



## THE INFLUENCE OF IMPLEMENTING PORTFOLIO ASSESSMENTS IN SCIENCE LEARNING ON STUDENT LEARNING OUTCOMES: A SYSTEMATIC REVIEW

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### Abstract :

This literature review aims to investigate how the portfolio assessment used in research influences the learning outcomes of students based on the objectives of the analysis, research design used, level of education, learning topic, and form of an assessment tool. The most significant benefit of portfolio assessment was obtained in applied research/influence/effectiveness, namely 61.54%. Science learning with a research design had the highest frequency in a quasi-experimental design of 42.31%. The level of education was another factor that affected the portfolio assessment of science learning. Portfolio assessment in science learning was more prevalent at the upper secondary education level, with a percentage of 57.69%. Applying portfolio assessment in science learning (integrated science, physics, and biology) revealed that physics subjects attracted more research interest, namely 50%. Based on the research results and discussion presented in this article, it can be concluded that the portfolio assessment of science learning can be used at various levels of education. The novelty of this research is that it synthesizes the existing literature on the impact of implementing portfolio assessment in science learning on learning outcomes. Portfolio assessment in science learning implies that it can arouse students' interest in the subject, motivate them to engage in active learning, improve students' mastery of topics, and inform parents of their child's educational progress. Future research may explore other aspects of portfolio assessment, such as its validity, reliability, and feedback mechanisms.

Keywords: Learning Outcomes, Portfolio Assessment, Science Learning

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## INTRODUCTION

Teachers can use portfolios to administer assessments. A variety of learning experiences are required to achieve the expected results. Teachers must convey learning content and assessments following the characteristics of 21st-century learning. The process of collecting and analyzing data to

achieve student learning goals is called assessment. Assessment criteria should form the basis of pedagogical evaluation (Hidayat et al., 2012; Erduran et al., 2021; Wang et al., 2021).

According to Popham (1999), Portfolio assessment is a continuous assessment that systematically collects information or data about students' work results over a certain period. The assembled student portfolios can strengthen critical thinking and can motivate students to become Self-Directed Learners (SDL) who know how to lead their learning even better (Kicken et al., 2009; Ningtyas, 2017). Learning assessment: Evaluation of teachers is a crucial element that needs attention. It only focuses on mastery of concepts (cognitive) as measured by written tests. As a result, teachers lack focus on developing children's learning skills. This type of assessment also encourages students to memorize each daily test or study test so they cannot interpret the learning. This is also following research (Dewi, 2018). In learning, especially in science content, the majority of students are still below 70 minimum completeness criteria, making science knowledge not optimal. Of the 263 students, 149, or 56.65%, were below the minimum completeness criteria, while 114, or 43.35%, exceeded the minimum. Most students consider the content of science learning difficult, so students still do not understand the lesson and are less enthusiastic about following the lesson.

This is due to the weak implementation of teacher learning (Dewi, 2018). Apart from that, research from Ichwan (2012) states that authentic assessments, especially portfolios, are carried out in schools. However, this assessment is rarely carried out in practice due to the difficulty of compiling a portfolio of assessment tools. The delay in implementing the portfolio assessment was due to the teacher's main design being less than optimal because there was a lack of information regarding the actual evaluation, which prevented the implementation from producing the best results. As a result, it is essential to thoroughly understand the assessment context, which includes using portfolio assessment in science learning. Learning science studies living objects, inanimate objects, and the relationship between the two. In the 2013 curriculum, science teaching in junior high schools was developed as an integrative science subject. Science learning, especially in essential competencies, integrates science concepts based on Biology, Physics, and Earth and Space Sciences (Festiyed, 2018; Vyas et al., 2021; Peikos et al., 2022; Haynes et al., 2023).

So that the learning outcomes obtained by students can help apply this knowledge to real-world contexts. Learning outcomes enable students to develop intellectual skills (understanding concepts), cognitive strategies, verbal information, motor skills, and attitudes (complicated to measure but can be demonstrated in students' responses to people or situations) (Lee et al., 2021; Elvianasti et al., 2022; Chi, & Wang, 2023; Wu et al., 2023). To guide scientific learning so that student learning outcomes are optimal, continuous evaluation is needed because student performance is appreciated for test scores and non-test scores because students are always in good condition when solving test questions (Nuridin, 2011; Zhou et al., 2022; Özdeniz et al., 2023).

Based on the problems and potential solutions that have been studied by previous researchers and provided in the form of articles, researchers are interested in conducting a literature review on the influence of portfolio assessments in science learning on student learning outcomes. The formulation of the research topic is how portfolio evaluation assessment in science learning influences student learning outcomes, which can be concluded from the research objectives, research design, level of education, subjects, and type of learning outcomes assessment instrument used. This literature study aims to ascertain the extent to which research objectives, research design, level of education, and tools for assessing learning outcomes are influenced by research portfolio evaluation.

This research aims to examine portfolio assessment in science learning by reviewing and studying moderating variables.

## **RESEARCH METHOD**

This research uses literature review techniques to examine how portfolio assessment influences students' science learning. What is meant by "literature review" is a technique for reviewing and analyzing various study findings on relevant topics, namely the impact of portfolio assessment on science learning (physics, chemistry, and biology). The researchers themselves who function as research instruments can be utilized with the tools in this investigation. Journals about portfolio assessment in scientific learning over the last eight years (2015–2023) were found online and used as the population

in this research. Because the sample used in this study was consistent with the research problem, purposive sampling was used in the analysis. Data were analyzed using a qualitative descriptive design.

In this research, the assessment of the science learning portfolio uses a literature review methodology. A literature review or literature study research process compares various research findings in subjects related to the science learning portfolio assessment (physics, chemistry, and biology). This research uses a purposeful approach because samples are collected according to the research topic. Utilizing qualitative descriptions, the data is evaluated.

Data selection is carried out through identification, screening, eligibility, and inclusion. The study discovery process followed PRISMA rules as presented in Figure 1.

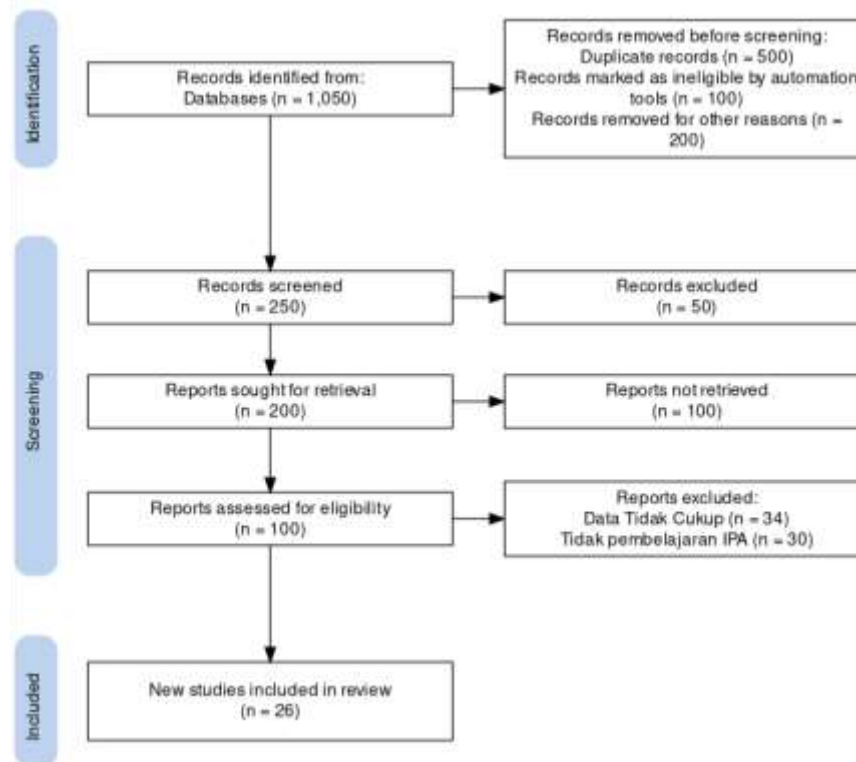


Figure 1. Literature Review Flowchart

## RESULTS AND DISCUSSION

Data comes from articles related to these findings that help examine each variable. Researchers searched online for Google Scholar with an ISSN license. In total, there were 26 articles that matched the specified search in the selected journals. The first examines the influence of portfolio assessment on science learning (Integrated Science, Physics, and Biology) which is decided from 2015 to 2023. The second examines the research objectives. The third examines the research design. The fourth examines education level. Fifth, examine the subjects studied, used when teaching science. This type of journal comes from a national publication recognized with ISSN.

Table 1. Grouping of articles based on year of publication

| References             | Years | Journal Code | Scale    | Amount | Percentage (%) | Results   |
|------------------------|-------|--------------|----------|--------|----------------|---|
| Nisa et al.            | 2015  | A1           | National | 2      | 7.69           | The portfolio assessment instrument meets the criteria very well, is good, and is reliable.   |
| Sukaisih and Verawati. | 2015  | A2           | National |        |                | Based learning portfolios can increase class XA students' activities and learning outcomes at Madrasah Aliyah Negeri Sengkol 2013/2014 academic year.   |
| Utami et al.           | 2016  | A3           | National | 8      | 30,77          | There is a significant difference in students' understanding ability in the experimental and control classes, where the experimental class's comprehension ability score is higher than the control class. This is influenced by the portfolio assessment applied to the practical class. |
| Hidayati.              | 2016  | A4           | National |        |                | The problem-based learning model accompanied by portfolio assessment shows that the learning outcomes of experimental class students are better than those in the control class.  |
| Astuti et al.          | 2016  | A6           | National |        |                | The guided inquiry learning model has a portfolio assessment that effectively improves students' critical thinking.   |
| Fitriani.              | 2016  | A7           | National |        |                | The results of the use trial obtained an  |

| References     | Years | Journal Code | Scale         | Amount | Percentage (%) | Results   |
|----------------|-------|--------------|---------------|--------|----------------|---|
|                |       |              |               |        |                | average suitability of 74.17%, convenience of 77.08%, and usability of 74.74%, and all three have high criteria so that the portfolio assessment product is suitable for use.   |
| Akbar et al.   | 2016  | A8           | National      |        |                | Portfolio assessment can significantly improve students' understanding of concepts and attitudes toward Physics. Apart from that, portfolio assessments can provide an overview of a student's track record during the learning process |
| Sadikin et al. | 2016  | A9           | National      |        |                | Implementation of portfolio-based learning assessments and capable learning journals improve metacognitive abilities and learning motivation  |
| Ling.          | 2016  | A10          | International |        |                | Use of portfolios in teaching and studying physics at private universities in Singapore can benefit because they will have a better idea of how their artifacts are valued  |
| Aqila.         | 2017  | A11          | National      | 2      | 7.69           | There is an influence of portfolio assessment on class X students on the material Biodiversity at Senior High School 13 Bandar Lampung.   |
| Apriani.       | 2017  | A12          | National      |        |                | Level of creativity good students by  |

| References           | Years | Journal Code | Scale    | Amount | Percentage (%) | Results   |
|----------------------|-------|--------------|----------|--------|----------------|---|
| Fatah and Setyarsih. | 2018  | A13          | National | 4      | 15.38          | using online portfolio assignments.<br>Portfolio assessment on all aspects of skills shows that the grades obtained by students increase with each meeting.   |
| Dewi.                | 2018  | A14          | National |        |                | The CTL approach based on portfolio assessment affects the science knowledge competency of class V students of Gugus I Gusti Ngurah Rai South Denpasar in the 2017/2018 academic year.  |
| Wulandari et al.     | 2018  | A15          | National |        |                | There is a significant influence on science learning outcomes between groups of students taught using the make-a-match learning model based on portfolio assessment and groups taught using conventional learning in class V elementary school students in Gugus VIII Sawan District, Buleleng Regency for the 2017/2018 academic year. |
| Kahar.               | 2018  | A16          | National |        |                | Improving physics learning outcomes with implementation of portfolio assessment is in place in the very high category, and student activity in learning has increased.  |
| Putri.               | 2019  | A17          | National | 4      | 15.38          | There is a significant influence of the use   |

| References        | Years | Journal Code | Scale    | Amount | Percentage (%) | Results  |
|-------------------|-------|--------------|----------|--------|----------------|--|
| Sholihah.         | 2019  | A18          | National |        |                | of assessment portfolios on students' critical thinking abilities.<br><br>With the application of portfolio assessment, it can be concluded that student learning outcomes increase after carrying out portfolio assessments. Student responses to the results of the portfolio assessment were mostly positive; namely, students agreed with the portfolio assessment |
| Firmansyah et al. | 2019  | A19          | National |        |                | Electronic portfolios effectively improve assignments and student portfolios and can improve student learning outcomes in experimental classes.  |
| Optiana.          | 2019  | A20          | National |        |                | E-Portfolio based practical guided on harmonic motion material simple springs developed are worthy of use as a guided practicum that can be used anywhere and anytime  |
| Anggreni et al.   | 2020  | A21          | National | 2      | 7.69           | The application of the Project Based Learning model assisted by portfolio assessment has an effect on the science literacy of class V students at Gugus IV Elementary School, Sawan District   |

| References          | Years | Journal Code | Scale         | Amount | Percentage (%) | Results  |
|---------------------|-------|--------------|---------------|--------|----------------|--|
| Utaminingsih et al. | 2020  | A22          | National      |        |                | There is a significant difference in students' understanding ability in the experimental class and control class, where the experimental class's understanding ability score is higher than the control class. This is influenced by the portfolio assessment implemented in the experimental class. |
| Mareta et al.       | 2021  | A23          | National      | 1      | 3.85           | There are differences in motivation scores and learning achievement for students learning using portfolio assessment and student learning using conventional assessment where Learning motivation and student achievement with the portfolio assessment method are higher.                           |
| Zuhriyah et al.     | 2022  | A24          | National      | 1      | 3.85           | The results of increasing student creativity in making mind maps using portfolio assessment are quite high.  |
| Syam et al.         | 2023  | A25          | National      | 2      | 7.69           | Implementation of portfolio assessment influence on the scientific literacy of class IVA students at Pannara State Elementary School, Makassar City.   |
| Hariadi.            | 2023  | A26          | International |        |                | Based on the research results, it can be concluded   |



| References | Years | Journal Code | Scale | Amount | Percentage (%) | Results   |
|------------|-------|--------------|-------|--------|----------------|---|
|            |       |              |       |        |                | that the average physical potential of program students registered through the portfolio system is in the very poor category. |

Based on Table 1, the results of collecting articles about portfolio assessment in science learning, there are 26 journals from 2015 to 2023, according to Google Scholar. The research took portfolio assessment keywords from 2015 to 2023. In the case of science learning, the keywords included were physics, chemistry, and biology subjects separately. Grouping articles based on year of publication, it was found that most research on portfolio assessment was carried out in 2016 with a percentage of 30.77%. This means that portfolio assessment research was the most researched in 2016.

In line with the research of Kuntarto & Gustina (2019), much research has been conducted on portfolio assessment. This portfolio functions as a basis for viewing and evaluating the development of students' knowledge, skills, and attitudes, demonstrating what students can achieve during learning (Marsegi et al., 2023). This portfolio can be seen as a collection of student work that is regularly documented. This portfolio includes assignments completed by students, observations made by teachers, several achievements, student essays, student activity reports, and negative notes made by students (Amanda et al., 2022).

Next, the grouping of articles based on research objectives can be seen in Table 2 and Figure 2 below.

Table 2. Grouping of articles based on research objectives

| Research Purposes                           | References                     | Journal Code | Amount | Percentage (%) |
|---|--------------------------------|--------------|--------|----------------|
| Application/<br>Influence/<br>Effectiveness | Sukaisih and Verawati., (2015) | A2           | 16     | 61.54          |
|   | Hidayati., (2016)              | A4           |        |                |
|   | Safitri et al., (2016)         | A5           |        |                |
|   | Astuti et al., (2016)          | A6           |        |                |
|   | Akbar et al., (2016)           | A8           |        |                |
|   | Sadikin et al., (2016)         | A9           |        |                |
|   | Aqila., (2017)                 | A11          |        |                |
|   | Fatah and Setyarsih., (2018)   | A13          |        |                |
|   | Dewi., (2018)                  | A14          |        |                |
|   | Wulandari et al., (2018)       | A15          |        |                |
|   | Putri., (2019)                 | A17          |        |                |
|   | Sholihah., (2019)              | A18          |        |                |
|   | Anggreni et al., (2020)        | A21          |        |                |
|   | Utaminingsih et al., (2020)    | A22          |        |                |
|   | Syam et al., (2023)            | A25          |        |                |
|   | Hariadi., (2023)               | A26          |        |                |
| Development                                 | Nisa et al., (2015)            | A2           | 4      | 15.38          |
|   | Fitriani., (2016)              | A7           |        |                |
|   | Firmansyah et al., (2019)      | A19          |        |                |
|   | Optiana., (2019)               | A20          |        |                |
| Implementation<br>Analysis                  | Utami et al., (2016)           | A3           | 6      | 23.07          |
|   | Ling., (2016)                  | A10          |        |                |
|   | Apriani., (2017)               | A12          |        |                |
|   | Kahar., (2019)                 | A16          |        |                |

| Research Purposes | References              | Journal Code | Amount | Percentage (%) |
|-------------------|-------------------------|--------------|--------|----------------|
|                   | Mareta et al., (2021)   | A23          |        |                |
|                   | Zuhriyah et al., (2022) | A24          |        |                |

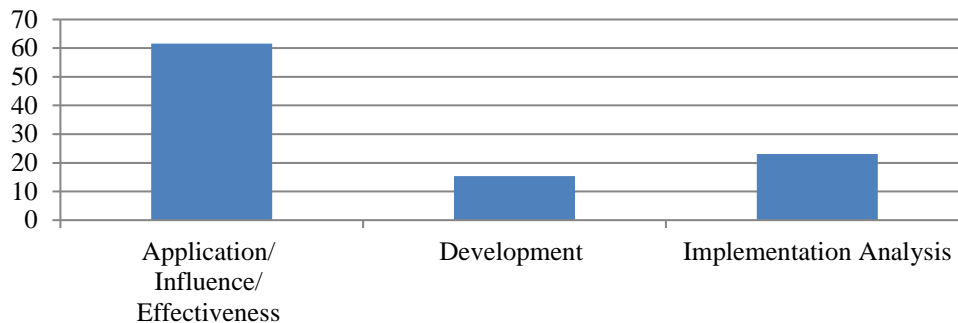


Figure 2. Grouping of Articles Based on Research Objectives

The results of a study of 26 articles on portfolio assessment in science learning in terms of research objectives showed that the highest gain was in Application/Influence/Effectiveness research, namely 61.54%. Therefore, the research objectives in this analysis are most widely used in Implementation/Influence/Effectiveness research. This confirms that researchers are more interested in applying existing assessments by correcting the shortcomings of previous research.

According to Fatah & Setyarsih (2018), Researchers are interested in applying existing assessments to maximize the limited time because implementing a portfolio assessment requires a long time. According to Wulandari et al. (2018) and Anggreni et al. (2020), because portfolio assessment is a class-based assessment of a collection of student's work that is systematically arranged and organized during the learning process over a certain period, researchers cannot make their assessments because it takes a long time.

Next is the analysis of grouping articles based on the research design, shown in Table 3 and Figure 3 below.

Table 3. Grouping of articles based on research design

| Research design           | Amount | Percentage (%) |
|---------------------------|--------|----------------|
| Experiment                |        |                |
| Pre-Experiment            | 4      | 15.38          |
| Quasi Experiment          | 11     | 42.31          |
| R&D                       |        |                |
| Addie                     | 1      | 3.85           |
| Borg & Gall               | 3      | 11.54          |
| Classroom Action Research | 3      | 11.54          |
| Quantitative descriptive  | 4      | 15.38          |

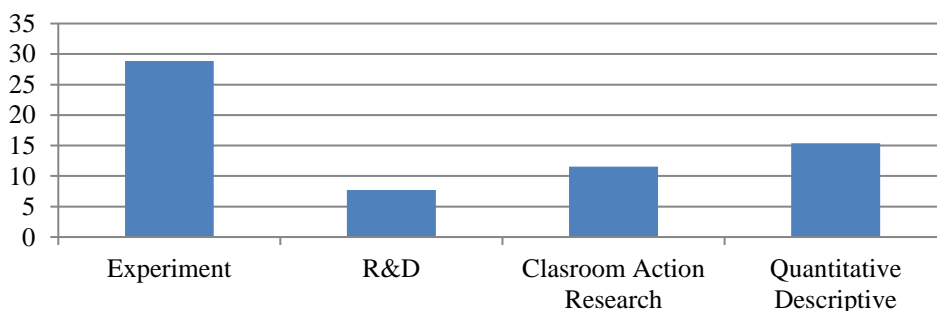


Figure 3. Grouping of Articles Based on Research Design

The analysis of portfolio assessment research on science learning in terms of research design showed that the Quasi-experimental design had the highest frequency, namely 42.31%. This shows that among all research designs, the most widely used are quasi-experimental designs. According to Aqila (2017), Assessment research using a quasi-experimental design functions to determine the effect of an experiment or treatment on the desired characteristics of the subject. Utaminingsih et al. (2020) dan Anggreni et al. (2020) uses a quasi-experimental design because it is not possible for researchers to select and sort subjects individually.

The next grouping analysis is based on educational level, as shown in Table 4 and Figure 4 below.

Table 4. Grouping of articles based on education level

| Educational Level  | Amount | Percentage (%) |
|--------------------|--------|----------------|
| Elementary School  | 5      | 19.23          |
| Junior High School | 3      | 11.54          |
| Senior High School | 15     | 57.69          |
| College            | 3      | 11.54          |

In Table 4, the research results regarding portfolio assessment in science learning can be seen from the level of education. Research on portfolio assessment in science learning is most popular in high school level education units in senior high school with a percentage of 57.69%.

According to Setiamiharja (2011), portfolio assessments can be carried out at all levels of education. Portfolio assessment involves many people. Teachers are not the only assessors. The final assessment of the portfolio is a collaboration between the assessments of teachers, students who own the portfolio, fellow students, younger/older classmates, parents, academics from other institutions (schools/college/course institutions), and/or other parties who have knowledge and authority regarding the results of the portfolio. will be assessed.

The final article analysis, based on the science subjects used in the research, can be seen in Table 5 and Figure 5 below.

Table 5. Grouping of articles based on science subjects

| Subjects        | Amount | Percentage (%) |
|-----------------|--------|----------------|
| Natural Science | 8      | 30.77          |
| Physic          | 13     | 50             |
| Biology         | 5      | 19.23          |

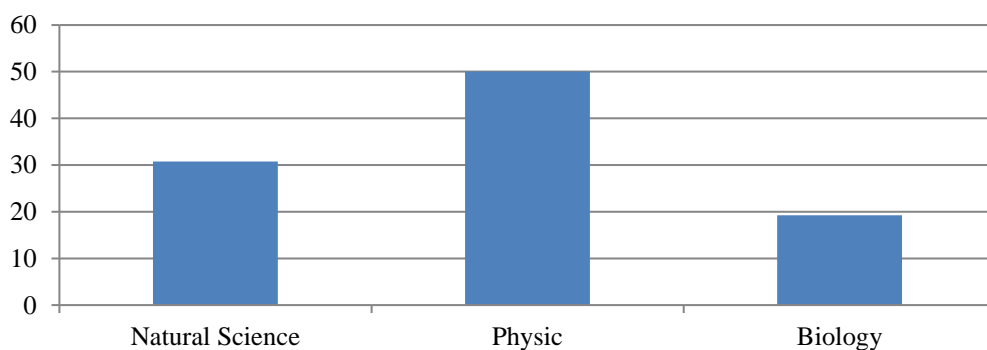


Figure 5. Grouping of Articles Based on Science Subjects

A literature review of 26 articles obtained regarding evaluation portfolios in science learning in terms of their use for science learning (Integrated Science, Physics, and Integrated Biology) determined that this research was carried out mainly on Physics subjects, precisely 50%. This is following research (Kahar, 2018). When used as a portfolio for mastering physics learning, it can arouse students' interest in the subject and motivate them to engage in active learning. The variety of assignments the teacher gives encourages students to practice questions more often, thereby increasing students' mastery of

topics. Students become more passionate about physics and inspired to learn more as they complete more assignments. Parents can also track their children's educational progress through portfolio evaluations and learn about their strengths and weaknesses. Indirect verbal communication between parents and teachers is also visible.

According to Dara Arka (2023), Learning through portfolio assessment places students at the center (student-centered). To enhance their work experience, students must be motivated to interact with their environment during the learning process. Students' self-confidence, understanding of diversity, and personality should grow due to this engagement. These interactions should increase attitudes and behavioral tolerance towards diversity and lifestyle variations. The novelty of this research is that it focuses on the impact of implementing portfolio assessment in science learning on learning outcomes. The implication of portfolio assessment in science learning is that it can arouse students' interest in the subject and motivate them to engage in active learning. It can improve students' mastery of topics, and parents can find out their child's educational progress with portfolio assessments. The limitation of this research is that it only examines the grouping of articles based on research objectives, research design, education level, and science subjects.

## CONCLUSION

Based on a collection of articles about assessment portfolios in science learning, there are 26 journals from 2015 to 2023, according to Google Scholar. Grouping articles based on year of publication, it was found that most research on portfolio assessment was carried out in 2016 with a percentage of 30.77%. This means that portfolio assessment research was the most researched in 2016. Based on the many research findings and discussions carried out in this research, it can be said that a lot of research has been conducted regarding the assessment of science learning portfolios. Based on objectives, Implementation/Influence/Effectiveness objectives are the most frequent research subjects (61.54%), while design objectives occupy second place. The most frequently used research design is a quasi-experimental design with a frequency of 42.31%. If we look at research utilization according to education level, senior high school is ranked third with a percentage of 57.69%. With a percentage of 50%, physics is the topic that uses the most portfolio assessment. Parents can track their children's educational progress through portfolio evaluations and learn about their strengths and weaknesses. Indirect verbal communication between parents and teachers is also visible.

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## REFERENCES

- Akbar, U. A. Q., Siahaan, P., & Saepuzaman, D. (2016). Dampak asesmen portofolio terhadap pemahaman konsep dan sikap siswa sekolah menengah pertama pada materi gaya dan gerak [The impact of portfolio assessment on middle school students' understanding of concepts and attitudes towards force and motion material]. *Prosiding SNPS (Seminar Nasional Pendidikan Sains)*, 3, 395–402. <https://jurnal.fkip.uns.ac.id/index.php/snps/article/view/9864/7294>
- Amanda, A., Anggela, C. A., Febrianti, F. M. D., Amalia, N., & Siwi, N. S. W. (2022). Tinjauan literatur: Pengaruh penerapan asesmen berbasis portofolio terhadap pemahaman materi pelajaran sekolah pada siswa SMA [Literature review: The effect of implementing portfolio-based assessment on understanding school subject matter in high school students]. *Seminar Nasional Psikologi Dan Ilmu Humaniora (SENAPIH)*, 1(1), 116–123. <http://conference.um.ac.id/index.php/psi/issue/view/81>
- Anggreni, L. D., Jampel, I. N., & Diputra, K. S. (2020). Pengaruh model project based learning berbantuan penilaian portofolio terhadap literasi sains [The influence of the project based learning model assisted by portfolio assessment on scientific literacy]. *Mimbar Ilmu*, 25(1), 41–52. <https://doi.org/10.23887/mi.v25i1.24475>
- Apriani, W. (2017). Penilaian kreativitas siswa SMA menggunakan tugas portofolio online melalui jejaring facebook pada konsep sistem gerak manusia [Assessment of high school students' creativity using online portfolio assignments via Facebook networking on the concept of human

- movement systems (B.S. thesis). Fakultas: Ilmu Tarbiyah dan Keguruan UIN Syarif Hidayatullah Jakarta. <http://repository.uinjkt.ac.id/dspace/handle/123456789/35155>
- Aqila, N. (2017). Pengaruh assessment portofolio terhadap kemampuan berpikir kreatif peserta didik kelas x SMA pada materi keanekaragaman hayati [The influence of portfolio assessment on the creative thinking abilities of class x high school students on biodiversity material] (Doctoral dissertation, UIN Raden Intan Lampung). <http://repository.radenintan.ac.id/2561/1/SKRIPSI.pdf>
- Astuti, H. D., Linuwih, S., & Marwoto, P. (2016). Keefektifan pembelajaran inkuiri terbimbing dilengkapi penilaian portofolio untuk meningkatkan berpikir kritis siswa SMA [The effectiveness of guided inquiry learning complemented by portfolio assessment to improve high school students' critical thinking]. *UPEJ Unnes Physics Education Journal*, 5(1). <https://doi.org/10.15294/upej.v5i1.12709>
- Chi, S., & Wang, Z. (2023). Students' science learning experiences and career expectations: mediating effects of science-related attitudes and beliefs. *International Journal of Science Education*, 45(9), 1-27. <https://doi.org/10.1080/09500693.2023.2175184>
- Dara, A. F. (2023). Pengembangan Instrumen Penilaian Sikap Ilmiah Pada Pembelajaran Fisika Untuk Memetakan Minat Belajar Siswa Di Sma Negeri 1 Menggala [Development of a Scientific Attitude Assessment Instrument in Physics Learning to Map Students' Learning Interests at SMAN 1 Menggala] (Thesis). <http://digilib.unila.ac.id/id/eprint/70580>
- Dewi, D. A. P. H. (2018). Pengaruh pendekatan contextual teaching and learning berbasis penilaian portofolio terhadap kompetensi pengetahuan IPA [The influence of a contextual teaching and learning approach based on portfolio assessment on science knowledge competency]. *Journal for Lesson and Learning Studies*, 1(3), 237–242. <https://doi.org/10.23887/jlls.v1i3.15387>
- Elvianasti, M., Lufri, L., Andromeda, A., Mufit, F., Pramudiani, P., & Safahi, L. (2022). Motivasi dan hasil belajar siswa IPA: Studi metaanalisis [Science students' motivation and learning outcomes: A meta-analysis study]. *Edukasi: Jurnal Pendidikan*, 20(1), 73–84. <https://doi.org/10.31571/edukasi.v20i1.3582>
- Erduran, S., Ioannidou, O., & Baird, J. A. (2021). The impact of epistemic framing of teaching videos and summative assessments on students' learning of scientific methods. *International Journal of Science Education*, 43(18), 2885-2910. <https://doi.org/10.1080/09500693.2021.1998717>
- Fatah, A. R. A., & Setyarsih, W. (2018). Penerapan penilaian portofolio dengan model pembelajaran inkuiri terbimbing pada materi fluida statis SMA Senopati Sidoarjo [Application of portfolio assessment with a guided inquiry learning model on static fluid material at Senopati Sidoarjo High School]. *Inovasi Pendidikan Fisika*, 7(2). <https://doi.org/10.26740/ipf.v7n2.p%25p>
- Firmansyah, S., Chandra, E., & Aripin, I. (2019). Pengembangan electronic portfolio (e-portofolio) sebagai a sssessment pembelajaran biologi [Development of an electronic portfolio (e-portofolio) as an assessment of biology learning]. *Jurnal Bio Education*, 4(2), 47-57. <http://dx.doi.org/10.31949/be.v4i2.1699>
- Fitriani, M. E. (2016). Pengembangan Perangkat Penilaian Portofolio pada Pembelajaran IPA Terpadu Melalui Scientific Approach [Development of Portfolio Assessment Tools for Integrated Science Learning Using a Scientific Approach] (Thesis). <http://digilib.unila.ac.id/id/eprint/22267>
- Hariadi, S. (2023). Physical Potential of Students' Portfolio for the Class of 2020. *UNICSSH*, 721–730. [https://doi.org/10.2991/978-2-494069-35-0\\_89](https://doi.org/10.2991/978-2-494069-35-0_89)
- Haynes, M., Brown, A., Nichols, K., & Parveen Musofer, R. (2023). Measurement of student attitudes to science and association with inquiry-based learning in regional schools. *International Journal of Science Education*, 45(8), 593-612. <https://doi.org/10.1080/09500693.2023.2168138>
- Hidayat, S., Festiyed, F., & Fauzi, A. (2012). Pengaruh pemberian assessment essay terhadap pencapaian kompetensi siswa dalam pembelajaran fisika menggunakan pendekatan ekspositori dan inkuiri di kelas XI IA SMA N 1 Kecamatan Suliki Kabupaten Lima Puluh Kota [The influence of providing assessment essays on students' achievement of competency in learning physics using expository and inquiry approaches in class XI IA SMA N 1 Suliki District, Limapuluh Kota Regency]. *Jurnal Penelitian Pembelajaran Fisika (JPPF)*, 1(1). <https://doi.org/10.24036/jppf.v1i1.600>

- Hidayati, N. (2016). Penerapan model pembelajaran berbasis masalah disertai penilaian portofolio pada pembelajaran fisika di SMA [Application of a problem-based learning model accompanied by portfolio assessment in physics learning in high school]. *Jurnal Pembelajaran Fisika*, 4(5), 573–580. <https://jurnal.unej.ac.id/index.php/JPF/article/view/3704>
- Ichwan, M. (2012). Pengembangan Instrumen Penilaian Portofolio Mata Pelajaran Bahasa Indonesia pada Kurikulum Tingkat Satuan Pendidikan SMP Kelas Viisemester Ganjil [Development of Indonesian Language Subject Portfolio Assessment Instruments in the Odd Semester Middle School Education Unit Level Curriculum] (Doctoral dissertation, State University of Surabaya). <https://ejournal.unesa.ac.id/index.php/bapala/article/view/2023/5418>
- Kahar, M. S. (2018). Assesmen portofolio untuk meningkatkan hasil belajar fisika [Portfolio assessment to improve physics learning outcomes]. *JEMS: Jurnal Edukasi Matematika Dan Sains*, 5(2), 53–61. <http://doi.org/10.25273/jems.v5i2.1987>
- Kuntarto, E., & Gustina, R. (2019). Pelaksanaan Penilaian Portofolio di Sekolah Dasar [Implementation of Portfolio Assessment in Elementary Schools]. *Jurnal Gentala Pendidikan Dasar*, 4(2), 190–200. <https://doi.org/10.22437/gentala.v4i2.8437>
- Lee, G. G., Jeon, Y. E., & Hong, H. G. (2021). The effects of cooperative flipped learning on science achievement and motivation in high school students. *International journal of science education*, 43(9), 1381-1407. <https://doi.org/10.1080/09500693.2021.1917788>
- Ling, M. K. (2016). The use of academic portfolio in the learning and assessment of physics students from a Singapore Private College. *International Journal of Assessment Tools in Education*, 3(2), 151–160. <https://doi.org/10.21449/ijate.245199>
- Mareta, B., Amara, D., Mayang, D., Arya, E., & Eva, N. (2021). Pengaruh asesmen portofolio terhadap peningkatan motivasi dan prestasi belajar siswa [The effect of portfolio assessment on increasing student motivation and learning achievement]. *Seminar Nasional Psikologi UM*, 1(1), 86–96. <http://conference.um.ac.id/index.php/psi/article/view/1228>
- Marsegi, S. M., Nurhayati, S., Ansori, A., & Hendriana, H. (2023). Digital-Based portfolio assessment competence of early childhood educators. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, 7(1), 267–275. <https://doi.org/10.31004/obsesi.v7i1.3360>
- Ningtyas, D. A. (2017). Pengaruh penerapan asesmen portofolio proses dalam model inkuiri terbimbing terhadap keterampilan berpikir kritis dan hasil belajar biologi siswa kelas x SMA Negeri 2 Batu [The influence of implementing the process portfolio assessment in the guided inquiry model on critical thinking skills and biology learning outcomes for class x students at SMA Negeri 2 Batu]. *Jurnal Pendidikan Biologi*, 9(1), 1–9. <http://dx.doi.org/10.17977/um052v9i1p1-9>
- Nisa, A. N. K., Budiharti, R., & Fauzi, A. (2015). Penyusunan instrumen penilaian portofolio dalam pembelajaran fisika kelas x SMA pada Materi Suhu dan Kalor [Preparation of portfolio assessment instruments in class x high school physics learning on Temperature and Heat Material]. *PROSIDING: Seminar Nasional Fisika Dan Pendidikan Fisika*, 6(4). <https://jurnal.fkip.uns.ac.id/index.php/prosfis1/article/download/7773/5708>
- Nuridin, G. (2011). Pemanfaatan asesmen portofolio pada pembelajaran sains di sekolah dasar [Utilization of portfolio assessment in science learning in elementary schools]. *Prosiding Seminar Biologi*, 8(1). <https://jurnal.fkip.uns.ac.id/index.php/prosbio/article/view/896>
- Optiana, N. (2019). Pengembangan panduan penilaian berbasis e-portofolio menggunakan edmodo dalam pembelajaran praktikum fisika untuk sekolah menengah atas [Development of an e-portfolio based assessment guide using Edmodo in physics practical learning for high school]. *Jurnal Riset Dan Kajian Pendidikan Fisika*, 6(2), 1–5. [https://www.academia.edu/download/86829371/T1\\_1500007040\\_NASKAH\\_20PUBLIKASI.pdf](https://www.academia.edu/download/86829371/T1_1500007040_NASKAH_20PUBLIKASI.pdf)
- Özdeniz, Y., Aktamış, H., & Bildiren, A. (2023). The effect of differentiated science module application on the scientific reasoning and scientific process skills of gifted students in a blended learning environment. *International Journal of Science Education* 45(10), 1-23. <https://doi.org/10.1080/09500693.2023.2175627>
- Peikos, G., Spyrtou, A., Pnevmatikos, D., & Papadopoulou, P. (2022). A teaching learning sequence on nanoscience and nanotechnology content at primary school level: evaluation of students'

- learning. *International Journal of Science Education*, 44(12), 1932-1957. <https://doi.org/10.1080/09500693.2022.2105976>
- Popham, W. J. (1999). *Classroom assessment: What teachers need to know*. Allyn & Bacon, A Viacom Company, 160 Gould St., Needham Heights, MA 02194; <http://www.abacon.com>
- Putri, F. S. (2019). Pengaruh Penggunaan Media Penilaian Portofolio Elektronik Terhadap Kemampuan Berpikir Kritis Peserta Didik Sma Negeri 1 Jatiagung [The Effect of Using Electronic Portfolio Assessment Media on the Critical Thinking Ability of Students at State High School 1 Jatiagung] (PhD Thesis). UIN Raden Intan Lampung. <http://repository.radenintan.ac.id/8793/1/SKRIPSI%20FITRI.pdf>
- Sadikin, A., Aina, M., & Hakim, N. (2016). Penerapan asesmen berbasis portofolio dan jurnal belajar untuk meningkatkan kemampuan metakognitif dan motivasi belajar mahasiswa pada mata kuliah Perencanaan Pengajaran Biologi [Application of portfolio-based assessments and learning journals to improve students' metacognitive abilities and learning motivation in the Biology Teaching Planning course]. *Biodik*, 2(2), 50–61. <https://repository.unja.ac.id/id/eprint/17522>
- Safitri, R., Susilawati, S., & Khoiri, N. (2016). Penggunaan penilaian portofolio berbantuan kit kalor terhadap keterampilan kinerja siswa kelas X Smk N 2 Kendal [The use of portfolio assessment assisted by a caloric kit on the performance skills of class X students at SMK N 2 Kendal]. *Lontar Physics Forum (LPF)* 2015. <http://prosiding.upgris.ac.id/index.php/lpf2015/2015/paper/viewFile/950/896>
- Setiamiharja, R. (2011). Penilaian portopolio dalam lingkup pembelajaran berbasis kompetensi [Portfolio assessment within the scope of competency-based learning]. *EduHumaniora: Jurnal Pendidikan Dasar Kampus Cibiru*, 3(2). <https://doi.org/10.17509/eh.v3i2.2806>
- Sholihah, F. N. (2019). Penerapan penilaian portofolio pada materi keanekaragaman makhluk hidup di SMP laboratorium Surabaya [Application of portfolio assessment to material on the diversity of living creatures at SMP laboratories in Surabaya]. *JoEMS (Journal of Education and Management Studies)*, 2(1), 78–85.
- Sukaisih, R., & Verawati, N. (2015). Penerapan model guided inquiry dilengkapi penilaian portofolio untuk meningkatkan aktivitas dan hasil belajar fisika siswa [The implementation of the guided inquiry model is complemented by portfolio assessment to improve students' physics learning activities and outcomes]. *Pembelajaran Dan Penilaian Sains Sesuai Tuntutan Kurikulum 2013*, 268–271.
- Syam, U. S., Jusmawati Jusmawati, Supardi, R., & HS, E. F. (2023). Implementasi asesmen portofolio terhadap literasi sains siswa kelas iv sdn Pannara Kota Makassar [Implementation of a portfolio assessment on the scientific literacy of class 4 students at Pannara Elementary School, Makassar City]. *Bina Gogik*, 10(1), 29–38. <https://doi.org/10.61290/pgsd.v10i1.7>
- Utami, K. M., Siahaan, P., & Purwanto, P. (2016). Analisis kemampuan pemahaman konsep siswa melalui penerapan asesmen portofolio pada pembelajaran fisika [Analysis of students' conceptual understanding abilities through the application of portfolio assessment in physics learning]. *Prosiding Seminar Nasional Fisika (E-Journal)*, 5, SNF2016-OER. <https://doi.org/10.21009/0305010406>
- Utaminingsih, T., Parmiti, D. P., & Astawan, I. G. (2020). Model quantum tipe VAK berbasis penilaian portofolio meningkatkan hasil belajar IPA [A VAK type quantum model based on portfolio assessment improves science learning outcomes]. *Mimbar Ilmu*, 25(2), 271–281. <https://doi.org/10.23887/mi.v25i2.26616>
- Vyas, V. S., Kemp, B., & Reid, S. A. (2021). Zeroing in on the best early-course metrics to identify at-risk students in general chemistry: an adaptive learning pre-assessment vs. traditional diagnostic exam. *International Journal of Science Education*, 43(4), 552-569. <https://doi.org/10.1080/09500693.2021.1874071>
- Wang, H. H., Lin, H. S., Chen, Y. C., Pan, Y. T., & Hong, Z. R. (2021). Modelling relationships among students' inquiry-related learning activities, enjoyment of learning, and their intended choice of a future STEM career. *International Journal of Science Education*, 43(1), 157-178. <https://doi.org/10.1080/09500693.2020.1860266>
- Wu, M., Sun, D., Yang, Y., Li, M., & Sun, J. (2023). Investigating students' performance at self-regulated learning and its effects on learning outcomes in chemistry class at the senior secondary

- school. *International Journal of Science Education*, 45(16), 1-24. <https://doi.org/10.1080/09500693.2023.2209693>
- Wulandari, K. E., Suarni, K., & Renda, N. T. (2018). Pengaruh model pembelajaran Make A Match berbasis penilaian portofolio terhadap hasil belajar IPA [The influence of the Make A Match learning model based on portfolio assessment on science learning outcomes]. *Journal of Education Action Research*, 2(3), 240–248. <https://doi.org/10.23887/jear.v2i3.16261>
- Zhou, Y., Li, X., Sing Chai, C., Tsai, C. C., & Liang, J. C. (2022). Do parents' conceptions of learning science predict students' approaches to learning science and their self-efficacy for learning science?. *International Journal of Science Education*, 44(13), 2085-2109. <https://doi.org/10.1080/09500693.2022.2113173>
- Zuhriyah, I., Rosidi, I., Tamam, B., Qomaria, N., & Putera, D. B. R. A. (2022). Analisis kreativitas siswa pada pembuatan mind mapping dengan penilaian portofolio materi sistem ekskresi [Analysis of student creativity in making mind maps by assessing the excretory system material portfolio]. *Natural Science Education Research*, 5(2), 92–104. <https://doi.org/10.21107/nser.v5i2.16558>