Implementation of think pair share model in physics learning to determine cognitive, affective and psychomotor learning outcomes and student responses

I M Astra¹*, A Henukh², and Algiranto³

¹Department of Physics Education, Faculty of Mathematics and Natural Sciences
Universitas Negeri Jakarta, Jalan Rawamangun Muka, Jakarta Timur 13220, Indonesia
²Department of Physics Education Faculty of Teacher Training and Education
Musamus University, Jl. Kamizaun Mopah Lama, Merauke, 99611

*imadeastra@unj.ac.id

Abstract. The purpose of this research is to describe the results of the implementation of the think pair share model on optical concepts that includes cognitive, affective, psychomotor learning outcomes and student responses. The type of this research is descriptive research. This research was conducted in class VIII THB Junior High School, Bekasi. The research design used was one group pretest-posttest design. Data collection techniques used were observation, tests, and student response questionnaires. The analysis technique of the research results used is quantitative descriptive analysis including the calculation of proportions and percentages. Based on the results of data analysis, cognitive, affective, and psychomotor learning outcomes are achieved with an average achievement of the cognitive proportion of 0.85, affective proportion through observation of 0.83, and the proportion of psychomotor through a portfolio of 0.82. Student responses to the implementation of learning by implementing a think pair share model that includes five aspects are very good, with an average percentage of the five aspects is 90.53%. Based on the data above, it can be concluded that the implementation of the think pair share model can improve students’ physics learning outcomes.

1. Introduction
The progress of a country can be seen from the development of technology and the conditions of its education. The development of Science and Technology (IPTEK) brings big changes in various aspects of human life, one of which is in the field of education. Education is one of the most important needs in human life, therefore it is necessary to make efforts so that the quality of education continues to be improved. One of the efforts to improve the quality of education in schools is to improve and develop the learning process that occurs in schools [1,2].

The 2013 curriculum demands a paradigm shift in education and learning, especially at the level and type of formal education (schooling). These changes need to be followed by teachers who are responsible for the implementation of learning in schools (inside and outside the classroom). The teacher is one of the components that is directly involved in carrying out the learning process so that teachers are required to play their role to create quality and quality human resources. Teachers are also required to be able to position themselves as competent teachers in their respective fields [3].
The 2013 curriculum also requires that learning be active, innovative, creative, effective and fun. Active learning means that in the learning process the teacher must create an atmosphere in such a way that students actively ask, question, and express ideas. Innovative learning can adapt from a fun learning model. Professional teachers are required to be able to respond to all conditions in school as creatively and wisely as possible[4–6]. There are many innovative learning models that teachers can apply in the learning process so that physics learning activities can be more active, innovative, creative, effective and fun, one of which is the think pair share (TPS) type of cooperative learning model[7–9].

This learning model is one type of cooperative learning designed to influence the interaction patterns of students, namely, students carry out discussions in two stages, namely the discussion stage with their peers then followed by a discussion with the whole class at the sharing stage. This learning model has three basic things that must be done, among others; think (think), pair (pairing), and share (share). This can stimulate the participation of students to be more creative to think and discuss optimally[10–12]. The evaluation system used in this school is as desired by the 2013 curriculum, namely: Attitude assessment (spiritual and social) which is assessed using observation, self-assessment, peer-to-peer assessments, and journals. Knowledge was assessed using written tests and oral tests. Skills are assessed using performance, products, projects, and portfolios. The assessment is carried out during the learning process by the teacher but it has not been carried out optimally[13–15].

In the learning process in the classroom, the teacher prefers to teach by using the direct learning model and the lecture method without any variation, which makes the learning atmosphere less exciting for students, especially on difficult materials. When learning takes place, students must be guided one by one by the teacher. If not guided, they are slow to respond to learning. Students tend to follow lessons only by listening, taking notes, and the rest doing the assignments given by the teacher without any response, criticism, and questions as feedback[8].

Students tend to learn on their own, or rather study with close friends, so they are unable to build cooperation. The impact is that these students cannot develop. Teachers rarely provide opportunities for students to conduct experiments to find concepts regarding physics materials because of the limited laboratory equipment and the lack of supporting books. The minimum completeness criteria for physics subjects in this school are classified as high, namely 78. Based on these minimum completeness criteria, according to the subject teacher, the learning outcomes of students are still not satisfactory. The evaluation system used in this school is as desired by the 2013 curriculum, namely attitude assessment (spiritual and social) which is assessed using observation, self-assessment, peer-to-peer assessment, and journals. Knowledge is assessed using written tests and oral tests. Skills are assessed using performance, products, projects, and portfolios[3].

Optics is one of the main subjects of physics at the junior high school level based on the 2013 curriculum. This subject matter discusses the properties of light, especially the reflection on flat and spherical mirrors and refraction on simple lenses. This material is closely related to the daily life of students who need analysis and synthesis so that learning requires students to think in understanding and finding facts, concepts, and theories that are synchronous in the daily lives of students.

In the TPS learning model, students are in heterogeneous learning groups. Students are expected to interact actively and help each other in solving problems together so that complex problems can become easier because they are solved together and can take responsibility for all students in the classroom[12,16,17]. Based on the description above, the formulation of the problem in this study is how is the completeness of cognitive, affective, and psychomotor learning outcomes and student responses by applying the TPS type cooperative learning model on the subject matter of optics? The purpose of this research is to determine students' cognitive, affective and psychomotor abilities, especially in optical concepts.

2. Research Method
The method used in this research is descriptive. In this case, what is described is the completeness of cognitive, affective, and psychomotor learning outcomes as well as students' responses to learning
activities. The research design used was one group pretest-posttest design. The data collection techniques used were tests to measure cognitive, affective, and psychomotor learning outcomes and questionnaires to determine student responses. The instrument used was validated using the person moment product and the reliability was calculated using alpha Cronbach’s using SPSS 25. The average validity results obtained were 0.86 and the reliability was 0.85. Interpretation of students' response scores refers to the following equation.

Data analysis was performed using a Likert scale. This scale is used to measure the attitudes of opinions and perceptions of a person or group of people about social phenomena[18–20]. In determining the percentage of success used equation (1).

\[ P = \frac{S}{N} \times 100\% \]  

Information:
- \( P \): Percentage of success (%)
- \( S \): Amount of obtained
- \( N \): Total maximum value

The interpretation of the proportion of cognitive, affective and psychomotor learning outcomes refers to equation (2) below.

\[ P = \frac{B}{N} \]  

Information:
- \( P \): Proportion Correction
- \( B \): The scores obtained by students
- \( N \): Maximum score

The data obtained is written in the interpretation of the score in table (2) below[21].

| Average Score | Interpretation |
|---------------|----------------|
| 0%-20%        | Bad            |
| 21%-40%       | Not Good       |
| 41%-60%       | Enough         |
| 61%-80%       | Good           |
| 81%-100%      | Very Good      |

3. Result and Discussion
Analysis, the completeness of the cognitive learning outcomes of students is known by using the cognitive learning outcomes test given to 37 students. The pretest results can be seen in Figure 1.
Figure 1. The proportion of individual student cognitive learning outcomes in the initial test

Figure 1 above presents the proportion of completeness of the cognitive learning outcomes test of 37 students who took the initial test. The green bar chart shows the proportions achieved by students with an odd serial number while the yellow bar chart shows the proportion achieved by students with an even serial number. It appears that in the initial test the proportion of 37 students did not complete because the proportion was below 0.75 with a range of 0.08-0.52. Students with serial numbers 11 have the lowest proportion with a proportion value of 0.08 and students with serial numbers 6 and 37 have the highest proportion with a proportion value of 0.52.

The results of the posttest analysis of cognitive abilities can be seen in Figure 2 below.

Figure 2. The proportion of individual student cognitive learning outcomes in the final test.
Figure 2 above presents the proportion of THB completeness products of 37 students on the final test. The green bar chart shows the proportions achieved by students with an odd serial number while the yellow bar chart shows the proportions achieved by students with an even serial number. In the final test, the proportion achieved by 37 students achieved completeness because the proportion was $\leq 0.75$ with a range of proportions from 0.76 to 0.96. The lowest proportion was owned by students with serial numbers 4 and 30 with a proportion value of 0.76 and the highest proportion was owned by students with serial number 37 with a proportion value of 0.96.

Following the results of the analysis of the completeness of the cognitive learning outcomes test shown in Figure 1, it is known that in the initial test a total of 37 students who took the test obtained the proportion below the average. This happens because students do not have sufficient knowledge regarding the material being tested. The average proportion of 37 students only reached a value of 0.33. Furthermore, according to the data in Figure 2, it can be seen that of the 37 students who took the final test, all of them achieved completeness with a proportion of $\geq 0.75$ with a range of score proportions from 0.76 to 0.96. Students with serial numbers 5 and 30 get the lowest proportion because the ability of students in the class is very low, while students with serial number 37 get the highest proportion because these students have good intelligence. Based on the results of the analysis of the completeness of the cognitive learning outcomes test in Figure 2, it was found that the class average proportion was 0.85, it can be concluded that the proportion of students reached completeness with an average proportion of 0.85\cite{22,23}.

The completeness of students' affective learning outcomes is known by using the affective learning outcome test sheet through observation of the attitudes and interests of students during the learning process. The results of the analysis of the affective learning outcomes of individual learners can be seen in Figure 3 below.

Figure 3 above shows the attainment of the proportion of completeness of the affective learning outcomes test of 37 students. The brown bar chart shows the proportions achieved by students with an odd serial number, while the green bar chart shows the proportions achieved by students with an even serial number. Based on the picture above, it can be seen that of the 37 students, 36 students achieved...
completeness because the proportion was ≥ 0.75 while 1 student with serial number 5 had the lowest proportion and did not achieve completeness because the proportion value was <0.75 with a value of 0.63 while 2 students with serial numbers 10 and 14 had the highest proportion with a proportion value of 0.97.

Based on the results of the thoroughness analysis of the affective learning outcomes through the observations shown in Figure 3, individually reviewed, it is known that of the 37 students whose attitudes were observed, 36 students obtained the proportion of completeness ≥ 0.75 which means that they are in a complete category. Meanwhile, the proportion achieved by 1 student was below 0.75 with serial number 5.

The main problem that causes the incompleteness of these students is because these students show a displeasing attitude according to the aspects assessed during the learning process. Therefore, it is hoped that teachers and researchers will take the same model and subject to give more attention to these students so that the attitudes shown are as expected. However, in general, by paying attention to the proportion of the average completeness of the affective learning outcomes through observation of class students reached 0.83. The results of the analysis of the proportion of completeness of the portfolio above can also be shown in Figure 4 below.

Figure 4. The proportion of completeness of psychomotor learning outcomes

Figure 4 above shows the proportion of completeness of psychomotor learning outcomes achieved by students. The red bar chart shows the proportion of completeness of students with an odd serial number, while the green bar chart shows the proportion of completeness of students with an even serial number. The lowest proportion was obtained by students with serial numbers 5, 17, 23, 25, and 29, namely 0.75, while the highest proportion was obtained by students with serial number 14, namely 0.92.

Based on the results of the mastery analysis of the psychomotor learning outcomes shown in Figure 4, individually reviewed, it is known that of the 37 students who observed the skills of compiling practicum reports, all of them reached a completeness proportion ≥ 0.75, which means they are in a complete category. This is because before compiling the report on the results of the practicum, students pay close attention to the explanation of the framework for preparing the practicum report from the teacher or researcher.

The results of the student response analysis can be seen in Figure 5 below.
Figure 5 above shows the average percentage of students' responses to the five aspects observed in the implementation of learning, namely preliminary activities, core activities, closing activities, time management, and class atmosphere. The average percentage of students' responses to these five aspects was 93.24%; 92.68%; 86.76%; 89.19%; and 90.81%. The aspect occupying the lowest percentage is closing activities with a percentage of 86.76%. This means that there needs to be an increase in activities that create an attractive impression from students. Meanwhile, those who occupy the highest percentage are preliminary activities with a percentage of 93.24% [24,25].

4. Conclusion
The cognitive, affective, and psychomotor learning outcomes of class VIII students on the subject matter of Geometry Optics generally achieved completeness with an average achievement of the product proportion of 0.85, the affective proportion through observation of 0.83; self-assessment of 0.85, and the proportion of psychomotor through the portfolio of 0.82. The response of students to the implementation of learning by applying the TPS type cooperative learning model which includes five aspects is very good, with an average percentage of the five aspects is 90.53%.

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