

## Development of Quizizz Application-Based Test to Measure Science Process Skills of High School Students on Biodiversity Materials

Dian Pangestuti<sup>1</sup>, Dewi Febriyana<sup>2</sup>, Isna Robiatul Adhawiyah<sup>3</sup>,  
Rifqi Tiara Febriyanti<sup>4</sup>, Setiyo Prajoko<sup>5\*</sup>.

<sup>1,2,3,4,5</sup> Pendidikan Biologi, Universitas Tidar, Magelang, Indonesia

Email: <sup>1</sup>[dian.pengestuti21@gmail.com](mailto:dian.pengestuti21@gmail.com),

<sup>2</sup>[febriyanadewi99@gmail.com](mailto:febriyanadewi99@gmail.com),

<sup>3</sup>[isnarobiatuladhawiyah@gmail.com](mailto:isnarobiatuladhawiyah@gmail.com),

<sup>4</sup>[rifqitiara360@gmail.com](mailto:rifqitiara360@gmail.com),

<sup>5</sup>[setiyoprajoko@untidar.ac.id](mailto:setiyoprajoko@untidar.ac.id),

\*Corresponding Author

### Article History

Received : 07-07-2021

Revised : 27-07-2021

Accepted : 08-08-2021

### Keywords:

Science process skill test,  
Instrument, Biodiversity.

### Article link



### Abstract

*This study aimed to develop a valid science process skills test both in terms of content and constructs. The selected biodiversity material is integrated into this test. The quizizz application is used so that this test can be accessed online. This study uses the Research and Development (R&D) 4-D model, namely define, design, develop, and disseminate. The final product of this development research is a science process-based test instrument to measure student skills that have been declared valid and feasible by experts in the form of 50 multiple-choice questions. This research trial was conducted on 40 high school students majoring in Mathematics and Natural Sciences. Quantitative data analysis was carried out based on the internal characteristics of the test, such as validity, reliability, level of difficulty, and discriminatory power. The results showed that the validity test contained 28 valid questions and 22 invalid questions. In the difficulty index, there are 33 easy questions, 16 easy questions and 0 difficult questions. There is also a distinguishing power of good criteria consisting of 12 questions, sufficient criteria for 20 questions, and flawed criteria for 18 questions. In the validity test with the material aspect, an average of 74% quite valid, the construction aspect on average 77% quite valid, and the language aspect are 91% quite valid. The students' science process skills are also classified as good, with 76.22 in the high category.*

©the authors

This is an open-access article under the CC-BY-NC-SA license

<https://creativecommons.org/licenses/by-nc-sa/4.0/>



### Introduction

The teaching and learning process is an interaction of all learning components so as to create a learning situation and achieve the desired goals. The learning components include objectives, materials, methods, and including evaluation media. Evaluation media is one of the essential things because indicators of learning success can be seen from the evaluation process (Yani et al., 2018).

Evaluation is basically a basis for decisions, formulating policies, and other programs, decisions about whether to continue, improve, or stop. Evaluation/assessment basically aims to determine the effectiveness and efficiency of learning activities with the leading indicators on the success or learning activities in achieving the learning objectives set.

Assessment is a systematic and continuous process to collect information about learning processes and outcomes with the aim of making decisions based on specific criteria. (Arifin, 2017). Meanwhile, according to Haryati (2012), assessment is a term that covers the entire method used to determine the success of learning outcomes by seeing and assessing the performance of students individually or in groups.

So it can be concluded that assessment is a structured process to determine student learning outcomes to make decisions based on specific characteristics.

In the assessment process, there are two forms that are often used, namely the evaluation instrument in the form of a test and a non-test. When viewed from the form of students' answers, the test instruments are divided into three, namely written tests, oral tests, and action tests. Then in the written test, there are two forms, namely descriptive and objective tests. In this research, the instrument to be developed is an objective form instrument. According to Asrul et al. (2015), objective tests are called objective because the method of examination is the same or uniform for all students who take the test. There are several types of objective tests, namely multiple-choice, complete form, matchmaking, and true-false method.

Development of assessment instruments to measure students' science process skills using quizizz media. According to Arief Sardiman et al. (1996), media is an intermediary or messenger from the sender to the recipient. The development of information technology today has been able to package the conditions and reality of learning to be more exciting and provide adaptive conditioning in the learning process wherever it is (Darmawan, 2012), and the use of technology in learning is even more effective than conventional learning (Serin, 2011).

The results of the assessment are not identical with only cognitive results but also skills that support the learning of students. One of the skills that can be assessed from student activities is process skills. Science process skills are a complex set of abilities used by scientists in conducting scientific investigations into the learning process. This skill is crucial as a provision to use the scientific method in developing science and is expected to acquire new knowledge. These skills involve cognitive, manual, and social skills (Mahmudah, 2016). According to (Semiawan 1985), the basic science process skills include observing or observing, making hypotheses, planning experiments, controlling variables, interpreting data, drawing up tentative conclusions, predicting, applying, and communicating. While the integrated science process skills include (Dimiyati & Mudjiono, 2009) identifying variables, tabulating data, presenting graphs, connecting between variables, collecting and processing data, analyzing, formulating hypotheses, interpreting variables, designing research, and carrying out experiments. Some of these assessment instruments can be combined with a variety of learning media to support students' interest in learning.

Measurement of science process skills can be done using non-tests and tests. Non-test measurement can be done by making a science process skill observation sheet. The advantage of this measurement is that it is possible to directly see students' process skills. However, there is also a disadvantage that requires a large sample. While the advantage of measuring science process skills with tests is the measurement of efficacy when using a large sample (Gerald & Okey, 1980; Vali 2009; Shahali & Halim, 2010 in Prajoko, 2016). Meanwhile, the drawback is that students cannot directly observe the science process skills. Other measurements can be made using the science process skills inventory sheet (Arnold, 2009). The material used is the material for class X SMA IPA, namely marine biodiversity

The material used is the material for class X SMA IPA, namely biodiversity, including the concept of diversity at the level of genes, species, ecosystems, biodiversity in similar living things, one gene or one ecosystem and its conservation efforts. In Indonesia, there are many types of biodiversity or biodiversity with various types and benefits. (Mulyawati, E. 2016). This study aims to develop a test assessment instrument to measure students' science process skills regarding biodiversity.

## **Methods**

This study uses the Research and Development (R&D) method. The instrument development model used in this research is the 4-D development model proposed by Thiagarajan (1974), namely define, design, develop, and disseminate. Develop a valid, practical, and adequate assessment instrument to measure high school students' science process skills at biology subjects with material on biodiversity. The subjects of this study were senior high school students of class X majoring in Mathematics and Natural Sciences in even semesters from various schools. The trial was limited to 40 students. The procedure of this research is carried out through 4 stages, (1) Define, this stage aims to define the needs of students, namely by observing the assessment method carried out by the teacher; (2) Design, at this stage an assessment instrument is designed in the form of making a grid outlining indicators of science process skills and compiling questions, and assessment rubrics; (3) Develop, this stage is the development of the assessment product by validating the product by the validator after it is revised and then conducting a limited trial; (4) Disseminate after the product is declared good it will be disseminated.

The results of the data obtained will be analyzed. The aim is to determine the feasibility of the contents of the assessment instrument. This analysis consists of content analysis and constructive analysis.

Content analysis was conducted based on the internal characteristics of the test, such as validity, reliability, level of difficulty, and discriminatory power.

The data analysis technique for expert validation is done by testing content validity using the product-moment correlation test formula.

$$Y_{pbi} = \frac{M_p - M_t}{S_t} \sqrt{\frac{p}{q}} \quad (1)$$

Note:

- Y<sub>pbi</sub> = Product Moment Correlation Coefficient
- M<sub>p</sub> = The average score of the subjects who answered correctly for the item whose validity was sought
- M<sub>t</sub> = Average total Score
- S<sub>t</sub> = Standard deviation of the total score
- p = The proportion of students who answered correctly
- q = Proportion of students who answered incorrectly (q = 1-p)

While the construct validity test was carried out by experts and then calculated using the following formula.

$$\text{Validity (V)} = \frac{\text{Total skor validation}}{\text{Total skor maximum}} \times 100\% \quad (2)$$

Then, the results of the validity test were converted according to the criteria presented in table 1.

Table 1. Criteria for Validity of Learning Devices

No	Score	Criteria
1	85,01-100,00%	Very valid
2	70,01-85,00%	Sufficient valid
3	50,01-70,00%	Deficient valid
4	01,00-50,00%	Invalid

Source: Akbar (2013).

Reliability test can use the formula (Sudijono, 2013):

$$r_{11} = \frac{2r_{xy}}{1+r_{xy}} \quad (3)$$

Note:

- r<sub>11</sub> = Coefficient of overall test reliability
- r<sub>xy</sub> = Product moment correlation coefficient between even and odd number items

According to Fraenkel et al. (2012), an instrument is said to be reliable if the reliability coefficient value is more than 0.70 (R<sub>11</sub>>0.70).

The item difficulty index can be obtained using the formula (Sudijono, 2013):

$$P = \frac{N_p}{N} \quad (4)$$

Note:

- P = Item difficulty index
- N<sub>p</sub> = The number of correct answers from students
- N = Number of test-takers

According to the difficulty index that is often followed, a good difficulty index (P) is questions that have an index between 0.30 to 0.70.

Differential power analysis aims to analyze the items to determine the ability of the questions to distinguish students who are classified as capable and students who are classified as lacking or weak in achievement. (Sudjana, N. 2010).

$$D = \frac{B_A}{J_A} - \frac{B_B}{J_B} = P_A - P_B \quad (5)$$

Note:

- D = The power of difference of the questions
- B<sub>A</sub> = The number of participants in the upper group who answered correctly
- J<sub>A</sub> = The number of participants in the upper group
- B<sub>B</sub> = The number of participants in the lower group who answered correctly
- J<sub>B</sub> = The number of participants in the lower group

### Science Process Skills Analysis

The mastery of science process skills is divided into five categories: high, high, medium, low, and very low. This category is adapted from Azwar (2014). The percentage is obtained by dividing the average score on the students' science process skills correctly by the number of questions.

The research instrument used was a test of students' science process skills using quizizz. The test questions consist of 50 multiple choice questions based on seven indicators of science process skills. Can be seen in table 2.

Table 2. Classification of science process skills based on indicators

No	Science Process Skill' aspects	Question Number
1	Observation	2,3,13,16,19,30,31,39,41,47
2	Classification	21,40,43,45,46
3	Prediction	4,5,15,22,34,36,42
4	Asking question	10
5	Hypothesis	8,9,14,17,27,29
6	Interpretation	6,7,11,18,24,26,28,44,48,50
7	Communication	1,12,20,23,25,32,33,35,37,38,49

To determine the students' scientific process ability, it is calculated using the formula (Purwanto, 2013):

$$S = \frac{R}{N} \times 100$$

Note:

S = The ability of science process skills

R = score obtained from correct answers

N = Total maximum Score of the test.

From the calculation using the formula can be obtained numbers that can interpret the assessment of students' science process skills, according to table 3.

Table 3. Criteria for assessing the ability of students' science process skills

No	Interval	Criteria
1	86 - 100	Very high
2	73 - 85	High
3	58 - 72	Moderate
4	45 - 57	Low
5	0 - 44	Very low

### Results and Discussion

The result of the development is an achievement obtained after completing the research procedure. The product developed is an assessment instrument to measure the science process skills of class X high school students on the subject of biodiversity. This form of instrument can be used to evaluate student learning outcomes in schools by taking into account several aspects (Alhamid, 2019). The following is a description of the results of the development of the assessment instrument.

Define stage, the product developed is in the form of a grid of questions and multiple-choice questions. The assessment is carried out using an online test that is entered into the quizizz media and the link is distributed to respondents. The test developed is in the form of multiple choice with 50 items that have been adjusted to the Basic Competence, namely analyzing various levels of biodiversity in Indonesia and their threats and conservation.

Design stage, assessment instruments are designed and compiled. Then generated a grid to prepare questions and the text of the initial questions, in the lattice of preparing the questions designed with the identity, KI, KD, question indicators, question numbers, cognitive level, and KPS (Science Process Skills) indicators. The initial question paper contains question instructions, sample questions of 50 items, and the answer key. For the assessment, a score of 1 if the answer is correct and 0 if the answer is wrong. In the end, the correct value will be added up and multiplied by 2 to find out the total score of the students.

Development stage, the product development of the assessment instrument planned is developed before it becomes a product that is ready to be tested. The step of developing the biological assessment instrument is validation by expert lecturers. Based on the validity test results, the number of valid and invalid item items is obtained as in table 4.

Tabel 4. Result of validity

No	Category	Question number	Total
1	Valid	2, 5, 6, 10, 11, 12, 13, 15, 17, 18, 21, 22, 25, 26, 27, 30, 34, 35, 36, 37, 39, 40, 43, 44, 45, 46, 48, 49	28
2	Invalid	1, 3, 4, 7, 8, 9, 14, 16, 19, 20, 23, 24, 28, 29, 31, 32, 33, 38, 41, 42, 47, 50	22

The results of the validation of the assessment instrument have been tested on a limited basis. Developing the knowledge instrument must be valid because when the question is valid, it can be used by students. A validity test is carried out in each item of the question. Then the results are compared with  $r$  tables. If  $r$  table  $<$   $r$  count, then the item can be called valid. The validation of the assessment instrument that has been tested on a limited basis to small groups is found that 28 questions (56%) are valid, and the remaining 22 questions (44%) are invalid. Following Arikunto (2012) opinion, validity is a measure that shows the levels of validity or validity of an instrument. A valid or valid instrument has high validity. On the other hand, an instrument that is less valid means it has low validity. Sudijono (2008) also states that the validity of a test is the measuring accuracy possessed by an item (an item that is an integral part of the test as a totality) in measuring what should be measured through item items.

Based on the study results, it can be concluded that there are 28 valid questions and can be used as student assessment instruments. Meanwhile, 22 questions that were not valid on the instrument being tested because they were not by the indicators had to be discarded or repaired for retesting. The content validity does not have a quantity that can be calculated statistically, but in logical analysis, so it can be understood that the test is valid based on the test grid. A valid instrument or test can represent the entire content or material that is mastered proportionally for the sample (Matondang, 2009).

The reliability test results refer to the level of reliability of something and can be trusted (Arikunto, 2006). Based on the word's meaning, a reliable instrument is an instrument whose measurement results can be trusted. The results of reliability testing in this study used the Kuder Richardson (KR) technique. Instruments that can be tested for reliability using KR are instruments with only one correct answer (Yusup, 2018). Based on the results of the reliability test, the value obtained is  $R_{11} = 0.858$ . According to Fraenkel et al. (2012), an instrument is said to be reliable if the KR reliability coefficient value is more than 0.70 ( $R_{11} > 0.70$ ). Therefore, it can be concluded that the assessment instrument made is reliable. The level of reliability on this instrument includes high reliability. This means this instrument has perfect reliability, where if used to measure repeatedly, the results are more or less always the same.

Difficulty index (Difficult index) is a number that shows the ease or difficulty of a question. According to Asrul (2014), a good question is a question with a moderate difficulty level. So not too easy and not too tricky. Based on the difficulty level, the item numbers of easy, medium, and difficult items are obtained, as shown in table 5.

Tabel 5. Result of difficult index

No	Category	Question Number	Total
1	Easy	1, 2, 3, 4, 5, 9, 11, 12, 13, 15, 17, 18, 19, 20, 24, 25, 26, 27, 30, 31, 32, 33, 34, 35, 36, 38, 39, 40, 41, 43, 44, 48, 49	33
2	Moderate	6, 7, 8, 10, 14, 16, 21, 22, 23, 28, 29, 37, 42, 47, 50	16
3	Difficult		0

In this assessment instrument, there are no complicated questions and more straightforward questions. There are 33 easy questions and 16 moderate questions. According to the difficulty index that is often followed, a good difficulty index (P) is questions that have an index between 0.30 to 0.70. It can be concluded that the assessment instrument is quite good because the distribution of the level of difficulty is not evenly distributed and is dominated by questions with easy categories. Although there are many easy questions, there are still valid questions and can be used, such as in item number 2, where according to the test results, question number 2 is valid even though it is relatively easy. Then, questions in the medium category must also be discarded because they are invalid, such as question number 8. If the questions are too easy, they cannot stimulate students' problem-solving abilities, and vice versa, if the questions are too tricky, it will make students easy to give up and desire.

Based on the differentiating power test results, the item number of good, sufficient, and wrong items is obtained, as shown in Table 6.

Tabel 6. Result of differentiating power

No	Criteria	Total
1	Good	12
2	Sufficient	20

3	Insufficient	18
Total Question		50

The table shows that there are 12 questions (24%) with good discriminatory power, 20 questions (40%) with sufficient discriminating power, and 18 questions (36%) with insufficient discriminating power. According to Arikunto (2012), suitable items have a discrimination index of 0.4 to 0.7 or are in good classification. The higher the value of the different power of the question (positive value), the better the question. Even though it has a positive value, the questions that should be used are sufficient, reasonable, and excellent distinguishing power.

Arikunto (2012) states that discriminating power is the ability of items to distinguish students' abilities. The measure of the power of difference is the correlation between the score on the question and the score on the set of questions. So it can be seen from the degree of compatibility between a question and a set of other questions (Syarif & Syamsurizal, 2019).

So overall, it can be concluded that this assessment instrument, which is dominated by items with sufficient discrepancy, can distinguishable students and those who have not been able to master the material seriously.

Based on expert validation carried out, the draft instrument used was validated by one expert, namely a biology education lecturer. Biological assessment instrument products are developed according to a grid that refers to KI, KD, and existing indicators (Fadillah, 2017). After that, it is validated by expert lecturers to determine the feasibility of the product of the biological assessment instrument.

The things that are validated are in the form of material, construction, and language. From the material, the aspects assessed are the suitability of the questions according to the indicators, the suitability of the material being asked with the measured competence, one answer key, and homogeneous and logical answer choices. Then from the construction, the aspects assessed are the clarity of the subject matter, which is formulated in a concise, concise, straightforward manner, does not provide answer essential instructions, is free from negative statements, pictures, and the like is clear and functional from the language aspect, namely the use of language and writing according to the rules. In addition, on the validation sheet, there are inputs and suggestions obtained from the validator operationally through the question sheet.

Tabel 7. Result of expert validation

No	Aspect	Average (%)	Criteria
1	Material	74 %	Sufficient Valid
2	Construction	77 %	Sufficient Valid
3	Language	91 %	Very Valid
Average Total		80 %	Sufficient Valid

The validation of the assessment instruments from expert lecturers shows that 80% of the assessment instruments are declared quite valid, and further improvements are needed to several components. Therefore, it can be concluded that the product is feasible to use.

The purpose of the validation test by experts is to get an assessment so that the level of product validity can be known and to find out the product's weaknesses by asking for suggestions for improvement from the validator to improve the product being developed. Furthermore, suggestions from the validator will be used to revise the product to make it better (Warsita, 2008).

### Science Process Skills

In this study, research data were obtained from students' answers to the assessment of science process skills through Quizizz. The students' answers were analyzed, and conclusions were drawn regarding the ability of the science process skills (SPS) possessed. Students' SPS mastery data per aspect is obtained through the SPS test given, namely an objective test of multiple-choice type with 50 questions with five answer choices. In this study, seven aspects of SPS were determined, consisting of basic SPS, namely: observing, classifying, communicating, and predicting. At the same time, the integrated SPS that is set is asking questions, hypotheses, and interpreting. Students are said to have sufficient SPS skills if from each SPS aspect tested by students, at least the scores show results with a minimum category of reasonable or moderate. SPS assessment or science process skills is an assessment related to how much students understand the SPS concept, which is described through questions that match the SPS indicators in observing, classifying, communicating, asking questions, hypothesizing, predicting, and interpreting. The result scores of students' answers will be depicted in figure 1.

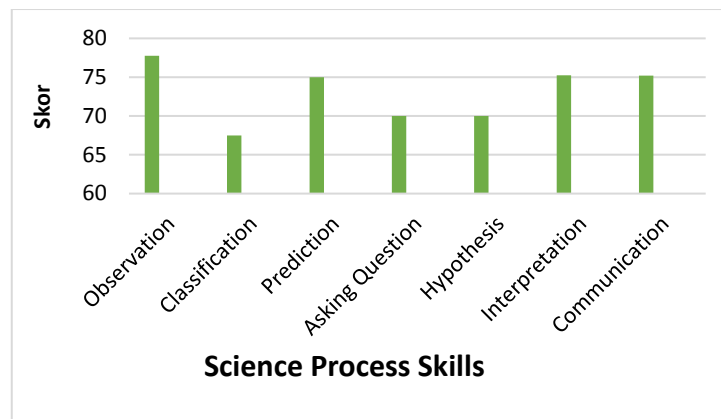


Figure 1. Result of Science Process Skills

The score of science process skills that has the highest value is the observing indicator (77.75). The importance of science process skills on observing indicators in the learning process can make students easy to be active in learning activities; in this aspect, students will use all their five senses. This is in accordance with Nurhasannah (2016) following observing indicators are basic scientific skills, and observing students must be able to use all their five senses, including seeing, hearing, feeling, tasting, and smelling. Observation process skills are the most fundamental skills in acquiring knowledge and for developing other process skills. According to Nurmalia (2014), the higher the involvement of students in observation, the higher the achievement of students' understanding and science process skills. The value of the lowest science process skills on the indicator classifies with an average score of 67.5 in the medium category. The ability to classify is a skill to classify an object according to specific characteristics, goals, or interests. In the activity of classifying, students are very required to be careful in observing. According to Nugraheni (2019), classifying activities is very dependent on the accuracy of students in making observations. Overall, the average score of students' science process skills was 76.22, with a high index. This is because the instrument used is closed or not necessarily students learn first when working on questions and only armed with material that the student understands. However, the researcher is optimistic that if the student learns before doing the work, the student will understand more about the answers to the instrument questions, and the assessment of his scientific processability will be in the very high category. Science process skills seen from the results of students' answers through multiple choice questions are already good, but in some aspects of science process skills, many answer incorrectly. This is caused by several factors, the first of which has previously been explained that the test is carried out in a secure manner.

Second, because there are several questions whose choices are still homogeneous so that they still confuse students, questions with sentences that are too long even though the time given for one question has a duration, feelings of nervousness, an unsupportive atmosphere, and ambiguous sentences in the questions, the score of the science process skill assessment criteria can still be improved by getting them used to work on science process ability type questions, in addition to improving the scientific process through direct practice can also be done. Biology subject assessment products are packaged in the online form using this quizizz media based on the product feasibility analysis. It can be concluded that it is valid and feasible to use several questions as an assessment instrument. Researchers chose online media as packaging or media for this product because online media makes it easier for both users (students) and supervisors (teachers). One of the criteria for a good instrument is practicability. According to Winarno (2011), the instrument is good because of its practicality or usability. With this media, it is hoped that it will make it easier for supervisors (teachers) to get results from students quickly.

### Conclusions and Recommendations

Based on the research conducted, it can be concluded that the Test Instrument is used to measure the Science Process Skills of High School Students on Biodiversity Materials by using Quizizz Media. It is known that from 50 multiple choice questions in the validity test, there are 28 valid questions and 22 invalid questions. In the difficulty index, there are 33 easy questions, 16 easy questions and 0 difficult questions. There is also a distinguishing power of good criteria consisting of 12 questions, sufficient criteria for 20 questions, and preliminary 18 questions. In the validity test with the material aspect, an average of 74% quite valid, the construction aspect is 77% quite valid, and the language aspect is 91% quite valid. The students' science process skills are also classified as good, with 76.22 in the high category. So that students' science process skills are classified as high by using this quizizz media.

For science process skills to have a higher score, in their implementation to students, it can be used as an open question so that students learn related material before working so that they better understand the concept and it is easier to work on the problem. In addition, teachers can also get used to give lessons based on science process skills and optimize this quizizz media to achieve these goals.

## References

- Akbar, S. (2013). *Instrumen Perangkat Pembelajaran*. Bandung: Remaja Rosdakarya Offset.
- Aji, B. S., & Winarno, M. E. (2016). Pengembangan instrumen penilaian pengetahuan mata pelajaran pendidikan jasmani olahraga dan kesehatan (PJOK) Kelas VIII semester gasal. *Jurnal Pendidikan: Teori, Penelitian, dan Pengembangan*, 1(7), 1449-1463.
- Alhamid, T., & Anufia, B. (2019). Resume: Instrumen Pengumpulan Data. Sorong: Sekolah Tinggi Agama Islam Negeri (STAIN).
- Arifin, Z. (2017). Kriteria Instrumen dalam suatu Penelitian. *Jurnal THEOREMS (The Original Research of Mathematics)* Vol. 2 No. 1, Juli 2017, hal. 28-36
- Arikunto, S. (2006). *Metodologi penelitian*. Yogyakarta: Bina Aksara.
- Arikunto, Suharsimi. (2010). *Prosedur penelitian: suatu pendekatan praktik*. Jakarta: Rineka Cipta.
- Arnold, I. J. (2009). Do examinations influence student evaluations?. *International Journal of Educational Research*, 48(4), 215-224.
- Asrul, A., Ananda, R., & Rosnita, R. (2015). *Evaluasi pembelajaran*.
- Arikunto, Suharsimi. (2012). *Dasar-Dasar Evaluasi Pendidikan*. Jakarta: Bumi Aksara.
- Azwar, S. (2014). *Penyusunan skala psikologi*. Yogyakarta: Pustaka Pelajar
- Darmawan, D. (2012). *Pendidikan Teknologi Informasi dan Komunikasi*. Bandung: PT. Remaja Rosdakarya.
- Dimiyati dan Mudjiono. (2009). *Belajar dan Pembelajaran*. Jakarta: Rineka Cipta.
- Fraenkel, L., Falzer, P., Fried, T., Kohler, M., Peters, E., Kerns, R., & Leventhal, H. (2012). Measuring pain impact versus pain severity using a numeric rating scale. *Journal of general internal medicine*, 27(5), 555-560.
- Fadillah, E. N. (2017). Pengembangan instrumen penilaian untuk mengukur keterampilan proses sains siswa SMA. *Didaktika Biologi: Jurnal Penelitian Pendidikan Biologi*, 1(2), 123-134.
- Gerald DF, & Okey, JR (1980). Tes keterampilan proses sains terpadu untuk siswa IPA SMP. *Pendidikan Sains*, 64 (5), 601-608.
- Haryati, S. (2012). Research and Development (R&D) sebagai salah satu model penelitian dalam bidang pendidikan. *Majalah Ilmiah Dinamika*, 37(1), 15.
- Mahmudah, M., Yaunin, Y., & Lestari, Y. (2016). Faktor-faktor yang berhubungan dengan perilaku seksual remaja di Kota Padang. *Jurnal Kesehatan Andalas*, 5(2).
- Matondang, Zulkifli. (2009). Validitas dan Reliabilitas Suatu Instrumen Penelitian. *Jurnal Tabularasa* Vol. 6 No.1, (87-97).
- Mulyawati, E. (2016). *Keanekaragaman Hayati*. Bandung: Universitas Pasundan.
- Nurhasanah. 2016. *Jurnal Penggunaan Tes Keterampilan Proses Sains (KPS) Siswa dalam Pembelajaran konsep Kalor dengan Model Inquiri Terbimbing*. 2 (12), 17-18.
- Nurmaliah, dkk. (2014). Penggunaan Metode Karyawisata untuk Meningkatkan Pemahaman Konsep dan Keterampilan Proses Sains Pada Materi Keanekaragaman Hayati, *Jurnal Biotik*, ISSN: 2337-9812, Vol. 2, No. 1, Ed. April 2014. Keguruan. UIN Syarif Hidayatullah Jakarta. Jakarta.
- Nugraheni, D., & Winarni, D. S. (2019). Pengembangan bahan ajar science teacherpreneurship berbasis karakter bagi mahasiswa pendidikan IPA. *In Seminar Nasional Sains & Entrepreneurship* (Vol. 1, No. 1).
- Prajoko, S., Amin, M., Rohman, F., & Gipayana, M. (2016). Pengembangan Tes Keterampilan Proses Sains Pada Mata Kuliah Praktikum IPA di SD. *Seminar Nasional IPA VII*, 2(1), 821-831.



- Prajoko, S., Amin, M., Rohman, F., & Gipayana, M. (2016). Development Watson-Glaser Critical Thinking Skills Assessment in Science Lab Course. *The 4th International Conference on Educational Research and Innovation*, 1(1), 240–249.
- Purwanto, D. (2013). Pengembangan Media Komik IPA Terpadu Tema Pencemaran Air Sebagai Media Pembelajaran Untuk Siswa SMP Kelas VII. *Pensa E-Jurnal: Pendidikan Sains*, 1(01).
- Sardiman Arief, dkk. (1996). *Media Pendidikan*. Jakarta: Rajawali Press, hal 6
- Semiawan, C. dkk. (1985). *Pendekatan Keterampilan Proses, Bagaimana Mengaktifkaa Siswa dalam Belajar*. Jakarta: Gramedia.
- Shahali, EHM, & Halim, L. (2010). Pengembangan dan validasi tes keterampilan proses sains terpadu. *Ilmu Procedia-Sosial dan Perilaku*, 9, 142- 146.
- Serin. (2011). The Effects of The Computer Based Instruction on The Achievement and Problem Solving Skills of The Science and Technology Students. *The Turkish Online Journal of Educational Technology* Vol 10 Issue 1.
- Sudijono, A. (2008). *Dasar Proses dan Efektivitas Belajar Mengajar Pendidikan Jasmani*. Jakarta: Departemen Pendidikan dan Kebudayaan Republik Indonesia.
- Sudijono, A. (2013). *Pengantar Evaluasi Pendidikan*. Jakarta: PT Raja Grafindo Persada.
- Sugiyono. (2014). *Statistika untuk penelitian*. Bandung: Alfabeta.
- Sudjana, N. (2010). *Penilaian Hasil Proses Belajar Mengajar*. Bandung: PT Remaja Rosdakarya.
- Syarif, E. A., & Syamsurizal, S. (2019). Analyzed Quality of Senior High School Biology Olympiad Questions at West Sumatera, Riau, Jambi, and Bengkulu in 2018. *Bioeducation Journal*, 3(2), 142-150.
- Thiagarajan, S., Semmel, D.S. & Semmel, M.I. (1974). *Instructional development for training teachers of exceptional children*. Minneapolis: University Of Minneasota.
- Warsita, B. (2008). *Teknologi Pembelajaran: Landasan dan Aplikasinya*. Jakarta: Rineka Cipta.
- Winarno, M.E. (2011). *Metodologi Penelitian dalam Pendidikan Jasmani*. Malang: Media Cakrawala Utama Press.
- Yani, A., Sahriah, S., & Haerunnisa, H. (2018). Efektivitas Pendekatan Sainifik Dengan Media Booklet Higher Order Thinking Terhadap Hasil Belajar Biologi Siswa Sma Di Kabupaten Wajo. *Biosel: Biology Science and Education*, 7(1), 1-12.
- Yusup, F. (2018). Uji validitas dan reliabilitas instrumen penelitian kuantitatif. *Tarbiyah: Jurnal Ilmiah Kependidikan*, 7(1).