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Constructive Learning Models on Students' Understanding and Application of Learning Concepts

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Keywords:
Learning, Constructivism, Understanding, Application of Concepts.

Abstract

This study aims to determine the differences between the constructivist learning model and the conventional learning model for 1) the ability to understand and apply science concepts; 2) interest in learning science; and 3) scientific performance in the field of science. Using a quasi-experimental research learning model with independent variables constructivist learning models and conventional learning models, the dependent variable includes the ability to understand and apply science concepts, interest in learning science, and scientific performance in science. The population in this study were students of SMP Negeri 34 Makassar, as a sample of students in class VII2 and class VII5 who were randomly selected. The results of the descriptive analysis showed that there was a significant difference in scientific performance between the class with the constructivist learning model and the control class with the conventional learning model. The experimental class obtained a mean = 85.94, the control class obtained a mean = 66.09. The results of the data analysis concluded that there were significant differences in the ability to understand and apply science concepts, interest in learning science, and scientific performance in science between students who were given a constructivist learning model and students who were given a conventional learning model.

Kata kunci:
Pembelajaran, Konstruktivistik, Pemahaman, Penerapan Konsep.

Abstrak

Penelitian ini bertujuan untuk mengetahui perbedaan model pembelajaran konstruktivistik dan model pembelajaran konvensional terhadap: 1) kemampuan pemahaman dan penerapan konsep sains; 2) minat belajar sains; dan 3) kinerja ilmiah dalam bidang sains. Menggunakan model pembelajaran penelitian eksperimen kuasi dengan variabel bebas model pembelajaran konstruktivistik dan model pembelajaran konvensional, dan variabel terikat meliputi kemampuan pemahaman dan penerapan konsep sains, minat belajarn sains, dan kinerja ilmiah sains. Populasi dalam penelitian ini adalah peserta didik SMP Negeri 34 Makassar, sebagai sampel peserta didik kelas VII2 dan kelas VII5 yang dipilih secara acak. Hasil analisis deskriptif menunjukkan ada perbedaan yang signifikan ada perbedaan yang signifikan pada kinerja ilmiah sains antara kelas dengan model pembelajarankonstruktivistik dan kelas kontrol dengan model pembelajarankonvensional, kelas eksperimen diperoleh nilai mean = 85.94, kelas kontrol diperoleh nilai mean = 66.09. Hasil analaisis data disimpulkan bahwa ada perbedaan yang signifikan pada kemampuan pemahaman dan penerapan konsep sains, minat belajar sains, dan kinerja ilmiah sains antara peserta didik yang diberi model pembelajarankonstruktivistik dengan peserta didik yang diberi model pembelajaran konvensional.

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INTRODUCTION

Educators are increasingly interested in developing twenty-first-century skills and leveraging them in science classes, particularly with regard to science education guidelines and the Next Generation Science Standards.[1] Critical thinking, communication, collaboration, problem-solving, and information literacy are abilities that fall into this category, therefore, learning in science should emphasize these skills.[2] Abstract and complicated science material makes students less understand and apply science concepts, reduces interest in learning science, and does not raise students' scientific performance.[3] In addition, the science learning process which is still teacher-centered with the implementation of conventional learning models, increasingly creates the perception of students that science lessons are abstract, complicated, and boring material.[4] The facts revealed that in South Sulawesi for the 2018-2019 academic year the failure of students was influenced by low scores in Science, Indonesian, several top schools only graduated 43 students out of 221 students, and graduation was only around 19%. This is of course inseparable from the learning conditions that have not touched the dimensions of the students themselves.

The growth of competencies in learning will be created if the learner is an active agent in the knowledge acquisition process.[5] Teachers cannot simply transmit knowledge to students, but students need to actively construct knowledge in their own minds. This kind of learning process is present in the view of constructivist learning. Constructivism, or the learning discipline, is about the way we all make sense of the world.[6] Constructivism is a learning theory found in psychology that explains how people can acquire knowledge and learn. Because it has a direct application to education. This theory suggests that humans construct knowledge and meaning from their experiences.[7]

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[1] Nurul Komariah and Ishmatun Nihayah, 'Improving The Personality Character of Students Through Learning Islamic Religious Education', *At-Tadzkir: Islamic Education Journal* 2, no. 1 (27 March 2023): 65–77.

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[6] Sunita Singh and Sangeeta Yaduvanshi, 'Constructivism in Science Classroom: Why and How', *International Journal of Scientific and Research Publications* 5, no. 3 (2015): 486–90; Aida Arini and Halida Umami, 'Pengembangan Pembelajaran Pendidikan Agama Islam Melalui Pembelajaran Konstruktivistik Dan Sosiokultural', *Indonesian Journal of Islamic Education Studies (IJIES)* 2, no. 2 (2019): 104–14, https://doi.org/10.33367/ijies.v2i2.845.

[7] Steve Olusegun Bada, 'The Psychogenisis of Knowledge and Its Epistemological Significance', *IOSR Journal of Research & Method in Education (IOSR-JRME)* 5, no. 6 (2015): 23–34, https://doi.org/10.9790/7388-05616670.

Skills in designing quasi-experiments and designing randomized experiments depend on knowledge of the elements of an experiment.[8] The elements of an experimental design can be grouped into four (4) elements, namely (a) placement of subjects into the experimental and control groups (assignment).[9] Placement into the experimental or control group has been explained in various ways, for example random, non-random, based on cutting scores, based on matching in one particular variable (matching), (b) measuring the impact of treatment or the dependent variable (measurement).

This study aims to determine the differences between the constructivist learning model and the conventional learning model for 1) the ability to understand and apply science concepts; 2) interest in learning science; and 3) scientific performance in the field of science. Using a quasi-experimental research learning model with independent variables constructivist learning models and conventional learning models, and the dependent variable includes the ability to understand and apply science concepts, interest in learning science, and scientific performance in science.

RESEARCH METHOD

This type of research is quantitative research using quasi-experimental research (quasi-experimental research).[10] According to Kerlinger, the quasi-experimental method shows sharply a causal relationship, whether the use of constructivist learning models results in an increase in students' cognitive abilities so as to produce good learning evaluation values.[11]

The research design uses random to select members of the experimental group and the control group. The research design used a pre-test and post-test design with a non-equivalent control group design. The design can be seen in the learning design diagram in Figure 1 below:

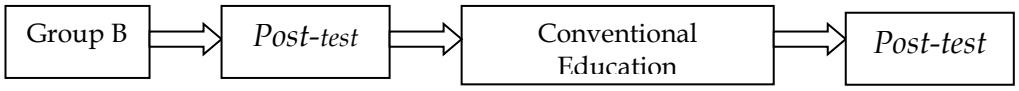

Figure 1.
Diagram of learning design using pre-test post-test design (Non-Equivalent Control Group Design)

[8] John W. Creswell and J. David Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (SAGE Publications, 2018).

[9] William R Shadish, T. D. Cook, and Donald T Campbell, 'Experimental and Designs for Generalized Causal Inference', *Experimental and Quasi-Experimental Design for Causual Inference*, no. 814 (2002): 1–643.

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Information:

A: The experimental group with the treatment of constructivist learning models in the cognitive development of students.

B: Control group with conventional learning model treatment in the cognitive development of students.

In determining the sample used a randomized control group pre-test and post-test design. Sampling was carried out randomly on students from a population class consisting of 7 population classes, and 2 subject classes were taken. All students in the population class are assumed to have the same science learning achievement based on the results of the odd semester report cards for the 2021-2022 school year. then a pre-test post-test was carried out before and after treatment, the pre-test post-test was given by controlling and controlling on variables related to internal and external validity.

The research variables consist of independent variables, dependent variables, and control variables.[12] The independent variables include constructivist learning models and conventional learning models, the dependent variable includes the results of learning evaluations assessed from the understanding and application of science concepts, interest in learning science, and scientific performance in science, while the control variables include subject matter teachers and length (time) lesson.

Data collection techniques on the ability to understand and apply scientific concepts are obtained through objective tests in the form of multiple choices. according to Gorman (2020: 316), the multiple-choice form test is used to evaluate students' cognitive abilities in understanding and applying scientific concepts[13]. The number of questions is 20 items by means of assessment x 100. Determination of the criteria for discriminating power of objective questions can be seen in Table 1 below:

Table 1: Question Distinguishing Criteria

No	Point Different	Category Questions
1	0.40 - 1.00	Good thing
2	0.30 - 0.39	Question accepted
3	0.20 - 0.29	The problem was received and fixed
4	0.19 – 0.00	Question rejected

[12] I B Siwa, I W Muderawan, and I N Tika, 'Pengaruh Pembelajaran Berbasis Proyek Dalam Pemebalajaran Kimia Terhadap Keterampilan Proses Sains Ditinjau Dari Gaya Kognitif Siswa', *E-Journal Program Pascasarjana Universitas Pendidikan Ganesha* 3, no. 3 (2013): 1–13; Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif, Dan R&D.* (Bandung: Alfabeta, 2017); Rada Sari and Dessi Susanti, 'Pengaruh Komunikasi Vertikal Dan Lingkungan Kerja Terhadap Kepuasan Kerja Guru', *Jurnal Ecogen* 3, no. 4 (2020): 549, https://doi.org/10.24036/jmpe.v3i4.10508.

[13] Robert S. Pulido et al., 'Neuronal Activity Regulates Blood-Brain Barrier Efflux Transport through Endothelial Circadian Genes', *Neuron* 108, no. 5 (2020): 937-952.e7, https://doi.org/10.1016/j.neuron.2020.09.002.

RESULT AND DISCUSSION

Result

The following are the results of the research described in the following section

Table 2. Question Discriminating Power Criteria

No	Point Different	Category questions
1	0.40 - 1.00	Good thing
2	0.30 - 0.39	Question accepted
3	0.20 - 0.29	Problem was received and fixed
4	0.19 – 0.00	Question rejected

The results of the analysis of objective questions based on 20 items with differential power greater than 0.30, the category of objective questions on understanding and applying scientific concepts is the "good questions" category. Then the level of difficulty of the objective items according to classical theory, is expressed in several ways, including: a) the proportion of correct answers; b) the linear difficulty scale; c) the Davis index; d) the Bivariant scale. The proportion of correct answers is the number of participants who answered correctly on the item being analyzed compared to all test takers. The equation used in determining the level of difficulty (P) is: $P = \frac{\Sigma\beta}{N}$

Information:

P = proportion of correct answers

ΣB = the number of participants who answered correctly,

N = the number of participants who answered correctly.

The level of difficulty of the questions is the average value of the group of test takers. Difficulty level is the average of a group score distribution of a test.

The difficulty level of the questions ranges from 0-1 with the categorization as shown in Table 3 below:

Table 3. Category Difficulty Level of Questions

No	Difficulty Level (p)	Question category
1	0.00 – 0.30	Hard
2	0.31 – 0.70	Currently
3	0.71 – 1.00	Easy

Based on data analysis, it is known that there are differences in the ability to understand and apply science concepts, interest in learning science, and students' scientific performance between students in the experimental class with the constructivist learning model and students in the control class with the conventional learning model. Data description can be seen in Table 4 below:

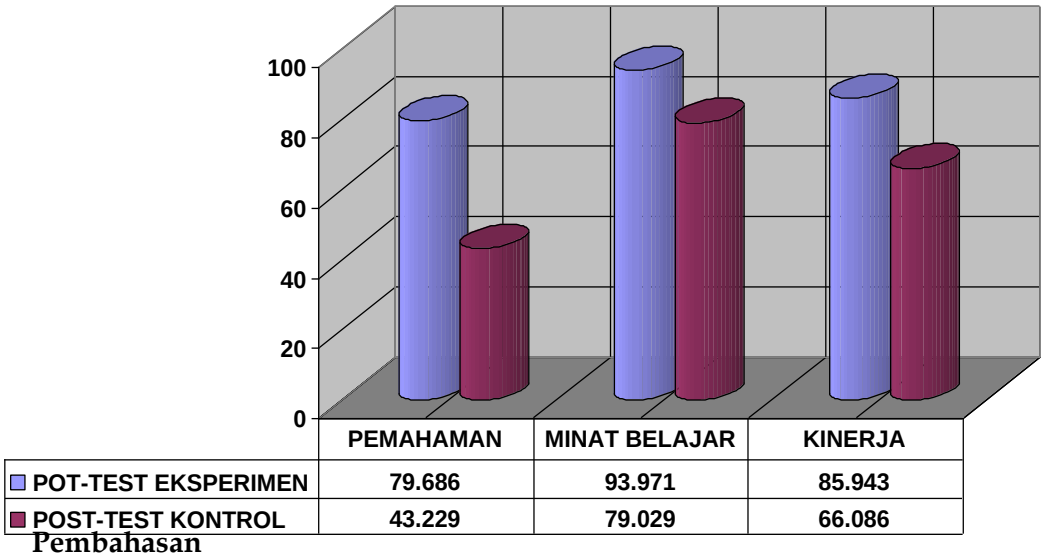
Table 4. Summary of Post-Test Data Description Ability to Understand and Apply Science Concepts, Interest in Learning Science, and Scientific Performance in the Field of Science

Acquisition	Science Learning Outcomes					
	Understanding and Application of Science Concepts		Interest in Learning Science		Scientific Performance	
	Eksperiment	control	Eksperiment	control	Eksperiment	control
N	35	35	35	35	35	35
Mean	79.69	43.23	93.97	79.03	85.94	66.09
Median	80	45	95	79	86	66
Std. Deviation	14.313	15.131	12.814	13.085	7.658	10.467
Minimum	50	15	65	55	75	45
Maximum	102	65	120	110	99	88

Sources : Processed primary data, 2023

By looking at the table above the average score obtained by the experimental class in understanding and applying science concepts with mean = 79.69, interest in learning science mean = 93.97, and students' scientific performance with mean = 85.94, while the control class is in understanding and applying science concepts with a mean = 43.23, interest in learning science with a mean = 79.03, and students' scientific performance in science with a mean of 66.09, it can be said that the experimental class with a constructivist learning model has a higher understanding and application of science concepts, interest in learning science, and students' scientific performance in science compared to the control class with conventional learning models. If the level of learning achievement of students in the experimental class and control class is described in a histogram, it can be seen in Figure 1 as follows:

Figure 3 Histogram of Post-Test Scores of Students on Science Learning Achievement



Pembahasan

The results of the research analyzed by t-test described that the results of hypothesis testing showed an increase in understanding and application of science concepts, interest in learning science, and scientific performance in science in experimental class students with a constructivist learning model compared to control class students with conventional learning models. The difference in improvement can be influenced by the implementation of two different learning models resulting in two different effects. Thus, it is said that the learning model (instructional approach) can influence the understanding and application of concepts, interest in learning, and scientific performance of students so that they can improve better achievement.[14]

The implementation of the constructivist learning model guides students to open their horizons of thought through the experience and potential of their initial knowledge[15], for example on the material concept of distinguishing between monocot and dicot seed plants, by showing direct objects students will easily understand, understand that differences in monocots and dicots can be seen from leaves, flower stems and roots, without notification from the teacher students can build their own knowledge through experience and observation.[16]

Implementing a constructivist learning model in science learning through observation of research results can overcome the boredom of students in learning, by showing students to direct objects, recalling experiences that have been passed, and making students the center of learning can focus students' attention on learning material, only Of course, one of the obstacles in implementing the constructivist learning model is the reality in South Sulawesi where many teachers do not know about several learning models, including the constructivist learning model. The results of Risnawati's research revealed that this model can improve learning outcomes and better learning experiences.[17]

Thus it is said that the constructivist learning model is better than the conventional learning model because this learning model can improve students' understanding and application of science concepts, foster students' interest in learning science, and bring out students' scientific performance. However, in South Sulawesi, especially at SMP Negeri 34 Makssar, the constructivist learning model has not been implemented optimally due to the lack of teachers' understanding of constructivist learning models, lack of teacher competence, lack of awareness of teachers to carry out learning innovations and lack of training of teachers in pedagogical improvement. Noly et al, revealed that one way to improve teacher

[14] Mirroh Fikriyati, Sri Katoningsih, and Sabbir Hasan, 'Use of Loose Part Media With Cardboard and Sand Materials in Islamic Children's Schools', *Nazhruna: Jurnal Pendidikan Islam* 6, no. 1 (10 January 2023): 60–71, https://doi.org/10.31538/nzh.v6i1.2858.

[15] Devi Solehat, 'Implementasi Model Pembelajaran Konstruktivisme Tipe Novick Keterampilan Generik Sains Siswa Smkn', *Edusains* 5, no. 1 (2013): 40–43.

[16] Nurul Annisa, A. Akrim, and Asrar Aspia Manurung, 'Development Of Teacher's Professional Competency In Realizing Quality Of Human Resources In The Basic School', *IJEMS:Indonesian Journal of Education and Mathematical Science* 1, no. 2 (15 May 2020): 156–60, https://doi.org/10.30596/ijems.v1i2.4590.

[17] M Risnawati, A Sudrajat, and ..., 'Penerapan Model Discovery Learning Untuk Meningkatkan Sikap Ilmiah Dan Hasil Belajar Ipa Materi Perubahan Wujud Benda', *Jurnal Pena Ilmiah* 1, no. 1 (2022): 371–80.

pedagogy is to carry out workshops, exemplified here in early childhood teachers with workshops on making children's videos.[18]

The results of this study are in line with research conducted by Ma'arij, the constructivist learning model can improve learning outcomes and the activeness of students in the teaching and learning process, and from the monitoring results of teachers who have positioned themselves as facilitators, in classes learning to use the constructivism learning model shows that students are very enthusiastic in working with their groups and with friends between groups and can help friends who have difficulty understanding the subject matter.[19]

CONCLUSION

From the results of the analysis, it was found that there were differences in the level of ability to understand and apply science concepts, interest in learning science, and students' scientific performance between the experimental class with the constructivist learning model and the control class with the conventional learning model. The increase in the ability to understand and apply science concepts in the experimental class by 47.938% in the experimental class decreased by -0.859%, the increase in the interest in learning science in the experimental class by 8.300% in the control class decreased by -12.909%, the increase in the scientific performance of students in the experimental class by 8.300% 26.064% control class decreased by 1.643%. This shows that the implementation of the constructivist learning model in science learning at SMP Negeri 34 for students in class VII2 and students in class VII 5 is better than the implementation of conventional learning models.

This research has limitations on research methods, so it needs to be further developed by combining several other research methods to make the results more interesting and consistent. In addition to the method, there are also limitations to the population and research samples, which tend to be small in number.

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