Schrödinger:Journal of Physics Education
Vol. 4, No. 1, March 2023, pp. 24~29
ISSN: 2716-1587, DOI: 10.37251/sjpe.v4i1.494

A Study of Science Process Skills on Simple Pendulum Materials

Samijo[1], Dinda Desma Romadona[2]
[1]Senior High School 1 Tanjung Jabung Barat, Jambi, Indonesia
[2]Physics Education, Faculty of Teaching and Eeducation, Universitas Jambi, Jambi, Indonesia

Article Info

Article history:

Received Jan 6, 2023
Revised Feb 13, 2023
Accepted Mar 21, 2023

Keywords:

Physics
Science Process Skills
Simple Pendulum

ABSTRACT

Research Objectives: The objective of this study was to describe students' science process skills in simple pendulum material.

Methodology: This research method is a mixed research method with a sequential explanatory research design. This research involved 100 students of Al-Falah Jambi Islamic High School. The instruments used were KPS observation sheets with 16 indicators and interview sheets which were analyzed statistically descriptively then analyzed qualitatively to strengthen the quantitative data.

Main Findings: The results of the student KPS indicator were very good, namely on the observation indicator with a percentage of 71% of 100 students, while the results on the KPS indicator with a percentage of 66%. of 100 students namely experimenting skills. The lowest result is the presence of predictive indicators that identify variables, and make hypotheses with a percentage of 45%, 66% and 44%. These results indicate that students have sufficiently mastered several KPS in this simple pendulum material.

Novelty/Original Research: How important it is for an educator to be able to improve students' science process skills so that they not only develop cognitive aspects, but also psychomotor aspects, according to the goals of education.

Corresponding Author:
Dinda Desma Romadona,
Department of Physics Education, Faculty of Teaching and Education, Universitas Jambi,
Jl. Lintas Jambi-Ma. Bulian Km. 15, Jambi, 36361, Indonesia
Email: ddromason937@gmail.com

1. INTRODUCTION

Education is a process of learning to students in order to have a knowledge. Education is carried out to create a learning atmosphere and learning process [1]. Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential [2]. Education can also be interpreted as a deliberate activity of student activities to produce a desired result so that the goal is achieved [3]. The implementation of learning at this time must experience changes, where students play an active role [4].

Physics is a lesson related to scientific concepts whose application is in everyday life [5]. Physics is a branch of science that has a unique and distinctive feature which lies in the existence of abstract concepts and requires idealization through mathematical modeling [6]. Problems that often arise in the learning process in the classroom include the inability of students to relate one concept to another, many misconceptions, and the low ability of students to solve problems and understand physics concepts [7]. In learning physics the most important is the process of science that can develop various skills in students. Skills that must be mastered by students are science process skills [8].

Science process skills are an approach that must be used as a reference for teachers in carrying out the learning process. Science process skills are an approach to the learning process that provides opportunities for students to be able to find facts, build concepts through activities or experiences as scientists do [9]. Science

process skills are needed in solving scientific problems [10]. Science process skills fall into two types, namely basic science process skills and integrated science process skills [11].

Basic science process skills make students actively involved while integrated science process skills are skills that see whether something can work and answer questions through an experiment [12]. Basic science process skills consist of observation, communication, classification, prediction, measurement, and conclusion skills. While integrated process skills consist of skills in identifying variables, creating data tables, creating graphs, describing relationships between variables, obtaining and processing data, investigative analysis, defining variables operationally, making hypotheses, designing investigations, and conducting experiments [13]. Science process skills, both basic and integrated science process skills, really need to be mastered by students. In the learning process, teachers are required to be able to manage classes so that students can obtain optimal learning outcomes [14].

To develop students' science process skills so that it is expected that students can better understand the concepts that have been studied theoretically and can foster a scientific attitude in students, namely through practicum activities. Practicum activities have a very important position in learning physics. Practicum is one of the factors that plays a very important role in supporting the success of the physics teaching and learning process [15]. Practicum-based learning is a good learning alternative for students to develop skills. Efforts to develop students' science process skills, namely involving students actively in physics practicum activities [16].

Physics practicum activities on simple pendulum material can be carried out to measure students' science process skills. Therefore this study aims to describe students' science process skills in simple pendulum material.

2. RESEARCH METHOD

The research method is the method used by researchers in collecting research data [17]. The method used in this study is a mixed research method with an explanatory sequential design. Mixed methods research is a method used to build data strength from quantitative data and qualitative data [18]. The researcher collected quantitative data first, then followed by collecting qualitative data to corroborate the results of the quantitative data.

The population of this study were students of class XII SMA Islam Al-Falah Jambi who majored in MIPA. The samples used were all 100 students of class XII MIPA. The sampling technique used is total sampling, which is a sampling technique in which all members of the population are used as samples [19]. This technique is considered the most accurate and free from sample errors so it is very well used in this study.

The instruments used in this research were science process skill observation sheets and interview sheets. This research was conducted by observing students' science process skills when carrying out practical activities on Simple Pendulum material. The observed indicators of science process skills are observation, classification, communication, measuring, prediction, conclusion, identification of variables, making hypotheses, describing relationships between variables, defining variables operationally, planning experiments, analyzing experiments, conducting experiments, obtaining and processing data, making data tables and create graphs. Meanwhile, the interview was carried out by asking questions freely according to the situation and conditions of the interview.

The data analysis used in quantitative is descriptive statistics with the SPSS program, descriptive statistics discusses the presentation of data in the form of frequency distribution tables or in other forms [20]. The data presented are the mean (average), mode, median and standard deviation. Then interviews were conducted to strengthen the quantitative data. The data obtained is then searched for the percentage and stated in several categories as shown in table 1. below.

Table 1. Categories of Students' Science Process Skills

Interval	Cateogry
25.00 – 43.75	Very not Good
43.76 – 62.50	Not Good
62.51 – 81.25	Good
81.26 – 100.0	Very Good

3. RESULTS AND DISCUSSION

The results of observations of 16 indicators of science process skills for class XII MIPA students at Al-Falah Islamic High School Jambi are shown in Table 2. below.

Table 2. Students' Science Process Skills in Simple Pendulum Practicum Activities

Science Process Skills	Indicator	Category			
		STB (%)	SB (%)	B (%)	SB (%)
Basic	Observation	0	0	29	71
	Classification	22	20	35	23
	Communication	1	16	36	47
	Measure	0	9	41	50
	predictions	23	45	24	8
	Conclusion	1	17	48	34
Integrated	Variable Identification	66	23	11	0
	Making a Hypothesis	44	14	23	19
	Describe the Relationship Between Variables	10	22	38	30
	Defining Variables Operationally	0	19	30	51
	Planning Experiments	2	14	38	46
	Experimental Analysis	4	9	35	52
	Experiment	2	6	26	66
	Obtaining and Processing Data	3	17	36	44
	Create Data Tables	1	10	33	56
	Creating Graphs	4	16	33	47

The science process skills observed in this study are basic process skills which include observation, classification, communication, measuring, prediction, and inference as well as integrated process skills which include identifying variables, making hypotheses, describing relationships between variables, defining variables operationally, planning experiments. , analysis of experiments, conducting experiments, obtaining and processing data, creating data tables and making graphs. Table 2.1 shows the percentage of observations for science process skills of 100 students. It was found that observation skills were included in the very good category with a percentage of 71%. Classification skills have a percentage of 35% and are included in the good category. Communication skills have a percentage of 47% included in the very good category. Students' measuring skills are included in the very good category with a percentage of 50%. The students' prediction skills with a percentage of 45% are in the bad category. Conclusion indicator skills are included in the good category with a percentage of 48%. Meanwhile, the variable identification skill indicator with a percentage of 66% is included in the very bad category. As well as students' hypothesis-making skills in the very not good category with a percentage of 44%. While skills describe the relationship between variables with a percentage of 38% in the good category. For the skills of operationally defining variables, planning experiments, trial analysis, conducting experiments, obtaining and processing data, making data tables and making graphs with successive percentages of 51%, 46%, 52%, 66%, 44%, 56 % and 47% are included in the very good category.

The results in Table 2.2 below are the results of science process skills that have been analyzed with descriptive statistics. The data in Table 2.2 provides information that the observation indicator basic science process skills is more dominant than other basic science process skills with an average value of 24.36. While the integrated science process skills are more dominant in the indicator describing the relationship between variables with an average value of 16.94.

Table 3. Statistical Description of Students' Science Process Skills in Simple Pendulum Practicum Activities

Science Process Skills	Indivator	Standar Deviasi	Mean	Min	Max	Range
Basic	Observation	2.32	24.36	20.00	28.00	8.00
	Classification	1.07	2.59	1.00	4.00	3.00
	Communication	1.24	6,.6	3.00	8.00	5.00
	Measure	2.76	16.48	10.00	20.00	10.00
	predictions	1.83	6.86	3.00	12.00	9.00
	Conclusion	3.18	18.44	6.00	24.00	18.00
Integrated	Variable Identification	1.73	5.11	3.00	9.00	6.00
	Making a Hypothesis	1.18	2.17	1.00	4.00	3.00
	Describe the Relationship Between Variables	4.20	16.94	6.00	2400	18.00
	Defining Variables Operationally	1.23	6.55	4.00	8.00	4.00
	Planning Experiments	2.48	12.99	4.00	16.00	12.00
	Experimental Analysis	0.81	3.35	1.00	4.00	3.00
	Experiment	1.61	9.91	5.00	12.00	7.00
	Obtaining and Processing Data	2.47	12.58	6.00	16.00	10.00
	Create Data Tables	1.67	9.66	5.00	12.00	7.00
	Creating Graphs	0.86	3.43	1.00	4.00	3.00

Science process skills are skills that must be possessed by a student. One of the important components in science education goals is to develop students' science process skills [21]. Science process skills are thinking skills that are used to build knowledge to solve problems and formulate results [22]. Science process skills are also scientific skills related to how to obtain information and the way of thinking of a student in formulating concepts, facts, principles or laws related to scientific objects and events [23]. Science process skills consist of basic and integrated science process skills. Science process skills are divided into two parts, namely basic process skills and integrated process skills [24]. Descriptions of the results of students' science process skills in simple pendulum are presented in Table 2.1 and Table 2.2 with a total of 16 indicators of process skills observed. The importance of science process skills for students where students will be directly involved in experiments. Learning that can involve students directly is meaningful learning.

Based on the results of the research, it can be seen that students' science process skills vary. From good to bad. In the indicator of students' basic science process skills, the results of observation skills were obtained which had the largest percentage, namely 71% of 100 students and this showed that students had very good observing skills. This can be seen when students carefully observe the tools and materials used in practicum activities. In the prediction indicator, the results are in the not good category, namely 45% and this shows that students are also less skilled in predicting an experimental result. This is because during the practicum, some students did not seem to make predictions about the experiments they were doing.

Furthermore, in the indicator of integrated science process skills, students have the greatest results in conducting experiments, namely 66% of the 100 students are categorized as very good. This shows that students are very skilled in conducting experiments, it can be seen that students are enthusiastic during practicum activities. While the results on the variable identification skill indicator obtained the lowest result, namely 66% of 100 students categorized as very bad. That is, students are not yet skilled in identifying variables because when the observer asks students, students look confused in differentiating each variable. In addition, in the skills of obtaining and processing data, 80% of students are classified as skilled. This is based on the students' observational ability which is also high in this practicum. Observational skills are the most basic skills that support the mastery of subsequent skills including integration process mastery skills, namely data acquisition and processing skills [25].

Students said during interviews that practicum activities really needed to be done because they were very interesting and could develop the skills they had. That is, according to the results of the data obtained students already have good science process skills. Although the indicators of basic and integrated science skills have a fairly high percentage. There are still some students who do not have good science process skills. As shown in Table 2.2. Based on the results of the interviews that have been conducted, students say that it is quite difficult for them to identify the tools and materials used during the practicum. This is because they don't like physics lessons, so they don't pay close attention when the teacher demonstrates the experiment. Teachers must also have skills with the aim of providing them with teaching [26].

4. CONCLUSION

Basic science process skills that are included in the good category are observation, classification, communication, measuring, and conclusions. While the basic science process skills that have not been mastered by students are prediction. Then the integrated process skills are in the good category, namely describing the relationship between variables, defining variables operationally, planning experiments, trial analysis, conducting experiments, obtaining and processing data, creating data tables and making graphs. While students have not mastered the indicators of identifying variables and making hypotheses. Suggestions from researchers, educators should be able to improve students' science process skills, both basic and integrated process skills.

ACKNOWLEDGEMENTS

The researcher would like to thank the stakeholders who have given permission for this research, as well as colleagues, so that this research has been completed.

REFERENCES

[1] H. Harizon, H. Haryanto, and A. Anisah, "Pengaruh Penerapan Model Pembelajaran Kooperatif Tipe Make-A Match Terhadap Hasil Belajar Siswa pada Materi Larutan Elektrolit dan Nonelektrolit di SMA PGRI 2 Kota Jambi", *jisic*, vol. 8, no. 2, pp. 47-56, Dec. 2016.

[2] Maison, Darmaji, D. A. Kurniawan, Astalini, U. P. Dewi, and L. Kartina, "Analysis of science process skills in physics education students", *Jurnal Penelitian dan Evaluasi Pendidikan*, vol. 23, no. 2, pp. 197-205, Dec 2019.

[3] M. D. W. Ernawati, H. Haryanto, and S. C. Nababan, "Analisis Penerapan Model Pembelajaran Kooperatif Numbered Head Together (NHT) dan Pengaruhnya Terhadap Hasil Belajar Siswa pada Materi Struktur Atom di Kelas X SMKN 3 Kota Jambi", *jisic*, vol. 9, no. 1, pp. 45-53, May 2018.

[4] H. Haryanto, A. Bakar, and M. Alfi Nur Ilahi, "Studi Perbandingan Hasil Belajar pada Materi Tata Nama Senyawa Kimia Antara Model Kooperatif Tipe STAD dengan Jigsaw Kelas X SMA Negeri 3 Kuala Tungkal", *jisic*, vol. 7, no. 2, pp. 54-62, Apr. 2018.

[5] Maison, Darmaji, Astalini, D. A. Kurniawan, and P. S. Indrawati, "Science Process Skills and Motivation. *Humanities & Social Sciences Reviews*, vol. 7, no. 5, pp. 48-56, 2019.

[6] Maison, Syahrial, Syamsurizal, and Tanti, "Learning Environment, Students' Beliefs, And Self-Regulation In Learning Physics: Structural Equation Modeling", *Journal of Baltic Science Education*, vol. 18, no. 3, pp. 389-403, 2019.

[7] Tanti, Jamaluddin, and B. Syefrinando, "Pengaruh Pembelajaran Berbasis Masalah terhadap Beliefs Siswa tentang Fisika dan Pembelajaran Fisika", *Jurnal Ilmiah Pendidikan Fisika Al-Biruni* vol. 6, no. 1, pp. 23-36, 2017.

[8] Darmaji, D. A. Kurniawan, H. Parasdila, and Irdianti, "Description of Science Process Skills' Physics Education Students at Jambi University in Temperature and Heat Materials", *The Educational Review*, vol. 2, no. 9, pp. 485-498, 2018.

[9] M. Ubaidillah, "Pengembangan Lkpd Fisika Berbasis Problem Solving Untuk Meningkatkan Keterampilan Proses Sains Dan Keterampilanberpikir Tingkat Tinggi", *Edufisika*, vol. 1, no. 2, pp. 09-20, 2016.

[10] Maison, Darmaji, Astalini, D. A. Kurniawan, and P. S. Indrawati, "Science Process Skills and Motivation", *hssr*, vol. 7, no. 5, pp. 48-56, Sep. 2019.

[11] Darmaji, Astalini, A. Rahayu, and Maison, "Pengembangan Penuntun Praktikum Fisika Berbasis Keterampilan Proses Sains Menggunakan Model Problem Solving", *EDUSAINS*, vol. 10, no. 1, pp. 83-96, 2018.

[12] Darmaji, D. A. Kurniawan, H. Parasdila, and I. Irdianti, "Deskripsi Keterampilan Proses Sains Mahasiswa pada Materi Termodinamika", *Berkalah Ilmiah Pendidikan Fisika*, vol. 6, no.3, pp. 345-353, 2018.

[13] Darmaji, Astalini, A. Rahayu, and Maison, "Pengembangan Penuntun Praktikum Fisika Berbasis Keterampilan Proses Sains Menggunakan Model Problem Solving", *EDUSAINS*, vol. 10, no.1, pp. 83-96, 2018.

[14] Tanti, Maison, A. Mukminin, Syahrial, A. Habibi, and Syamsurizal, "Exploring The Relationship Between Preservice Science Teachers'beliefs And Self-Regulated Strategies Of Studying Physics: A Structural Equation Model", *Journal of Turkish Science Education*, vol. 15, no. 4, pp. 79-92, 2018.

[15] H. Haryanto, H. Harizon, and N. Kumala Ratih, "Pengembangan Instrumen Penilaian Keterampilan Proses dan Sikap Ilmiah pada Materi Termokimia Kelas XI MIA SMA Negeri 10 Kota Jambi", *jisic*, vol. 8, no. 1, pp. 50 -62, Jan. 2016.

[16] Wiwin, E. & Kustijono, R. (2018). The use of physics practicum to train science process skills and its effect on scientific attitude of vocational high school students. *Journal of Physics*, 997, 1-8.

[17] A. Rahayu and D. D. Romadona, "Deskripsi Implikasi Sosial dari Fisika, Sikap Terhadap Penyelidikan dalam Fisika dan Adopsi dari Sikap Ilmiah", Sch. Jo. Phs. Ed, vol. 1, no. 1, pp. 13-17, Jan. 2020.

[18] J. W. Creswell, *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research*. USA: Pearson, 2012.

[19] Tarjo, *Metode Penelitian Sistem 3x Baca*. Yogyakarta: Deepublish, 2019.

[20] E. Anggereini, R. S. Budiarti, and M. E. Sanjaya, "The Effect of ICT-based Classwide Peer Tutoring (CWPT) Application and Motivation to Biology Education Student Creativity in ICT Learning", *BIO*, vol. 4, no. 2, pp. 105-113, Dec. 2018.

[21] H. Durmaz and S. Mutlu, "The effect of an instructional intervention on elementary students' science process skills", *The Journal of Educational Research*, pp. 1-13, 2016.

[22] S. Ozgelen, "Students' Science Process Skills within a Cognitive Domain Framework", *Eurasia Journal of Mathematics, Science & Technology Education*, vol.8, no.4, pp. 283-292, 2012.

[23] H. Harlis and R. S. Budiarti, "Pengembangan Bahan Ajar Praktikum dan Instrumen Penilaian Berbasis Keterampilan Proses Sains pada Mata Kuliah Mikologi Program Studi Pendidikan Biologi Universitas Jambi", *BIO*, vol. 3, no. 2, pp. 102 - 112, Dec. 2017.

[24] P. Turiman, J. Omar, A. M. Daud, and K. Osman, "Fostering the 21st century skills through scientific literacy and science process skills", *Procedia-Social and Behavioral Sciences*, vol. 5, no. 9, pp. 110-116, 2012.

[25] D. A. Kurniawan and H. Parasdila, "Description of Science Process Skills' Physics Education Students at Jambi University in Temperature and Heat Materials", *The Educational Review, USA*, vol. 2, no.9, 485-498, 2018.

[26] E. Sulistiani, R. S. Budiarti, and M. muswita, "Analisis Kemampuan Berpikir Kritis Siswa Lintas Minat Pada Pembelajaran Biologi Kelas X IIS SMA Negeri 11 Kota Jambi", BIO, vol. 2, no. 1, Dec. 2016.