



Enhancing Science Process Skills in Fifth-Grade Students at SD Negeri 5 Unggul Tapaktuan through Experimental Methods in Heat Transfer Material Application

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Abstract: This study was prompted by the observed inadequacy in students' science process skills during learning activities, attributed to the utilization of inappropriate teaching methods that fail to offer a comprehensive understanding of the material. Consequently, these methods struggle to engage students' interest and curiosity effectively. The primary objective of this research is to assess the enhancement of students' science process skills through the implementation of the experimental method, focusing on the science subject of heat transfer material. Employing a true experimental research design with a posttest-only control group, the study unfolded during the second semester of the academic year 2022/2023, specifically from May 16 to 21. The participants comprised two classes: Class VB as the experimental group and Class VA as the control group. Data collection utilized an observation sheet for students. The analysis of data to evaluate science process skills employed the percentage formula. The findings revealed a substantial increase in science process skills, as evidenced by the experimental class's post-test scores rising from 54% to 98%. This indicates a noteworthy improvement of 44% attributable to the application of the experimental method in heat transfer material. In conclusion, the study affirms that employing experimental methods in heat transfer material significantly enhances students' science process skills, validating a substantial and statistically significant increase in their proficiency.

Keywords: Experimental Method; Heat Transfer Material; Science Process Skills.

1. Introduction

Education is a process that cannot be separated from humans, who are the subject and object of educational efforts themselves. Education is stated to directly encourage changes in a person's abilities, as stated by Redja Mudyahardjo that education is said to be important because it directly encourages changes in the quality of cognitive, affective, and psychomotor abilities [1]. Furthermore, education is defined as an effort carried out by a person or group of other people to become mature or reach a higher level of life in mental terms [2][1]. Elementary education is basic education so that you can take the next level of education, therefore elementary education should be carried out in the right way so that it can become a strong foundation for the next level of education. The problem with education in elementary school is that students' ability to remember and understand is still low. The low level of students' ability and mastery of learning material is caused by the learning process carried out not being appropriate to the level of development of elementary school age children [3].

Natural Sciences is one of the mandatory subjects studied at elementary school level [4]. Science lessons are one of the subjects that are considered abstract in concept, so learning needs tools to help with learning, namely in the form of media or teaching aids that support the learning material presented so that students can understand the concepts well. As determined based on the 2013 curriculum content standards in science subjects, heat transfer material contains; 1) apply the concept of heat transfer, 2) identify surrounding objects in everyday life that can conduct heat, 3) demonstrate activities to differentiate temperature and heat, 4) discuss changes in temperature of objects with the concept of heat released and heat received by objects, 5) report the results of observations regarding heat transfer. Meanwhile, based on the science learning indicators themselves, the heat transfer material requires students to be able to understand and demonstrate activities to differentiate temperature and heat.

Based on the results of researchers' observations, teaching and learning activities at SD Negeri 5 Unggul Tapaktuan are less active because they are influenced by the methods used by teachers in the learning process which do not involve students directly. Learning carried out in schools does not equip students to develop Science Process Skills. In the teaching

and learning process at the school in question, educators tend to explain concepts, provide example questions, practice, discuss, and pay less attention to students' needs in the learning process. So that in learning students are less active, less creative, and less productive. In the learning process the teacher plays a major role, if it is related to the current K13 curriculum where students are required to be active, and the teacher is only a facilitator. Students sometimes only listen and note down the material, so this kind of learning process has little impact on KPS, because it does not train students to observe, ask, reason, communicate and try.

Based on the results of this identification, appropriate methods are needed to stimulate students and be able to increase students' understanding. So, teachers are required to understand the learning methods they will apply [5]. One example is the experimental method. The experimental method is a teaching method carried out by teachers and students together [6]. Experimental method is a way for students to learn by conducting experiments, to experience and prove for themselves something they are learning. With this method, students can do it themselves, follow a process, analyze, observe an object, prove, and draw conclusions about an object or process [7] Moh Sholeh Hamid believes that the experimental method is a method that provides opportunities for students, individually or in groups, to be trained to carry out an experiment. With the experimental method, it is hoped that students will be involved in planning, from collecting data, finding facts, to solving the problems they face [8]. In other words, the experimental method is a form of learning that involves students working with objects, materials, and tools both in groups and individually [9]. Heat transfer can occur in three ways, namely conduction, radiation, and convection.

- 1) Conduction is the propagation of heat without the movement of intermediate substances. Conduction heat transfer occurs when heat flows from a place with a high temperature to a place with a low temperature and comes into direct contact between two objects. If the end of a metal bar is heated over a fire, the other end will become hot.
- 2) Heat Transfer by Convection. Convection is the transfer of heat through a flow in which intermediate substances also move. If the particles move and cause heat to propagate, then convection will occur.
- 3) Radiation is the transfer of heat without an intermediary substance.
- 4) Science Process Skills. Process skills are skills to grow and develop several certain skills in students so that they can process information and discover new things that are useful for students in the form of concepts, facts, as well as developing values and attitudes [10].

According to Dimiyati and Mudjiono, science process skills are defined as insights that can develop intellectual, social, and physical skills that originate from basic abilities that in principle already exist within students [11]. Dimiyati and Mudjiono argue that basic process skills activities can be carried out in the following forms:

Table 1. Indicators of Science Process Skills

1	Observation or observation	Students carry out learning activities using all the senses, such as the process of hearing, seeing, smelling, feeling, tasting, measuring, and gathering information.
2	Classification	Students carry out learning activities through the process of looking for similarities, finding differences, comparing and classifying the same things.
3	Interpret	Make predictions about things that will happen based on estimates of the relationship between concepts and facts in science.
4	Measure	Comparing two things with certain predetermined units of measurement.
5	Conclude	Students can carry out learning activities using information, concepts, theories, which are then drawn into conclusions.
6	Communication	Students carry out learning activities through the process of discussing among themselves, asking questions, demonstrating, reporting research results in oral or written form [11].

2. Method

The type of research used is True Experimental research [11]. It is said to be a True Experiment, because in this design the researcher can control all external variables that influence the course of the experiment. Thus, internal validity (the quality of implementing the research design) can be high. The main characteristic of True Experimental is that the samples used for experiments and as control groups are taken randomly certain population. This means that there is a control group and the sample is chosen randomly. The experimental design used was Post-Test only Control Group Design. The purpose of the design is that there are two groups selected at random. The first group was given treatment while the second group was not. The first group was given treatment by the researcher and then measurements were taken, while the second group, which was used as a control group, was not given treatment but only took measurements. The design is as follows [12], namely :

Table 2. Form of experimental design

	Group	Dependent variable	Posttest
(R)	Experiment	X	O ₁
(R)	Control	-	O ₂

Information :

Effect of treatment (O₁ - O₂)

Treatment Effect (TE) so TE = (O₁ - O₂)

The treatment or experimental group is class VB while the control group is class VA. The research was conducted at SD Negeri 5 Unggul Tapaktuan, which is held in the even semester from 16 to 21 May of the academic year 2022/2023. The population in this study were all 5th grade students at SD Negeri 5 Unggul Tapaktuan. The sample in this study was class VB as the experimental group and class VA as the control group. Data collection techniques use 1 observation sheet, which is used as a means for researchers to make the assessment process easier when researchers apply experimental methods in the learning process, to assess students' science process skills. The observation sheet used by researchers is a statement of student activities in the Teaching and Learning Process, the statements used consist of 12 items based on indicators of the science process skills themselves. On the assessment sheet, the researcher provides a name and value column, with information regarding the score: 1 = Poor, 2 = Fair, 3 = Good, 4 = Very Good. Data analysis was carried out with the aim of finding out the percentage of students' mastery of science process skills. The percentage of science process skills is generated by calculating the score obtained on the science process skills indicator, then dividing it by the maximum score on the science process skills indicator [13].

$$NP = \frac{R \times 100}{BC}$$

Information:

N.P : Percentage value of scientific process skill indicators

R : Score obtained on the science process skills indicator

SM : Maximum score on the science process skills indicator

Mastery of science process skills is divided into five categories, namely very high, high, medium, low, and very low [13][14]. This category is useful for interpreting students' level of mastery of science process skills.

3. Results

Students' science process skills by applying experimental methods can be seen through skill observation sheets by calculating frequencies and finding percentages. Data processing carried out from the results of student observation sheets was readjusted to indicators of science process skills in the form of statements totaling twelve statements, which were developed from six indicators of science process skills. The recapitulation results on the students' science process skills observation sheet above show that each student experienced an increase in scores from meeting one to meeting two. This increase can be recapitulated from the results of the scores obtained by students when conducting experiments. This value is obtained from the statement written on the observation sheet, then the value is given according to the activities carried out by the students. From the existing data, researchers found that there had been an increase since the first meeting. At the first meeting, the results of the recapitulation of student scores ranged from 54% to 98%. This proves that the use of experimental methods in heat transfer material can increase students' science process skills by 44%. So, it can be concluded that the use of experimental methods in heat transfer material can improve students' science process skills, this is proven by a significant increase in student learning outcomes.

Improvement in one of the aspects that will be measured in this research is through process skills observed during learning activities. These process skills focus on student activities to obtain a more meaningful learning experience. The use of experimental methods in looking at science process skills is an activity to make students understand the learning material better, guide students to think critically, familiarize students with scientific methods and train students to be more active in learning activities. Researchers consider that process skills are an important aspect in measuring students' level of completeness in terms of psychomotor skills in science subjects, especially in heat and displacement material.

The results of the science process skills test improved and were better at the second meeting because experimental activities were carried out in the learning process. As research conducted states that a learning model based on improving science process skills is a form of learning that integrates science process skills into a series of teaching and learning processes to direct students to the process of constructing knowledge independently.

4. Conclusion and Recommendation

There was an increase in students' science process skills in heat transfer material by 44% after learning using experimental methods at the first meeting by 54% to 98% at the second meeting. So it can be concluded that the use of experimental methods in heat transfer material can improve students' science process skills, this is proven by a significant increase in student learning outcomes. Based on the research results, there are several suggestions that can be proposed as a follow-up to this research, namely:

- 1) For teachers to be able to develop and utilize learning methods and media that are appropriate to the material to be taught and continue to strive to improve student discipline even better to improve the subsequent learning process.
- 2) Students are expected to be able to participate in the teaching and learning process better so that it can be useful for educational purposes and can also increase knowledge, experience and increase student responsibility.
- 3) For researchers, we hope that this research can be an experience and add insight for the application of further learning. The researcher's hope is that this work can become a reference for readers in further research

References

- [1] Rahmat, A., 2014. Pengantar Pendidikan: Teori, Konsep, dan Aplikasi. *Gorontalo: Ideas Publishing*.
- [2] Hasbullah, 2012. *Dasar-Dasar Ilmu Pendidikan*, Jakarta: Rajawali press.
- [3] Hamalik, O., 2006. Proses belajar mengajar. Bandung: Bumi Aksara
- [4] Wisudawati, A.W. and Sulistyowati, E., 2022. *Metodologi pembelajaran IPA*. Bumi Aksara.
- [5] Uno, H.B. and Mohamad, N., 2022. *Belajar dengan pendekatan PAILKEM: pembelajaran aktif, inovatif, lingkungan, kreatif, efektif, menarik*. Bumi Aksara.
- [6] Zain, A., 2020. Strategi belajar mengajar. Jakarta: Rineka Cipta
- [7] Djamarah, S.B. and Zain, A., 2010. Strategi belajar mengajar. (*Edisi Revisi*). Jakarta: PT Rineka Cipta
- [8] Hamid, M.S., 2012. Metode edutainment. Jogjakarta: Diva Press
- [9] Kodir, A., 2011. Strategi belajar mengajar. *Bandung: Pustaka Setia*.
- [10] Anisa, T.M., Supardi, K.I. and Sedyawati, S.M.R., 2014. Keefektifan Pendekatan Keterampilan Proses Sains Berbantuan Lembar Kerja Siswa pada Pembelajaran Kimia. *Jurnal Inovasi Pendidikan Kimia*, 8(2).
- [11] Dimiyati, D., 2003. Belajar dan Pembelajaran, Jakarta, Rineka Cipta. *Gordon Dryden & Jeannette Vos*.
- [12] Juliansyah, N., 2011. Metodologi Penelitian: Skripsi, Tesis, Disertasi dan Karya Ilmiah. *Kencana Prenada Media Group. Jakarta*.
- [13] Elvanisi, A., Hidayat, S. and Fadillah, E.N., 2018. Analisis keterampilan proses sains siswa sekolah menengah atas. *Jurnal Inovasi Pendidikan IPA*, 4(2), pp.245-252. DOI: <http://dx.doi.org/10.21831/jipi.v4i2.21426>.
- [14] Haryono, H., 2006. Model pembelajaran berbasis peningkatan keterampilan proses sains. *Jurnal Pendidikan Dasar*, 7(1), pp.1-13.