

# Improving Students' Science Knowledge Competence through the Implementation of Index Card Match Type of Cooperative Learning Model

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## ARTICLE INFO

### Article History:

Received October 02, 2022

Accepted November 20, 2022

Available online November 25, 2022

### Kata Kunci:

Kompetensi pengetahuan IPA, Model Kooperatif, Index Card Match

### Keywords:

Science knowledge competency, Cooperative Model, Index Card Match



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## ABSTRAK

Rendahnya kompetensi pengetahuan IPA siswa yang disebabkan oleh kurang optimalnya penggunaan model pada saat pembelajaran sehingga peserta didik sulit dalam memahami pembelajaran. Penelitian ini bertujuan untuk menganalisis Model Pembelajaran Kooperatif Tipe Index Card Match terhadap kompetensi pengetahuan IPA kelas siswa. Penelitian ini merupakan penelitian eksperimen semu dengan rancangan kelompok non-equivalent control group design. Populasi adalah seluruh kelas V SD yang terdiri dari 15 kelas sebanyak 463 siswa. Sampel ditentukan menggunakan teknik cluster random sampling. Pada pengumpulan data, instrumen yang digunakan berbentuk tes objektif pilihan ganda biasa, sehingga didapatkan data berupa skor kompetensi pengetahuan IPA yang berbentuk data kuantitatif, kemudian hasil GSn dianalisis menggunakan analisis uji-t. Rerata skor GSn kompetensi pengetahuan IPA kelompok eksperimen 22,96 dan kelompok kontrol 17,46. Hasil analisis data membuktikan bahwa terdapat perbedaan yang signifikan antara kelompok eksperimen dan kelompok kontrol. Penerapan model Pembelajaran Kooperatif Tipe Index Card Match mampu meningkatkan kompetensi pengetahuan IPA siswa. Maka disimpulkan model Pembelajaran Kooperatif Tipe Index Card Match berpengaruh terhadap kompetensi pengetahuan IPA kelas V SD.

## ABSTRACT

The less optimal use of models causes the low competence of students' science knowledge during learning, so students find it challenging to understand learning. This study aims to analyze the Index Card Match Type Cooperative Learning Model for the science knowledge competence of class students. This research is a quasi-experimental study with a non-equivalent control group design. The population is all of the fifth grades of elementary school, comprising 15 classes with a total of 463 students. The sample was determined using the cluster random sampling technique. In data collection, the instrument used was an ordinary multiple-choice objective test to obtain data in the form of scientific knowledge competency scores in the form of quantitative data. The GSn results were analyzed using t-test analysis. The mean score of the GSn science knowledge competency in the experimental group was 22.96, and that of the control group was 17.46. The results of the data analysis proved that there were significant differences between the experimental group and the control group. Applying the Index Card Match Type Cooperative Learning model can increase students' science knowledge competence. So it was concluded that the Index Card Match Type Cooperative Learning model affected the science knowledge competence of class V SD.

## 1. INTRODUCTION

Education is the basis for developing the abilities and potential of individuals in dealing with the times. During the learning process in the world of education, educators and students interact to achieve learning goals (Dewi & Sujana, 2021; Nugraha & Wahyono, 2019; Tafonao, 2018). The learning process aims to increase maximum learning outcomes in teaching and learning activities (Mustagfiroh, 2020; Rahmat & Akbar, 2019; Satria & Herumurti, 2021). Maximum improvement in learning outcomes is expected in all learning content in the 2013 curriculum. One of the learning contents in the 2013 curriculum is science.

Science is one of the subjects in elementary schools which aims to give students knowledge, ideas, and experiences about the natural surroundings obtained from natural processes to shape their personalities in developing their knowledge competencies (Oktavioni, 2017; Pramana et al., 2016; Pramita et al., 2019). Natural Science is knowledge related to how to find out about nature systematically, so science is not only mastering a collection of knowledge in the form of facts, concepts, or principles but also a process of discovery (Desnita & Susanti, 2017; Suparmi, 2019). Natural Science (IPA) is a scientific discipline, and its application in society makes science education important because of the child's cognitive structure. In the process of learning science, renewal and other support are needed to arouse students' enthusiasm in learning science. Science material must have a strong foundation so students do not experience difficulties understanding the material and concepts they will get at the next level (Astalini et al., 2020; Mulyadinata et al., 2020).

Given the important role of science content for students, educators should maximize students' understanding of science content material (Pindo & Rinci, 2018; Zulfiani et al., 2020). However, based on observations and interviews with the homeroom teacher of grade V at cluster 1 primary schools, North Kuta District, many students' science knowledge competency scores were still below the minimum mastery percentage on the Benchmark Reference Assessment. The students' low knowledge competence in science content is caused by their lack of creativity (Andriana et al., 2017; Cemara & Sudana, 2019). Low science knowledge competence is caused by students who are less active in participating during the learning process and the delivery of material that is not optimal (Lestari et al., 2017; Sujana et al., 2018). In addition, it is also caused by the application of learning models that are less innovative and do not take advantage of the environment around them (Larasanty, 2020; Widiartini et al., 2018). The learning model is one of the determinants of the success or failure of a learning process (Rahmawati & Yulianti, 2020). If a teacher can choose and use learning models appropriately and in accordance with the material he teaches, it is likely that students will more easily accept the material presented by the teacher.

Therefore, in the course of a learning process, there needs to be an innovation in applying learning models that can spur students' interest and motivation so that their competence in science knowledge improves (Isa et al., 2017; Mahardika et al., 2017; Pramita et al., 2019). One of the innovations that teachers can use is by using a learning model that does not require students to memorize but a learning model that can increase their interest in learning and encourage them to learn to express opinions, discuss, find and understand a concept (Tigwandi, 2019; Wijanarko, 2017b). Based on their development, elementary school children are still in the concrete operational stage (Agung, 2019; Basri, 2018). They still like to play, so the teacher needs to choose and use a learning model with a pleasant atmosphere according to the development of elementary school children. A learning model that can create an active, fun learning atmosphere will help students understand the difficult subject matter. Therefore, conventional teaching methods must be changed so students are motivated to learn and actively participate in learning process activities. One of the fun learning models is the Cooperative learning model, Index Card Match type (Hartiningrum & Ula, 2020). Various studies using this Cooperative learning model have been done (Rangkuti et al., 2019; Widyaningrum & Harjono, 2019). However, such a learning model has never been implemented in this population. It is expected that this learning model can solve the students' low science knowledge competence problem.

The cooperative learning model is carried out by forming small groups whose members are heterogeneous to work as a team in solving problems, doing assignments, or doing something to achieve a common goal (Haryanti, 2017; Ulya et al., 2020; Witarsa, 2017). Cooperative learning model; Index Card Match type is a learning model that is quite fun to use to strengthen students' knowledge of the material being studied by recalling what they have learned by looking for pairs of question cards or answers in groups (Ririsl, 2018; Sirait & Apriyani, 2020). This learning model directs students to be more active and participate in learning activities while the teacher becomes a facilitator and motivator. This learning process is more interesting because students discuss finding partners in groups while learning about a concept or topic in a fun atmosphere, such as learning while playing the Model Index Card Match (Wahyuningtyas & Zulherman, 2022; Wijanarko, 2017a). This allows students to learn actively and have an independent spirit. In applying this model, the researchers designed the cards with pictures of cartoons known by children and the characters in online games to make them interested in getting these cards. Even though they play, this cooperative learning model can stimulate students to carry out learning activities in a responsible and disciplined manner so that learning objectives can be achieved. This learning model can foster a sense of cooperation and increase a sense of responsibility and communication between students because they have to make question-and-answer cards in groups and then look for pairs that match the cards they get. Therefore, communication between students will be built and will train them to respect others' opinions (Ulya et al., 2020; Yatini, 2021). Cooperative learning is a teaching system that provides opportunities for

students to work together with fellow students in structured tasks, referred to as a mutual cooperation learning system.

This model consists of 6 syntax, which includes: Convey learning objectives and prepare students, Present information, Organize students into study groups, Guide study groups, Presentation of results and evaluation, and Awarding (Jubaedah, 2017; Pianda & D. Jon, 2018). This learning model's strength is its ability to foster joy in teaching and learning activities. It makes learning material more attractive to students, creating an active and fun learning atmosphere, increasing collaboration among students through the learning process, cultivating student learning creativity in the teaching and learning process, and improving student learning outcomes to reach the level of mastery of learning and spurring a process of discussion and presentation that can strengthen the topics/concepts to be repeated or new topics. This cooperative learning model can be applied in the learning process to improve the students' science knowledge competence. Other research showed that the influence of the Index Card Match type Cooperative learning model in improving the learning outcomes (Annisa & Marlina, 2019; Prabowo et al., 2020; Wahyuningtyas & Zulherman, 2022).

If student learning outcomes are low and proper follow-up or treatment is not received, it will negatively impact students and schools. Student learning outcomes, which are less than optimal, can cause student achievement to decrease, affecting low learning outcomes (Demitra & Sarjoko, 2018; Krismayoni & Suarni, 2020; Maman & Rajab, 2016). Low learning outcomes will result in students' inability to compete with other school students. It will also make it difficult for them to accept new science material at the next level of education. The low Science Knowledge competence also indicates that the learning objectives cannot be achieved optimally. Students with low knowledge competence will find it difficult to compete and balance learning material at the next level, which will certainly affect their psychology. Therefore, it is necessary to conduct research that applies the Cooperative Learning Model Index Card Match type at Cluster 1 elementary schools, North Kuta District, Academic Year 2022/2023, to see if it affects the students' science knowledge competence. If the application of this model has a positive effect in the form of an increase in the average scores, then it can be a solution for teachers in overcoming problems regarding the students' low science knowledge competence.

## 2. METHOD

This research was conducted at Cluster I elementary schools, North Kuta District, 2022/2023 Academic Year. This research was a quasi-experimental research with a non-equivalent control group design. This design has a control group but cannot fully function to control external variables that affect the implementation of the experiment (Sugiyono, 2010). In research with a non-equivalent control group design, there are two groups of the subject; the experimental group, which gets the treatment, and the control group, which does not get the treatment. Before the treatment was given, it began with the initial measurement or pretest for the experimental and control groups. Then, the experimental group was given treatment (X), namely the learning model Index Card Match PowerPoint. In the control group, learning activities were carried out with conventional learning. After the treatment was given, the two groups were given a post-test. Based on this, the pretest was used as a group equalization, and the t-test was used for data analysis.

The research was conducted at Cluster I elementary schools in North Kuta District. The population was chosen from 7 schools with a total of 463 students. The samples from the population were determined by a cluster random sampling technique. In this technique, the samples were determined randomly (random) in the form of groups of individuals. This was necessary because the population in this study consisted of groups of individuals (cluster), so the sample selection only randomized each class, and each class had the same opportunity to become a research sample. The data collected in this study was in the form of students' science knowledge competency data which consisted of data from the pretest before applying the learning model and the post-test after the students learned using the model. Data collection was carried out using the multiple choice test method, which consisted of 30 questions that had been validated and tested for reliability with an  $r$  count of 0.94, indicating high reliability. With the test, the researchers obtained data that could represent the students' knowledge and abilities. The standard competency (known as KD) included in the test instrument was KD 3.2, explaining the circulatory organs and their functions in animals and humans and how to maintain the health of the human circulatory organs. The research instrument grids used are presented in the Table 1.

The data obtained from the test were then analyzed using inferential statistics, which consisted of a normality test to determine whether the data were normally distributed and a homogeneity test to ensure that the two sample groups had a homogeneous variance. Furthermore, after passing the normality and

homogeneity tests, the data were analyzed using an independent T-test to determine whether there was an average difference between the experimental and control groups.

**Table 1. Instrument Grid**

Indicator	Cognitive level	No. Question	Number of Question
3.2.1 Analyze the circulatory system in humans	C4	1,5,25,37	4
3.2.2 Analyze the human heart and blood vessels and their functions	C4	2,4,7,13,16,18,20	7
3.2.3 Analyze blood and its function on the human respiratory system	C4	10,11,31	3
3.2.4 Analyze the major and minor circulatory systems in humans	C4	9,19,24,27,30	5
3.2.5 Analyze the circulatory system in animals	C4	8,14,22,32	4
3.2.6 Analyze the benefits of smooth blood circulation in humans	C4	3,36	2
3.2.7 Analyzing health disorders in the human heart and blood vessels	C4	6,15,28,39	4
3.2.8 Predicting health disorders in human blood	C5	21,33	2
3.2.9 Analyze the factors that affect the health of the human circulatory system	C4	12,38	2
3.2.10 Identify ways to prevent health problems in the heart and human blood vessels	C4	17,34,40	3
3.2.11 Analyzing how to prevent health problems in human blood	C4	23,26	2
3.2.12 Predict how to maintain the health of the human circulatory organs	C4	29,35	2

### 3. RESULT AND DISCUSSION

#### Result

Based on the data analysis, the results show that applying the Index Card Match type increased the students' science knowledge competence. The data analyzed and collected in this study were pretest and post-test scores. The data from the pretest were used to analyze the equality of the initial abilities of the experimental group and the control group before being given different treatments. Additionally, they were also used to find the value of the Normalized Gain Score (GSn) of the two sample groups. From the pretest data obtained, a t-test was calculated to determine whether the initial ability values were equivalent or vice versa. The t-test calculation can be seen in the [Table 2](#).

**Table 2. T-Test Calculation on the Pre-test Data**

	Pretest		Df	T <sub>count</sub>	T <sub>table</sub>	Conclusion
	Control	Experiment				
N (number of students)	28	28				
$\bar{x}$ (average)	6	6	54	0.688	2.00	Equal
s (standard deviation)	10	16				
s <sup>2</sup> (Variance)	10.43	10.93				

[Table 2](#) shows that the value of T<sub>count</sub> < T<sub>table</sub>, indicating that the two groups had equal initial abilities before different treatments were applied. After the pretest, treatment was given in the form of applying the Index Card Match Type in the experimental group. After each group received treatment by applying the learning model 6 times, a post-test was given.

The experimental group's average score was 22.96, which belonged to the high category. In contrast, the sample group's average score was 17.46, which belonged to the medium category. Before being analyzed using the T-Test, the post-test results in both sample groups were first analyzed using Chi-Square to determine the normality of the data distribution. Based on the Chi-Square calculation, the values of the experimental and control groups, respectively, were 3.683 and 1.683, which were below the table's value (11.07). This means the post-test results of the two groups followed the normal distribution. Further analysis involved the Fisher test in determining if the two groups' post-test results had a homogeneous



variance. The *f*count value obtained was 1.81, which was below the *F*table value (1.90) at a significance value of 0.05 and *df* 1 27, *df* 2 27. Therefore, the two groups can be stated to have a homogeneous variance. Next, the pretest and post-test results were analyzed to determine the value of the Normalized Gain Score (GSn). The value of this GSn was further analyzed using the T-Test. The results of the GSn T-Test analysis are presented in Table 3.

**Table 3.** Recapitulation of T-Test Gain Normalized Score Science Knowledge Competency

	<i>Pretest</i>		<i>Df</i>	<i>T</i> <sub>count</sub>	<i>T</i> <sub>table</sub>	<b>Conclusion</b>
	<b>Control</b>	<b>Experiment</b>				
N (number of students)	28	28				There is a difference in mean
$\bar{x}$ (average)	6	6	54	8.98	2.00	
<i>s</i> (standard deviation)	10	16				
<i>s</i> <sup>2</sup> (Variance)	10.43	10.93				

According to the Table 3, the *T*count was 8.98, which was above the *T*table value (2.00) at a *df* of 54 with an alpha of 0.05. Therefore the null hypothesis (*H*<sub>0</sub>) was rejected. The interpretation of these results is that there is a difference in the mean of the group of students treated with the cooperative learning model, Index Card Match Type, and the control group. The difference also indicates that the applied model significantly affects student learning outcomes.

**Discussion**

The difference in the experimental and control classes was due to the application of the cooperative learning model, Index Card Match Type, taught in the experimental class. It encouraged students to be more active and have fun while participating in learning activities. This learning model requires students to be active and participate in discussions to find partners in groups while learning about a concept or topic (Hengki et al., 2017; Leonard & Nwanekezi, 2018; Zakiah & Samlawi, 2019). This learning model uses cards in its application so that students learn in a pleasant atmosphere during the learning process because they have to discuss, find and match pairs of question cards or answer cards in groups. Meanwhile, the control class experienced conventional learning, which was teacher-centered.

The steps taken in the learning process are, first, the teacher conveys the learning objectives and presents information. Then the teacher divides the class into heterogeneous groups before distributing cards according to the groups that have been formed. Each group must discuss with each other to find the answers they get so that no one person in the group will not find a partner (Çolak, 2015; Karta et al., 2021). After discussing, they look for a partner that matches the card they got, and after that, each pair will convey the results that have been obtained. Then the teacher provides clarification in the form of a brief explanation if there are pairs that are not suitable, and at the end of the activity, the teacher evaluates and gives appreciation (Devi et al., 2016; Hijrihani & Wutsqa, 2015). Thus, the difference in the results of students' science knowledge competence can be seen from the superiority of applying the cooperative learning model Index Card Match in the average score gains the normalized score of science knowledge competence, and the results of hypothesis testing from the experimental group and the control class group.

Previous research stated that the Index Card Match Type Cooperative learning model improves student learning outcomes (Annisa & Marlina, 2019; Apriyanti, 2021; Prabowo et al., 2020). One of the advantages is that it can foster joy in teaching and learning activities. It is making learning material more attractive to students, creating a vibrant and fun learning atmosphere, increasing collaboration between students through the learning process, cultivating student learning creativity in the teaching and learning process, and improving student learning outcomes to achieve a level of mastery of learning and spurring discussion and presentation processes that can reinforce the topic/concept to be repeated or a new topic. Therefore, this learning model has the advantage of making learning more fun (Subiyantari et al., 2019; Yemi et al., 2018). Second, learning varies (only listening to the teacher's explanation). Third, learning by looking for pairs of cards makes students interested in increasing motivation and understanding of the material that has been taught and teaches students to foster a sense of solidarity (Herrmann, 2013; Nurhusain, 2017; Qusyairi & Jannati, 2018).

The implication of this study is that the selection of a good and appropriate learning model can affect the students' science knowledge competency. This study states that the cooperative learning model, Index Card Match Type, can be used as a reference for creating an active learning atmosphere in expressing opinions and increasing students' interest and motivation in learning so that they can make a good contribution in carrying out the learning process. The results of this study can be generalized to the population, namely fifth-grade students at Cluster 1 elementary schools, North Kuta District, 2022/2023

academic year, and can be used as a reference for teachers to apply the learning model to create more innovative learning atmosphere that is suitable for use in science knowledge competencies. By conducting this research, students get new experiences in the learning process and instill new concepts that learning is not only done seriously and tensely but can also be done in a relaxed and fun atmosphere.

#### 4. CONCLUSION

The study results show significant differences in science knowledge competence between the groups taught through the index card match type cooperative learning model and the control group. Therefore, learning using the index card match type affects the science knowledge competence of fifth-grade students. It is concluded that applying the cooperative learning model. Index Card Match Type can improve students' science knowledge competence.

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