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The Influence of Essay Assessment on Student Competency Achievement in Science Learning: Literature Review

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Abstract: The low scores of Pisa and TIMSS Indonesia show that students' abilities are still weak in 3 categories, namely linguistic literacy, scientific literacy, and mathematical literacy. To measure how far the achievement of student competence can be used assessment essay. Therefore this study aims to see the effect of essay assessment on students' competency achievement in science learning. This study used the literature review method through searches on Google Scholar and ERIC with the keywords "student competency achievement", "Essay Assessment", and "scoring". As research subjects, 16 articles were used which had been extracted from 1000 articles in national journals and international journals between 2019 and 2023. The results showed that the use of assessment essays based on educational level, namely at the high school level had a percentage of 62.5% while at the university level has a percentage of 60%. Furthermore, based on the material, it can be seen that the percentage of using assessment essays in biology and physics subjects obtained a percentage of 60%. So it can be concluded that Essay Assessment has an influence on the Achievement of Student Competence in Science Learning.

Keywords: Assessment; Competency; Essay

Introduction

Science is important to study and develop, because science plays a major role in designing and developing technology. Therefore, various efforts have been made so that science learning can run well and provide satisfactory results. To determine student competency achievement, data collection must be carried out. The process of collecting and analyzing data to determine whether students have achieved their learning goals is called assessment. Assessment of Student Learning Outcomes is based on Minister of Education and Culture Regulation no. 23 of 2016 concerning assessment standards and contains elements of attitude, knowledge and ability. Educator learning outcomes evaluation intends to continue to track and assess student learning progress, processes and better learning outcomes (Sutami, 2020). This is in line with what is expected by 21st century education, namely developing student competencies in terms of knowledge, attitudes and skills, so evaluation is needed to assess the level of development of student competencies (Nafsih et al., 2020). Where the competencies that are more demanded in the 21st century are understanding information, thinking critically, analytically and reflectively (Annisa, 2020).

However, in reality, based on the results of data collection, it is known that students' abilities in language literacy, mathematical literacy, and scientific literacy are still low. This is in accordance with the results of international benchmarks carried out by the Indonesian state as part of the evaluation, including the Trends in International Mathematics and Science Study (TIMSS) and the Program for International Student Assessment (PISA). The three categories of PISA-based assessment are language literacy, mathematics literacy and science literacy. Based on statistics on the results of the PISA exam from 2000 to 2018, the scientific literacy level of students in Indonesia is still relatively low (Hewi, 2020). In 2003, Indonesia was even ranked 38th with a score of

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360, which is relatively low compared to other countries (Noviana, 2020). In terms of scientific literacy, students in 2018 were ranked 70th out of 78 countries with a low score of 396. In contrast, in the 2015 TIMSS assessment, Indonesia was ranked 44th out of 49 participating countries with an average score of 397 and an average score of international average. 500. The survey respondents' achievements were categorized into four categories based on TIMSS criteria: low (low 400), moderate (medium), high, and very high. Indonesia's position is at a low level (Suparya, 2022) as evidenced by statistics showing low (550 low), high (550 high), and advanced (625 advanced).

The poor scores of PISSA and TIMSS show that there are still challenges in increasing students' understanding of the subjects being taught. According to Wahyuni (2022), one of the factors causing students' poor PISA performance is their inability to translate problems and think visually. The cause of poor PISA scores is the paradoxical nature of public education, which leads to low creative thinking abilities (Suharyat et al., 2022). To develop as individuals, generate original ideas, and develop their skills and knowledge, students must be able to think creatively. One strategy to overcome this problem is to speed up the educational process and encourage students to use their imagination (Fradila et al., 2021). This thinking skill involves solving students' ideas to produce new knowledge or concepts.

Essay assessment is a type of test that can be used to measure student competency achievement. Where in Anderson and Kartwohl's taxonomy on achievements C4, C5, and C6, as well as affective and psychomotor elements of critical thinking skills and creative thinking skills, all of them are included in the PISA-oriented essay assessment. Competency-based evaluations called assessment essays require students to formulate, produce and offer original answers. Because essay tests can show how well students are at gathering, organizing, synthesizing, and analyzing knowledge, education professionals sometimes use them. Essay assessment provides several benefits, including the ability to test students' thinking and reasoning processes, test higher-order thinking skills or critical thinking skills, and offer real-world experiences (Zubaidah, 2018). Students with strong conceptual understanding will be able to apply this information to solve new problems in other contexts because knowledge received through higher-order thinking processes is more easily transferred than simply remembering (Hutapea, 2021).

Apart from that, essay assessments can also be used to improve students' learning skills. Meanwhile, the 4C skills (critical thinking, creativity, collaboration and communication) needed in the 21st century can also be obtained through essay evaluation. Problem solving ability is the foundation of critical thinking (Nurhida, 2021). This statement is in line with research conducted by Hasanah (2023) which states that good critical thinking skills will influence students' ability to understand the material well and is reinforced by research conducted by Nurlinda (2019) who applies journals as teaching materials that can improve abilities. student. High level thinking skills and encourage students to actively look for answers so that their ability to understand science material becomes better.

Based on the explanation above, this study aims to see how much influence Essay Assessment has on Student Competency Achievement in Science Learning in terms of subject matter and educational level.

Method

This research uses a literature review method. Literature review is an activity that focuses on a specific topic that is of interest to critically analyze the contents of the text being studied (Wahyuni, 2022). The data collected begins by conducting a literature review search on Google Scholar and ERIC with the keyword "achievement of student competency", "Essay Assessment", and "scoring". As research subjects, 16 articles were used which had been extracted from 1000 articles in national journals and international journals between 2019 and 2023. The research flow can be seen in figure 1.

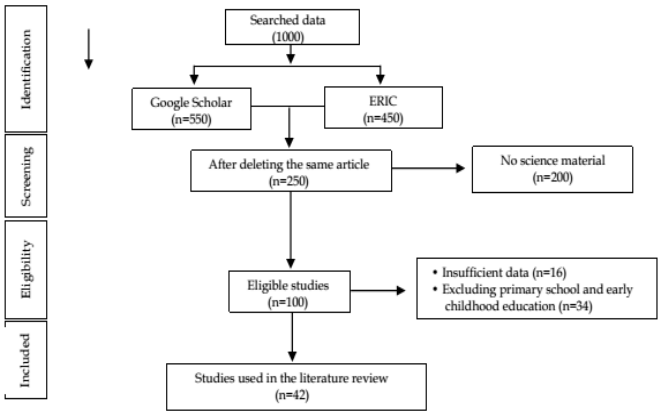

Figure 1. Literature review systematic flowchart

Researchers may find it simpler to comprehend the evolution of journal contents, as well as the differences and similarities across journals that have been the subject of research, thanks to the availability of this journal matrix. According to the constraints of the topic that the researcher is trying to address, namely the impact of assigning an assessment essay on the development of student competency in learning science, the researcher will examine each journal one at a time.

Result and Discussion

The findings of this study examined the body of literature on the impact of assigning an evaluation essay on students' accomplishment of scientific learning competency. 42 scientific publications that have been validated and will be utilized as data in accordance with the criteria of necessity were obtained from the many articles that were evaluated. According to Table 1, the collected articles were coded from A1 to A42.

Table 1. Systematic Data Literature Review

Code	Researcher Identity	Year of Publication	Subject	Education Level
A1	(Ulmi, 2018)	2019	Physics	SHS
A2	(Mahfuzah et al., 2020)	2020	Biology	SHS
A3	((Bodori et al., 2023)	2023	Biology	SHS
A4	(Arifaldi et al., 2019)	2019	Physics	SHS
A5	(Marzam et al., 2021)	2021	Physics	University
A6	(Risnita et al., 2020)	2020	Chemistry	SHS
A7	(Harta et al., 2020)	2020	Chemistry	SHS
A8	(Sandi et al., 2019)	2019	Physics	SHS
A9	(Martin & Eliza, 2020)	2020	Physics	University
A10	(Simanjuntak et al., 2021)	2021	Physics	University
A11	(Duda et al., 2019)	2019	Biology	University
A12	(Muhali et al.,2021)	2021	Chemistry	SHS
A13	(Pantiwati et al., 2022)	2022	Biology	University
A14	(Astriani et al., 2020)	2020	Biology	University
A15	(Fauzan, 2021)	2021	Biology	SHS
A16	(Rahayu et al., 2019)	2019	Chemistry	SHS
A17	(Hikmawati et al., 2022)	2022	Physics	University
A18	(Mahanal et al., 2019)	2019	Biology	SHS
A19	(Sujanem et al., 2023)	2023	Physics	SHS
A20	(Irma et al., 2023)	2023	Physics	SHS
A21	(Hikmawati et al., 2021)	2021	Biology	JHS
A22	(Adhelacahya et al., 2023)	2023	Physics	SHS
A23	(Zulhamdi et al., 2022)	2022	Biology	SHS
A24	(Arif et al., 2023)	2023	Physics	JHS
A25	(Saputri et al., 2019)	2019	Biology	SHS
A26	(Fauzi et al., 2019)	2019	Biology	JHS
A27	(Wumu et al.,2023)	2023	Physics	JHS
A28	(Rapi et al., 2022)	2022	Physics	SHS
A29	(Sanova., 2023)	2023	Chemistry	SHS
A30	(Siburian et al., 2019)	2019	Biology	University
A31	(Verawati et al., 2021)	2021	Physics	University
A32	(Harahap et al., 2019)	2019	Biology	JHS
A33	(Wiratma et al., 2023)	2023	Chemistry	SHS
A34	(Sudarmin et al., 2019)	2019	Chemistry	SHS
A35	(Khairi et al., 2023)	2023	Physics	SHS
A36	(Juanda et al., 2022)	2022	Biology	University
A37	(Jamaluddin et al., 2023)	2023	Biology	University
A38	(Pujani et al, 2022)	2022	Physics	University
A39	(Suradika et al., 2023)	2023	Chemistry	SHS
A40	(Ansurmawaty et al., 2023)	2023	Physics	SHS
A41	(Nurlina et al., 2022)	2022	Physics	University
A42	(Susilawati et al., 2022)	2022	Physics	SHS

Articles with codes A1, A6, A7, A9, A11, A13, A17, A18, A20, A21, A23, A24, A25, A26, A27, A28, A29, A30, A31, A32, A33, A35, A36, A37 , A38, A39 and A41 present articles about the use and development of essay assessment in learning which shows an increase in student competencies such as critical thinking, creative thinking and others. Meanwhile, articles with codes A2, A3, A8, A10, A12, A14, A15, A19, A22, A34 and A40 show the use of assessment essays in research to demonstrate a competency which is part of the skills needed in the 21st century and the competencies needed to improve students' PISSA. and TIMSS scores. in Indonesia.

The use of essay assessment can also be integrated with several learning model approaches as seen in articles coded A2, A3, A4, A18, A20, A21, A23, A24, A25,

A27, A29, A30, A31, A32, A38 and A39, namely models Pjbl, PBL, blended learning, Recorse, R2L, stem-PBL and inquiry. Where by implementing essay assessment with the Pjbl learning model approach can improve students' metacognitive abilities. The PBL model improves students' critical and creative thinking skills. The RICORSE model and blended learning can improve critical thinking skills. The R2L model increases academic literacy, while using the inquiry model can improve students' critical thinking, problem solving and cognitive abilities. The ability to assess essays using the inquiry model is in line with research conducted by Fadli (2020), who in his research proved that using the inquiry model and measuring students' abilities using essay tests can improve students' skills. Apart from that, as has been mentioned, the use of essay assessments can improve students' cognitive abilities, in line with research conducted by Safaruddin et al. (2020) and Darmawan (2020) and Muhayati (2023) who in their research succeeded in proving that the use of essay assessments can improve students' cognitive abilities.

Minimum competency assessment based on MCA is used in the education system in Indonesia. The three elements that form student skills assessed by the national exam are the Minimum Competency Examination (MCA), character survey, and learning environment survey. Students' cognitive abilities are evaluated using the reading and mathematics literacy components of the Minimum Competency Assessment (MCA). Students must meet the MCA competency criteria.

A sign of increased cognitive and logical thinking is the capacity for self-criticism and one's challenges in generating new ideas (Akromah, 2019). Marisa (2020), on the other hand, notes that cognitive indicators in scientific literacy also include indicators of scientific knowledge, indicators of understanding the nature of science, indicators of science as a way of thinking, and indicators of interactions between science, technology and technology, and society.

According to studies (Ulmi, 2018) and (Sari, 2021) essay assessment can have an impact on students' critical and creative thinking abilities. Fluency, adaptability, originality when generating new ideas, and detail (or elaboration) when presenting ideas are indicators of creative thinking, while information, concepts and ideas, points of view and conclusions must be clear, relevant and precise indicators of critical thinking. The ability of essay assessments to improve critical thinking skills is in line with research conducted by Sidiq et al. (2021), who in their research used essay assessments to improve critical thinking skills. This research was conducted through quasi-experimental research with a sample of 60 students who were given pretest and posttest questions and the results showed that essay assessments for HOTS-based science learning could improve students' critical thinking skills. This is in line with research conducted by Astawa et al. (2022) who in their research succeeded in proving that by using essay assessments critical thinking skills can be measured and research conducted by Yusuf (2019) which proves that the use of essay assessments in secondary schools in Kuala Lumpur can measure increasing students' critical thinking skills. Essay assessments can improve critical thinking skills because written assessments take the form of essay tests, which require students to compose answers using their own words (Wiyastuti, 2020). This was further clarified by research conducted by Alsaleh (2022) which stated that students were asked to write essays to improve their critical thinking skills and were encouraged to use higher order thinking skills.

Students' critical thinking skills will encourage students to have good problem solving abilities. Thus, it can be concluded that essay assessments that can be used to improve students' critical thinking skills will encourage students' problem solving abilities. This is in line with research conducted by Ramdani (2021) who in his research utilized science teaching materials based on the 5E learning cycle integrated with local wisdom to improve students' critical thinking skills using essay assessments in their evaluations. The results show that the essay assessment is effective in improving students' critical thinking skills, which also encourages students' problem solving abilities. This is further strengthened by research conducted by researchers with journal codes A36, A38, A42. Code A38 uses teaching materials and code A40 uses worksheets that integrate essay assessments for evaluation.

Research A38 uses a quasi-experimental method and A40 uses an R&D method with a 4D model. A38 by utilizing essay assessments in teaching materials after the pre-posttest shows an increase in students' problem solving skills, while code A40 in the LKS effectiveness test shows that LKS containing essay assessments can improve students' problem solving skills. Problem solving skills are also related to scientific literacy abilities where these skills will develop students' thinking skills because in learning students are conditioned to be able to dig up as much information as possible, then formulate questions and determine solutions to the problems created so this is very good for increasing students' scientific literacy. This is in line with research conducted by Fakhriyah et al. (2019) which in their research proves that scientific-based teaching materials (scientific literacy) that have been developed are effective in improving students' thinking skills and this is further strengthened by research conducted by Pursitasari (2023) using essays, in interactive teaching materials improve students' critical thinking skills and scientific attitudes.

Ulmi (2018)/Kode to encourage student creativity in learning physics, A1 created an essay exam. Physics is the subject that uses the most assessment instruments (Tanjung, 2022). Therefore, by using essay evaluation, students' creative thinking abilities are evaluated in 4 areas. The four abilities considered are clarity of thought, adaptability of thought, originality of thought, and detail-oriented thinking. The research results showed that the essay assessment worksheet created was successful in improving students' original thinking abilities (73.08 in physics learning). Pantiwati et al. (2022)/code in A13 used an essay exam to assess participants' capacity for original thinking on biodiversity-related topics. Six questions were asked to examine how essay exams impact students' ability to think creatively. one question on originality, one question on fluency, one question on elaboration, one question on flexibility, one question on metaphor, and two questions on thinking. The experimental class had a higher proportion of creative thinkers than the control class, according to test results for six creative thinking questions. Students' responses to questions demonstrate their capacity for original thinking. Because this study found that assessment essays impact students' creative thinking capacity, it is recommended that assessment essays be used in conjunction with other biological resources.

The increase in student creativity due to the use of essay assessments is in line with research conducted by Rizal et al. (2022) who in their research succeeded in proving that the use of essay assessments in measuring the level of creative thinking abilities and science process skills was effectively used. The ability of essay assessment to increase student creativity has previously been proven by researchers at code A20 who in their research explored the scientific creativity of high school students on static fluid material in STREM PBL with an e-authentic assessment using 3 essay questions for the pre-posttest showing an increase in student creativity. This statement is also in line with research conducted by Jawad (2021) in his research to determine the impact of science, technology, engineering and mathematics education on creative thinking and research conducted by Suliyanthini (2023) who in his research used project-based learning with evaluation. Using essays can improve students' creative thinking. By utilizing essay assessments, students' creativity can be measured. Based on the explanation above, it can be seen that the use of essay assessments can improve students' 21st century skills, namely creativity and critical thinking Supena (2021), besides being able to increase student creativity.

Astriani et al. (2020)/codes A14 and A26 use essay assessments to measure students' metacognitive abilities. Where metacognition is a person's ability to control their cognitive aspects. Where the cognitive aspect in question is the cognitive aspect in accordance with Bloom's taxonomy. Metacognitive skills are measured in 3 types of science material, namely community, ecosystem, food chain and food web. Students are required to read the content before the lecture, make a mind map, present it in front of the class, and discuss to observe how mind mapping in the learning paradigm by applying essay evaluation affects metacognition. Students took identical essay tests on metacognitive abilities both before and after learning. Metacognitive ability indicators used in this research include goal setting, documenting related information, and drawing conclusions. It has been proven through research that using essay assessments allows for the measurement of students' metacognitive skills. The statement above is in line with research conducted by Mahfuzah et al. (2020)/article code A2 which is based on research by utilizing essay assessments in biology learning to measure students' metacognitive abilities. To clarify the effect of providing essay assessments on student competence, categorization is carried out, namely based on educational level and subject. The effect of essay assessment based on education level on student competence can be seen in Table 2.

Table 2. Categorization by Education Level

Education Level	Frequency	Percentage (%)
JHS	5	11.63
SHS	24	55.81
University	13	32.56%

Based on the data in Table 2, it shows distribution data on the use of essay assessments as student competency assessments, consisting of 5 articles for junior high school (JHS) level, 24 articles for senior high school (SHS) level and 13 articles for tertiary institutions. Based on Table 2, it can also be seen that at the SHS education level the percentage is 55.81%, while at the university level the percentage is 32.56%. This shows that the use of essay assessments as an assessment of student competency is quite widely used at both high school and university levels. This is because based on research conducted by Stavinibelia (2021), essay assessment can improve students' critical thinking skills and to better understand learning independently without the help of a teacher and before the teacher teaches the material to be studied at school so that it can be understood. It is said to be useful for competency assessment, namely the extent to which students' thinking competence is based on the answers given in the essay assessment.

The appropriateness of using essay assessments to measure student competence is strengthened by research conducted by Faudzan (2021)/A15 which states that essay assessments are a methodology for collecting

information about student learning processes and outcomes using measuring tools in the form of essay tests (description). This information gathering process is carried out continuously in every learning process so that essay assessments are very well used to measure the level of student competency achievement in all cognitive aspects (knowledge, understanding, application, analysis, synthesis and evaluation). Meanwhile, for the JHS level, the level of essay use is still relatively low compared to the other two levels, namely SHS and university. This is because according to Hadi (2020) the level of students' intellectual development differs from one student to another. There are several factors that influence students' intellectual development. Among them is age, the older the child becomes, the clearer the tendency towards process maturity and maturity in the thinking process will help answer the essay assessment well. After it is known that essay assessments are widely used in assessing student competency at the SHS and tertiary level because of their good ability to measure the level of achievement based on the essay answers given, the percentage of essay assessments used to measure student competency based on subjects can be seen in Table 3.

Tabel 3. Categorization Based on the material

Material	Frequency	Percentage (%)
Biology	15	34.88
Physics	19	46.51
Chemistry	8	18.61

Based on the data in Table 3, it shows data on the distribution of the use of essay assessments as an assessment of student competency based on subject type, consisting of 19 articles for physics, 15 articles for biology and 8 articles for chemistry. Based on Table 4, it can also be seen that the highest percentage of using essay assessments to measure students' competency levels is in physics subjects, namely 46.51% and biology, 34.88% and the lowest percentage is chemistry, namely 18.61%. This proves that the use of assessment essays to measure students' competency levels in chemistry subjects is still lacking.

This is due to the shortcomings of essay answers, namely that it is difficult to assess the answers and requires a lot of time to correct them. Teachers also have their own obstacles in the process of correcting answers, sometimes corrections have to be taken home by the teacher, whereas at home the teacher also has responsibilities that cannot be left behind, whereas chemistry is a science that has many symbols or elements of an element that take a long time to correct. one by one (Mulatsari et al., 2021). However, the use of essay assessments in science learning is very necessary to improve student competencies such as creative thinking and critical thinking competencies which are part of the skills needed in the 21st century. Meanwhile, critical thinking indicators include information, concepts, points of view and conclusions that must be clear, Relevant and appropriate indicators of creative thinking include fluency, adaptability when thinking about a problem, originality when coming up with other ideas, and detail (or elaboration) when presenting ideas (Sari, 2021).

Conclusion

Based on the data and research results, it can be concluded that essay assessment can influence students' achievement of competence in science learning. When viewed from the moderator variable, the following conclusions can be drawn: First, based on education level, it can be seen that at the high school level it has a percentage of 62.5% while at the university level it has a percentage of 60%. This shows that the use of assessment essays as an assessment of student competence has an influence at the high school level and at the university. Second, based on the material, it can be seen that the percentage of using assessment essays in biology and physics subjects obtained a percentage of 60%. This shows that the use of assessment essays as an assessment of student competence has an influence on science subjects, especially in biology and physics subjects.

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Author Contributions

Author contributions include Utari Prisma Dewi, and Fleony Dea Amanda: collecting data, analyzing data, writing original drafts, and so on; Fatni Mufit and Festiyed: focus on methodology and review writing.

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Conflicts of Interest

The authors declare no conflict of interest.

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