

# Instrument Appropriateness On The Assessment Of Fourth Grade Science Learning Outcomes In Elementary Schools

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## ABSTRAK

Adanya permasalahan dalam kualitas penilaian disebabkan oleh proses pembelajaran yang tanpa diiringi dengan adanya instrumen yang layak digunakan, sehingga mempengaruhi hasil belajar siswa. Adapun tujuan penelitian ini adalah untuk menganalisis kualitas instrumen yang digunakan dalam menilai hasil belajar IPA. Penelitian ini merupakan penelitian pengembangan yang menggunakan model ADDIE. Subyek penelitian ini adalah validitas dan reliabilitas instrumen penilaian hasil belajar IPA. Metode pengumpulan data yang digunakan dalam penelitian ini yaitu pemberian lembar validasi kepada dua pakar/ahli dalam bidang IPA. Instrumen yang digunakan pada penelitian ini adalah lembar validasi instrumen dan tes objektif pilihan ganda yang dikembangkan untuk menganalisis reliabilitas. Teknik analisis data yang digunakan pada penelitian ini adalah teknik analisis statistik kuantitatif. Berdasarkan hasil analisis memperoleh hasil penelitian yaitu rata-rata validitas instrumen yang diperoleh sebesar 1,00 dan koefisien reliabilitas sebesar 0,66.

Simpulan penelitian ini adalah instrumen hasil belajar IPA memperoleh tingkat validitas dan reliabilitas yang dikategorikan tinggi. Implikasi penelitian ini adalah instrumen hasil belajar IPA siswa yang dikembangkan telah teruji validitas dan reliabilitasnya, sehingga layak digunakan untuk mengukur hasil belajar IPA siswa Kelas IV SD.

## ABSTRACT

*The existence of problems in the assessment quality is caused by the learning process that is not accompanied by suitable instruments, affecting student learning outcomes. This study aimed to analyze the quality of the instruments used in assessing science learning outcomes. This research is development research using the ADDIE model. The subject of this study was the validity and reliability of the science's learning outcome assessment instrument. The data collection method used in this study was to provide validation sheets to two experts in science. The instruments used in this study were the instrument validation sheet and the multiple-choice objective test developed to analyze reliability. The data analysis technique used in this research is quantitative statistical analysis techniques. Based on the analysis results, the results obtained were that the instrument's average validity was 1.00, and the reliability coefficient was 0.66. This research concludes that the instrument of science learning outcomes obtains a high level of validity and reliability. This research implies that the instrument of student learning outcomes developed has been tested for its validity and reliability. It is suitable to be used to measure the learning outcomes of Fourth- Grade elementary school students.*

## 1. Introduction

The development of science and technology in the current era of globalization requires the nation to increase its education potential. Education is currently one of the obligations that must be taken by a person to be able to compete in facing the development of science and technology itself. Education has dynamic power (influence) in human life in the future. Education is a process or activity in which an educator and students interact to develop students' abilities, attitudes, and potential to achieve

educational goals. (Judiani, 2017; Oktaviani et al., 2019). Success in education is highly expected, such as success in the learning process at school.

The main goal of schools in achieving the learning process's success is to improve students' ability to think critically and make rational decisions about what to believe (Krissandi & Rusmawan, 2015; Kristiyanto, 2020). Several roles can be involved, including the roles of teachers and students. Teachers and students interact to achieve success in learning. In addition, efforts to further improve student success are carried out through improving the learning process. (Hartana et al., 2016; Putra, 2017) argues that learning is a process or activity of changing individual behavior in obtaining knowledge after he/she gets a lesson or experience for a change for the better (positive).

Maturity in a person is imperfect without being supported by experience in training, learning, and important processes for someone to become an adult. The existence of learning outcomes is one of the main goals in holding the learning process. Learning outcomes are changes concerning cognitive, affective, and psychomotor aspects as a result of learning activities (Mintarto, 2007; Murwanto, 2020), also argues that learning outcomes are the culmination of learning activities that produce changes in knowledge (cognitive), attitudes (affective), and behavior (psychomotor) that are continuous and dynamic and can be measured or observed. (Novitasari, 2018; Ragil & Sukiswo, 2011) Learning outcomes also become everything that belongs to students due to the learning activities carried out by each student.

Before implementing improvements in the learning process, an assessment is carried out to measure learning outcomes. Assessment in learning is carried out in an integrated manner with learning activities. It can be carried out both in a formal atmosphere (in the classroom) and in an informal atmosphere (outside the interrogated class) in learning activities or carried out at any time. This assessment aims to determine student competencies, learning outcomes, curriculum achievement, motivate students to learn, and motivate teachers to do better teaching. However, assessment assesses students and assesses all the learning process components, such as teachers, learning methods, and the learning media used. Learning activities are oriented to student activities and use a system that involves all components in learning activities (Angrain & Veronica, 2015; Burhanah Farida, 2015).

In the assessment process, teachers need an assessment instrument to assess student learning processes and outcomes. Assessment is collecting and processing information to measure the achievement of student learning outcomes, which includes authentic assessment and self-assessment (Tendrita et al., 2017; Zainudin, 2018). The assessment is carried out using an assessment instrument. (Arif, 2016; Juniarta & Winarno, 2016), In general, an instrument is a tool used to measure natural phenomena and social phenomena observed. The preparation of assessment instruments must be tailored to the needs in assessing the process and student learning outcomes themselves. The preparation of the assessment instrument is carried out as well as possible. It begins by reviewing competency standards and basic competence, formulating competency achievement indicators, compiling and developing learning outcome assessment instruments. It refers to competency achievement indicators that meet the requirements, apply or carry out assessment of learning outcomes as objectively as possible to students, and analyze the results of the assessment that has been done, then hold a follow-up program regarding the results of the assessment. Learning assessment has a very close relationship with the learning process. The results of the learning assessment are also strongly influenced by the condition of the students. Good learning should be carried out in conditions and an atmosphere that is fun, challenging, and motivates students to be able to actively participate when the learning process in class takes place, so that it leads to an assessment of the learning process and optimal student learning outcomes. One of the subjects is to assess the learning process, science subjects.

Science subjects aim to develop students' potential to investigate the surrounding environment, solve problems, and make decisions. They can increase awareness in maintaining, protecting, and preserving the natural environment. This goal can be achieved if the science subject programs in schools are implemented properly. Science is a lesson that expects students to plunge directly with systematic stages through various logical stages and lead to a discovery about nature to achieve effective learning goals. (Efendi et al., 2019; Saputra, 2017). Science learning in elementary schools emphasizes providing direct learning experiences.

However, there are still various kinds of education problems, especially at the elementary school level. Student learning outcomes in Indonesia are still very low. It can be reflected in the results of the 2018 Program for International Student Assessment (PISA) study, which was released on December 3, 2019. Based on these test results, Indonesia's 2018 PISA ranking fell when compared to the test results. TIMSS (Trend in International Mathematics and Science Study 2015 for fourth-grade elementary schools. Indonesia received 403 average scores for science (3rd from below) from 72 countries that participated in the OECD PISA 2018 Database. Despite the significant increase in Indonesia's achievement Compared to 2012, it is still below the OECD (Organization for Economic Co-operation and Development) country

average. Less optimal science learning outcomes in elementary school are due to the lack of quality assessment instruments used to measure students' level of understanding of science material (Saputra, 2017; Suparlan, 2017).

This fact also occurred in Gugus II, Kecamatan Gerokgak. Based on the results of interviews conducted on October 25-28 2019 with fourth-grade teachers and several fourth-grade students in Gugus II, Kecamatan Gerokgak, indicating that the lack of optimal student learning outcomes was due to lack of quality science assessment instruments. Lack of quality means that the assessment instrument has not measured the competence of students' science knowledge optimally. Such assessment instruments lead to low student learning outcomes, which can be seen from the midterm test scores (UTS). Based on the results of recording fourth-grade documents in Gugus II, Kecamatan Gerokgak, the average midterm test scores in science subjects were still below the minimum completeness criteria (KKM). The following table will present the midterm test scores of students from each school in Gugus II, Kecamatan Gerokgak.

Based on the interview results, of the total number of fourth-grade students in Gugus II, Kecamatan Gerokgak for the 2019/2020 academic year were 148 students. There were 49 students or 33.62% who reached KKM. Then there were 99 students or 66.38% who have not reached the KKM. Based on these data, the fourth-grade students' science learning outcomes in Gugus II, Kecamatan Gerokgak are still low. This condition must get special attention because it affects students' ability to understand science subject matter. Learning outcomes that have not been maximized are caused by teachers' use of instruments to measure students' competence in science knowledge. (Setianingsih, 2019; Yupriyanti, 2015) argues that the assessment in science learning uses the principle that the assessment used is part of the learning used to help students achieve their learning goals.

This research is used to produce certain products, a needs analysis, and test these products' effectiveness to function in the field. Therefore, development research is longitudinal (gradual). According to (Fauzi et al., 2016; Sujuni et al., 2014) stated, the instrument must meet the standard to be used as a proper assessment instrument by analyzing validity and reliability testing in instrument development research. Validity test and reliability test are criteria that must be owned by an assessment instrument. The validity test will question how the conclusions obtained from the tests carried out are appropriate and meaningful following the desired assessment objectives. While the reliability test will question the extent to which a measurement is consistent in measuring and obtaining results that are relatively the same as the instrument (Pratini & Rianasari, 2015; Sugiyanto et al., 2015). This instrument has been validated by experts and analyzed based on empirical tests so that the instrument is suitable for use in the assessment.

Based on these problems, one of the methods that can be used by fourth-grade teachers in Gugus II Kecamatan Gerokgak is the need for a quality instrument that can measure students' competency in science knowledge so that students' science learning outcomes can be optimized. It shows that the assessment instrument's requirements are valid and transparent. The assessment quality is good and worthy of use (Amalia & Susilaningsih, 2014; Budiarta et al., 2016). One of the subjects in elementary school is science subject.

Science learning on the theme The Beauty of Diversity in My Country contains 3 sub-themes, , sub-theme 1 The diversity of ethnic groups and religions in my country, sub-theme 2 The beauty of the diversity of my country's culture, sub-theme 3 The beauty of unity and unity in my country Natural science learning in elementary schools must also be related to the influence of giving style against human activities in everyday life. The style has many types according to the source who does the style. The types of forces include muscle force, electric force, magnetic force, gravity force, and friction force (Kariani et al., 2014; Wijanarko, 2017).

This research is also supported by research conducted previously by (Juniarta & Winarno, 2016), which showed that the assessment instrument's product for PJOK subject knowledge is very valid and very feasible to use. The research conducted by (Amalia & Susilaningsih, 2014) showed that instrument questions' critical thinking skills are valid. Furthermore, research conducted by (Kurniawan et al., 2018) showed that the mathematical assessment instrument based on solving mathematical problems is valid. However, some of the relevant previous studies have conducted research related to the instrument for assessing fourth-grade elementary school students' science learning outcomes.

The purpose of this study was to analyze the instrument for assessing science learning outcomes of fourth-grade elementary school students in Gugus II, Kecamatan Gerokgak in fourth-grade students in the second semester for the 2019/2020 academic year.

## 2. Method

This research was conducted in Gugus II, Kecamatan Gerokgak, in fourth-grade students in the second semester of the 2019/2020 academic year. This research was a research and development used to produce certain products and test their effectiveness (Sugiyono, 2016). Development research is an effort to develop and produce a product in materials, media, learning tools, and strategies to overcome classroom learning and not test theories. This study aimed to analyze the quality of the instruments used in assessing science learning outcomes. This study's development model used the ADDIE development model (Analyze, Design, Development, Implementation, Evaluation). (Tegeh, I Made., n.d.), stated that the ADDIE model is one of the systematic learning design models. The ADDIE model chose based on the consideration that this model was developed systematically and rests on the theoretical foundation of learning design. Besides that, this development model rests on the theoretical foundation of design and is based on considering that this model is easy to understand (Budiarta et al., 2016; Gaol et al., 2017).

This study's subject was an instrument for assessing science learning outcomes in a grid and an objective test (multiple choice). The objective test was also known as the short answer test, and one of the learning outcome tests, which consists of question items that can be answered by the tester. In this study, the data required was the science learning outcomes. The data collection method was used according to the research needs.

This study's data collection method was a validation sheet involving two experts in science to validate the contents of the appropriateness of the instruments to be used. The instrument used was an instrument in the form of a test because the data required resulted from learning. The test can be said to be a form of an evaluation tool to measure how far the learning objectives achieved to obtain data in the form of tasks and must be done by a person or group that will produce a score (interval) (Abdul Kadir, 2015; Agung, 2014). The data collection method was used according to the research needs. In this study, the data required was the science learning outcomes.

Science learning outcomes are changes in behavior that occur in students after participating in the learning process. Students' science learning outcomes will be measured using an assessment instrument in the form of a test in an objective test (multiple choice). Each question item was equipped with an alternative answer chosen by the student (a, b, c, and d). If the student answers the question correctly, a score is given by 1. In contrast, if the student answers the question incorrectly, 0 score is given. The students' answers are then added up, and the number is the score of the science learning outcomes. The range of scores for science learning outcomes is measured using an interval scale. The range of science learning outcomes was 0-100, with 0 being the minimum score. In contrast, 100 was the maximum score of learning science learning outcomes.

This study's data analysis techniques were validity analysis (content validity, item validity) and instrument reliability analysis. The instrument's validity can indicate the extent to which the instrument can measure (provide information), which is appropriate and can be used to achieve certain objectives. Two experts conducted the validity test in this study. Then the reliability test was carried out after the validity test has been completed. The reliability test was only carried out on valid items. In this study, the reliability of the test was calculated using the KR-20 formula.

## 3. Result and Discussion

This study was conducted to test the fourth-grade students' science learning outcomes assessment instrument's appropriateness as seen from its validity and reliability. The study's results were an instrument for assessing fourth-grade elementary school students' learning outcomes in the form of analysis and objective test sheets that had been tested for their validity and reliability. These results were obtained through the analysis, design, development, implementation, and evaluation stages.

The analysis stage consists of needs analysis, student characteristic analysis, and curriculum analysis. The needs analysis was carried out in the field, in the fourth grade of SD Gugus II, Gerokgak Subdistrict, to determine the teacher's needs regarding the assessment instruments used to measure students' science results to make them more qualified. Student character analysis determines students' characteristics who will use the science learning outcome assessment instrument. The curriculum analysis was carried out to determine the analysis of SK (Competency Standards), KD (Basic Competencies), and indicators following the curriculum in the fourth grade SD learning outcome assessment instrument developed.

At the design stage of the fourth grade SD student learning outcomes assessment instrument on the theme The Beauty of Diversity in My Country, starting with the arrangement of the learning outcomes instrument grid using Bloom's Taxonomy (Gaol et al., 2017; Gunawan & Palupi, 2012). Next, make the

items according to the predetermined lattice. After the initial product in the form of a draft was designed, it was continued by consulting with the supervisor to improve the instrument's quality at the development stage. After being approved by the supervisor, the feasibility test was carried out with the expert judges test. At the implementation stage, a trial of the instrument designed was carried out for fifth-grade elementary school students in Gugus II, Kecamatan Gerokgak, Academic Year 2019/2020 with 104 students. Furthermore, the evaluation stage was carried out after the assessment instrument has been implemented. At this stage, an analysis was carried out in the form of a validity test and a reliability test, to determine the quality of the instrument for assessing science learning outcomes for fourth-grade elementary school students in Gugus II, Kecamatan Gerokgak, Academic Year 2019/2020 on the theme of the Beauty of Diversity in My Country.

The results of the validation of the assessment instruments that had been assessed by the two experts were then analyzed to determine the relevance of each item. Valid and reliable instruments can also produce valid and reliable data to lead to conclusions that are following the actual situation. The results of the assessment of the two experts' instruments are presented in Table 1.

**Table 1.** Instrument Assessment Results

First Expert		Second Expert	
Less Relevant	Relevant	Less Relevant	Relevant
-	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30.	-	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30.

Based on Table 1, it can be concluded that the 30 items arranged were declared all relevant. Furthermore, the validity and reliability analysis test was carried out to determine the instrument's quality for assessing fourth-grade elementary school students' learning outcomes in science as presented in Table 2.

**Table 2.** Quality of Science Learning Outcomes Assessment Instruments

Analysis	Result	Criteria
Content Validity	1,00	Very High
Reliability	0,66	High

Based on Table 2, the analysis of the validity test of the instrument for assessing the results of learning science learning outcomes for fourth grade elementary school students was obtained at 1.00 with very high criteria. Furthermore, the reliability test results, which are based on the calculation of the reliability coefficient ( $r_{1.1}$ ) with the Microsoft Excel 2013 program's, for item 27 valid items, a reliability coefficient of 0.66 is obtained in the "high" category.

Based on the description of the research results described above, the development of an instrument for assessing science learning outcomes for fourth-grade elementary school students was carried out using the ADDIE model, which went through the analysis stage, the design stage, the development stage, the implementation stage, and the evaluation stage (evaluation). The ADDIE development model was chosen for use in this research because this model's arrangement is programmed with a systematic sequence of activities to solve learning problems and is related to learning resources that match their needs and characteristics.

At the Analyze stage, analysis is carried out to analyze student needs, characteristics, and curriculum analysis to obtain data that can be used to design products. The needs analysis results were carried out following the results during the observation and direct interviews with the fourth-grade homeroom teacher regarding the learning process's problems. Based on the interview results, science learning outcomes tend to be below the KKM, due to the lack of quality assessment instruments used to measure student learning outcomes. Therefore, the assessment instrument used needs to be developed to measure student learning outcomes so that they are of higher quality. Furthermore, analyzing student characteristics using the developed assessment instrument. Then perform a curriculum analysis regarding SK (Competency Standards), KD (Basic Competencies), and indicators according to the curriculum in the developed science learning outcome assessment instrument.

The design stage was carried out to determine the instrument for assessing the fourth-grade students' science learning outcomes on the beauty of diversity in My Country. This activity begins with preparing a learning outcome instrument grid using indicators from Bloom's Taxonomy (Gaul et al., 2017; Gunawan & Palupi, 2012). Next, make the items according to the predetermined lattice. Science learning outcomes change behavior that was formed from teaching and learning activities in science subjects that are predominantly permanent and continuous. Students' science learning outcomes will be measured using an assessment instrument in the form of a test in an objective test (multiple choice).

The three aspects of student learning outcomes use were developed as a whole into 16 indicators. Each indicator was developed into 1-4 questions. The number of questions in the questions was arranged as many as 30 items. Each question item is equipped with an alternative answer chosen by the student (a, b, c, and d). If the student answers the question correctly, a score of one is given.

In contrast, if the student answers the question incorrectly, then a score of zero is given. The students' answers are then added up, and the number is the score of the science learning outcomes. The range of scores for science learning outcomes is measured using an interval scale. The range of science learning outcomes is 0-100, with 0 being the minimum score. In contrast, the score of 100 is the maximum score of learning science learning outcomes.

After the initial product in the form of a draft has been designed, then consult with the supervisor to improve the instrument's quality. After being approved by the supervisor, the feasibility test was carried out with the expert judges test. The expert test in this expert judges test involves two experts: filling out an instrument validation sheet consisting of two assessments, the relevant and less relevant assessments. After the expert test was carried out, the next stage is the implementation (implementation). At the implementation stage, an assessment instrument trial was carried out on fifth-grade elementary school students in Gugus II, Kecamatan Gerokgak, 2019/2020 academic year on March 3, 2020 104 students. After testing the assessment instrument, then the evaluation stage was carried out in the form of analysis in the form of validity and reliability tests to determine the quality of the instrument for assessing the learning outcomes of fourth-grade elementary school students on the theme of the beauty of diversity in my country. Based on the analysis test, the validity analysis test results were 1.00, and the reliability coefficient was 0.66. It showed that the average learning outcome assessment instrument is valid and has a high category. This research is a set of instruments for assessing science learning outcomes on the theme of Beautiful Diversity in My Country, which consists of 27 multiple-choice questions. This product has been validated by experts and analyzed based on the presence of empirical tests. This research implies that the students' science learning outcomes instrument that has been developed has been tested for its validity and reliability. It is feasible to be used as an accurate learning evaluation tool on the cognitive aspects of students. Appropriate assessment instruments can create quality assessments so that the learning process's objectives will be achieved properly. This development research produced an instrument for assessing fourth-grade students' science learning outcomes. This assessment instrument is designed in the form of a set of grids and objective questions.

Implementation of assessments was to measure the quality of learning outcomes. Assessment in learning is carried out in an integrated manner with learning activities that can be carried out both in a formal atmosphere (in the classroom) and in an informal atmosphere (outside the interrogated class) in learning activities or carried out at any time. This assessment aims to determine the level of achievement of student competencies, learning outcomes, curriculum achievement, motivate students to learn, and motivate teachers to do better teaching. However, assessment assesses students and assesses all components in the learning process, such as teachers, learning methods, and the learning media used. Learning activities are not solely oriented towards student activities but use a system that involves all components in learning activities (Anggrain & Veronica, 2015; Burhanah Farida, 2015).

In the assessment process, teachers need an assessment instrument to assess student learning processes and outcomes. Assessment is the process of collecting and processing information to measure the achievement of student learning outcomes, which includes authentic assessment and self-assessment (Tendrita et al., 2017; Zainudin, 2018). The assessment is carried out using an assessment instrument. (Arif, 2016; Juniarta & Winarno, 2016), In general, an instrument is a tool used to measure natural phenomena and social phenomena observed. The preparation of assessment instruments must be tailored to the needs in assessing the process and student learning outcomes themselves. The preparation of the assessment instrument is carried out as well as possible which begins by reviewing competency standards and basic competence, formulating competency achievement indicators, compiling and developing learning outcome assessment instruments that refer to competency achievement indicators that meet the requirements, apply or carry out an assessment of learning outcomes as objectively as possible to students, and analyze the results of the assessment that has been done, then hold a follow-up program regarding the results of the assessment (Wardani, 2010). Learning assessment has a very close

relationship with the learning process. The results of the learning assessment are also strongly influenced by the condition of the students. Good learning should be carried out in conditions and an atmosphere that is fun, challenging, and motivates students to actively participate when the learning process in class takes place so that it leads to an assessment of the learning process and optimal student learning outcomes.

This research is also supported by research conducted previously by (Juniarta & Winarno, 2016), which shows that the assessment instrument's product for PJOK subject knowledge is very valid and very feasible to use. The research conducted by (Amalia & Susilaningsih, 2014) shows that the critical thinking skills instrument questions are valid. Furthermore, research conducted by (Kurniawan et al., 2018) shows that the mathematical assessment instrument based on solving mathematical problems is valid. However, some of the relevant previous studies have conducted research related to the instrument for assessing fourth-grade elementary school students' learning outcomes.

This research implies that the instrument of student learning outcomes developed has been tested for validity and reliability, so it is appropriate to use it to measure fourth-grade elementary school students' learning outcomes in Gugus II, Kecamatan Gerokgak at the second semester of the 2019/2020 academic year.

#### 4. Conclusion

Based on the results and discussion that has been described above, it can be concluded that the development of an instrument for assessing fourth-grade students' science learning outcomes in elementary schools can produce a product in the form of a test consists of 27 multiple choice questions that have been tested for validity and reliability. This research implies that the instrument of student learning outcomes developed has been tested for validity and reliability, so it is appropriate to use it to measure fourth-grade elementary school students' learning outcomes in Gugus II, Kecamatan Gerokgak at the second semester of the 2019/2020 academic year.

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