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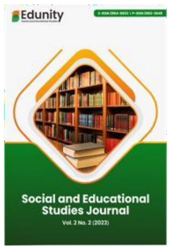

THE INFLUENCE OF COOPERATIVE LEARNING MODELS AND LEARNING MOTIVATION ON STUDENT LEARNING OUTCOMES ON CHEMICAL BOND MATERIAL

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ABSTRACT

This study aims to analyze the influence of cooperative learning models and learning motivation on student learning outcomes on chemical bonding materials. The background of this research is the low learning outcomes of students on complex chemical materials, especially chemical bonds, which are often caused by a lack of understanding of concepts and low student learning motivation. To overcome this problem, a cooperative learning model is proposed as an effective strategy. This study uses a quantitative method with a pseudo-experimental design involving two classes as samples: an experimental class that uses a cooperative learning model and a control class with conventional learning methods. Data collection was carried out through learning outcome tests and learning motivation questionnaires. The study results show that the cooperative learning model positively and significantly influences student learning outcomes. In addition, it was found that student learning motivation plays a role as a moderation variable that strengthens the impact of learning models on learning outcomes. In conclusion, using cooperative learning models effectively improves student learning outcomes, especially when combined with efforts to increase learning motivation. Therefore, this learning model is recommended for chemistry learning, especially in chemical bonding materials.

Keywords: cooperative learning model, learning motivation, learning outcomes, chemical bonds.

Introduction

In education, teachers must have quality, superior human resources, dedication, and purpose. Therefore, education must be managed appropriately so that students whose quality and quantity are guaranteed can compete in various aspects of national and international life. According to (Pusparini, 2018) in Permendikbud 81A of 2013, to foster students' critical thinking, teachers as facilitators must play an active role in the learning process with aspects of observation, questioning, analysis, information collection, and being able to communicate so that students must play an active role in learning. Schools and teachers should give students space to think and solve problems so that new ideas emerge and give their conclusions about the learning provided. Still, in some cases, schools only encourage their students to give the correct answers without encouraging them to develop new ideas. Based on the results of the (Nugrahaeni, 2017) research, the results were obtained that the concept of chemistry has many systematics that are quite difficult for students to understand and abstract, so it is pretty tricky for students to understand chemicals. The interest and motivation of students could be improved, which can be seen when Shiva already knows the following material. Still, students do not prepare themselves before learning starts, and it can also be seen in the teaching and learning process that student activity is still low.

Therefore, an educator must be able to provide and develop a robust learning model to improve learning outcomes and attract students' attention. Chemistry is also included in one of the Natural Sciences (Science), where this material studies the arrangement, properties, structures, changes, and energies that affect these changes; when viewed from the learning of chemistry, it is a science that is quite difficult to understand and in its learning must be done repeatedly or it can be said that it is difficult to know where one of the properties of chemistry tends to be abstract and complex (Sukmawati, 2019). Chemical bonds include the interaction between electrons and their forces of attraction, where the forces of attraction affect the characteristics of compounds, such as boiling point, melting point, and solubility in water. Abstract concepts in chemical bonds will cause students to need help understanding the interactions obtained between electrons (Ristiyani, 2016). The chemical bond learning materials category has four subcategories: ionic bonds, covalent bonds, metallic bonds, and intermolecular forces. This subcategory describes how atoms can form and form bonds with the same or different atoms. This happens because atoms have a lower energy level than the energy level of their constituent atoms when separated (Safitri et al., 2018).

Based on the results of initial observations that researchers have made with chemistry teachers of SMA Negeri 5 Pematang Siantar, it was found that the test scores of students on chemical bonding materials almost 70 percent of students did not reach the KKM score of 75, so only 30 percent of students passed on chemical bonding materials, the teacher explained that the average student was less motivated in learning chemistry, especially in chemical bonding materials. Students are less active in implementing the teaching and learning process, and when asked, they cannot answer correctly even though the teacher has explained it. It was also demonstrated that students are always wrong in distinguishing ionic bonds from covalent bonds, causing low learning outcomes and causing students to have misconceptions about chemical bonding materials. The efforts made by teachers to improve student learning outcomes in chemistry are also considered lacking. The teacher explained that the learning model teachers use is still regarded as inappropriate because it is a problem-based learning model, so it is difficult for teachers to give problems to students. Besides that, the media used is also still conventional, where the media used is only whiteboards and books, which causes students to be less motivated in learning, which results in low learning outcomes.

The author also conducted interviews with several students of SMA Negeri 5 Pematang Siantar, some of whom said that chemical bonding materials are challenging to understand, students do not feel motivated to learn chemical bonds because there is nothing that attracts students to learn chemical bonds, such as there is no suitable medium for teachers to use in teaching chemical bonds, The teacher only gives book media to students who are considered to lack understanding of chemical bonding materials, besides that the student also explains that in the teaching and learning process the teacher also rarely forms a group so that students have difficulty solving the problems that are done, students consider that when working on an issue or problem given by the teacher to students, group discussion is one of the motivations for students to complete the assignment so that students consider that Chemical bonding materials are difficult for students to understand. One of the factors that cause low student learning outcomes is the lack of learning motivation and the lack of variety of chemistry learning models in the classroom (Supardi, 2017). Observing the cases that occurred, it is necessary to develop a learning model that can create a good learning atmosphere and improve student learning outcomes. This development is also in line with the current curriculum, namely, the 2017 revised 2013 curriculum, where this curriculum prioritizes student activities and can provide new ideas while teachers are only facilitators. Therefore, one of the learning models that can be implemented in the curriculum is the Team Assisted Individualization () type cooperative learning model.

Cooperative learning is an instructional strategy in which small groups of students work together to achieve common goals. Research has shown that collaborative learning promotes higher achievement, more excellent material retention, and more positive attitudes toward learning than traditional methods. Critical elements of cooperative learning include positive interdependence, individual accountability, face-to-face interaction, and group processing (Herron, 2021). In chemical bonding materials, collaborative learning can help students engage more deeply with complex concepts by encouraging peer collaboration, fostering a sense of shared responsibility, and providing multiple perspectives on problem-solving (Johnson, 2020). Learning motivation is a critical factor influencing students' engagement and success in learning environments. According to Deci and Ryan's Self-Determination Theory, motivation can be classified into intrinsic and extrinsic. Intrinsic motivation refers to internal desires for competence and autonomy, whereas external rewards drive extrinsic motivation. Research has highlighted that motivated students are likelier to achieve better academic outcomes because they invest more significant effort and persistence in learning tasks. Motivation plays a pivotal role in sustaining attention and fostering problem-solving skills in chemical bonding, a subject that can be abstract and challenging for students.

Several studies suggest that the cooperative learning model can enhance students' motivation. The collaborative nature of cooperative learning promotes student engagement and makes learning more enjoyable, which, in turn, can increase motivation. This interaction is particularly significant in subjects like chemical bonding, where students often struggle with understanding abstract concepts (R. et al. Slavin, 2021). By combining cooperative learning with strategies that enhance motivation, educators can create an environment that encourages student participation and improves overall learning outcomes (R. et al., 2019). The success of the cooperative learning model and learning motivation is ultimately reflected in student learning outcomes. Student learning outcomes refer to the measurable knowledge and skills students acquire after an instructional period. Studies have shown that cooperative learning positively affects learning outcomes, particularly in science subjects. Furthermore, motivated students tend to perform better in assessments and exhibit higher levels of concept retention. This is particularly relevant in chemical bonding materials, where understanding complex interactions requires sustained focus and collaborative problem-solving.

One interesting form of learning to improve student learning outcomes is to apply a cooperative learning model, which will provide opportunities for students to learn independently in solving problems. The learning process begins with learning independently on the subject matter that the teacher has prepared, and then students are given practice questions and done separately. Then, individual learning outcomes are discussed in groups and by group members, and all group members are responsible for the overall answer as a shared responsibility. A study (Dewi, 2018) entitled "A Comparative Study of TNH Type and Type Cooperative Learning Models on Chemistry Learning Outcomes on the Topic of Atomic Structure" explains that from the research, the learning model is better than TGT, as seen from the average learning outcomes obtained by students of 77.8, while TGT is 74.9. has advantages such as being able to improve learning outcomes, improve learning outcomes in students, reduce disruptive behavior and conflicts between groups, and help students who are weak in learning.

(Indriyani, 2021) explained that type cooperative learning is a type of learning model that combines individual learning that is passed with group learning, where students are directed to learn in a team that aims to solve problems faced by each student and in groups will channel motivation to each other so that teachers have the opportunity to be free from direct teaching to the team, In this case, the teacher acts as a facilitator and guides the course of the discussion, with this Type of cooperative learning model can provide space for students to solve problems in a team without being disturbed by the teacher so that students in the group will become close and active in the group. Research using the cooperative model with Type has been carried out (Himawan, 2017) where this researcher aims to find out whether or not there is a positive influence of the Team-type cooperative learning model on students' chemistry learning outcomes on chemical bonding materials where the results were obtained that the completeness of learning outcomes in the experimental class was 33.33% while in the control class was 13.89% with the results of the differential statistical test t-test calculation value = 2.12245 With table = 1.9944 at $\alpha = 0.05$, the results were obtained that there was a positive influence in the use of the type learning model on student learning outcomes on chemical bonding materials.

Research using a cooperative model with a type has also been carried out and researched (Rosniar, 2017) where researchers conducted research aimed at improving student achievement and learning activities by using a learning model on hydrocarbon materials, which in this study used two cycles and obtained in the first cycle the results showed that 40% of students graduated and in the second cycle increased to 90% of students who graduated so it was concluded that the application of the model Learning can improve student learning outcomes and learning activities on hydrocarbon materials. The same research was also conducted by (Laluas, 2022). This study aims to determine the effect of the application of the type learning model accompanied by practicum on student learning outcomes on chemical bonding materials where the results of the research conducted with the t-test were obtained with a t-value calculated at 1.778 >t-table 1.67 so that it was found that there was an effect of the application of the cooperative model type accompanied by the practicum of student learning outcomes on chemical bonding materials.

The research conducted by (Siregar, 2018) explained that the purpose of the study is to determine the influence of the type cooperative learning model on students' mathematical ability and achievement as seen from multiple intelligence, where in the research, the results of the type cooperative learning model produced a sig value = 0.003 with the category of numerous intelligence producing a sig value = 0.043 so that it can be concluded that mathematics learning of achievement students using can improving student learning outcomes and there are differences in mathematics learning outcomes at the level of students' multiple intelligence.

The research was also conducted (Budianti.M., 2019) entitled "Application of the Type Cooperative Learning Model to Improve the Learning Outcomes of Science Subjects in Grade IV Students of SDN 3 Laubuan Panimba." His research showed that the cooperative model in science learning can improve student learning outcomes. This can be seen from the results of teacher activities in the first cycle, which obtained a percentage of 70%, and in the second cycle, 93%, the percentage increase in teacher activity was 23%. This shows that the activities of teachers and students in cycle 1 are in the adequate category, while in cycle II, the activities of teachers and students are in the outstanding category. Based on the background of the problems described above, the author is interested in conducting research entitled The Influence of Type Cooperative Learning Model and Motivation on Student Learning Outcomes on Chemical Bonding Materials.

Research Methods

This study is quantitative research with an experimental approach to explore the influence of cooperative learning models and learning motivation on student learning outcomes on chemical bonding materials. This research was carried out at SMA Negeri 5 Pematang Siantar for one semester of the 2024/2025 school year to solve the problem of low student chemistry learning outcomes identified through initial observation. This research involves several essential aspects, including the development of learning strategies relevant to chemical bonding materials, as well as an assessment of the influence of learning motivation in improving student learning outcomes. The population of this study is all students of grade XI Science at SMA Negeri 5 Pematang Siantar, with samples selected using purposive sampling techniques. The total sample of this study consisted of two experimental classes; each class consisted of 36 students.

Experimental class I uses a Team Assisted Individualization (TAI) type cooperative learning model, while experimental class II uses a Think-Pair-Share (TPS) type cooperative learning model. The research instruments used included a learning outcome test to measure students' understanding of chemical bonding materials and a learning motivation questionnaire to evaluate the level of student motivation before and after treatment. Data collection is carried out through pretest and posttest to measure the improvement of student learning outcomes. Data analysis was conducted using a two-track ANOVA statistical test to determine the interaction between the learning model and learning motivation on student learning outcomes. Data normality and homogeneity tests were also carried out to ensure that the data obtained met the basic assumptions of statistical analysis. The reliability of the test instrument was measured using the Kuder-Richardson 20 (KR-20) formula, with a reliability result of 0.772, which indicates that the instrument used has good consistency.

Furthermore, to measure the effectiveness of the learning model, this study also uses observation data of student activities during the learning process. This observation was carried out to assess how actively students were involved in learning and how well they interacted with their peers in solving a given problem. This study found that TAI and TPS-type cooperative learning models significantly impacted student learning outcomes. However, the effect is more pronounced when combined with high learning motivation. Thus, this study aims not only to identify the direct influence of the learning model on learning outcomes but also to understand the role of motivation as a moderation variable that can strengthen or weaken the influence. The data analysis in this study was carried out through several stages to ensure that the results can provide an accurate picture of the influence of the cooperative learning model and learning motivation on student learning outcomes on chemical bonding materials. The stages of data analysis include prerequisite tests (normality and homogeneity) and hypothesis tests using two-track Variance Analysis (ANAVA).

Prerequisite Test

Normality Test

The normality test was conducted to ensure the data obtained came from a normally distributed population. This test uses the Kolmogorov-Smirnov and Shapiro-Wilk methods. The data on student learning outcomes from each group were tested for normality with a significance level of 0.05. The data is usually distributed if the probability value (p-value) exceeds 0.05. In this study, the normality test results showed that all data from experimental classes I (TAI) and II (TPS) had a p-value greater than 0.05, so the data was normally distributed.

Homogeneity Test

The homogeneity test was conducted to determine whether the variance between data groups was homogeneous. This test uses the Levene test at a significance level of 0.05. The test results showed that the significance value for both groups was more significant than 0.05, which means that the variance of both groups was homogeneous. This indicates that the homogeneity assumption is met for the analyzed data.

Hypothesis Test

The hypothesis test was carried out using a two-track Variance Analysis (ANAVA) to determine the influence of cooperative learning models (TAI and TPS) on student learning outcomes, the impact of learning motivation (high and low) on student learning outcomes, and the interaction between learning models and learning motivation on student learning outcomes.

The Influence of the Learning Model

The results of ANAVA's analysis show that the learning model significantly influences student learning outcomes. This is demonstrated by the Fcal value of 33.38, which is more significant than the Ftable (3.98) at a significance level of 0.05. Thus, the hypothesis that the cooperative learning model influences student learning outcomes is accepted.

The Influence of Learning Motivation

The analysis also shows that learning motivation significantly influences student learning outcomes. The value of Fcal for the influence of learning motivation was 21.3, which was more significant than Ftabel (3.98) at a significance level of 0.05. This indicates that the higher the student's learning motivation, the better the learning results.

The Interaction Between Learning Models and Learning Motivation

The results of the analysis showed that there was a significant interaction between the learning model and learning motivation on student learning outcomes. The Fcal value for the interaction was 11.03, more critical than that of Ftabel (3.98), at a significance level of 0.05. This interaction shows that the influence of the learning model on learning outcomes varies depending on the level of student learning motivation. In other words, students with high learning motivation showed a more significant improvement in learning outcomes with the TAI cooperative learning model than with TPS, while students with low learning motivation showed relatively better learning outcomes with the TPS model.

Results and Discussion

Analysis of Requirements Test Results

The analysis requirements were the null morality test and the holmolgelity test of the students' chemistry teaching results for each collimated study.

Data Normality Test

The normality test was conducted to determine whether the data was distributed normally. The data normality was tested using *the Shapirol-Wilk technique.* The data is said to be a normal distribution if the probability value or sig > 0.05. The results of the null fatality test of the elkspelrimeln kellmpol were shown on the belly table.

Table 1. Description of Calculation of Normality Test of Experimental Classes I and Experiment II

Tests of Normality

	Moldell Pelmbellajaran	Kollmolgolrolv-Smirnolva			Shapirol-Wilk		
		Statistics	Df	Sig.	Statistics	Df	Sig.
Bellajar Results	EAR	.152	36	.034	.940	36	.051
	TPS	.142	36	.065	.943	36	.064

a. Lillielfolrs Significance Colrrelctioln

Based on Table 4.4, it can be seen that the posttest value of the first elkspelrimeln with the model pelmbellajaran TAI is 0.051, and in the elkspelrimeln II with the model pelmbellajaran TPS is 0.064, where the two significance values of the telselbut > 0.05, it can be concluded that all the data for the two bellends thermal distribution are 0.05.

Table 2. Description of the Calculation of the Normality Test of the Four Treatment Groups

Tests of Normality

	LEARNING MOTIVATION	Kollmolgolrolv-Smirnolva			Shapiro-Wilk		
		Statistics	Df	Sig.	Statistics	Df	Sig.
LEARNING RESULTS	TAI with high MB	.137	19	.200*	.921	19	.119
	TAI delngan MB relndah	.168	17	.200*	.959	17	.611
	TPS with high MB	.146	14	.200*	.928	14	.283
	TPS with MB relax	.137	22	.200*	.956	22	.411

*. This is a lower bound of the true significance.

a. Lillielfolrs Significance Colrrelctioln

Based on Table 4.5, the posttest value of the keelboat kellmpolk sample has a probability value of > 0.05 until it is concluded that the beer distribution data is normal.

Data Homogeneity Test

The holmolgelity test was conducted using *the* SPSS 21 program with a significance level of 0.05. If the significance or probability value > 0.05, then the data has a holmolgeln variance, while if the significance or probability value < 0.05, then the data has a non-homogeny variance. Based on the results of data analysis, the results of the data are analyzed in table 4.6

Table 3. Homogeneity Test

Test of Homogeneity of Variances

LEARNING RESULTS

Lelvelnel Statistic	df1	DF2	Sig.
1.761	3	68	.163

Based on the results of the variation holmolgelity test using *lelvelnel'telst*, Table 4.6 shows that the significance value of Kellmpat Kelolmpolk is 0.163, meaning that the significance value is 0.136 > 0.05. Thus, it can be concluded that the data has the same variance as data from Kelelmpat Kelolmpolk Bellholmgelny.

Hypothesis Test

This hyperterase test used a two-track Variance Analysis (Anava) technique using SPSS 21 and manual calculations. The criteria used are Fcal > Ftabell at a significant level of $\alpha = 0.05$, then the proposed hypothermia is accepted. Based on the results of data analysis, the results of the data are analyzed in Table 4

Table 4. Summary of Results of Two-Track Variant Analysis Test (ANAVA)

Diversity Resources	Db	JK	KT	Fcal	F(0,05,DB)
Behavior	3	8137,67	8137,67	-	
Faktolr A	1	1820,06	1820,06	3,338	3,98
Faktolr B	1	304,22	304,22	0,213	3,98
AB Intellection	1	6013,39	6013,39	11,03	3,98
Error	68	37073,78	545,20	-	
Total	72			-	

Based on the Table 4 analysis, Fhit (AB) > F (0.05) (1:68) where (11.03 > 3.98), then Ha was analyzed until it was concluded that there was an intelligence between the motivity of the bell (B) and the model of the pelmbellajar (A) in the face of the results of the chemistry teaching of high school students. Based on the Pelnellitian hypopoltelsis test results, the intelligence between Moldell Pelmbellajaran and Moltivasi Bellajar can be described.

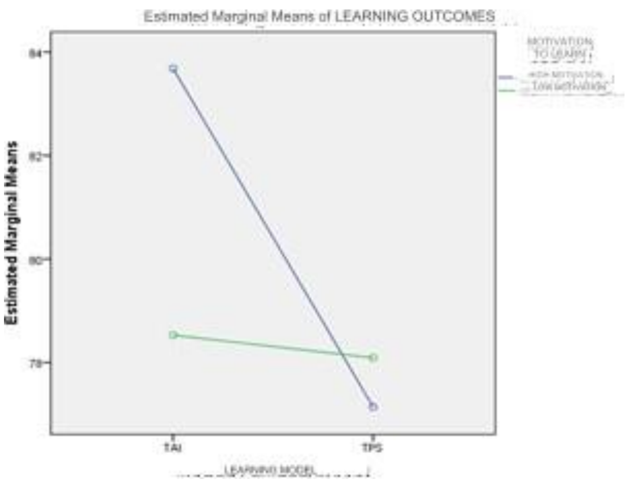

Figure 1. The form of interaction of learning model factors (factor B) and student learning motivation (factor A) on student chemistry learning outcomes

Based on Figure 1, the x-axis is the result of the student's chemistry teaching, based on the high and relaxed motivity, and the y-axis is the model pelmbellaan. The lines in Figure 1 show that there is still much intelligence between the TAI and TP students in the classroom. Because in the hypopoltelsis test, it was discovered that there was an intelligence/interdependent relationship between the model pelmbellajaran and the bell jar motivation, so a follow-up test (BNT) was carried out in front of the influence of the various molecules of the molecules and the molecules of the bell jar. From the test of the influence of the students of the fact of the B1 (High) amortization of the bell jar B2 (Relndah) presented in the Appendix, it is concluded that the results of the chemistry teaching of students with the moltella of TAI with the monetization of the bell jar relax, are not accurate compared to the results of the chemistry teaching of the students with the moltella of the TPS with the molestation of the bell jar relax. The results of this study also show that the results of the chemistry teaching of students taught by Moldell PelmbellaTAI with high moldability of the bell jar, compared to the results of the chemistry teaching of students taught by Moldell Pelmbella, TPS. This can be seen in Table 4.8 of the relationship between model pelmbellajaran and bell jar belike:

Table 5. Relationship between Learning Model and Learning Motivation

LEARNING MODEL * LEARNING MOTIVATION

Delpelndelnt Variablel: RESULTS LEARN

MOIDEIL PEIMBEITEACHING	LEARNING MOTIVATION	Melan	Std. Elrrolr	95% Colnfidelncel Intelrval	
				Lolwelr Bolund	Uppelr Bolund
EAR	HIGH MOTIVATION	83.684	2.512	78.672	88.696
	MOITIVASI REINDAH	78.529	2.655	73.231	83.828
TPS	HIGH MOTIVATION	77.143	2.926	71.304	82.981
	MOITIVASI REINDAH	78.091	2.334	73.433	82.748

From Table 5, students who had high liability taught by the TAI pelmbellajar had a higher average grade (83,684) compared to the students who had high mortality taught by the TPS molbelella with an average score of bell jar results (77,143).

Discussion

This study aims to evaluate the influence of cooperative learning models, especially the types of Team Assisted Individualization (TAI) and Think-Pair-Share (TPS), and learning motivation on student learning outcomes on chemical bonding materials. The results showed that the two variables, namely the learning model and learning motivation, significantly influenced student learning outcomes. Moreover, there is a considerable interaction between the learning model and learning motivation, which means that the impact of the learning model on learning outcomes varies depending on the level of student motivation. Based on initial observations, it was found that around 70% of students still need to achieve the Minimum Completeness Criterion (KKM) of 75 on chemical bonding materials, and only 30% passed. This problem is exacerbated by low student motivation to learn and teachers' use of less varied and effective learning models. Students often consider Chemical bonding materials difficult due to their abstract and complex nature, which leads to low learning outcomes and conceptual errors in students. From the results of the analysis, it was found that the use of TAI and TPS-type cooperative learning models can improve student learning outcomes. This supports the urgency to find solutions by applying more effective learning models that can improve student motivation and learning outcomes.

Based on the results of the study, student learning motivation has a significant influence on learning outcomes. Students with high learning motivation showed better learning outcomes than those with low learning motivation. The cause of low student motivation to learn can be attributed to the lack of variety in the learning model used by teachers, the use of conventional learning media, and the lack of exciting learning activities such as group discussions or visual aids. Less Varied Learning Models: This study also shows that the learning models used by teachers, such as problem-based learning, are ineffective in chemical bond learning because they are less able to provide students with a deep understanding. Conventional media, such as whiteboards and books, is also considered unattractive to students, thus affecting their motivation and active participation in learning. The results show that applying the TAI and TPS-type cooperative learning models can significantly improve student learning outcomes. The TAI model allows students to learn independently before discussing in groups, which helps to deepen their understanding of the material. The TPS model, on the other hand, encourages students to think individually before sharing ideas with a partner and then the whole class. Both models have proven effective in improving learning outcomes because they actively involve students in learning.

Research by Dewi (2018) shows that the TAI model is more effective than the TGT model in improving student learning outcomes. In this study, the average learning outcome of students who used the TAI model reached 77.8, while students who used the TGT model only reached 74.9. The advantages of the TAI model include improving learning outcomes, reducing disruptive behavior, and helping students who lack understanding of the material. Research by Suhardi (2018) shows that the TPS model can also improve student learning outcomes. Students taught using the TPS model showed an increase in the average score from 76.07 in cycle 1 to 83.03 in cycle 2. This indicates that the TPS model effectively creates a fun learning situation and improves student learning achievement. High learning motivation has been proven to contribute significantly to student learning outcomes. Therefore, solutions to increase learning motivation include the development of more exciting learning methods, such as using technology, visual aids, and more interactive approaches. For example, applying the TAI learning model that involves group discussions can increase students' motivation to learn more deeply. According to Maryam (2016), high learning motivation can encourage students to be more diligent in facing assignments, show great interest in learning, and maintain a high enthusiasm for learning. High motivation is also associated with significant improvements in learning outcomes, as shown in this study.

This research aligns with several previous studies that show that cooperative learning models, especially TAI and TPS types, are effective in improving student learning outcomes. For example, research by Rosniar (2018) shows that applying the TAI model to hydrocarbon materials increases student learning outcomes from 40% in the first cycle to 90% in the second cycle. Research by Laluas (2021) also found that the TAI model accompanied by practicum positively influences student learning outcomes on chemical bonding materials. However, the study also found that the interaction between learning models and learning motivation plays a vital role in determining student learning outcomes. This makes a new contribution (novelty) to previous research by showing that the learning model's effects vary depending on students' motivation level. In other words, this study confirms that no one learning model is universally effective for all students. The individual motivational factors of students greatly influence the model's effectiveness.

The leading cause of low student learning outcomes in chemical bonding materials was a need for more learning motivation and using less varied learning models. Based on the research results, the recommended solution is the application of TAI and TPS-type cooperative learning models, which can increase students' motivation and active participation in the learning process. If the cooperative learning models of TAI and TPS are implemented correctly, the impact on chemistry education at the high school level will be significant. First, student learning outcomes will increase, as evidenced by the data of this study and previous studies. Second, students' motivation to learn chemistry will also increase, considering that this learning method is more interactive and exciting for students. In addition, increasing motivation and learning outcomes will positively impact students' competence in understanding abstract chemical concepts, which in turn can improve student achievement in various aspects of life, both at the national and international levels.

Conclusion

This study evaluates the influence of Team Assisted Individualization (TAI) and Think-Pair-Share (TPS) types of cooperative learning models and learning motivation on student learning outcomes on chemical bonding materials. The results showed that the two learning models and the learning motivation level significantly affected student learning outcomes. There is an essential interaction between learning models and learning motivation, where the effectiveness of each model depends on the level of student motivation. The study makes a new contribution to the existing literature by showing that no one learning model is universally effective for all students. The effectiveness of the learning model is greatly influenced by the level of individual motivation of students, emphasizing the importance of a more adaptive approach to teaching. In addition, this study strengthens the evidence that cooperative learning methods such as TAI and TPS can improve learning outcomes, especially when combined with strategies to increase learning motivation.

The study has several limitations, including population coverage limited to only one school and two learning models. The study also did not consider other external factors that might affect motivation and learning outcomes, such as family support or the learning environment outside of school. For further research, it is recommended that studies be conducted with a broader and more diverse sample to improve the generalization of findings. Research also needs to consider other variables that have the potential to affect learning outcomes, as well as explore additional interventions to increase learning motivation. In this way, a more comprehensive understanding of the factors influencing student learning outcomes in chemistry can be achieved, which can improve the effectiveness of education.

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