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Scientific Approach in Cognitive Conflict Strategy: Effects on Cognitive Learning Outcomes Based on the Assertive Attitude of High School Students

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Abstract. Distance learning requires teachers to determine and use appropriate learning methods, models, and strategies. However, the lack of variety in these three things makes students less active. The research objectives include finding out whether or not there are: 1) difference the influence of the application of cognitive conflict learning strategies and *mind mapping* with a scientific approach on students' cognitive learning outcomes, 2) the difference in the influence of high and low category students' assertive attitudes on students' cognitive learning outcomes, and 3) the interaction of the influence between the use of learning strategies and assertive attitudes on the results Cognitive learning for class The research method applies experiments through a 2x2 factorial design. The population includes all class XI MIPA students, comprising five classes and totals 166 students. Samples were taken from 2 classes from 5 classes. The sampling technique refers to *Cluster Random Sampling*. Data collection techniques are done through documentation, tests, and questionnaires. The data analysis technique uses prerequisite tests, namely the normality and homogeneity tests. Next, a hypothesis test was carried out using a two-way ANOVA with unequal cell contents. The results of the research are that there are differences in the influence of the use of cognitive conflict learning strategies and *mind mapping* using a scientific approach on students' cognitive learning outcomes ($F_{observation} = 4.227 > F_{table} = F_{0.05;\,1;\,53} = 4.02$); t there is a difference in the influence of assertive attitudes of students in the high and low categories on students' cognitive learning outcomes ($F_{observation} = 7.265 > F_{table} = F_{0.05;1;53} = 4.02$); and there is no interaction effect of the use of learning strategies with an assertive attitude on students' cognitive learning outcomes ($F_{observation} = 0.809 < F_{table} = F_{0.05;\,1;\,53} = 4.02$). This study's contribution the effectiveness of applying cognitive conflict learning strategies and *mind mapping* through a scientific approach to Cognitive learning outcomes on Elasticity and Hooke's Law material.

Keywords: Cognitive conflict; cognitive learning outcomes; learning strategies; *mind mapping;* student assertive attitude.

INTRODUCTION

Coronavirus Disease 2019, or COVID-19, impacts various aspects of life, including education. The Minister of Education has adopted a policy to implement learning from home to anticipate the spread of the COVID-19 virus. Referring to the related Circular Letter from the Minister of Education

Nadiem Anwar Makarim Number 4 of 2020, the implementation of educational policies during the emergency period of the spread of COVID-19 explains that learning procedures from home are carried out remotely or online. The home learning policy requires teachers to be able to determine and apply appropriate learning models, methods, and strategies so that learning remains meaningful. Knowledge transfer must continue to be carried out, and students can actively digest the knowledge provided by the teacher as facilitator (Aji, 2020). Sugiyono (2019) stated that the experimental method is one of several methods that are used primarily if researchers want to carry out tests to examine the effects of *independent variables/*specific treatments on dependent variables/outcomes under controlled conditions.

To optimize learning, teachers must apply learning while still adapting to the current curriculum, namely the 2013 curriculum. Minister of Education and Culture Regulation Number 69 of 2013 states that regarding the 2013 curriculum, development was carried out by perfecting the mindset, namely the learning paradigm with the teacher being the center of learning, changing to students as the center, The form of learning which was originally one-way changed to interactive learning, and passive learning patterns then became active and critical learning. The implementation of the 2013 curriculum aims to create people who can have vital, creative, analytical, systematic, and logical thinking through the development of 3 main domains, including knowledge (cognitive), skills (psychomotor), and attitudes (affective). A learning approach that can integrate these three aspects is a scientific approach. Based on the existing definition, the conclusion is related to the scientific approach as a learning approach that supports students to be critical, active and analytical in solving problems in learning (Mastur, 2017). So a scientific approach is considered appropriate when used in the 2013 curriculum.

The learning strategy to support the success of students' cognitive learning outcomes is the mental conflict learning strategy. Cognitive conflict was born from research carried out by Piaget in the 1970s. This strategy is experiencing development, referring to the assumption that students' previous knowledge will be influenced when they learn new knowledge to create an image of a new idea. This includes students who feel a mismatch between their cognitive structure and the environmental conditions around them or between the various components of their cognitive structure (Zulkarnain, 2011). In Piaget's theory, students already have knowledge before they enter school. Students will construct their expertise according to previous learning, experience, various environmental phenomena, and others (Fatimah, 2016). Changing students' cognition into correct concepts takes work, so the application of this learning strategy emphasizes intense teacher-student interaction to train students to get physics concepts correctly until students can carry out self-evaluation regarding various conceptions that need to be improved and those that need to be changed (Khasanah, 2010).

Wiradana's research (2012) explains that implementing cognitive conflict learning strategies has a more substantial influence on student learning achievement if a comparison is made using conventional learning models. This research is supported by Supliyadi's (2017) findings, which show that student activities that use cognitive conflict strategies can optimize student learning achievement. The magnitude of the contribution and influence of student activities on their learning achievement is 93.8%. Other relevant research was conducted by Sari (2017), where the cognitive conflict learning strategy can have an influence on student learning outcomes because a series of learning activities that apply the cognitive conflict strategy make students more active so they can understand the concepts well, thereby improving their learning outcomes. Will increase.

One of the behaviors students should have is an assertive attitude because it is needed in the 2013 curriculum learning, where students must actively express their opinions and thoughts. An assertive attitude is an attitude or behavior that shows an honest and open expression of someone's views, feelings, and needs by expressing what that person wants clearly while still respecting their various rights and those of other individuals. Someone with an assertive attitude will dare to express their wishes (Potts, 2013). This attitude is deemed appropriate if every student has it, especially when using cognitive conflict learning.

Physics is one of several subjects in the science family that requires students to be able to implement concepts with a high level of understanding. Therefore, physics is seen as a subject that needs to be explained. Because studying physics includes two dimensions, including processes and results, students do not just remember what they have learned but also need to have the proper understanding of

concepts (Khasanah, 2010). The physics material Elasticity and Hooke's Law is one of the many materials studied by class XI students in semester 1. There are various events related to Elasticity and Hooke's Law. Apart from that, this material was chosen because students had misconceptions, such as the concept of elastic energy and elastic modulus (Hidayati, 2016).

Referring to the background above, the aim of conducting research is to find out **if** there is a difference or not the effect of applying cognitive conflict learning strategies and *mind mapping* through a scientific approach to Cognitive learning outcomes of class 2021/2022 academic year in the material Elasticity and Hooke's Law and find out whether or not there is an interaction effect between the use of learning strategies and assertive attitudes on the cognitive learning outcomes of class XI MIPA students at SMA Negeri 1 Kedungreja for the 2021/2022 academic year in the material Elasticity and Hooke's.

METHOD

The research was carried out in Kedungreja 1 Public High School with the address of Jalan Raya Tambaksari Tromol Post 212 Kedungreja, Cilacap Regency, Central Java. The research was applied to class XI MIPA in the odd semester of the 2021/2022 academic year. The choice of SMA Negeri 1 Kedungreja as a place for research was due to several considerations, namely the facilities and infrastructure facilitate conducting research, the curriculum used by SMA Negeri 1 Kedungreja uses the 2013 curriculum, so it is appropriate to apply research with a scientific approach, cognitive conflict strategies have never been used in learning. So researchers have an interest in conducting research, and students' assertive attitudes have never been measured during learning. The research was carried out in August-September 2021.

In the research carried out, an experimental method was applied through a 2x2 factorial design, which included quantitative research methods. The population in the study included all students in class 5, totaling 166 students. Samples were taken from 2 of the five population classes and used as research subjects. The independent variables used are cognitive conflict learning strategies and learning strategies using *mind mapping*. Meanwhile, the dependent variable is the student's cognitive learning outcomes, the moderator variable used is the student's assertive attitude, and the control variables used in this research are the scientific approach and *discovery learning model*.

The research carried out selected two classes to be used as research objects, including the experimental class, which would receive treatment with cognitive conflict-based learning strategies, while the control class would be treated with *mind-mapping learning strategies*. Students' assertive attitudes are categorized into two categories, namely high and low assertive attitudes. Students' cognitive abilities are obtained from daily physics assessment scores of 25 questions.

The sampling technique was conducted using *Cluster Random Sampling*, namely random sampling from 5 classes of XI. Based on the five classes, two classes were taken, and the two classes were randomized again so that one experimental class could be determined with the control class. The choice of this technique is based on considering students who receive material referring to the same curriculum, class divisions where there are no superior classes, and taught by the same teacher.

Data collection techniques include documentation techniques, tests, and questionnaire techniques. Documentation techniques are carried out to obtain supporting documents and data for research, for example, a list of student names used for the population and research samples and Final Semester Assessment (PAS) scores for Physics class X even semester 2020/2021 academic year for normality and homogeneity testing. Test techniques are used after students are given treatment in the form of learning strategies that are different from objective test forms. A questionnaire technique was used to determine the level of assertiveness of students from the experimental class and control class. The instrument for assessing assertiveness includes a self-assessment questionnaire (questionnaire).

The data analysis technique was carried out using prerequisite tests, namely the normality test using the Liliefors method and the homogeneity test using the Bartlett test. Before the research, normality, and homogeneity tests were carried out to find out whether the two samples were in the same initial state in terms of the Final Semester Assessment (PAS) scores for 2020/2021, even semester class X academic year at SMA Negeri 1 Kedungreja. The two statistical tests are a prerequisite for the t-test. Based on the results of the 2-tailed t-test, the initial state of the students was sig=0.156. The value above

exceeds 0.05, so there is no significant difference in initial abilities between the experimental class and the control class.

Next, a homogeneity test was carried out using a two-way ANOVA with unequal cell contents to test the significance of the influence and interaction of the two variables in one dependent variable. At the end of the test, a post-ANOVA follow-up test was carried out. The significance of the difference in influence from the analysis can be seen from the multiple comparison test using the Scheffe method.

RESULT AND DISCUSSION

RESULTS

Data Description

Data on the assertive attitudes of experimental class and control class students are explained in Table 1.

Table 1. Description of Student Assertive Attitude Data

Class	The number of students	Highest Score	Lowest Score	Total Score
Experiment	29	38	25	935
Control	28	40	24	894

Based on Table 1, the results of calculating students' assertive attitudes showed an average of 32.24 for the experimental class, while for the control class, it was 31.92. Referring to this average, students' assertive attitudes were categorized in the experimental class and control class, which can be seen in Table 2. Data diagrams of the assertive attitudes of students in the experimental class and control class are shown in Figures 1 and 2.

Table 2. Experimental Class Students' Assertive Attitude Category

Intervals	Category	The number of students	Frequency
Score ≥ 33	Tall	18	62.06 %
Value < 33	Low	11	37.93 %

Based on Table 2, the categorization of students' assertive attitudes into high and low categories is based on the average score of experimental class students, which is 32.24. These averages were grouped into categories of high and low assertiveness. Referring to the Table, the most significant frequency is in the high assertiveness category, with 18 students or a percentage of 62.06 %. Meanwhile, there were 11 students with low assertive attitudes, with a percentage of 37.93 %.

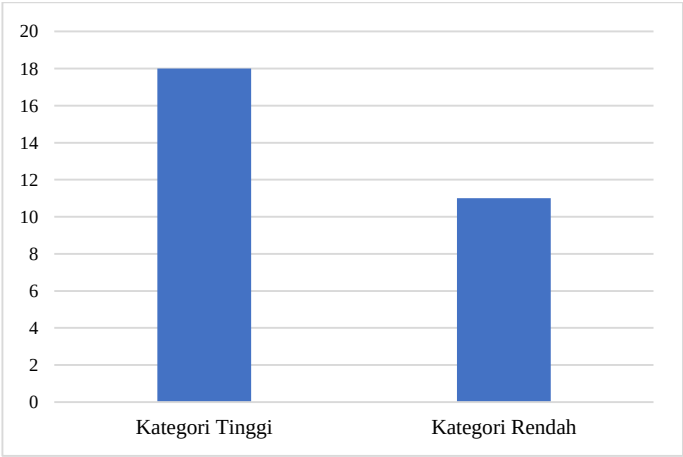

Figure 1. Bar Chart of Assertive Attitudes of the Experimental Class

From the diagram in Figure 1, it can be observed that in the experimental class, there were 18 students in the high assertive attitude category, while in the low assertive attitude category, there were 11 students.

Table 3. Control Class Students' Assertive Attitude Category

Intervals	Category	The number of students	Frequency
Score ≥ 32	Tall	16	57.14%
Value < 32	Low	12	42.85%

Based on Table 3, the categorization of students' assertive attitudes into high and low categories is based on the average score of control class students, namely 31.92. This average is then divided into categories of high and low assertiveness. Referring to Table 3, the most significant frequency is in the high assertive attitude category, with 16 students or a percentage of 57.14 %. Meanwhile, for low assertiveness, there were 12 students with a percentage of 42.85 %. Figure 2 show the difference of control class assertive attitude bar diagram.

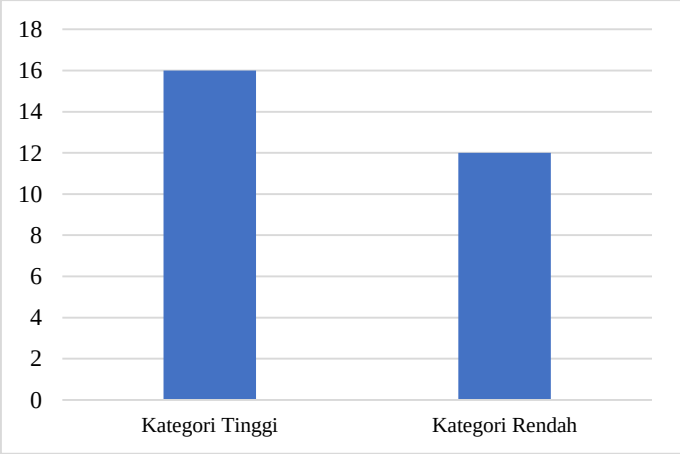

Figure 2. Control Class Assertive Attitude Bar Diagram

From the diagram in Figure 2, it can be seen that in the control class, there were 16 students in the high assertive attitude category, while in the low assertive attitude category, there were 12 students.

Data on students' cognitive abilities was obtained from the results of cognitive physics tests. Cognitive tests were given to two classes after implementing different learning strategies. The mental test was conducted using 25 multiple-choice questions. The student's cognitive abilities in the experimental and control classes are described in Table 4.

Table 4. Cognitive Ability Data for Experimental and Control Classes

Class	The number of students	Cognitive Ability		
		Average	Lowest	Highest
Experiment	29	67.03	28	96
Control	28	56.29	16	96

The distribution of students' cognitive ability scores in the experimental class can be seen in Figure 3. Figure 3 explains the most significant frequency in the experimental class, namely in grades 72 and 84, with a total of 4 students. A negative squint curve is formed, meaning that the tail of the distribution shifts towards the left side of the peak with a mean value (67.03) <median (72,00)<mode (84.00). The distribution of cognitive ability scores for control class students can be seen in Figure 4. Figure 4 explains that the most significant frequency is in the control class, namely scores 72 and 76 with a total of 4 students each, so a negative squint curve is formed, meaning that the tail of the distribution shifts towards the left side of the peak with a mean value (56.29) <median (64.00)<mode (72.00), (76.00).

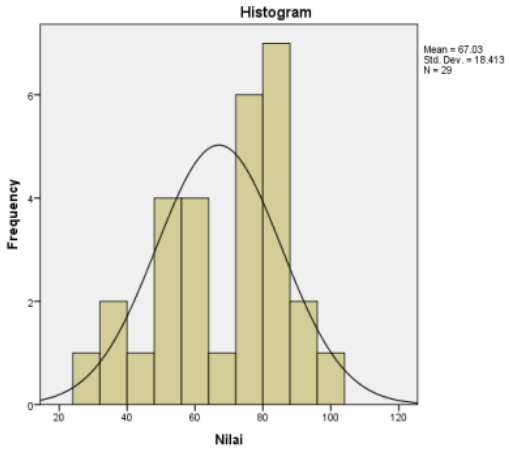

Figure 3. Histogram of Experimental Class Cognitive Ability Data

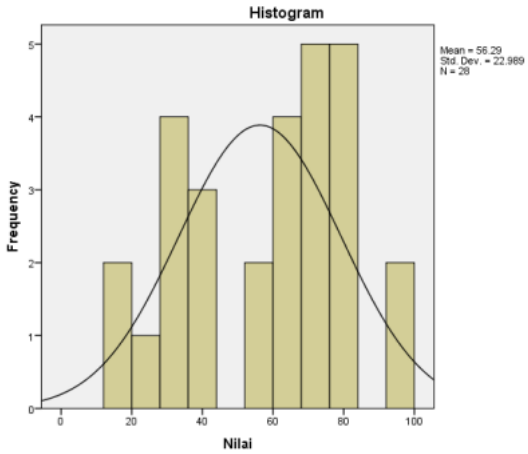

Figure 4. Histogram of Control Class Cognitive Ability Data

Analysis Prerequisite Test Results

Before carrying out the ANOVA hypothesis testing, an analysis prerequisite test is carried out to ensure that the data obtained has a regular and homogeneous distribution. The two prerequisite tests use data from students' cognitive ability test results at the end of treatment. Below are the results of this test, namely:

Normality Test of Students' Cognitive Abilities

The normality test must be achieved because the ANOVA test is basically a mean difference test, the same as the t-test, which requires data to be normally distributed (Budiyono, 2013). Test statistics use SPSS *software with the Liliefors method*. H0 $_{is}$ rejected if the significance value is < (0.05). Referring to the results of normality testing, the significance value for the experimental class (XI MIPA 5) is 0.062, and for the control class (XI MIPA 4) is 0.133, meaning both exceed Sig. (0.05), then H $_{0}$ is accepted. The conclusion obtained is that the two samples were obtained from a population with a normal distribution. Table 5 shows that all groups, both the experimental class, namely class XI MIPA 5, and the control class, namely class XI MIPA 4, are groups that have a normal distribution.

Table 5. Student Cognitive Ability Normality Test Results

Class	Sig.(α =0.05)	Conclusion
Experiment	0.062	Normal
Control	0.133	Normal

Homogeneity Test of Students' Cognitive Abilities

The homogeneity test is a prerequisite analysis test for the ANOVA test. Calculation of the homogeneity test using the Bartlett test through a significance level (α) of 5% (0.05). If the significance value is > 0.05, then the data is homogeneous, but if the significance value is < 0.05, then the data is not homogeneous. The test results for both classes are available, and they are looked at closely in Table 6.

Table 6. Cognitive Ability Homogeneity Test Results Student

Class	Sig.(α =0.05)	Conclusion
Experiment-Control	0.134	Homogeneous

Table 6 shows that both the experimental class and the control class are homogeneous. This is what is seen when the significance value is 0.134. The value exceeds 0.05, so the data is homogeneous.

Hypothesis Test Results

Two-Way Analysis of Variance (ANOVA)

The research hypothesis was tested by two-way ANOVA with unequal cell contents after the prerequisite tests were met, namely that the population had a normal distribution and was homogeneous. This test is used to examine whether there is an influence of the independent variable on the dependent variable, the impact of the moderator variable on the dependent variable, and the interaction between the independent variable and the moderator variable. The results of the average calculation and cognitive ability values are displayed in Table 7.

Table 7. Average and Total Ability Scores Student Cognitive

	Assertive Attitude (B)		
	Tall	**Low**	**Total**
Cognitive Conflict Learning Strategy (A1)	70,667	61,091	131,758
Mind Mapping Learning Strategy (A2)	64,500	45,333	109,833
Total	135,167	106,424	241,591
Average	69,818	50,667	

Based on Table 7, the average cognitive score of students treated with cognitive conflict learning strategies is higher than in classes with *mind-mapping* learning strategies.

Table 4. Summary of Two-Way ANOVA with Different Cell Contents

Sources of Variation	**F_{count}**	**F_{table} $F_{(0.05;1;53)}$**	**Sig (0.05)**	**Decision**
Cognitive Conflict and *Mind Mapping Learning Strategy* (A)	4,227	4.02	0.045	H_{0A} is rejected
Assertive Attitude (B)	7,265	4.02	0.009	H_{0B} is rejected
Interaction (AB)	0.809	4.02	0.372	H_{0AB} accepted

Referring to Table 8, the results obtained include the following:

First Hypothesis

The results of the data analysis are as follows: $F_{observation} = 4.227 > F_{table = F\ 0.05;\ 1;\ 53} = 4.02$, so H_{0A} is rejected. Thus, there are differences in the influence of learning strategies with cognitive conflict and *mind mapping* on students' cognitive learning outcomes. The critical area configuration of the ANOVA test for the first hypothesis is presented in Figure 5.

Second Hypothesis

The results of research data analysis show that $F_{observation} = 7.265 > F_{Table =} F_{0.05;1;53} = 4.02$, so H_{0B} is rejected. So, there are differences in the influence of high and low categories of assertive attitudes on students' cognitive learning outcomes. The critical area configuration for the ANOVA test for the second hypothesis is presented in Figure 6.

Third Hypothesis

The results of the research data analysis are $F_{observation} = 0.809 < F_{table} = F_{0.05;1;53 = 4.02,}$ so H_{0AB} is accepted. The conclusion is that there is no interaction effect of using learning strategies and assertive attitudes on students' cognitive learning outcomes. The critical area configuration for the ANOVA test for the third hypothesis is presented in Figure 7.

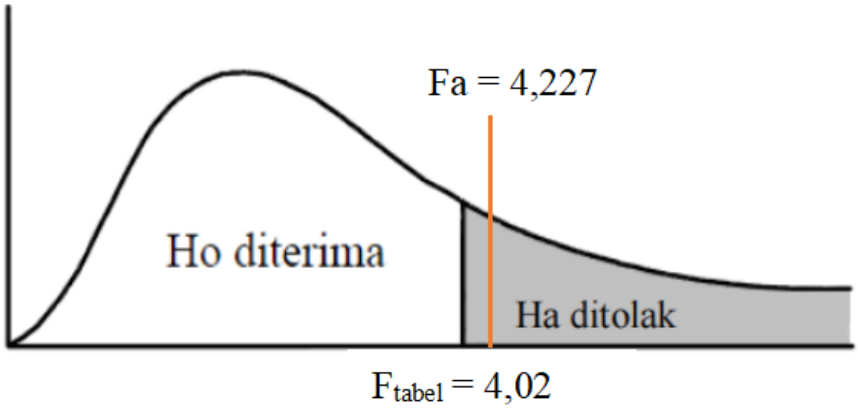

Figure 2. Critical Area Configuration First Hypothesis ANOVA Test

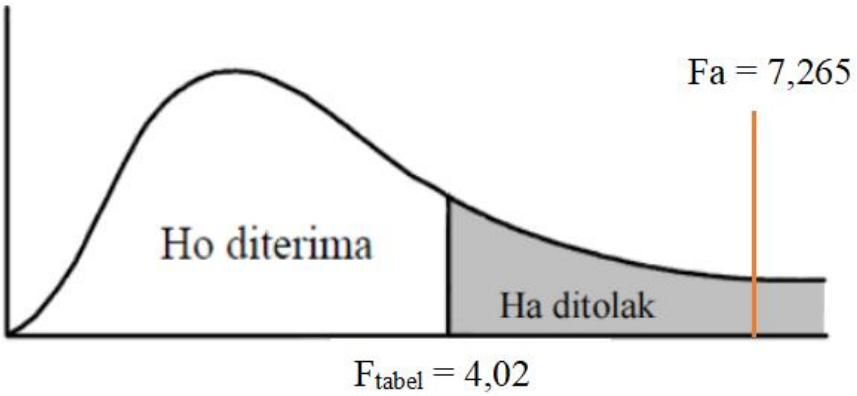

Figure 3. Critical Area Configuration Second Hypothesis ANOVA Test a

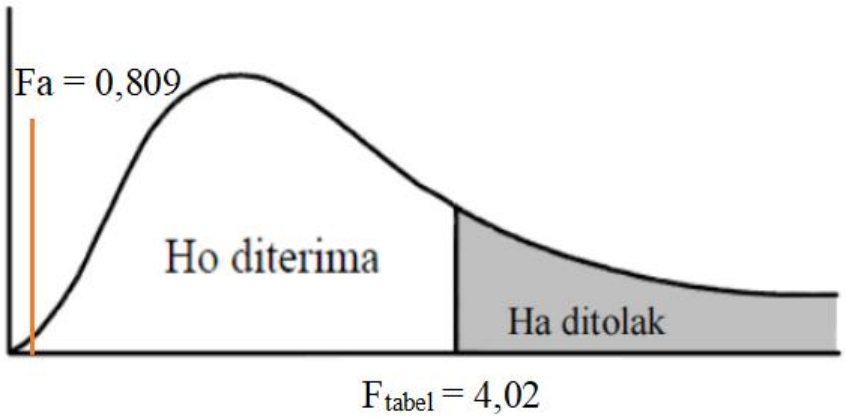

Figure 4. Critical Area Configuration Third Hypothesis ANOVA Test

Further Test Post Analysis of Variance (ANOVA)

In the first and second ANOVA tests, H0 was rejected, so a further analysis of variance test was carried out using the multiple comparison test using the Scheffe method. Referring to further tests, the results obtained include:

First Hypothesis

In the ANOVA of two different cell paths, the test decision is obtained. Namely, H0A was rejected, so a further ANOVA test was needed. If we look at the learning strategies, which consist of two types, there is no need for a mean comparison test between rows, so a better learning strategy can be determined through the marginal mean values obtained. The average of the two learning strategies can be seen in Table 9. Table 9 explains that using a cognitive conflict-based learning strategy with better results with a marginal mean of 65.879 than using a *mind mapping* learning strategy with a marginal mean of 54.917.

Table 9 . Learning Strategy Average

Comparison	Marginal Mean		Conclusion
	Xi	Xj	
X_1 vs. X_2	65,879	54,917	$X_1 > X_2$

Information:
X_1 = Cognitive Conflict Learning Strategy
X_2 = *Mind Mapping* Learning Strategy.

Second Hypothesis

In a two-way ANOVA with unequal cells, the test decision is obtained, and $H0B_{is}$ rejected, so it is necessary to carry out a double comparison test between columns.

Table 10. Multiple Comparison Test between Students' Assertive Attitude Columns

Comparison	Average		F_{test}	F_{table}	Conclusion
	Xi	Xj			
$\bar{X}_1$ vs $\bar{X}_2$	67.58	53.21	9.00	4.02	$\bar{X}_1 > \bar{X}_2$

Information:
$\overline{X_1}$ = rataan nilai siswa dengan sikap asertif tinggi
$\overline{X_2}$ = rataan nilai siswa dengan sikap asertif reokay

The results of the multiple comparison tests in Table 10 show that the test statistic is 9.00 and the F_{table} is 4.02, so $H0_{is}$ rejected. This means that there is a significant difference between the assertive attitudes of students in the high and low categories. This is consistent with the fact that students with a highly assertive attitude have better cognitive learning outcomes, with an inter-column average of 67.58 than students with a low assertive attitude, with an inter-column average of 53.21.

DISCUSSION

This research was carried out in two classes in 4 meetings, with details of 3 meetings to provide learning strategy treatment and one meeting to take cognitive learning outcome scores by carrying out daily assessments. The cognitive conflict learning strategy was applied to the experimental class, while the *mind mapping learning strategy* was applied to the control class. The material studied in both classes is the same, namely Elasticity and Hooke's Law.

At the first meeting, the sub-material of elasticity was discussed. In the experimental class, students are still adapting to the learning being applied. Many students still need clarification and feel uncomfortable with the learning process using cognitive conflict learning strategies. This is because the learning activities implemented by physics subject teachers in schools are different. At the beginning of the lesson, students saw a demonstration of rubber being pulled and then released. Then, the students were asked, " Why does a rubber band that is pulled grow longer, but when the pull is released, it returns to its original size?" Answers from students are needed to determine their initial understanding.

Next, the students will work on Student Worksheets (LKPD). In this stage, students can express their own opinions in groups to make decisions about which objects are elastic and plastic so that students' ability to classify objects correctly is visible. This aims to ensure that students get used to implementing cognitive conflict strategies in the learning process in the classroom so that they can improve their ability to solve problems based on their initial knowledge. However, in reality, group discussion activities could have been carried out better because several students did not dare to express their opinions. Apart from that, many students need clarification in answering, so some students' work results still need to be accurate. This is because students must interpret their knowledge first and then be able to digest and solve problems regarding the given elasticity sub-material.

The second meeting examined the sub-material of Hooke's law. In the second meeting, students began to be able to adapt and adapt to their learning process. Students look more enthusiastic and try to be active in class. When students are asked, "Why does a spring that is pulled down grow longer, but when the pull is released, the spring bounces until it finally returns to rest and its original size?" Several students tried to answer this question, of course, with their own understanding and knowledge. Next, students work on the Student Worksheet (LKPD).

Entering the cognitive conflict stage, each LKPD contains questions that can cause conflict or problems in students' mental abilities. Conflict is a problem that can contain misconceptions. Students will read and then understand the questions in the LKPD; then, the teacher will provide students with the opportunity to discuss the results of their previous thoughts with their respective groups. In this condition, students begin to adapt to a learning process based on cognitive conflict strategies. Students are invited to conduct virtual experiments about springs using PHeT Colorado. Then, look for the relationship between the three existing variables.

Students are accustomed to working in groups and respecting their friends' opinions, and some students dare to express their views to share knowledge, even though the opinions expressed by some are not entirely correct. Each group is able to convey the results of their thoughts, which are used to solve problems in the LKPD presented by the teacher. Teachers also provide facilities for groups that have difficulties. From the second meeting, students discovered the relationship between force (F), spring constant (k), and the increase in spring length (Δx).

The third meeting discussed the arrangement of parallel series springs. The teacher shows a video about pulling two springs arranged in series and then releasing them. The teacher then asks students to pay attention to what happens to the springs. This is repeated with two springs arranged in parallel to explain the concept of series and parallel spring circuits. Next, students work on the LKPD and then discuss it with their groups. At this meeting, students could express their opinions accurately by using their knowledge related to the material.

After the discussion with the group, the teacher next asks one of the groups to explain the discussion results. In this stage, students are given the freedom to exchange ideas and opinions with other groups to resolve conflict issues. If a group has a different opinion, that group will present their opinion and the reasons. Next, together with the other groups, they discussed the results of the group's solution. At the end of the activity, the teacher will review the results of the group discussion, convey conclusions about the correct answers, and provide material reinforcement so that there is a clear understanding among students. Learning activities end with homework (PR) to increase students' knowledge.

Meanwhile, learning in the control class applies *mind-mapping learning strategies*. At the first meeting of the learning process in the control class, students were also stimulated with questions like in the experimental class. After that, the teacher delivered elasticity sub-material through lectures and demonstrations. Once finished, students are then given LKPD and work in groups to create *a mind map* or concept map from the material that has been presented. Making concept maps can be sourced from books, the internet, or other teaching materials. After the process of making the mind *map* is complete, the teacher then asks several groups to present the results of *the mind map* that has been completed. Students discuss and exchange opinions regarding the results of each group's discussion. At the end of the lesson, the teacher and students reflect on the results of their discussion and then conclude on the concept of material elasticity regarding elastic and non-elastic objects. The learning process at the second and third meetings was similar to the first.

Students in the control class tend to be passive in learning because they only listen and note down the teacher's explanation, so students need help understanding the material. This can be observed when students create concept maps. Students experience difficulties in compiling a summary of the material that will be used as *a mind map*, but students remain silent and do not dare to express the problems they are experiencing to the teacher. Some students actively ask questions, but the percentage is still tiny. Judging from the results of each group's discussion, several groups needed to be more fitting in creating the concept map structure. Errors occur in inappropriate preparation of material. However, in several other groups, the concept maps created were in accordance with the material concept. The appearance of the concept map created is also perfect and easy to understand. The following data analysis results include:

First Hypothesis

The results of the two-way ANOVA test with unequal cell contents show $_{\text{calculated F = 4.227}} > F_{\text{table}} = F_{0.05;1;53} = 4.02$ and *Sig.* $0.045 < 0.05$ so $H0_{\text{is}}$ rejected. The results show differences in the influence of using cognitive conflict learning strategies *and mind mapping* learning strategies on the cognitive learning outcomes of class.

Referring to the further ANOVA test, using the cognitive conflict learning strategy, with an average score of 65.879, shows that cognitive learning results are better than the *mind mapping learning strategy,* which gets an average score of 54.917. This is because in learning through cognitive conflict learning strategies, students are given problems that are at odds with their previous knowledge. Applying *the mind-mapping* learning strategy could have given better results because students only made *mind maps* of the material without carrying out direct experiments involving students. Apart from that, only some students understand the material well so that the results could be better. In addition, during the COVID-19 pandemic, online learning hours were reduced compared to usual, so implementing *mind-mapping learning strategies* could have been more optimal.

The findings align with Suryadi's research (2019), which shows that cognitive conflict strategies can improve science learning outcomes for class VIII students at SMP Negeri 6 Labakkang. Supported by Masyuni's research (2019), the implementation of experimental-based cognitive conflict learning has a positive influence on cognitive learning outcomes and has significant qualifications with the average critical thinking ability of students as well as students' mastery of concepts.

Second Hypothesis

The results of the two-way ANOVA test with different cell contents showed that $F_{count = 7.265} > F_{table} = F_{0.05;\ 1;\ 53} = 4.02$, and the significance level is. $0.009 < 0.05$ so $H0_{is}$ rejected. The conclusion obtained is that there is an influence between the assertive attitude of students in the high and low categories on the cognitive learning outcomes of class. The average cognitive learning outcome of students with an assertive attitude in the high category is 67.583, while an assertive attitude in the low category is 53.212.

The research results are in line with Sofian (2020), namely that student assertiveness has a positive or significant influence on the mathematics learning achievement of class IX students at Salahuddin Middle School, Malang. The higher the student's assertiveness, the higher their learning achievement. In line with Meli (2019), the results of assertive behavior positively and significantly influence the learning outcomes of class XI IPS students at SMA Negeri 7 Balikpapan in Economics lessons.

Third Hypothesis

The two-way ANOVA test analysis results with unequal cell contents were $F_{calculated} = 0.809 < F_{table} = F_{0.05;1;53} = 4.02$. The significance value is $0.372 > 0.05$, so H_{0AB} is accepted. In conclusion, there is no interaction effect between the use of learning strategies and students' assertive attitudes on the cognitive learning outcomes of class.

The use of learning strategies and students' assertive attitudes each have their own influence on students' cognitive learning outcomes. This is because the cognitive conflict learning strategy and *mind mapping* have something in common. Namely, they use a scientific approach and a *discovery learning model*. No interaction was found between learning strategies and students' assertive attitudes because online learning cannot guarantee that students with highly assertive attitudes and learning strategies will get better learning outcomes and vice versa.

Choosing the right learning strategy can provide optimal results for students' cognitive learning outcomes. An assertive attitude has an impact on students' cognitive abilities. The higher the student's forceful attitude, the higher the student's cognitive learning outcomes, and vice versa; the lower the level of assertive attitude, the lower the student's cognitive learning outcomes.

Another contributing factor is that teachers cannot supervise students directly in online learning like offline learning. Other independent variables that are not used, such as students' interest in a subject, students' level of understanding, students' learning styles, and students' conditions during learning, also have an influence. Fathulloh (2017) explains the importance of the teacher's role when designing learning.

CONCLUSION

Conclusions obtained from the research include 1) there are differences in the influence of the use of cognitive conflict learning strategies and *mind mapping using* $_a$ scientific approach on the cognitive learning outcomes of class $4.227 > F_{table} = F_{0.05;1;53} = 4.02$); 2) there is a difference in the influence of

the assertive attitude of students in the high and low categories on the cognitive learning outcomes of class $_{1;53}$ = 4.02); and 3) there is no interaction effect of the use of learning strategies with an assertive attitude on the cognitive learning outcomes of class$_{;1;53}$ = 4.02).

Recommendations that can be given include further research that can examine the influence of the learning process with cognitive conflict learning strategies on students' cognitive learning outcomes and other aspects. Apart from that, it can also be developed into other physics material that suits the learning strategy used. It is necessary to carefully pay attention and prepare for the implementation of learning, such as the availability of facilities and infrastructure in the form of laptops/ *cellphones*, internet quota, adequate signal, class management, time allocation, and the condition of the students themselves so that the learning can run well..

REFERENCES

Aji, RHS (2020). The impact of COVID-19 on education in Indonesia. *Syar-i Social & Cultural Journal*, *7*(5), 395-402.

Budiyono. (2013). *Statistics for Research.* Surakarta: UNS Press.

Fatimah, N., Gunawan, G., & Wahyudi, W. (2016). Problem-based learning with cognitive conflict strategies on concept mastery and critical thinking abilities in physics for class XI I students at SMKN 1 Lingsar for the 2015/2016 academic year. *Journal of Physics and Technology Education*, *2*(4), 1 8 4-189.

Fhathulloh, MR, Yusup, M., & Nurhayati. (2017). Teacher implementation in designing the PAI learning process. *Atthulab, 2*(2), 133-140.

Hidayati, FN, Akhsan, H., & Syuhendi. (2016). Identifying misconceptions of class X students regarding elasticity and Hooke's law at SMA Negeri 1 Indralaya. *Journal of Physics Innovation and Learning*, *3*(2), 1-9.

Khasanah, N. (2010). Using a cognitive conflict approach to remediate misconceptions about learning about elasticity and Hooke's law (case study at MAN 1 Madiun in class XII Science, first semester of the 2008/2009 academic year). *Thesis, Postgraduate at Sebelas Maret University.*

Master. (2017). Implementation of the 2013 curriculum in implementing learning in junior high schools. *Journal of Educational Technology Innovation*, *4*(1), 50-64.

Masyuni, S., & Asyhari, A. (2019). Implement a cognitive conflict approach based on experimental methods to master concepts and critical thinking skills. *Indonesian Journal of Science and Mathematics Education*, *2*(2), 184-193.

Meli, H., Aini, TAN, & Yuliani, T. (2019). The influence of assertive and confident behavior on students' economic learning outcomes. *Balikpapan University Competency*, *12*(1), 63-74.

Indonesian Minister of Education and Culture. (2014). Regulation of the Minister of Education and Culture of the Republic of Indonesia number 69 of 2013 concerning the basic framework and structure of the High School/Madrasah Aliyah curriculum.

Indonesian Minister of Education and Culture. (2020). Circular number 4 of 2020 concerning implementing education policies during the emergency period for the spread of *coronavirus disease* (COVID-19).

Potts, P. (2013). *Assertiveness: how to be strong in every situation.* United Kingdom: Capstone Publishing.

Sari, DR (2017). The influence of cognitive conflict learning strategies on student learning outcomes on the excretion system concept. *Thesis, UIN Syarif Hidayatullah.*

Sugiyono. (2019). *Quantitative, qualitative, and R&D research methods.* Bandung: Alphabeta.

Sofian, H. (2020). The influence of student assertiveness and perceptions of mathematics on the mathematics learning achievement of class IX students at SMP Salahuddin Malang. *Paradigm: Journal of Philosophy, Science, Technology and Socio-Culture*, *26*(1), 60-70.

Supliyadi, S. (2017). Application of cognitive conflict strategies in dynamic electrical learning. *JP3 (Journal of Education and the Educator Profession)*, *3*(1), 18-27.

Suryadi, A. (2019). Increasing science learning outcomes through the use of cognitive conflict learning strategies. *Journal of Physics Education*, *7*(2), 97-102.

Wiradana, IWG (2012). The influence of cognitive conflict strategies and critical thinking on IPA learning achievement class V II SMP Negeri 1 Nusa Penida. *Indonesian Journal of Science Education and Learning*, *2*(2), 1-19.

Zulkarnain , I. (2011). *I am increasing relational understanding through cognitive conflict strategies.* Banjarmasin: FKIP U of Lambung Mangkurat University.