Edubiotik: Jurnal Pendidikan, Biologi dan Terapan
ISSN 2528-679X (print), ISSN 2597-9833 (online)
Vol. 8, No. 01, March 2023, pp. 62 – 69

Available online at:
http://ejurnal.budiutomomalang.ac.id/index.php/edubiotik

Research Article

OPEN ACCESS

Analysis of biology teacher candidates' science process skills in vertebrate zoology courses

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Article Information

Submitted: 2022-12-23
Accepted: 2023-07-30
Published: 2023-08-02

ABSTRACT

Science Process Skills (SPS) need to be developed to improve teacher quality in teaching. The existence of the Covid-19 pandemic caused Biology teachers to be unable to carry out practicums so the SPS were helpless. This study aims to analyze the science process skills of biology teacher candidates in vertebrate zoology courses. The research method used is descriptive quantitative through survey techniques. This research was conducted at the PGRI Ronggolawe University and involved 21 participants. This study uses an instrument in the form of an observation sheet to measure scientific process skills. The SPS indicators that are measured are the skills of observing, measuring, compiling tables, and obtaining and processing data. The data obtained is then interpreted into very high, high, low, and very low categories. The percentage of students in each category is then calculated as a map of their science process skills through analysis of quantitative descriptive data. The results showed that 65.5% of prospective biology teachers had SPS scores that were in the very high, high, low, and very low categories. 7.5% has an SPS value which is included in the very low category. In general, biology teacher candidates tend to have very high levels of competency in performing science process skills.

Keywords: Biology; science process skill; zoology

Publisher

Biology Education Department
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How to Cite

Murtini, I., Mustofa, A., & Cintamulya, I. (2023). The Analysis of biology teachers candidates' science process skill in vertebrate zoology courses. *Edubiotik : Jurnal Pendidikan, Biologi Dan Terapan, 8*(01), 62-69. https://doi.org/10.33503/ebio.v8i01.2546

INTRODUCTION

Education in the 21st century places more emphasis on student-centered learning (student center), where students are required to play an active role in the learning activities. This activity can improve the various abilities and skills of students. Learning can improve a variety of abilities, including critical thinking, creative thinking, reasoning, and science process abilities (BSNP, 2010). Process skills are formed from basic, interrelated skills and are trained continuously (Dwianto et al., 2017; Tosun, 2019; Zeidan & Jayosi,

2014). Physical, mental, and social skills are the basic skills that makeup process skills (Handayani et al., 2018).

Scientific activities require a scientific process to create scientific products (Dwianto et al., 2017; Handayani et al., 2018; Prayitno et al., 2017). This means scientific work can be obtained through the scientific process. Science process skills (SPS) are developed through a scientific activity carried out to produce scientific work. These skills are needed to form deep scientific understanding and experience through learning activities (Anggraeni et al., 2018; Ristanto & Djamahar, 2019). This skill can be used as a provision in developing science and students' knowledge (Prayitno et al., 2017; Zeidan & Jayosi, 2014). SPS plays a role in supporting students' ways of thinking, reasoning, solving problems, and creativity (Özgelen, 2012). This skill is a basic one that must be mastered by students because it reflects the identity of scientists when solving problems and planning research experiments (Tanfiziyah et al., 2021). This SPS can be obtained by completing practicum tasks in laboratories, one of which is biology.

Biology is a science that studies all studies of natural phenomena, living things, and various matters relating to their application to create technology to solve societal problems. The natural phenomena contained in this study can be seen from the issue, theme, object, and location. If students only rely on theory when learning biology, then it is difficult to apply it when faced with reality (Ismail et al., 2019). In general, direct object observation exercises in the lab are necessary for learning biology as part of process-intensive scientific work (Prajoko et al., 2017). Fadllan (2016) stated that practicum activities support students' understanding of theories and concepts obtained in theoretical lessons. The practicum activity aims to further clarify the teaching material that can be observed directly (Putri et al., 2022).

Many biology teachers do not do a practicum, and one of the causes is the lack of process skills that the COVID-19 pandemic has brought about. The existence of this outbreak had a major influence on face-to-face learning activities in educational institutions, which were replaced with an online learning system (Masahere, 2020). Online learning creates obstacles for students who do not understand the courses studied so they experience difficulties in learning (Putri et al., 2022). When the outbreak of the COVID-19 pandemic has begun to subside, learning will return to new normal conditions. The shift from learning methods that were originally online to face-to-face again requires adaptation. The reason is, post-pandemic learning activities before the pandemic are very different. This is because during the pandemic many lessons are not carried out with scientific procedures such as practicum, so the process skills do not develop. Face-to-face learning after the COVID-19 pandemic takes time and guidance from lecturers to help prospective teacher students develop process skills. The novelty of this study is that SPS analysis was carried out after the COVID-19 pandemic, where prospective teachers vacuumed in practicum activities that supported the improvement of these skills. It can prepare future biology instructors' scientific abilities with in-person lectures.

The science skills of prospective biology instructors need to be increased because there are no significant differences in terms of gender or age (Hamdani, 2017). In learning biology, science process skills are very important to be empowered. This is so that they can help their students understand the concept of the material and how to obtain this knowledge (Susanti et al., 2018). Biology teachers must be able to apply learning strategies creatively to improve students' thinking abilities, skills, and attitudes (Anggraeni et al., 2018). Thus, this study aims to analyze the science process skills of biology teacher candidates.

RESEARCH METHODS

This research method is qualitative descriptive research, analyzing science process skills carried out by practicum methods in the laboratory. This research was conducted in March–June 2022 at PGRI Ronggolawe University. The subject in this study is a biology education student who is taking a vertebrate zoology course. The number of research subjects was 21. Observation sheets were one of the study's equipment. SPS indicators are the skills to observe, measure, construct tables, and obtain and process data. Data collection technique with observation according to the observation sheet. According to Darmaji et al. (2018), Student scores are divided into four categories as shown in Table 1.

Table 1. Students' Science Process Skills Scale

No	Interval	Category
1	25,00< x< 43,75	Very Low
2	43,75<x< 62,50	Low
3	62,50<x<81,25	High
4	81,25<x<100,00	Very High

After categorizing the SPS per indicator, the percentage of each indicator is then calculated, which aims to map the number of students who are classified into the categories of very high, high, low, and very low scores. The percentage is calculated in reference to Sukarno et al. (2013), which can be seen in the equation.

$$\frac{x}{n}\ x\ 100\ \% = \cdots$$

Information:
x = Number of students in one of the categories
n = Total number of students

FINDING AND DISCUSSION

Based on the research results, the average value of science process skills was obtained for each indicator which can be seen in Figure 1.

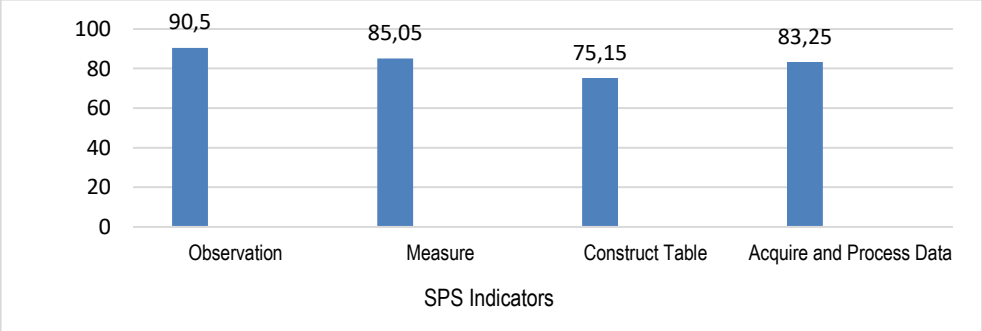

Figure 1. The Average Score of Science Process Skills (SPS)

In Figure 1, it is shown that the average SPS value from the highest to the lowest is the observing indicator, which is equal to 90.5; the indicator of obtaining and processing data is 83.25; the measuring indicator is 85.05; and the indicator constructs tables with a value of 75.15. This is because observing is an indicator of the basic SPS. Basic SPS is easier for teachers to apply in their learning; it tends to be higher than integrated SPS. Everyone can do this because, by observing, they become aware of things they did not know before (Susanti et al., 2018). Agustina & Saputra (2016) stated that training SPS for

prospective biology teacher candidates is important so that later when they become teachers, they can develop student SPS in learning activities. The overall percentage profile of SPS mastery by category is presented in Table 2.

Table 2. Percentage of Mastery of the Concept of SPS

No	Category	Percentage (%)
1	Very High	65,5
2	High	15,25
3	Low	11,75
4	Very Low	7,5

Based on the data in Table 2, students have SPS mastery with a very high category score of 65.5%, a high category score of 15.25%, a low category score of 11.75%, and students in a very low category totaling at least 7.5%. In general, biology education students taking vertebrate zoology courses have good scientific skills. This means that the skills possessed by prospective teachers are well-developed. Harja & Sinaga (2021) states that the tendency for the percentage of indicators to be high indicates success in mastering SPS. Further analysis was carried out to see the mapping of SPS values based on the SPS indicators and their categories. The distribution of the SPS value mapping can be seen in Figure 2.

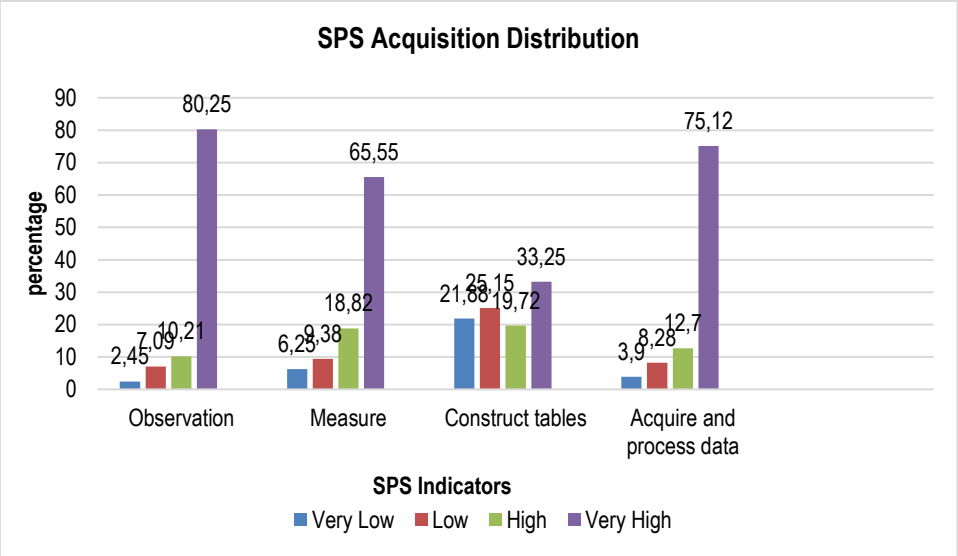

Figure 2. SPS Acquisition Distribution

Based on the data above, it can be seen that almost all indicators get percentages in the very high category. Observing the indicators, 80.25% are in the very high category, 10.21% are in the high category, 7.09% are in the low category, and 2.45% are in the very low category. The indicator measures a percentage of 65.55% in the very high category, 18.82% in the high category, 9.38% in the low category, and 6,25% in the very low category. In the indicators of obtaining and processing data, 75.12% are in the very high category, 12.7% are in the high category, 8.28% are in the low category, and 3.9% are in the very low category. This is different from the aspect of obtaining and processing data, where one category is almost the same as another. Figure 2 shows that this indicator obtains a percentage of 33.25% for the very high category, 19.72% for the high category, 25.15% for the low category, and 21.88% for the very low category.

Observing activities include various activities that use the senses of sight, smell, hearing, taste, and touch when observing the characteristics of an object, as well as using relevant and adequate facts from the results of observations (Rustaman, 2005). In the indicators observed in this study, all prospective teachers observed both the morphology and anatomy of the test animals. One example of the animal is tilapia, so what is observed are the fins of the fish, the shape of the scales, the slit of the gills, the operculum of the eyes, the mouth, and the anus. Meanwhile, anatomically, students observe parts of internal organs in the animals studied, such as excretory devices, digestive devices, respiratory devices, and urogenital devices. In this observation activity, supporting tools such as lup and microscopes are needed to help facilitate practicum activities. In this section, students observe each section and then draw and record it. Based on this, prospective teachers can already carry out observation activities according to existing procedures, so that they meet the observing indicators well. Observing activities can provide more meaningful learning because students directly observe events in their environment. The ability to observe is the most fundamental skill in science and can be a fulcrum for the development of other science process skills (Fitriana et al., 2019).

The second indicator is measuring. In this activity, prospective teachers use a ruler to measure the length of the fish's body, the length of the fish's intestines, and the length of the fish's fins. In addition, an analytical balance is also used to measure the weight of the observed fish. This is done to determine the size of the fish according to its age. To obtain accurate data, accuracy, and patience are needed in its implementation. Based on the results of the study, it can be seen that students' skills in using measuring instruments and reading are very good. Hayati & Ami (2022) state that the right way to train aspects of measuring is to use practical tools and materials. The more often the skills to use certain tools are trained, the more skilled they will be at using them (Hamdiyati & Kusnadi, 2007). The data obtained from the measurements is then entered into the table.

In the third indicator, namely, constructing tables, prospective teachers create tables and enter data from observations and measurements. In making an observation table, there are several table components that must be considered, including the table title and the position of the title, the number of table columns and rows, and the elements in the table. At this stage, prospective teachers get low scores compared to other indicators. This is caused by the lack of table components, both in terms of columns and elements. Furthermore, the table title is placed below the table due to a lack of knowledge in table construction.Many prospective teachers do not pay attention to the procedure for making the correct observation table. This can be seen from the results of percentage gains in indicators compiling tables. Other studies are also in line with this study, where students who are not used to explaining material through graphs or tables will have difficulty when asked to make tables (Andini et al., 2018).

On the indicators of obtaining and processing data, prospective teachers have done well in processing the data contained in the practicum report. They have also been able to find information from pictures and translate this information into written form (Hamia et al., 2020). The writing that is done has begun to be structured, even though it uses simple language. The use of the scientific name of the experimental animal is also in accordance with the applicable regulations. The lack of discussion in strengthening data becomes an impediment in this indicator. Many prospective teachers cite blogspot to back up their observational data. In addition, the lack of literacy makes prospective teachers poor at managing sentences. Because the information that comes from blogspot is not certain to be true. In addition, lack of literacy makes prospective teachers poor in organizing sentences. Literacy is very good for enriching and expanding the reader's vocabulary (Aswan, 2020).

The skill of communicating the results of observations (communication skills) is an aspect of basic SPS that is also related to social skills. The ability to communicate is very necessary because humans interact with other humans through communication, whether verbally, in writing, visually, or through impressions. In this study, the communication skills measured were written communication skills, namely through reports. According to prior study, biology learning can apply communication skills through written assignments like compiling reports (Hamia et al., 2020). Based on the reports of observations made, prospective teachers can communicate quite well. Prospective teachers can describe the results of observations that have been made in sequence. According to Wilsa et al., (2017) students are said to be communicative if they can translate images into written descriptions. The ability to convey clear and understandable information is used to judge the quality of writing (Spektor-Levy et al., 2009).

Biology teacher candidates are expected to have good mastery of both basic and integrated SPS. Mastery of SPS cannot be separated from a good understanding of the nature of science itself or Nature of Science/NOS (Sujarwanto & Putra, 2018). According to Kruea-In & Thongperm (2014), the lack of sufficient laboratory equipment is one of the barriers to integrating SPS into the learning process. Various important efforts are made to improve SPS because prospective Biology Teachers' Candidates are expected to understand SPS well, apply SPS in future learning when they become teachers, and equip students to face scientific problems. With this effort, students are expected to be able to easily make connections between the knowledge possessed by their teachers and real-world experiences in learning. (Erkol & Ugulu, 2014).

CONCLUSION

There were 65.5% of biology teacher candidates for vertebrate zoology courses who had SPS in the very high category, 15.25% in the high category, 11.75% in the low category, and 7.5% in the very low category. The four indicators studied received very high ratings with various percentages. So, it can be concluded that the ability to perform science process skills possessed by biology teacher candidates tends to be very high. This is a good provision for them to teach and educate their students when the class where they work becomes a teacher. Because this research is limited, the best advice that researchers can give is that it is necessary to carry out SPS analysis on other indicators to determine the level of SPS.

ACKNOWLEDGMENT

We thank the PGRI Ronggolawe University for facilitating this research and all parties involved in the research process

REFERENCES

Agustina, P., & Saputra, A. (2016). Analisis Keterampilan Proses Sains (KPS) Dasar Mahasiswa Calon Guru Biologi pada Matakuliah Anatomi Tumbuhan (Studi Kasus Mahasiswa Prodi P. Biologi FKIP UMS Tahun Ajaran 2015/2016). *SNPS (Seminar Nasional Pendidikn Sains),* 71–78. https://jurnal.fkip.uns.ac.id/index.php/snps/article/view/9816

Andini, T. E., Hidayat, S., Fadillah, E. N., & Permana, T. I. (2018). Scientific Process Skills: Preliminary Study towards Senior High School Student in Palembang. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *4*(3), 243–250. https://ejournal.umm.ac.id/index.php/jpbi/article/view/6784

Anggraeni, H., Rahayu, S., Rusdi, R., & Ichsan, I. (2018). Pengaruh Pengajaran Timbal Balik dan Pembelajaran berbasis Masalah terhadap Kemampuan Berpikir Kritis Peserta Didik pada Materi Sistem Reproduksi. *Biota*, *11*(1), 77–95. https://biota.ac.id/index.php/jb/article/view/84

Aswan, A. (2020). Implementasi Gerakan Literasi Sekolah di Community Learning Center sebagai Upaya Meningkatkan Kosakata Bahasa Indonesia Siswa. *KLITIKA: Jurnal Pendidikan Bahasa Dan Sastra Indonesia*, *2*(1), 1–10. https://doi.org/10.32585/klitika.v2i1.708

BSNP. (2010). *Paradigma Pendidikan Nasional Abad XXI*. Departemen Pendidikan Nasional. https://repositori.kemdikbud.go.id/

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

Dwianto, A.; Wilujeng, I.; Prasetyo, ZK; & Suryadarma, I. (2017). Pengembangan Perangkat Pembelajaran berbasis Domain Sains yang Terintegrasi dengan Kearifan Lokal untuk Meningkatkan Keterampilan Proses Sains dan Sikap Ilmiah. *Jurnal Pendidikan IPA Indonesia*, *6*(1), 23–31. https://doi.org/10.15294/jpii.v6i1.7205

Erkol, S., & Ugulu, I. (2014). Examining Biology Teachers Candidates' Scientific Process Skill Levels and Comparing these Levels in Terms of Various Variables. *Procedia - Social and Behavioral Sciences*, *116*, 4742–4747. https://doi.org/10.1016/j.sbspro.2014.01.1019

Fadllan, A. (2016). Strategi Pengembangan Science Generic Skills (SGS) Calon Guru Fisika melalui Model Pembelajaran Group Investigation pada Mata Kuliah Praktikum. *Phenomenon : Jurnal Pendidikan MIPA*, *1*(1), 31–44. https://doi.org/10.21580/phen.2011.1.1.443

Fitriana, F., Kurniawati, Y., & Utami, L. (2019). Analisis Keterampilan Proses Sains Peserta Didik Pada Materi Laju Reaksi Melalui Model Pembelajaran Bounded Inquiry Laboratory. *JTK (Jurnal Tadris Kimiya)*, *4*(2), 226–236. https://doi.org/10.15575/jtk.v4i2.5669

Hamdani. (2017). *Strategi Belajar Mengajar*. Pustaka Setia.

Hamdiyati, Y., & Kusnadi. (2007). Profil Keterampilan Proses Sains Mahasiswa melalui Pembelajaran Berbasis Kerja Ilmiah pada Matakuliah Mikrobiologi. *Jurnal Pengajaran MIPA*, *9*(2), 36–42. https://ejournal.upi.edu/index.php/jpmipa/article/view/35751

Hamia., Muhiddin, P., & Arsal, A. F. (2020). Keterampilan Komunikasi Peserta Didik: Studi Kasus pada Pembelajaran Biologi di SMA Negeri 1 Sidrap. 1-7. http://eprints.unm.ac.id/id/eprint/19226

Handayani, G., Adisyahputra, A., & Indrayanti, R. (2018). Korelasi antara Ilmu Terpadu Keterampilan Proses, dan Kemampuan Membaca Pemahaman hingga Literasi Sains pada Guru Biologi Siswa. *Biosfer: Jurnal Pendidikan Biologi*, *11*(1), 22–32. https://doi.org/10.21009/biosferjpb.11-1.3

Harja, M., & Sinaga, P. (2021). Evaluation of Science Process Skills of High School Students in Tapaktuan City on Static Fluid Material. *Journal of Physics: Conference Series*, *1806*(1). https://doi.org/10.1088/1742-6596/1806/1/012016

Hayati, N., & Ami, M. S. (2022). Students' Learning Activities and Science Process Skills: The Effectiveness of Group Investigation Learning Model. *JPBIO (Jurnal Pendidikan Biologi)*, *7*(1), 51–66. https://doi.org/10.31932/jpbio.v7i1.1519

Ismail, S., Rahman, M. H., & Muhammad, N. (2019). Pengaruh Model Pembelajaran Guided Inquiry terhadap Hasil Belajar Siswa pada Materi Momentum dan Impuls Kelas X Mia 5 SMA Negeri 1 Kota Ternate. *Saintifik@ (Jurnal Pendidikan MIPA)*, *4*(2), 31–36. https://ejournal.unkhair.ac.id/index.php/Saintifik/article/view/1392

Kruea-In, N., & Thongperm, O. (2014). Teaching of Science Process Skills in Thai Contexts: Status, Supports and Obstacles. *Procedia-Social and Behavioral Sciences*, *141*, 1324–1329. https://doi.org/10.1016/j.sbspro.2014.05.228

Masahere, U. (2020). Analisis Proses Pembelajaran dalam Jaringan (DARING) dalam Masa Pandemi COVID-19 pada Mahasiswa Studi Kasus Mahasiswa Jurusan Akuntansi Kelas 61.5B.07 Kampus Salemba 22 Universitas Bina Sarana Informatika. *Edutech Consultant BandungJurnal Aksara Public*, *4*(4), 83–94. https://garuda.kemdikbud.go.id/documents/detail/1856935

Özgelen, S. (2012). Students' Science Process Skills within A Cognitive Domain Framework. *Eurasia Journal of Mathematics, Science and Technology Education*, *8*(4), 283–292. https://doi.org/10.12973/eurasia.2012.846a

Prajoko, S., Amin, M., Rohman, F., & Gipayana, M. (2017). The Usage of Recycle Materials for Science Practicum: Is There Any Effect on Science Process Skills? *International Journal of Evaluation and Research in Education (IJERE)*, *6*(1), 1. https://doi.org/10.11591/ijere.v6i1.6340

Prayitno, B. A., Corebima, D., Susilo, H., Zubaidah, S., & Ramli, M. (2017). Closing the science process skills gap between students with high and low level academic achievement. *Journal of Baltic Science Education*, *16*(2), 266–277. https://doi.org/10.33225/jbse/17.16.266

Putri, D. T., Wardhani, S., & Indawan, I. (2022). Analisis Pembelajaran Daring Biologi di Masa Pandemi Covid-19 Prodi Pendidikan Biologi FKIP Universitas Muhammadiyah Palembang. *Biodik*, *8*(1), 1–9. https://doi.org/10.22437/bio.v8i1.14495

Ristanto, R. H., & Djamahar, R. (2019). Penguatan Keterampilan Penilaian Autentik Guru IPA Biologi di Kabupaten Bogor. *BAKTIMAS : Jurnal Pengabdian Pada Masyarakat*, *1*(1), 61. https://www.researchgate.net/

Rustaman, N. Y. (2005). Perkembangan Penelitian Pembelajaran Berbasis Inkuiri dalam Pendidikan Sains. *Seminar Nasional II Himpunan Ikatan Sarjana Dan Pemerhati IPA Indonesia*, 22–23. http://file.upi.edu/Direktori/FPMIPA/JUR._PEND._BIOLOGI/195012311979032-NURYANI_RUSTAMAN/PenPemInkuiri.pdf

Spektor-Levy, O., Eylon, B. S., & Scherz, Z. (2009). Teaching Scientific Communication Skills in Science Studies: Does It Make A Difference?. *International Journal of Science and Mathematics Education*, *7*(5), 875–903. https://doi.org/10.1007/s10763-009-9150-6

Sujarwanto, E., & Putra, I. A. (2018). Investigasi Keterampilan Proses Sains Terintegrasi Mahasiswa Pendidikan Fisika Universitas KH. A. Wahab Hasbullah. *Momentum: Physics Education Journal*, *2*(2), 79–85. https://doi.org/10.21067/mpej.v2i2.2726

Sukarno; Permanasari, A., & & Hamidah, I. (2013). The Profile of Science Process Skill (SPS) Student at Secondary High School (Case Study in Jambi). *International Journal of Scientific Engineering and Research (IJSER)*, *1*(1), 79–83. https://www.ijser.in/archives/v1i1/MDExMzA5MTg=.pdf

Susanti, R., Anwar, Y., & Ermayanti, E. (2018). Profile of Science Process Skills of Preservice Biology Teacher in General Biology Course. *Journal of Physics: Conference Series*, *1006*(1). https://doi.org/10.1088/1742-6596/1006/1/012003

Tanfiziyah, R., Akbar, B., & Anugrah, D. (2021). Development Instrument Science Process Skills Biology for Junior High School. *Edubiotik: Jurnal Pendidikan, Biologi Dan Terapan*, *6*(01), 58–65. https://doi.org/10.33503/ebio.v6i01.884

Tosun, C. (2019). Scientific Process Skills Test Development within The Topic “Matter And Its Nature” and The Predictive Effect of Different Variables on 7th and 8th Grade Students’ Scientific Process Skill Levels. *Chemistry Education Research and Practice*, *20*(1), 160–174. https://doi.org/10.1039/C8RP00071A

Wilsa, Asrizal W., Susilowati, Sri Mulyani E., & Rahayu, Enni S. (2017). Problem Based Learning Berbasis Socio-Scientific Issue untuk Mengembangkan Kemampuan Berpikir Kritis dan Komunikasi Siswa. *Journal of Innovative Science Education*, *6*(1), 129–137. https://journal.unnes.ac.id/sju/index.php/jise/article/view/17072

Zeidan, A. H., & Jayosi, M. R. (2014). Science Process Skills and Attitudes toward Science among Palestinian Secondary School Students. *World Journal of Education*, *5*(1), 13–24. https://doi.org/10.5430/wje.v5n1p13