Enhancing students collaboration skills in learning geometrical optics through the ICARE learning model at Kabawo

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Abstract. This study aims to see the improvement of students' collaboration skills by applying the ICARE learning model to geometrical optics material. The method used is pre-experimental with one group pretest-posttest design. The sample used were 31 students of class XI IPA2 with random sampling technique. The main instrument in this research is the researcher himself, while the supporting instrument is a written test in the form of an essay test and analyzed using the rubik's collaboration skills. To find out the improvement of students' collaboration skills, it was done by comparing the pretest and posttest scores and then analyzed using N-Gain. Based on the results of research using the ICARE learning model in improving students' collaboration skills based on the N-Gain value, where the average N-Gain value is 40.05. This shows that students' collaboration skills have increased in the moderate category after applying the ICARE learning model, while to see the implementation of the learning model using an observation sheet with a score of good category. The recommendation in this study is to pay more attention to the time management allocated for each aspect of ICARE so that each stage in ICARE can be carried out properly.

1. Introduction
In the development of the 21st century today, it is now having a huge impact in various fields of life. Where, in the 21st century, it can be marked by the development of science, technology and the availability of a lot of information and the rapid development of computing which is a challenge for students this development is not only in academic ability, but also in developing other abilities, such as creativity, communication, cooperation, and adaptation [1]. According [2] states that increasing the scientific creativity of students is one of the core goals of education. Scientific creativity is categorized as the ability to collaborate to create ideas and cooperation between groups.

Development of critical thinking skills has been emphasized at the individual level, and collaboration skills are emphasized on teamwork to create ideas and collaboration between groups [3]. In fostering critical and collaborative thinking skills, the emphasis is now on three things, namely constructivism, situationism, and collaboration. For further, that developments that must be created by students must have the ability to think critically and collaboratively. Collaboration encourages the development of critical thinking through discussion, clarification, ideas, and evaluation of other people's ideas, so that students' collaboration skills must be further improved.

Based on the results of observations made in schools, it appears that the conditions where students are still less effective in learning, but teachers are more likely to be active than students. Students still feel bored and sleepy with the explanation of the material with a long duration from the teacher without...
discussion among students. From this it can be seen that the collaboration skills performed by students are still low. The lack of collaboration skills carried out by students is caused by learning patterns that are still teacher-centered. Learning using a method like this does not provide opportunities for students to always be active and interact with other students so that their learning activities are still individual.

Based on the problems that have been presented, that the things that affect the teaching and learning process in the classroom are less effective, which causes the level of knowledge and skills of students to be less good are teaching factors, factors from students and also factors from the teaching material. In this case, the teacher plays an important role in teaching and learning activities. Therefore, teachers do not just convey knowledge to students, but teachers are also required to play various roles aimed at developing the potential of students. Where the method or learning strategy used greatly influences the teaching and learning atmosphere in the classroom.

One alternative action in an effort to improve the physics learning process is to use the ICARE learning model. The reason why choosing the ICARE learning model is because the learning model can make students active in the learning process and can improve speaking skills because they are active in ongoing learning activities [4]. Several previous researchers, who used the ICARE learning model, namely [5] in their journals, explained that one of the learning models that can encourage and increase the effectiveness of students is the ICARE learning model. The ICARE learning model can facilitate the application of knowledge that has been learned from the five elements, namely introduction, connecting, applying, reflecting on and continuing. Based on these five elements, the ICARE learning model can be applied in physics learning because physics learning does not only focus on things that are conceptual understanding, but students are guided to be able to integrate these concepts in everyday life.

Collaboration skills are important skills for a person to survive in the world of work and in the surrounding environment where, in the 21st century, it demands that someone be able to work in a team or in a group [6]. To survive in a team or in a group, of course one needs good collaboration skills to get maximum results Sipayung [7]. Now the facts can be seen from the results of observations made at school, that the interaction between students in collaborating is still very low, where the learning results show that of the eight study groups created by the teacher, not all members of the group are actively involved in collaborating in solving problems given by the teacher. Where, students tend to rely on each other on other group members, even though in the learning process the teacher has implemented a group learning process. So, social interaction is important in collaboration, collaboration skills can be measured in individuals, and their contribution in groups [8]. Meanwhile [9] revealed that someone who can collaborate with others has the characteristic of showing the skills to work effectively and systematically in a team, being flexible, and conscious to be seen in achieving goals, and appreciating contributions in the team. In several previous studies, there were many students who experienced misconceptions, including in Geometry Optics [10]. This situation indicates students have difficulty in terms of cooperation between groups. So that the ability in student collaboration skills is still low. Therefore, efforts are needed to improve the collaborative abilities of students, especially on geometric optics through an appropriate learning model. One learning model that can be used as an alternative is ICARE learning. From several previous researchers, argued that the ratio of the speed of light in a vacuum to the speed of light in a substance is called the refractive index, mathematically formulated as:

\[ n = \frac{c}{v} \]  

(1)
Figure 1. the phenomenon of refraction in everyday life

Internal refraction phenomenon from the above phenomenon, it appears that the bottom of the pool will look shallow when viewed from land, this is because light coming from the air (less dense) towards the water (more dense) will be refracted away from the normal line in the process of light refraction takes place in the pool so that what is seen as the bottom of the pool is a shadow of the bottom of the pool, not the bottom of the original pool.

Basically, the ICARE learning model now provides facilities for students to be able to collaborate in the learning process. In this study, emphasizing ICARE learning with collaborative activities, it is hoped that students can improve their collaboration skills. In this case, the ICARE learning model of students is required to be active like individually or in groups. From the various problems above, now the author is interested in researching "Increasing Student Collaboration Skills in Learning Physics in Geometry Optics Materials Using the ICARE at one of the public high schools in kabawo".

2. Method

2.1. Types and Objects of Research

This study used a pre-experimental method with one group pretest design and posttest design. design pre-experimental is a design that only includes one group or class that is given a pretest and posttest. This study involved 31 students consisting of 20 women and 11 men. class XI IPA2 SMA Kabawo. To find out the increase in the collaboration ability of students, it is done by comparing the pretest and posttest and then analyzed using normalized gain <g> to see the increase in collaboration skills. Meanwhile, to see the implementation of the learning model using the teacher activity observation sheet in the application of the ICARE learning model.

Furthermore, in this study using the ICARE learning model. In this ICARE learning model, it provides facilities for students to collaborate in their learning. As the name implies, this ICARE consists of 5 stages, namely as follows:

| Stage of Icare Models | Explanation |
|-----------------------|-------------|
| Introduction          | At the Introduction stage, the teacher instills an understanding of the learning content that will be delivered and conveys the learning objectives that will be achieved by students. |
| Connection            | At this connection stage, the teacher tries to connect new teaching materials with something that students are familiar with from previous learning or experiences. |
| Application           | At this application stage, it is a stage that provides opportunities for students to practice or apply these knowledge and skills. |
| Reflection            | At the reflection stage, this is a stage to summarize or conclude the learning that has been obtained. |
| Extension             | In the final stage, namely extension, which at this stage is the stage to increase mastery of understanding the material outside of class hours which can be done by giving homework. |
2.2. Research Instruments
The instruments of this study consisted of the main instruments and supporting instruments. The main instrument in this study is the researcher himself and the supporting instrument consisting of a written test in the form of an essay test, and analysed using the Rubik of collaboration skills. One of the collaboration skills instruments is as follows:

Indicator: A picture is presented regarding the properties of light refraction, students can make conclusions based on the results of the observations presented.

Nana conducted a refraction experiment on a concave lens and a convex lens to determine the properties of refraction on the lens by shining a light source on the lens as shown below. Describe how the refractive light beam will be obtained by Nana and make conclusions based on the refractive light beam obtained!

2.3. Instrument Analysis Techniques
To find out the increase in students' collaboration skills, it begins by calculating the pre-test and post test scores. Comparison of students' collaborative abilities will produce a gain value. The N-Gain value can provide an overview in improving student learning outcomes [11], so the normalized gain equation is used as follows:

$$< g > = \frac{< S_{post} > - < S_{pre} >}{100 - < S_{pre} >}$$  (2)

| Limitation | Interpretation |
|------------|----------------|
| g > 0.7    | High           |
| 0.3 ≤ g ≤ 0.7 | Medium       |
| g < 0.30   | Low            |

Furthermore, the data from the observations of teacher activities were analyzed by adding up the number of activities observed with respect to the implementation of the learning stages with the ICARE learning
model contained in the observation sheet on the implementation of the learning model that had been observed by the observer. Data analysis of teacher activity observation sheets in teaching and learning activities using the formula:

\[
Rata - rata = \frac{\sum skor item}{\sum item}
\]

(3)

to classify the average teacher activity score, by following the categorization rules as follows:

| Implementation Criteria Classification |
|---------------------------------------|
| 1 ≤ average < 1.75                  | Less teacher activity       |
| 1.75 ≤ average < 2.5                | Teacher activity is enough   |
| 2.5 ≤ average < 3.25                | Good teacher activity       |
| 3.25 ≤ average < 4                  | Teacher activity is very good|

### 3. Result and Discussion

#### 3.1. Description of data on the improvement of students' collaboration skills

The analysis of the improvement of students' collaboration skills was obtained from the scores of the students' pre-test and post-test results. Furthermore, to see the increase in student learning outcomes, Normalized Gain (N-Gain) is used. The table below shows the recapitulation of the average pre-test and post-test results as well as the N-Gain obtained by students.

| Students-grade | Pretest | Posttest | N-Gain | % N Gain |
|----------------|---------|----------|--------|----------|
| 48             | 68.42   |          | 0.4    | 40       |

Based on the results of the calculation of the N-Gain value above, it can be seen that the average N-Gain score of students on the pretest is 48 while the average score on the posttest is 68.42. So that the average value of N-Gain on the pretest and posttest is 0.4.

#### 3.2. Description of teacher activity implementation data

| Observed Aspects | Meeting | I  | II | III | IV |
|------------------|---------|----|----|-----|----|
| Intraductions    |         | 6  | 6  | 7   | 9  |
| Connection       |         | 7  | 8  | 7   | 9  |
| Application      |         | 8  | 6  | 8   | 9  |
| Reflection       |         | 5  | 5  | 5   | 6  |
| Extension        |         | 9  | 7  | 8   | 8  |
| Jumlah           |         | 35 | 32 | 36  | 41 |
| Kategori         |         | 2.5| 2.3| 2.6 | 2.9|

Furthermore, based on the results of the analysis of implementation in the application of the ICARE learning model to teacher activities, the average score for each aspect of the ICARE learning model obtained a score of 2.5, 2.3, 2.6 and 2.9 with good categories. Collaboration skills in the learning process can be seen from the participation and effectiveness of students during learning. Students' collaboration skills have the benefit of being able to come up with new ideas, can practice cooperation in a group, and
appreciate the commitments that have been agreed upon with their group friends. Collaboration skills in learning can be seen from the ability of students to carry out discussions between students in groups, by providing ideas and input in a discussion between students in the group, by providing ideas and input on learning topics and the courage of students in criticizing and providing suggestions to other friends to be well received, as a joint evaluation material. The indicators of collaborative ability assessed in this study consist of the ability to cooperate and respect among group members, the ability to participate and contribute to group members, the ability to manage time and do assignments, and the ability to be responsible for the results of joint work. Collaboration skills can be trained by cooperating with each other by starting to listen, and being open to others and being able to learn from others. Therefore, the teacher can provide interesting learning methods so that students can be actively involved during the learning process.

Based on research conducted at a public high school in Kabawo, teachers use the ICARE learning model to see the improvement of students' collaboration skills with education, because the learning model can provide broad opportunities for students to be actively involved in the learning process. The ICARE learning model consists of five stages of learning, namely Introduction, Connection, Application, Reflection, and Extension. Where, learning physics using this model is very interesting because the time taken at each stage is very flexible. In this learning model, it also provides opportunities for teachers to be able to change the learning experience of students through emphasis on each stage. Where, if the teacher focuses on the connection stage, then the teacher must use a method that reflects constructivism learning and the teacher must function as a facilitator in learning for students.

Based on the results of the research above, to determine the improvement of students' collaboration skills at the beginning of learning, a prettest is carried out, and at the end of the learning a posttest is carried out, where the results of the prettest and posttest will produce the N-Gain value which is used to see the increase in students' collaboration abilities. Where the higher the N-Gain value, the student's collaboration ability is also getting better. For the results obtained in table 4 above, regarding the results of students' pre-test, post-test, and N-Gain scores, it can be seen that the average value of students' pre-test results has increased in students' post-test results after using the ICARE learning model. Furthermore, to see the increase in student learning outcomes on the N-Gain value, it can be seen that the average N-Gain score is 40.05. The minimum N-Gain value is 21.66%, and the maximum value obtained is 68.89%. Based on the results of research using the ICARE model to analyze its effectiveness in improving student learning outcomes in communication and collaboration skills. Where the final result of the research is to obtain the results of improving students' communication skills and collaboration skills, because each stage in the ICARE model directs students to complete knowledge with good skills to optimize skills and collaboration.

Furthermore, based on the results of the analysis of implementation in the application of the ICARE learning model to teacher activities, the average score for each aspect of the ICARE learning model obtained a score of 2.5, 2.3, 2.6 and 2.9 with good categories. Although in the good category, there are several aspects of teacher activities that need to be improved. such as time according to the allocation, where at the initial learning meeting, until the final meeting, the allocation of learning time used by the teacher is still not in accordance with the time allocation that should be. In this way, students learn to acquire the knowledge needed directly from the teacher, and students are actively involved in developing their knowledge, attitudes, and skills in an open teaching and learning environment. From previous research conducted by Yusrina [13], through the development of learning innovations with the ICARE model in understanding astrophysics material, where from the results of his research, learning achievement both from teacher and student activities has increased after the ICARE learning model is applied, because at every stage in the learning model ICARE is easy to implement. Based on these results, it can be concluded that the use of the ICARE learning model is very well applied in schools.

4. Conclusion
Based on the results of research conducted in one of the public high schools in Kabawo, that the use of the ICARE learning model can improve students' collaboration skills on Geometric Optics material.
Furthermore, based on the results of the analysis, the implementation of the ICARE learning model on teacher activities is in the good category. In the implementation of the ICARE learning model, more attention should be paid to the time management allocated to each aspect of ICARE so that each phase in ICARE can be carried out properly.

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