hasil belajar. *Edutainment*, 7(1), 71-81.
- Saptono, S., Rustaman, N. Y., Saefudin, S., & Widodo, A. (2016). Memfasilitasi higher order thinking skills dalam perkuliahan biologi sel melalui model integrasi atribut asesmen formatif. *Unnes Science Education Journal*, 5(3).
- Sari, I. P., Mustikasari, V. R., & Pratiwi, N. (2019). Pengintegrasian penilaian formatif dalam pembelajaran IPA berbasis saintifik terhadap pemahaman konsep peserta didik. *JIPVA (Jurnal Pendidikan IPA Veteran)*, 3(1), 52-62.

- Sari, I. P., Mustikasari, V. R., & Pratiwi, N. (2019). Pengintegrasian penilaian formatif dalam pembelajaran IPA berbasis saintifik terhadap pemahaman konsep peserta didik. *JIPVA (Jurnal Pendidikan IPA Veteran)*, 3(1), 52-62.
- Septianingrum, A. D., Suhandi, A. M., Putri, F. S., & Prihantini, P. (2022). Peningkatan kompetensi pendidik dalam literasi digital untuk menghadapi tantangan pembelajaran abad 21. *Jurnal Ilmiah Wahana Pendidikan*, 8(7), 137-145.
- Siswanto, S. (2010). Systematic review sebagai metode penelitian untuk mensintesis hasil-hasil penelitian (sebuah pengantar). *Buletin Penelitian Sistem Kesehatan*, 13(4), 21312.
- Sulistiyowati, S., Sujito, S., & Kusairi, S. (2017). Pengaruh pemberian feedback formatif online materi fluida dinamis berbasis isomorphic problems terhadap prestasi belajar siswa. In *Seminar Nasional Fisika dan Pembelajarannya* (pp. 51-58).
- Suryani, E. S., & Andriani, S. (2012). Evaluasi formatif mahasiswa terhadap karakteristik dan keterampilan mengajar dosen berkaitan dengan prestasi belajar matematika di jurusan pendidikan matematika FKIP Universitas Suryakencana (unsur) cianjur. *Pasundan Journal of Mathematics Education Jurnal Pendidikan Matematika*, 2(1), 1-8.
- Syam, A. R. (2017). Posisi manajemen kurikulum dan pembelajaran dalam pendidikan. *Muaddib: Studi Kependidikan Dan Keislaman*, 7(01), 33-46.
- Thomas, J., Utley, J., Hong, S. Y., Korkmaz, H., & Nugent, G. (2020). A Review of the Research. *Handbook of Research on STEM Education*.
- Ulya, H., Maulida, L., Aini, N., & Ainur, D. (2018). Westlive: web-based assessment for learning using go formative application for improving student's physics concept mastery. *International Innovation, Design and Articulation i-IdeA*, 1, 174-179.
- Winaryati, E. (2018). Penilaian kompetensi siswa abad 21. In *Prosiding Seminar Nasional & Internasional* (Vol. 1, No. 1).
- Wiyaka, W., Prastikawati, E. F., & Adi, A. K. (2020). Higher-order thinking skills (hots)-based formative assessment: A proposed model for language learning assessment. *Vision: Journal for Language and Foreign Language Learning*, 9(2), 115-130.
- Zahir, A., Nur, H., Jusrianto, J., Hidayat, W., & Parubang, D. (2021). Evaluasi hasil belajar elektronika digital melalui tes formatif, sumatif, dan remedial. *Jurnal Literasi Digital*, 1(2), 122-129.