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# Chemistry Learning Innovation: Discovery Learning Modified STAD to Motivate and Complete Learning of Inclusive Classroom Students

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**Abstract**

This study aims to find out the impact of Discovery Learning model combined with Student Teams Achievement Division (STAD) method on students' learning motivation in the one of inclusion class at SMAN 10 Surabaya. This study used a Collaborative Classroom Action Research (CCAR) approach with the Kurt Lewin model. This model contain of four stages, among them are: plan, action, observation, and reflection. The subjects on this research were 36 learners, including 4 learners with special needs. The results be seen that in cycle I, the implementation of Discovery Learning had not fully increased students' learning motivation. However, after improvements were made in cycle II by integrating the STAD method, there was a very significant improvement in motivation indicators, especially in the aspect of tenacity in facing difficulties. The mode score of learning motivation increased from 2 to 3 on this indicator, indicating a high learning motivation category. In addition, cognitive learning outcomes also improved, with 69.4% of students achieving learning completeness according to school criteria. Therefore, in summary that the Discovery Learning strategy combined with the Student Teams Achievement Division (STAD) method is effective to improve the motivation and learning outcomes of inclusion class students.

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## INTRODUCTION

Education constitutes a fundamental element in the advancement of human resource quality. To effectively attain educational objectives, a curriculum is needed as a guide to determine the direction of education (Sofyan, 2021). The curriculum can be interpreted as a learning program that includes learning experiences and goals to be achieved (Usdarisman et al., 2024). Along with the times, the curriculum has also changed to adapt to the needs of the times. Starting from the 2022/2023 academic year, the government has established an independent curriculum as a unit curriculum in Indonesia. The independent curriculum is a curriculum with diverse intracurricular learning, where materials are organized more effectively so that learners have sufficient time to understand concepts and improve their skills (Alfaeni et al., 2023). The learner-centered learning strategy, which aligns the learning process with the needs and potential of learners, is a unique element of the autonomous curriculum (Mardiana & Emmiyati, 2024).

In its implementation, Merdeka Curriculum encourages the use of learner-centered learning models. One of the instructional models applicable within the Merdeka Curriculum is Discovery Learning, which promotes active student engagement through exploration, inquiry,

and the construction of personal understanding of the concepts being studied. (Ellizar et al., 2019). This model allows them to discuss, identify problems, formulate hypotheses, collect and analyze data, and present results through presentations (Dewa et al., 2021). Discovery Learning is designed to foster active student engagement by encouraging exploration, inquiry, and self-guided learning within the instructional process. Complementing this approach, the Student Teams Achievement Division (STAD) represents a cooperative learning strategy that is particularly well-suited for educators who are beginning to adopt student-centered methodologies, as it promotes interaction, teamwork, and shared responsibility in achieving academic goals (Fuadi & Supardi, 2020). The integration of the discovery learning model with the STAD method can create an interactive and collaborative learning environment where students are not only active in discovering concepts but also work together in groups to exchange ideas and solve problems.

SMAN 10 Surabaya is a school that actively supports the implementation of inclusive education. The goal of inclusive education is to provide equal learning opportunities to students with diverse abilities and backgrounds, including those with physical, mental, emotional, social challenges, as well as students with exceptional talents or intellectual capabilities (Wijaya et al., 2021). In practice, inclusive learning requires appropriate classroom management strategies. One of them is to facilitate group work involving regular learners and learners with special needs. This strategy can help learners with special needs improve their social interaction, communication skills and collaboration (Nurfaidah et al., 2024).

According to the findings from observations, interviews, and questionnaires conducted with students in the inclusive class X at SMAN 10 Surabaya, it is known that their learning motivation towards chemistry subjects is still low. Out of 36 respondents, 22 people (61.6%) stated that they were not motivated to learn chemistry. From the responses gathered through the questionnaire, the main reason students are not motivated is because the learning provided by the teacher is considered less interesting and does not encourage them to be active. In addition, the material presented did not make them curious or want to know more deeply, so they felt bored while learning. The results of interviews with students also show that teachers tend to use the lecture method, seldom provide opportunities for students to actively engage in the learning process, and do not apply a variety of learning models that can increase their participation. Learners are only given individual assignments without any strategies that encourage motivation and collaboration in the classroom. In fact, learning motivation plays an important role in determining learners' academic success. The desire and drive from within learners is the main factor in determining whether they will try to understand a material or not (Haster et al., 2019).

Given the issues outlined, there is a need for an instructional strategy capable of boosting students' motivation to learn, particularly in inclusive classrooms. The Discovery Learning model is a relevant solution because this model encourages learners to be active in discovering and building their own knowledge (Dessutianti, 2022). To create a more collaborative learning atmosphere and increase interaction between learners, the Discovery Learning model can be combined with the Student Teams Achievement Division (STAD) method. The STAD method emphasizes cooperation in heterogeneous groups, so it can increase interaction between regular learners and learners with special needs (Fuadi & Supardi, 2020). The combination of the two is expected to create more interesting, interactive and effective learning. The basic laws of chemistry have been selected as the focal point of instruction, as they represent fundamental concepts essential for understanding more advanced topics, such as moles and stoichiometry (Hafifah & Hardeli, 2022). Thus, this study was conducted to determine the effect of the application of the Discovery Learning model combined with the STAD method on students'

learning motivation on the material of the basic laws of chemistry in the inclusion class of SMAN 10 Surabaya.

## METHOD

This study utilizes a Collaborative Classroom Action Research (CCAR) approach, conducted in SMAN 10 Surabaya. The research involved 36 students in an inclusive classroom, consisting of 32 regular students and four special needs students. The study followed Kurt Lewin's Classroom Action Research model, which contain of four key phases: plan, acting, observing, and reflecting, which can be illustrated in the following scheme.

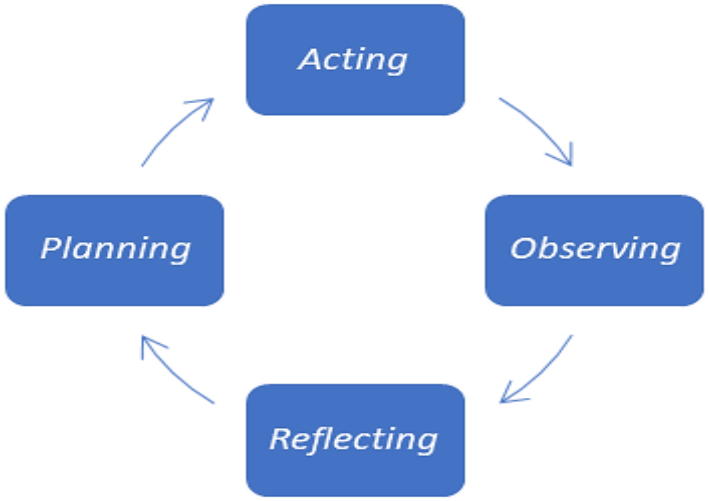


Figure 1. CCAR Model Kurt Lewin (Utomo et al., 2024)

The study was directed over multiple cycles, starting with a pre-cycle phase, followed by first cycle (Cycle I) and second cycle (Cycle II).

### Pre-cycle Activities

The pre-cycle stage is the stage of identifying problems regarding students' learning motivation. At this stage, data accumulation on students' learning motivation is accomplished using these instruments:

a. Observation sheet: To track students' behavior and participation in the classroom
b. Interview guide for student: to explore students' experiences in chemistry class, including learning methods, their learning motivation and its causes, assignments, and academic achevement (grades).

### Cycle I

***Planning:***

Based on the background of complexity that has been observed and identified through observation data at the pre-cycle stage, planning in cycle I is carried out use the Discovery Learning model. Lesson plans were constructed based on Discovery Learning syntax: (1) stimulation, (2) problem statement, (3) data collection, (4) data processing, (5) verification, and (6) conclusion.

***Action:***

The lesson plans were implemented using the Discovery Learning model to enhance student engagement and foster learning motivation.

***Observation:***

Observations were made by collecting learning motivation data using a questionnaire instrument adapted from Suhudi et al. (2024) research which measuring learning motivation using 1-4 Likert scale. The questionnaire consists of five indicators: (1) perseverence in learning, (2) resilience in facing challenges, (3) interest and sharp attention in learning, (4) academic performance, and (5) self-directed learning. Each indicators has three items with a total of 15 items.

***Reflection:***

After the action and observation were performed, a reflection was carried out to evaluate the results of the planning and actions that had been carried out from first cycle based on the success indicators.

Indicators of success in this research are derived from students' learning motivation. The action is said to be successful if students show high learning motivation. Student learning motivation data obtained from questionnaires is ordinal and can be analyzed by calculating the mode for each dimension or indicator, based on the following criteria:

a. If the learning motivation indicator measured has a score ≥ 3, then learning motivation is declared high.
b. If the learning motivation indicator measured has a score < 3, then learning motivation is declared low.

If there are indicators of learning motivation that do not meet the criteria for high learning motivation, improvements must be made in the next cycle until they reach the specified criteria (Lutfi, 2021).

**Cycle II**

***Planning:***

Enhancements were made in cycle II by combining the syntax of discovery learning and STAD modified from Rahmawati & Wolo's (2022) research. The modifications made resulted in five stages of learning, namely (1) delivery of learning objectives, formation of heterogeneous groups, distribution of LKPD, and provision of stimulation, (2) problem identification, hypothesis formulation, data collection, and data processing in groups, (3) presentation of group discussion results with a quiz system as part of verification of hypotheses and student answers. Other groups can respond if there are differences. The teacher gives scores to groups that actively ask and answer correctly (verification), (4) drawing conclusions (generalization), (5) a reward was given to the group that attained the highest score and exhibited the most active participation throughout the learning process.

***Action:***

The lesson plans were implemented using Discovery Learning model combined with STAD as an improvement if Cycle I did not meet the success criteria.

***Observation and Reflection:***

Carried out using the same process and instruments as Cycle I.

In addition to measuring learning motivation, this study also reviewed the fullness of learning outcomes from all the students after involved in a learning process with the Discovery Learning model of the STAD method. Measurement of student learning outcomes is carried out using the posttest method with a score range of 0-100. Students are claim to have completed learning individually if they get a score ≥ 75, in agreement with the requirements for absolutness set by the school. After individual learning completeness is obtained, can be determined the percentage of classical learning completeness using the formula:

$$\text{Classical completeness (\%)} = \frac{\text{Number of completed students}}{\text{Total number of students}} \text{ x } 100\%$$

## RESULTS AND DISCUSSION

### Pre-cycle Activities

Pre-cycle activities were carried out by observation and interviews with chemistry teachers and students of SMAN 10 Surabaya. Another activity is to carry out observations related to the characteristics of students in class X-K which is an inclusive class with 36 students. It is intended to investigate the problems that teachers often experience when teaching chemistry.

Informed by the results of observations and interviews involving students from inclusive classrooms, it was found that their motivation to learn chemistry was still low. Many students consider chemistry as a boring subject, as the learning that occurs is still one way. Teachers do not provide enough chances for involvement in the learning process are not provided to students and do not apply a variety of learning models that can improve student participation. Likewise, the method used is still dominated by the lecture method, then students are given individual assignments without any strategies that encourage interaction and collaboration in the classroom. Therefore, chemistry learning at SMAN 10 Surabaya requires a learning model that can encourage fosters student engagement in exploration, discovery, and the development of understanding, one such model being the Discovery Learning approach combined with the STAD method. To figure out the level of motivation of students to learn chemistry, data is collected through a questionnaire designed according to the indicators of student learning motivation and measured using the mode score.

### Cycle I

In cycle I, the Discovery Learning model was used in learning the basic laws of chemistry. The results show that: (1) Most students have not shown activeness during learning; only one or two students are active in doing the tasks, while others are less actively involved in discussions and concept exploration; (2) Students' learning motivation is still low, as observed from the lack of participation in asking questions or expressing opinions; and (3) The outcomes of the questionnaire of student enthusiasm for learning have indicators that have not been achieved. Based on the results of the first cycle reflection, it was founded that additional strategies were needed to improve interaction and collaboration between students. Therefore, in cycle II the STAD method in the Discovery Learning model was applied.

### Cycle II

According to the evaluation's results in cycle I, by combining the STAD method with the Discovery Learning model, the learning approach was improved in cycle II. Improvements made include: (1) Heterogeneous grouping based on the diagnostic assessment of cloud ability, using animal names and sounds in each group to create a more pleasant learning atmosphere, (2) Implementing interactive quizzes at every stage of learning to increase learning motivation and learner engagement, (3) Increase interaction opportunities by encouraging students should be more active in asking questions, voicing opinions, and answering questions during group and class discussions, (4) Giving points to groups that can answer the quiz correctly and show activeness in asking questions and discussing as a form of appreciation and additional motivation. With evaluation and improvement in learning, students become more focused, more participatory, and more motivated in learning.

### Application of Discovery Learning Model and STAD

The process of teaching and learning through the use of the STAD method and Discovery Learning model, from preparation to reflection, has been done well. The preparations made by teachers include the preparation of teaching modules, learning resources, learning media, and

evaluations in accordance with the syntax of the Discovery Learning model and the STAD method. The implementation of this learning model went well, as evidenced by the difference in the acquisition in terms of student enthusiasm for learning questionnaire scores between cycle I and cycle II. The following is a table of the acquisition of students' motivation questionnaire scores in cycles I and II.

Table 1. Results of the Learner Motivation Questionnaire

| Indicator | Mode Cycle 1 | Mode Cycle 2 |
|---|---|---|
| Perseverance in learning | 3 | 3 |
| Tenacious in the face of adversity | 2 | 3 |
| Interest in and attentiveness in learning | 3 | 3 |
| Achievement in learning | 3 | 3 |
| Independent in learning | 3 | 3 |

Based on the table 1, the indicator of tenacious in the face of adversity shows an increase in learning motivation. In cycle I, this indicator had a mode score of 2, indicating that the majority of students disagreed with the statement. However, after applying the Discovery Learning model with the STAD method in cycle II, the mode score increased to 3, indicating that learners began to agree with the indicator.

According to Lutfi (2021), if an indicator of learning motivation has a mode score ≥ 3, then students' learning motivation is categorized as high. Thus, in cycle II, every indicator has made it to the criteria for high learning motivation, which shows that the use of the Discovery Learning model with the STAD method is effective in increasing students' learning motivation.

Based on table 1. In cycle II learning motivation improved, especially in the indicator “resilient in facing difficulties”. This indicates that students began to experience increased confidence in facing learning challenges. This may be due to the support from group members in STAD, as well as the learning structure that encourages active exploration through Discovery Learning. In inclusive classrooms, this improvement is particularly important. Learners who previously lacked confidence due to differences in ability began to feel recognized and supported, so they dared to try, ask questions, and actively discuss. The use of heterogeneous groups with a touch of fun (grouping using animal sounds and interactive quizzes) created a safe and inclusive learning environment, which strengthened their intrinsic motivation.

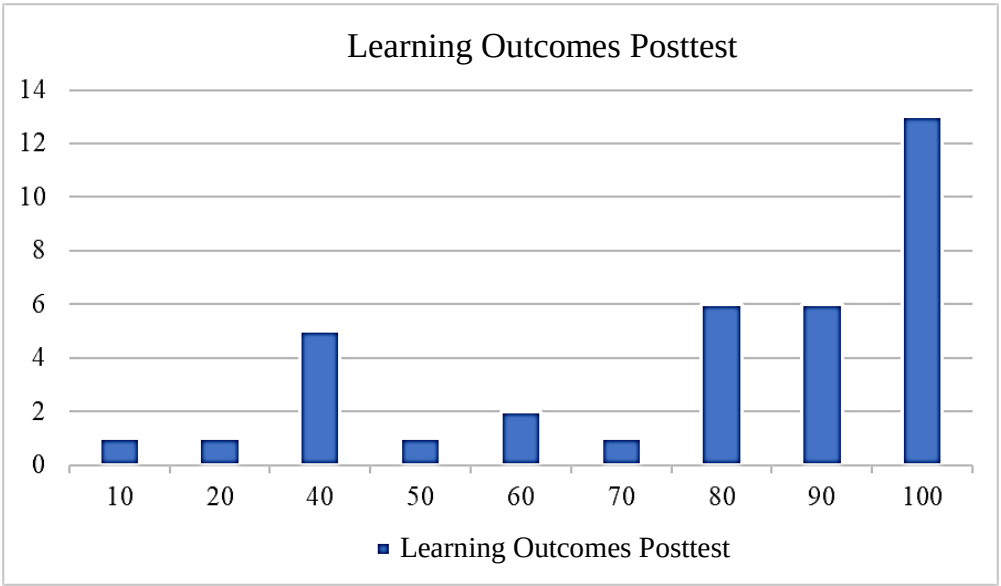


Figure 2. Data on student learning outcomes

Based on class action research conducted by Haryani (2021), It is emphasized that the application of the Discovery Learning model influences students' learning motivation. In cycle I there were two statements in the "sometimes" category and cycle II there was only 1 statement in the "sometimes" category. The "sometimes" category in question is a statement about student habits in terms of learning process activities that are positive. Thus, it can be concluded that the application of the Discovery Learning model enhances students' learning motivation.

The improvement in learning motivation also positively influences student learning outcomes. This is evident from the achievement of their learning evaluation results following the implementation of the Discovery Learning model integrated with the STAD method. Below are the posttest results of students based on cognitive learning assessment.

Based on the Figure 2, 69.4% of inclusive class students achieved learning completeness according to the predetermined criteria. This rise in learning outcomes demonstrates that the application of a more active, collaborative, and interactive learning model contributes to students' concept understanding and academic achievement. Motivation is an essential component of the learning process, especially in improving academic achievement. Learning motivation contributes positively to learning outcomes (Waritsman, 2020). Given the results of Farianti et al. (2020) research, students' learning outcomes in chemistry and their motivation to learn are significantly and favorably correlated.

This is relevant to the class action research conducted by Israil (2019) which states that the implementation of cooperative learning type STAD (Student Team Achievement Divisions) can increase the motivation and learning outcomes of VII grade students of SMP Negeri 1 Kayangan. This is evidenced in cycle I, then in cycle II, 91% completeness was achieved with an average score of 75 and student activity of 13 was categorized as very active, this shows that student performance results in cycle II have met the curriculum target.

**Students' Learning Motivation**

Every student's motivation is crucial to their learning process (Wibrowski et al., 2016). Motivation arises because it is impacted by two primary factor, specifically internal (encouragement from within) and external (influence from the surrounding environment). Internal factors encompass intelligence, interest, talent, emotion, physicality, and attitude. On the other hand, external influences include a supportive surrounding environment, such as family support, school conditions, and social interactions in the community (Djarwo, 2020).

Students who have learning motivation will have the desire to achieve their goals by enthusiastically taking on a variety of learning activities. In this situation, there are several factors that cause student motivation to decrease during the learning process, including: students' perception that the lesson is not particularly significant; the teacher's influence; the style or learning method used; and the impact of using little resources. Facilities for learning, issues with family and classmates, and classroom conditions that make students uncomfortable (Vincent, 2017).

In the context of this study, students' learning motivation improved following the implementation of the Discovery Learning model and the STAD method, as evidenced by the increase in both the learning motivation questionnaire scores and student learning outcomes. The application of the Discovery Learning model positively influenced both students' motivation and their academic performance (Primantiko et al., 2021).

**Discovery Learning Model and STAD method**

The Discovery Learning model is a learner-centered approach that encourages students to independently construct their understanding through exploration, discussion, and problem-

solving. The goal of the Discovery Learning model is for students to find concepts under the direction of teachers as a facilitator and questions through practicum activities in learning activities that can arouse students' curiosity so that they can construct their thinking skills in problem solving so that they better comprehend the information given and the process of learning is more meaningful. The Discovery Learning model consists of distinct stages, which include stimulating interest, presenting a problem statement, collecting data, processing data, verifying findings, and generalizing conclusions. (Farianti et al., 2020).

The STAD (Student Teams Achievement Divisions) method is a cooperative learning method that encourages learners to work in heterogeneous groups to complete academic tasks. With the combination of these two models, learners can be more actively involved in learning and enhance their analytical thinking abilities. From the research that has been conducted, implementing the Discovery Learning model in conjunction with the STAD method has proven to be effective in boosting students' learning motivation and improving their academic outcomes.

### Achievement of Learning Effectiveness

Analyze the influence of the application of the Discovery Learning model combined with the STAD method on students' motivation and learning outcomes in inclusive classrooms. The findings indicated that the implementation of this learning model significantly increased learning motivation, encouraged students' participation in the educational experience, and created a more interactive and conducive learning environment. In addition, the increase in learning motivation also exerts a beneficial impacts on students learning outcomes. Thus, the Discovery Learning model with the STAD method can be implemented as an effective strategy to improve learners' engagement and educational attainment, especially in the context of inclusive learning.

## CONCLUSION

The study’s findings suggest that the implementation of the Discovery Learning model combined with the STAD method in the inclusive classrooms of SMAN 10 Surabaya has been effective in improving both student motivation and learning outcomes. In cycle II with the integration of the STAD method, all indicators of learning motivation reached a high category, including a significant increase in the aspect of tenacity in facing difficulties with a mode score increasing from 2 to 3. In addition, the increase in motivation then had an impact on student learning achievement which showed an increase, where 69.4% of students achieved learning completion according to school criteria.

The application of the Discovery Learning model combined with the STAD method in inclusive classes not only increases motivation and learning outcomes quantitatively, but also shows how the learning process that emphasizes independent exploration and cooperation can shape students' attitudes of tenacity and resilience in facing learning challenges. This model and approach encourage students to actively participate and develop critical and reflective thinking skills, which are important aspects in meaningful and sustainable learning. Therefore, the implementation of the Discovery Learning model combined with the STAD method can be used as an effective approach to enhance active student engagement and academic performance, particularly within the framework of inclusive education.

## RECOMMENDATIONS

Future studies are recommended to involve a larger sample size and diverse contexts to explore the effectiveness of this model in enhancing motivation and learning outcomes in inclusive classrooms. In addition, the timing of the research should also be considered so that time constraints do not become an obstacle in the course of the research. Selecting an appropriate timeframe for data collection is crucial, as it allows researchers to capture a comprehensive view of the learning process and its outcomes. The last, further research can involve a variety of data collection methods, such as surveys, teacher interviews, and observations. By using this mixed approach, researchers can obtain more comprehensive data on students' experiences and the impact of the Discovery learning model on their motivation and academic performance.

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