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Analysis science process skills of grade viii students on digestive system material

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ABSTRACT

Science process skills are the ability to solve problems through scientific research. Science process skills serve as a foundation for other cognitive skills such as logical thinking skills, reasoning and problem solving, making students grow into individuals who are able to access information and understand information, so that students are able to apply the knowledge they acquire in real terms. -world context. For this reason, science process skills are important to be trained in the learning process. The purpose of this study was to analyze the mastery of science process skills for Grade VIII students of SMP Negeri 15 Padang on the digestive system material. This research is a descriptive research with a quantitative approach. The population of this study were all students of class VIII, the sampling technique was carried out by random sampling technique, the number of students who were sampled was 60 students. Data collection techniques were carried out by observation, documentation and written tests. The results showed that the average value of each indicator was divided into three categories, namely high, medium and low. From the results of the study it can be seen that: (1) students get the low category on the indicators of asking questions and formulating hypotheses with a value of 40 and 38.5, (2) students get the medium category on the indicators of investigative skills, classification, interpretation, communication, application. concept, conclude, and predict with a value of 61.2; 69; 52; 52; 60.7; 58.5; and 61.9, (3) students are classified as high on the observation skills indicator with a value of 90 and the average value of mastery of science process skills by students based on the ten indicators used is 58.38, so it can be concluded that mastery of students' science process skills is in medium category.

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INTRODUCTION

The 21st century learning paradigm emphasizes learning processes that can activate students. This is illustrated in one of the main principles of 21st century learning, namely; Instruction should be student-centered (Syahputra, 2018; Pratiwi et al., 2019; Jack, 2013). Students are no longer required just to listen to and memorize material delivered by educators, but are directed to be able to build their knowledge and skills, according to their capacity and level of development of thinking, and are invited to contribute to finding solutions to problems that occur in the surrounding community (Rahayu et al., 2022; Hadinugrahaningsih et al., 2017; Ridwan et al., 2022). Science learning does not only prioritize the product but also the process, a good product will result from a good learning process as well. currently learning process and the assessment are only focused on the knowledge possessed, the teacher solely teaches target values on aspects of knowledge but lacking on measuring students' processing abilities (Fatmawati, 2012; Jack, 2013; Rustaman, 2007)

Science process skills are skills to solve problems through scientific research activities. Science process skills (SPS) are thinking skills that are used to gain knowledge, reflect on problems, and formulate results to (Aydin, 2013). SPS is a skill possessed by a student in using reason, logic, and good deeds to achieve goals. Thus it ca be concluded that SPS are students' thinking skills using the scientific method so that students are able to discover concepts or knowledge. SPS is very useful for students to build a sense of responsibility in the teaching and learning process and to build minds about the importance of the scientific method in the learning and teaching proces (Darmaji et al., 2022; Elvanisi et al., 2018). Students can take a direct role in mastering various activities including observing, classifying, interpreting, predicting, making temporary conjectures, communicating, and investigating these are the goals of SPS (Solé-Llussà et al., 2020). SPS is able to bridge the gap in achieving science learning goals, through experiences that are directly carried out in scientific investigations. KPS is a competency that can be implemented by teachers to improve students' skills in carrying out scientific activities, which are carried out independently with teacher guidance so that learning is more meaningful. This is what underlies the need to apply SPS, especially in science learning(Surwadani, Asrial, 2021).

The digestive system is one of the materials in science subject that are taught to class VIII junior high school students. One of the characteristics of this material is that it is loaded with concepts. Based on the previous observation in intended Junior high school, the problem that occurs in the learning process in this material is that the teacher tends to provide concepts with the direct method and students memorize the concepts given by the teacher, as a result students easily forget the material they have learned. For this reason, the learning process should be directed to the process of obtaining concepts (Process skills). Process skills involve students to take part in the teaching and learning process, these process skills are known as Science Process Skills (SPS).Through various activities in SPS such as observing, measuring, predicting, analyzing and concluding, the concepts learned become more embedded and not just memorized (Yuliani et al, 2016) and help students gain an understanding of material that is more long term memory in nature (Abungu et al., 2014).

Urgency of this study is that the results can be used as a reference for improving or developing the learning process so that SPS can be trained and mastered by students properly. Science Process Skills are very important for students to master because through SPS students are able to form basic concepts or prior knowledge in their minds. Science process skills also serve as a foundation for other cognitive skills such as logical thinking, reasoning and problem solving skills (Rauf et al., 2013); helping students to become problem solvers, so that students are able to apply the knowledge they get in real-world contexts (Monhardt & Monhardt, 2006); make students grow into individuals who are able to access information and understand information (Bati et al., 2010); direct students to become independent learners through a series of activities (Cakir, 2011);.

METHODS

Research Design

This is a descriptive study with a quantitative approach. The data obtained will be analyzed quantitatively and measured categorically. The object to be examined in this study was students' science process skills, while the research subjects were class VIII students of SMPN 15 Padang.

Population and Samples

The population used in this study were all Grade VIII students of SMPN 15 Padang who were enrolled in the 2020/2021 academic year, which consisted of 150 students. The number of samples used in this study amounted to 60 people who were calculated based on the slovin formula with a 10% precision error allowance due to sampling error. Samples were selected using random sampling techniques or randomly selected.

Instrument

There are two instruments used in this study, namely; (1) observation sheet and (2) written test. Instrument validation was carried out by three expert validators. The empirical validity of objective test items is carried out through test questions by calculating the reliability, difficulty index, discriminating power and item validity.The observation used is direct observation, collecting data based on observations using the five senses. The observation format used in this study is the Flanders format. Researchers made observations in student learning activities in class to find out the students' emerging science process skills at the time of learning. Students' science process skills to be in observe researchers include; questioning skills, classification, interpretation, communication, hypothesis, investigation and observation. Observations were made by five observers consisting of researchers, two science teachers, and two students who were conducting research. The written test contains questions to measure science process skills students on the digestive system material. Developed question items multiple choice form. Written test questions are intended to measure students' science process skills which are limited to indicators applying concepts, inferring, predicting and classifying. The reason for this restriction is due to the assessment by written test cannot reach all abilities, because using the senses of hearing and touch cannot be assessed by a written test (Fatmawati, 2012), so indicators that allow for done by students is just that indicator.

Table 1.
Science Process Skills Observation Sheet Grid

Variable	Indicator	Question
Science Process Skills	Observation	8
	Questioning	1
	Investigation	3, 4, 5, 6, 7
	Classification	9
	Formulate hypotheses	2
	Communication	11, 12
	Interpretation	10

Table 2.
Science Process Skill Objective Test Grid

No	Variable	Indicator	Question
1	Science Process Skill	Aplly the Concept	1, 5, 9, 13, 14
2		Conclude	2, 4, 6, 11, 13
3		Prediction	3, 7, 8, 10, 15

Procedure

This research was conducted through several stages. The first stage was to determine the indicators of science process skills to be analyzed, create research instruments, validate research instruments by experts, namely three science education lecturers. before being used in the study, test questions were carried out first to determine the validity, reliability, index of discrimination, and the quality of the detractor from the instrument in the form of a written test. The number of written test questions used is 15 items. The next stage is to observe students in learning activities and administer multiple-choice tests to students that are used to measure SPS. The research phase can be briefly seen in Figure 1.

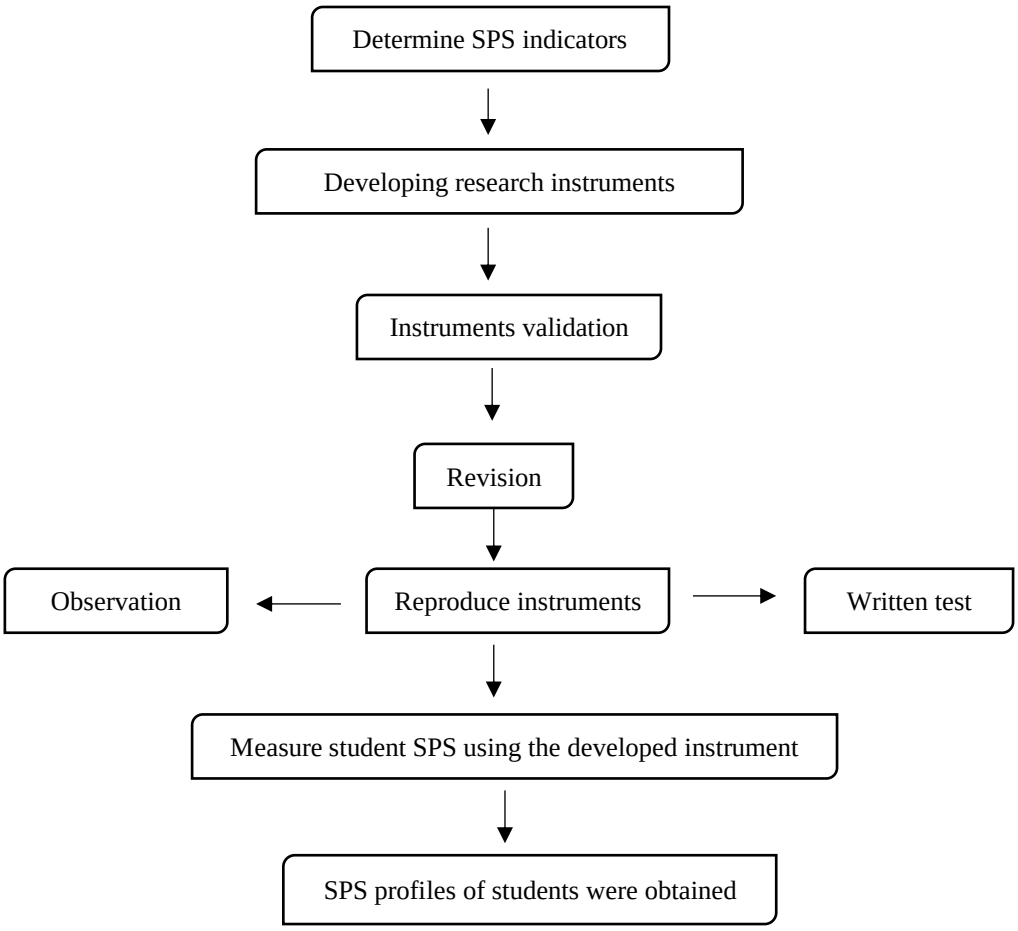

Figure 1. Research procedure

Data Analysis Techniques

Give a raw score to each sub-aspect of science process skills from the observations, following the flanders format in the Table 3.

Table 3.
Score in flanders format

Score	Description
3	Yes, and appropriate
2	Yes, but not yet appropriate
1	Not yet

Reference: (Subana, 2001)

Assigns a raw score to each student's answer on the written test based on the assessment criteria that have been made. Converts the raw score of each science process skill to grade form by adding up the scores obtained by students for each aspect. Determining the category of emergence for each aspect of science process skills. Total criterion score (if each item gets the highest score) = 3 x 1 x 30 = 90 . for this the highest score for each item is 3, the number of items is 1, and the number of respondents is 30. Meanwhile, if each item gets the lowest score = 1 x 1 x 30 = 30. This value is then categorized based on the attitude scale score interval in the Table 4.

Table 4.
Attitude scale score interval

Value	Description
72 - 90	High
51 - 71	Moderate
30 - 50	Low

Reference: (Widoyoko, 2014)

RESULTS AND DISCUSSION

This study obtained data regarding students' science process skills in the digestive system material. The data is in the form of observations of each SPS indicator which was conducted twice face to face and written test in one meeting with 60 grade VIII students of SMP N 15 Padang. The data obtained was then grouped into three groups of SPP occurrence rates including: (1) low, (2) medium (3) high. The occurrence rate of each student SPS indicator is shown in Table 5.

Table 5. The average value of science process skills on each indicator

No	Indicator	Average	Category
1	Asking questions	40.0	Low
2	Formulate hypotheses	38.5	Low
3	Investigation/designing experiment	61.2	Moderate
4	Observation	90.0	High
5	Classifying/grouping	69.0	Moderate
6	Interpretation	52.0	Moderate
7	Communication	52.0	Moderate
8	Applying the concept	60.7	Moderate
9	conclude	58.5	Moderate
10	predict	61.9	Moderate

The data above shows that class VIII students' mastery of SPS at SMPN 15 Padang varies from low to high. One indicator shows the high category, namely the observation aspect. Seven indicators show the medium category, namely in the aspects of investigation, classification, interpretation, communication, applying concepts, concluding and predicting and two indicators showing the low category, namely in the aspects of asking questions and formulating hypotheses.

The first indicator is questioning skills. Indicators questioning skills has low category. The questioning indicator has a sub-indicator asking to ask for an explanation about learning. Students' ability to ask questions was assessed using the SPS observation sheet. The low mastery of science process skills in the questioning indicator is due to the fact that during the learning process students are not actively involved. Based on observations made during the learning process, the lack of students' ability to ask questions was also due to students not having prior knowledge, students are not used to reading material at home before learning is carried out. Good questions are questions with exposure to observations or by using their own language by students (Trianto, 2012). Students can have critical thinking skills if students train and get used to asking questions in learning.

The second indicator is formulating a hypothesis, formulating a hypothesis is a step in improving SPS. Formulating a hypothesis is knowing that there is a possibility of how or why something can happen, based on data that has been analyzed by existing problems that need proof (Sanjaya, 2013). SPS on sub-indicators formulates simple hypotheses or conjectures in their own language with low categories. Indicators formulate a hypotheses has the lowest percentage, On instrument questions with formulating indicators hypothesis, factor that causes the low indicators formulate hypotheses due students are not serious in participating in learning activities in class, so students do not understand material explained by the teacher. Besides that, the students' low science process skills on the indicators of formulating hypotheses were also influenced by the minimal implementation of practicum activities at school.

These results were strengthened through interviews with Scince teachers Class VIII SMPN 15 Padang, states that during th learning process students are often noisy in the classroom and did not pay attention to the teacher when explaining Theory. This is in accordance with the facts on the ground,

based on the results of observations it was found that when the learning process takes place students do not pay attention to the explanation of the teacher. This is in accordance with research (Kartimi et al., 2013), formulating indicators the hypothesis is low because it doesn't many students have extensive knowledge, so that a few students can answer or make temporary guesses about what the teacher asked. In accordance with the results of observations when the teacher asks students to express their opinion about the problems given by the teacher, students could not answer what was asked by the teacher.

The results of this study are also appropriate with research from (Ratnasari et al., 2017), which states that the indicators of science process skills have low occurrence percentage is on indicators construct hypotheses. Science process skills on indicators formulate hypotheses can be trained with invite students to formulate hypotheses before carry out practical activities. But based on the results of interviews and observations, students never do practicum activities, this is one of the factors causing the low indicators to formulate hypotheses. (Prasojo, 2016) states that the indicators for formulating hypotheses are still low because students rarely even have not ever learn to do experiments, with asked to write a hypothesis, so students I'm not used to writing hypotheses. (Rifqiawati et al., 2017), the low indicators of formulating hypotheses because teachers rarely train students to formulate hypotheses in learning.

The third indicator, namely Investigation / planning an experiment, has the first several sub-indicators, namely preparing tools and materials, this sub-indicator gets a high category where students' activities bring and prepare tools and materials according to the guidelines on worksheets. The second sub-indicator is knowing the function of each tool, in this sub-indicator students do not know each tool to be used, this assessment is carried out before doing the practicum each student is asked to introduce the tools to be used. The third sub-indicator is knowing how to use the tool, in this indicator students get moderate results, this can be seen during individual practicum where many students are confused when doing practicum. the fourth sub-indicator is knowing the function of the materials needed, in this indicator students get moderate results, this can be seen before the practicum individually there are some students who cannot explain the function of the materials to be used. The fifth sub-indicator is knowing hazardous materials, in this sub-indicator students get moderate results, this can be seen during the practicum, some students pay little attention to the placement of the materials used. Practicum implementation will run well if the facilities and infrastructure are adequate, the fulfillment of facilities and infrastructure will make students want to always carry out practicums and make students more confident in the truth or conclusions obtained (Djamarah, 2010).

The fourth indicator, namely observation with sub-indicators observing changes in the starch test experiment on food, appears with a high value. Observing skills are the use of the senses properly to collect data or information (Usman, 2011). Students are assigned to record observations by filling in the observation table and answering questions contained in the LKS so that this activity is easy for students to do. So this observation indicator appears well because students follow the practicum according to the work instructions. Suansah (2015) said in his research that observing is a basic skill so this skill must be owned by every individual in carrying out scientific investigation activities (the basic of all scientific inquiry is observation), especially on students. The things that are observed in the learning process directly or in the form of images on the internet. The process of observing can be practiced using senses, but if the object cannot be observed using the senses it can be observed using tools help (Rustaman, 2003). Some research says that observing skills students do not experience constraints because students are used to doing observation (Saleh, 2020).

Dimyati & Mudjiono (2006) argues that observing is our response to natural objects and events by using the senses. The ability to observe is the most basic skills in the process and acquire knowledge as well is the most important thing for develop process skills other. This also agrees with (Agustina & Saputra, 2016) observation (observation) is one of the most important aspects of KPS base. Based on the opinion of Dimyati & Mudjiono (2006) and (Agustina & Saputra, 2016) which stated that the aspect of observing is an aspect the basis of KPS owned by someone, then from the results of the assessment aspects of observing shows that the KPS basis is owned students are high. (Darmaji et al., 2018) say that observation skills can develop other skills such as skills summing up, communication, predictive action, engaging conclusion.

The fifth indicator is Classification/grouping, with sub-indicators recording each observation into a table that gets the medium category. Clustering skills are the ability to divide various events based on their special characteristics so as to get similar groups/groups of events (Dimyati &

Mudjiono, 2006). Assessment is carried out by observers by monitoring each student who records the results of the experiment well or not and seeing whether students can distinguish foods containing starch in the starch test practicum.

Based on the results of interviews with science teachers at SMPN 15 Padang, the learning process is carried out by providing concepts and theories in class and complemented by practical implementation. With practicum activities students can learn directly the process of digestion, so students understand and understand more about what they have learned in class. Through practicum students can see directly based on the characteristics of similarities and differences for grouping activities. In practicum activities the teacher invites students to identify the characteristics of the objects being observed, so that students are able to group objects based on similarities and differences in their characteristics. classifying indicators have moderate categotiry because grouping has been experienced by students in everyday life, and have been trained in the learning process, especially in natural science learning (IPA).

The sixth indicator is interpretation/interpretation, the sub-indicator making conclusions gets moderate results. Interpreting or interpretation is the ability to explain something that has happened by observing an object (Sanjaya, 2013). Students can make conclusions from the practicum that has been carried out after the practicum activities according to the observer's direction, but many students are less active in helping to work together to conclude the results of the practicum that has been carried out and only rely on other group members to make conclusions.

The seventh indicator is communication. Communication is the ability to express ideas/ideas through writing, uttering words, pictures, demonstrations or objects (Trianto, 2012). the sub-indicators present the results and listen and respond to the opinions and descriptions conveyed by each group. These two sub-indicators include things that can be done easily by students because students are free to express their opinions during class discussions. But in reality, many students are not confident about presenting the results of the experiment and due to time constraints, the presentations are only made by group representatives. That too a Influence the sub-indicators to listen and respond to the opinions/pictures conveyed by each group. So overall the communication indicators get the medium category.

Communication skills are the ability to choose and use sentences, so that information, ideas or what is communicated can be received easily by listeners. Based on the results of teacher observations have asked students to communicate the results of the experiment, but students can not communicate the results of the trials that have been carried out. (Iswatun et al., 2017), states that communicating is not only done verbally, communication can also be done in written form. Student skills communicating in writing can help students in transferring, presenting knowledge in a consistent and correct way so that students are not wrong in abstracting the information obtained.

The eighth indicator is implementing the concept in the moderate category. Assessment of this indicator is carried out by measuring students' abilities by answering multiple choice questions, there are as many as 15 multiple choice questions, where the questions applying the concept are found in multiple choice questions number 2, 4, 6, 11, and 12. Students get a high category on questions numbers 2 and 4 because many students can answer questions about applying the concept of food and food content. Students got a low category on question number 6 because many students still did not understand the concept of how to calculate energy needs. Students got the medium category in question 11 because many students did not understand the concept of the causes of choking while eating so that many students only guessed the causes of choking while eating. Students got a low category on question number 12 because many students still did not know about enzymes and their functions. So overall the indicator applying the concept gets the medium category.

The ninth indicator is concluding with the medium category. Assessment of this indicator is carried out by measuring students' abilities by answering multiple choice questions number 1, 5, 9, 13, and 14. Many students are still unable to explain the results of the food test when using Lugol's and Biuret solutions, the function of food ingredients, the function of one parts of the small intestine, organs of the digestive system sequentially, and understanding of the various digestive systems.

The tenth indicator is predicting the moderate category. This can be seen from the results of the test questions at number 3, 7, 8, 10, and 15. Where there are still many students who still do not understand the concept of the function of foodstuffs, the function of energy for the body, the function of the digestive organs, and diseases of the digestive organs. This predicting skill will determine the

deducing skill. Concluding skills have not been done well by students because students do not yet have the correct predictive skills. Science process skills on indicators predicting can be trained with activities learning other than group discussion, ie with practical activities. This goes hand in hand with research (Damopolii et al., 2018), predictive indicators have the highest score because students are trained to find their own patterns and regularities of the results test. Wahyuni Salosso et al. (2018), also stated the same thing that students able to predict well caused because students have gained understanding the concept of the practicum that has been carried out.

CONCLUSION

The science process skills indicator, which consists of ten indicators, appears with varying values. Low questioning skills with a value of 40; the skill of formulating a low hypothesis with a value of 38.5; moderate investigative skills with a value of 61.2; high observation skills with a score of 90; moderate classification skills with a value of 69; moderate interpretation skills with a score of 52; moderate communication skills with a score of 52; moderate concept applying skills with a score of 60.7; summing skills with a value of 58.5; and moderate predictive skills with a value of 61.9. and the average value of mastery of science process skills by students based on the ten indicators used is 58.38, so it can be concluded that mastery of students' science process skills is in medium category.

From these results, the researcher suggests increasing practicum activities in science learning in general, so that science process skills can be mastered by students better. In addition, learning should be more directed to.

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REFERENCES

Abungu, H. E., Okere, M. I. O., & Wachanga, S. W. (2014). The Effect of Science Process Skills Teaching Approach on Secondary School Students' Achievement in Chemistry in Nyando District, Kenya. *Journal of Educational and Social Research*, *4*(6), 359–372. https://doi.org/10.5901/jesr.2014.v4n6p359

Agustina, P., & Saputra, A. (2016). Analisis keterampilan proses sains (KPS) dasar mahasiswa calon guru biologi pada mata kuliah anatomi tumbuhan. *Jurnal Pendidikan Indonesia*, *2*(7), 381-388. https://jurnal.fkip.uns.ac.id/index.php/snps/article/view/9816

Aydin, A. (2013). Representation of Science Process Skills in the Chemistry Curricula for Grades 10, 11 and 12 / Turkey. *International Journal of Education and Practice*, *1*(5), 51–63. https://doi.org/10.18488/journal.61/2013.1.5/61.5.51.63

Bati, K., Ertürk, G., & Kaptan, F. (2010). The awareness levels of pre-school education teachers regarding science process skills. *Procedia - Social and Behavioral Sciences*, *2*(2), 1993–1999. https://doi.org/10.1016/j.sbspro.2010.03.270

Cakir, M. (2011). L. B. Flick and N. G. Lederman (eds): Scientific Inquiry and Nature of Science: Implications for Teaching, Learning, and Teacher Education. *Science & Education*, *20*(3–4), 381–387. https://doi.org/10.1007/s11191-010-9274-7

Damopolii, I., Yohanita, A. M., Nurhidaya, N., & Murtijani, M. (2018). Meningkatkan keterampilan proses sains dan hasil belajar siswa melalui pembelajaran berbasis inkuiri. *Jurnal Bioedukatika*, *6*(1), 22. https://doi.org/10.26555/bioedukatika.v6i1.8029

Darmaji, Astalini, Kurniawan, D. A., & Widodi, B. (2022). The relationship between science process skills and students' creative thinking skills at the Nurul Ilmi 1 Islamic Junior High School on Magnetism material. *Jurnal Pedagogi Dan Pembelajaran*, *5*(3), 492–500. https://doi.org/10.23887/jp2.v5i3.48636

Darmaji, D., Kurniawan, D. A., Parasdila, H., & Irdianti, I. (2018). Deskripsi Keterampilan Proses Sains Mahasiswa pada Materi Termodinamika. *Berkala Ilmiah Pendidikan Fisika*, *6*(3), 345. https://doi.org/10.20527/bipf.v6i3.5290

Dimyati, & Mudjiono. (2006). *Belajar dan pembelajaran*. Jakarta: Rineka Cipta

Djamarah, S. B. (2010). *Strategi Belajar Mengajar*. Jakarta: Rineka Cipta

Elvanisi, A., Hidayat, S., & Fadillah, E. N. (2018). Analisis keterampilan proses sains siswa sekolah

menengah atas. *Jurnal Inovasi Pendidikan IPA*, *4*(20), 245–252. https://journal.uny.ac.id/index.php/jipi/article/view/21426/12225
Fatmawati, B. (2012). Menilai Keterampilan Proses Sains Siswa Melalui Metode Pembelajaran Pengamatan Langsung. *Seminar Nasional X Pendidikan Biologi FKIP UNS*, 1–10. https://jurnal.uns.ac.id/prosbi/article/view/6362
Hadinugrahaningsih, T., Rahmawati, Y., & Ridwan, A. (2017). Developing 21st century skills in chemistry classrooms: Opportunities and challenges of STEAM integration. *AIP Conference Proceedings*, *1868*. https://doi.org/10.1063/1.4995107
Iswatun, I., Mosik, M., & Subali, B. (2017). Penerapan model pembelajaran inkuiri terbimbing untuk meningkatkan KPS dan hasil belajar siswa SMP kelas VIII. *Jurnal Inovasi Pendidikan IPA*, *3*(2), 150. https://doi.org/10.21831/jipi.v3i2.14871
Jack, G. U. (2013). The influence of identified student and school variables on students' science process skills acquisition. *Journal of Education and Practice*, *4*(5), 16-22. https://core.ac.uk/download/pdf/234634065.pdf
Kartimi, Gloria, R. Y., & Ayani. (2013). Penerapan Pendekatan Keterampilan Proses dalam Pengajaran Biologi untuk Mengetahui Hasil Belajar Siswa Pada Pokok Bahasan Ekosistem Kelas VII di SMPN 1 Talun. *Jurnal Scientiae Educatia*, *2*(1), 73–85. http://www.syekhnurjati.ac.id/jurnal/index.php/sceducatia/article/view/524
Monhardt, L., & Monhardt, R. (2006). Creating a context for the learning of science process skills through picture books. *Early Childhood Education Journal*, *34*(1), 67–71. https://doi.org/10.1007/s10643-006-0108-9
Nuryani., R. (2003). *Kemampuan Proses Ilmiah Dalam Pembelajaran Sains*.
Prasojo. (2016). Pengembangan Perangkat Pembelajaran IPA Berbasis Inkuiri Terbimbing untuk Meningkatkan KPS dan Berpikir Kritis. *Jurnal Pendidikan Matematika Dan Sains*, *4*(2), 130–141. http://journal.uny.ac.id/index.php/jpms
Pratiwi, S. N., Cari, C., & Aminah, N. S. (2019). Pembelajaran IPA Abad 21 dengan Literasi Sains Siswa. *Jurnal Materi Dan Pembelajaran Fisika*, *9*, 34–42. https://doi.org/10.20961/jmpf.v9i1.31612
Rahayu, R., Iskandar, S., & Abidin, Y. (2022). Inovasi Pembelajaran Abad 21 Dan Penerapannya Di Indonesia. *Jurnal Basicedu*, *6*(2), 2099–2104. https://doi.org/10.31004/basicedu.v6i2.2082
Ratnasari, D., Sukarmin, S., & Suparmi, S. (2017). Analisis Implementasi Instrumen Two-Tier Multiple Choice Untuk Mengukur Keterampilan Proses Sains. *Jurnal Pendidikan Dan Kebudayaan*, *2*(2), 166–179. https://doi.org/10.24832/jpnk.v2i2.627
Rauf, R. A. A., Rasul, M. S., Mansor, A. N., Othman, Z., & Lyndon, N. (2013). Inculcation of science process skills in a science classroom. *Asian Social Science*, *9*(8), 47–57. https://doi.org/10.5539/ass.v9n8p47
Ridwan, A., Fatimah, C., Hadinugrahaningsih, T., Rahmawati, Y., & Mardiah, A. (2022). Development of 21st Century Skills in Acid-Base Learning Through STEAM Projects. *JTK (Jurnal Tadris Kimiya)*, *7*(1), 121–134. https://doi.org/10.15575/jtk.v7i1.4913
Rifqiawati, I., Wahyuni, I., & Rahman, A. (2017). Pengaruh metode field trip dengan pemanfaatan rumpon buatan terhadap keterampilan proses sains dan sikap ilmiah di SMP Satu Atap Pulau Tunda. *Biodidaktika Jurnal Biologi Dan Pembelajarannya*, *12*(1), 23–30. http://dx.doi.org/10.30870/biodidaktika.v12i1.1832
Rustaman, N. (2007). Asesmen Pendidikan IPA. In *Diklat NTT04*.
Saleh, S. Y. Mu. Nu. H. R. M. A. (2020). Studi Keterampilan Proses Sains (Kps) Peserta. *Jurnal IPA Terpadu*, *3 (No 2)*(2), 75–86. https://doi.org/10.35580/ipaterpadu.v3i2.11294
Solé-Llussà, A., Aguilar, D., & Ibáñez, M. (2020). Video-worked examples to support the development of elementary students' science process skills: a case study in an inquiry activity on electrical circuits. *Research in Science and Technological Education*, *00*(00), 1–21. https://doi.org/10.1080/02635143.2020.1786361
Sanjaya, W. (2013). Penelitian Pendidikan. Jakarta: Kencana
Subana. M. (2011). Dasar-dasar Penelitian Ilmiah. Bandung: Pustaka Setia.
Suansah. (2015). Penerapan Pendekatan Inkuiri Untuk Meningkatkan Keterampilan Proses Siswa Pada Pembelajaran IPA Pokok Bahasan Konduktor dan Isolator Panas. *Profesi Pendidikan Dasar, 2*(1), 59– 67. http://journals.ums.ac.id/index.php/ppd/article/view/ 1493/1035
Surwadani, Asrial, Y. U. (2021). Analisis Model Pembelajaran Inkuiri Terbimbing Terhadap

Keterampilan Proses Sains Siswa pada Mata Pelajaran IPA SMP (Analysis of Guided Inquiry Learning Models on Students ' Science Process Skills in Science Subjects in Junior High School). *Jurnal Ilmiah Pendidikan Biologi*, *07*(03), 185–194. https://doi.org/10.22437/bio.v7i3.13072

Syahputra, E. (2018). PEMBELAJARAN ABAD 21 DAN PENERAPANNYA DI INDONESIA. *Prosiding Seminar Nasional SINASTEKMAPAN (E-Journal)*, *I*, 1276–1283. https://www.researchgate.net/publication/331638425

Trianto. (2012). Model Pembelajaran Terpadu. Jakarta: Bumi Aksara

Usman, U. (2008). Menjadi Guru Profesional. Bandung: Remaja Rosada

Wahyuni Salosso, S., Nurlaili, & Kusumawardani, R. (2018). Analisis keterampilan proses sains siswa SMA melalui penerapan model pembelajaran learning cycle 5E pada pokok bahasan larutan asam dan basa. *Bivalen: Chemical Studies Journal*, *1*(1), 45–50. https://doi.org/10.30872/bcsj.v1i1.280

Widoyoko, E. P. (2014). Teknik Penyusunan Instrumen Penelitian. Yogyakarta: Pustaka belajar

Yuliani, C. D., & Roviati, E. (2016). Penerapan Pembelajaran Ipa Berbasis Keterampilan Proses Sains Untuk Meningkatkan Literasi Sains Pada Mata Pelajaran Ipa Di Kelas Vii Materi Pokok Pencemaran Lingkungan Di Smpn 1 Cikijing. *Jurnal Sains Dan Pendidikan Sains, 5(*45132), 122–135.