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Activating Classroom Interaction through Think–Pair–Share: Evidence from Chemistry Learning

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ABSTRACT

Purpose of the study: The purpose of this study is to improve the chemistry learning outcomes of class X students at the Muallimin Muhammadiyah Bangkinang Islamic Boarding School on the main material of electrolyte and non-electrolyte solutions through the application of the Think Pair Share type cooperative learning model.

Methodology: The subjects of this research were 10th grade students of the Muallimin Muhammadiyah Bangkinang Islamic Boarding School. The number of students was 24 students consisting of 10 male students and 14 female students. The stages passed in the classroom action research were: 1) Planning/preparation of action, 2) Implementation of action, 3) Observation, and 4) Reflection.

Main Findings: Based on the analysis of research results and discussion, it was concluded that the application of the Think Pair Share type of cooperative learning model can improve the chemistry learning outcomes of class X students of the Muallimin Muhammadiyah Bangkinang Islamic Boarding School. This is illustrated by the results of the learning completion obtained by students in accordance with the learning completion requirements set in the class. Student learning outcomes have met the minimum completion criteria as determined, where out of 24 students, 20 students have completed the learning, or are above the classical completion (75%).

Novelty/Originality of this study: The novelty of this study is to determine the effectiveness of applying the think pair share type cooperative learning model to improve chemistry learning outcomes in the discussion of electrolyte and non-electrolyte solutions.

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1. INTRODUCTION

Effective classroom interaction is a crucial component of meaningful learning, particularly in science education where conceptual understanding and active engagement are essential [1], [2]. Chemistry learning requires students not only to memorize concepts but also to actively construct knowledge through discussion, questioning, and collaboration [3], [4]. However, in many secondary school classrooms, chemistry instruction remains predominantly teacher-centered, resulting in limited student interaction and passive learning behaviors that negatively affect learning outcomes [5], [6].

One of the persistent challenges in chemistry learning is the low level of student participation during classroom activities [7], [8]. Students often hesitate to ask questions, express ideas, or engage in discussions due to low confidence, limited prior knowledge, or fear of making mistakes [9], [10]. This condition is especially evident in abstract chemistry topics such as electrolyte and non-electrolyte solutions, which demand conceptual reasoning and the ability to relate theory to observable phenomena. As a consequence, students' learning outcomes frequently fail to meet expected competency standards [11], [12].

To address these challenges, instructional strategies that actively involve students in the learning process are needed [13], [14]. Cooperative learning has been widely recognized as an effective approach to fostering interaction, collaboration, and deeper understanding [15], [16]. Among various cooperative learning models, the Think–Pair–Share model provides structured opportunities for students to think individually, discuss ideas with peers, and share their understanding with the class [17], [18]. This learning sequence encourages equal participation, reduces anxiety in expressing ideas, and promotes meaningful classroom interaction.

Previous studies have demonstrated that the Think–Pair–Share model can enhance student engagement and academic achievement across various subjects [19], [20]. Nevertheless, empirical evidence focusing on its role in activating classroom interaction within chemistry learning, particularly in the context of secondary education, remains limited. Many studies emphasize learning outcomes without sufficiently examining how structured peer interaction contributes to improved understanding and participation during chemistry instruction [21], [22].

The novelty of this study lies in its emphasis on classroom interaction as a central mechanism through which the Think–Pair–Share model enhances chemistry learning, rather than focusing solely on learning outcomes. This research provides empirical evidence from a classroom action research context that explicitly demonstrates how structured peer interaction activates student participation, supports low-achieving students, and fosters collaborative knowledge construction in learning electrolyte and non-electrolyte solutions. The urgency of this study is underscored by the continuing prevalence of passive, teacher-centered chemistry instruction, which limits students' opportunities to engage in scientific discourse and develop meaningful conceptual understanding. In the context of rapidly evolving educational demands that prioritize active learning and communication skills, this study offers timely and practical insights for chemistry teachers seeking effective instructional strategies to promote interactive and student-centered learning environments.

Based on these considerations, this study aims to investigate the implementation of the Think–Pair–Share cooperative learning model as a strategy to activate classroom interaction and improve students' chemistry learning outcomes on the topic of electrolyte and non-electrolyte solutions. By employing a classroom action research approach, this study provides practical evidence on how Think–Pair–Share can transform passive learning environments into interactive chemistry classrooms, thereby contributing to more effective and engaging chemistry instruction.

2. RESEARCH METHOD

2.1. Type of Research

This study employed classroom action research aimed at improving and enhancing the quality of the chemistry learning process through the implementation of the Think-Pair-Share cooperative learning model [23], [24]. This approach was chosen because it allows teachers and researchers to conduct reflective and ongoing learning activities to enhance classroom interaction and student learning outcomes. The research was conducted in two cycles, each consisting of planning, action implementation, observation, and reflection [25], [26].

2.2. Population and Sample

The population in this study was all 10th-grade students of the Muallimin Muhammadiyah Bangkinang Islamic Boarding School. The research sample was determined using a total sampling technique, in which all 24 10th-grade students (10 male students and 14 female students) were used as research subjects. This technique was chosen because the population size was relatively small and all students were directly involved in the learning process [27], [28].

2.3. Data Collection Instruments and Techniques

Data collection in this study was conducted using several instruments to obtain comprehensive data, both quantitative and qualitative [29], [30]. Data collection techniques included learning achievement tests, observations of student activities, and documentation [31], [32]. To ensure data measurability, the research instruments were compiled based on indicators relevant to the research objectives. The outline of the research instruments is presented in the following table:

Table 1. Research Instrument Grid

No	Instrument Type	Measured Aspects	Indicators	Data Collection Techniques
1	Learning Outcome Test	Mastery of Chemistry Concepts	Understanding the concept of electrolyte and non-electrolyte solutions	Written Test
2	Student Activity Observation Sheet	Student Interaction and Participation	Actively participating in discussions, asking questions, and expressing opinions	Observation
3	Teacher Observation Sheet	Implementation of Think-Pair-Share	Suitability of Think-Pair-Share steps to the learning process plan	Observation
4	Documentation	Evidence of Research Implementation	Activity photos, score lists, and reflection notes	Documentation

2.4. Data Analysis Techniques

The data in this study were analyzed using qualitative and quantitative data analysis. Qualitative data were obtained from observations of student and teacher activities, which were analyzed descriptively to illustrate changes in student interaction and activeness during the learning process [33], [34]. Meanwhile, quantitative data, in the form of student learning outcomes, were analyzed by calculating the average score and percentage of learning completion in each cycle. Classical learning completion is determined when at least 75% of students achieve the predetermined Minimum Completion Criteria.

2.5. Research Procedures

This research consists of 2 cycles. Each cycle is conducted in two meetings and one daily test. This classroom action research is carried out in 4 stages, namely: a. Planning/preparation of action, b. Implementation of action, c. Observation and d. Reflection [35], [36]. The types of data obtained in this study are qualitative and quantitative data, which consist of teacher and student activities producing data obtained from teacher and student activities according to the steps through cooperative learning Type Think Pair Share and student learning outcomes are data about student learning outcomes after conducting learning outcome tests in cycles I and II. Data collection techniques in this study use test techniques and observation techniques. The procedures for this research can be seen in the following figure:

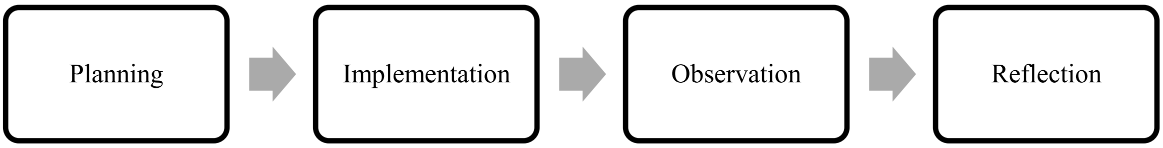

Figure 1. Research Procedure

3. RESULTS AND DISCUSSION

The implementation of the Think–Pair–Share cooperative learning model was conducted through two classroom action research cycles. Each cycle was designed to improve classroom interaction and students' chemistry learning outcomes on electrolyte and non-electrolyte solutions.

3.1. Cycle I

The results of Cycle I indicated that students began to adapt to the Think–Pair–Share learning structure, although classroom interaction had not yet developed optimally. Some students were willing to participate in group discussions, particularly during the *pair* stage, but many still showed hesitation when expressing ideas during the *share* phase. Student participation was generally limited to note-taking and listening to teacher explanations, while questioning, responding to peers' ideas, and presenting discussion results were still dominated by higher-achieving students.

From the perspective of learning outcomes, there was an improvement in students' understanding of the material compared to the initial condition. However, classical learning mastery had not yet been achieved, as several students still failed to reach the minimum mastery criterion [37], [38]. These findings indicate that although

Think–Pair–Share had begun to activate classroom interaction, students required further guidance and habituation to fully engage in cooperative learning activities.

3.2. Cycle II

In Cycle II, significant improvements were observed in both classroom interaction and student learning outcomes. Students demonstrated greater confidence in expressing ideas, asking questions, and responding to peers during discussions. Interaction was no longer limited to high-achieving students; students with lower academic ability also actively participated in discussions and presentations. The *think*, *pair*, and *share* stages were implemented more effectively, creating a more balanced and inclusive learning environment.

Learning outcomes also improved substantially in Cycle II. Most students achieved the minimum mastery criterion, and classical learning completeness was attained. The increased level of interaction and engagement during learning activities was accompanied by better conceptual understanding of electrolyte and non-electrolyte solutions [39], [40]. These results indicate that the Think–Pair–Share model was effective in transforming passive learning behavior into active and collaborative chemistry learning.

3.3. Student Activities

There has been an increase in student learning activity from cycle I to cycle II. Furthermore, the percentage of student learning activity in cycles I and II can be described as follows:

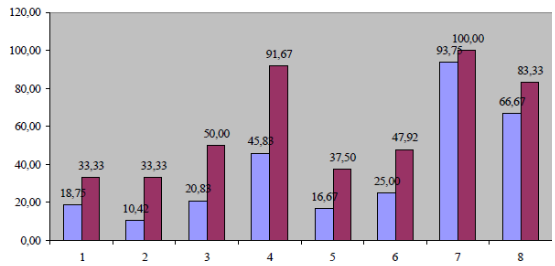

Figure 1. Average Student Activity in Cycle I and Cycle II

3.4. Student Learning Outcomes

Judging from the level of student mastery of the subject matter in cycle II, it can be said to be better than in cycle I. Data on mastery of the subject matter before the action, cycles I and II can be summarized in the frequency distribution table of student learning outcomes as follows:

Table 1. Frequency Distribution List of Student Learning Outcomes

Interval			Before Action	Cycle I	Cycle II
0	-	52	10	1	0
53	-	64	3	9	4
65	-	76	11	12	8
77	-	88	0	2	11
89	-	100	0	0	1
Number of Students Who Completed			11	14	20
Number of Students			24	24	24

Based on the research results that have been presented, it turns out that the implementation of the Think Pair Share cooperative learning model can improve the chemistry learning outcomes of class X students at the Muallimin Muhammadiyah Bangkinang Islamic Boarding School. The increase in activity and learning outcomes obtained through the implementation of the Think Pair Share cooperative learning model is caused by several factors, including:

1. Learning emphasizes activities and interactions between students to help each other and motivate each other in mastering the lesson material in order to achieve maximum achievement.
2. Learning requires students to be able to work together with their group mates to master the lesson material, so that each group member has the responsibility to help their friends for the success of their group.
3. In mastering the subject matter, students who have low abilities can easily understand (communicate) what is conveyed by their friends who have high abilities.

Mastery of subject matter is one indicator of learning success. Research data shows that high-ability students have excellent mastery of the material, resulting in high learning outcomes, while low-ability students have mastery far below average. The uneven level of subject matter mastery during Cycle I is evident in the large number of students who did not complete the learning process compared to the number of students who did not complete it.

The uneven mastery of subject matter by students in Cycle I indicates that some students were not actively engaged in learning activities. Students who are less active tend to fail to master the material they are learning because learning activities affect learning outcomes. It can be argued that students will understand the material if they are actively learning. Based on the data analysis and discussion of the research findings, it can be concluded that the implementation of the Think Pair Share cooperative learning model can improve the Chemistry learning outcomes of 10th-grade students at the Muallimin Muhammadiyah Bangkinang Islamic Boarding School.

The findings of this study demonstrate that the Think–Pair–Share cooperative learning model plays a significant role in activating classroom interaction and improving students' chemistry learning outcomes. The gradual improvement from Cycle I to Cycle II highlights that effective cooperative learning requires an adaptation process, both for students and teachers. Initially, students' limited participation reflected their unfamiliarity with interactive learning environments and their reliance on teacher-centered instruction.

The increase in student interaction observed in Cycle II can be attributed to the structured stages of Think–Pair–Share, which provide students with sufficient time to think individually, discuss ideas with peers, and share their understanding in a supportive classroom atmosphere. This structure reduces students' anxiety, particularly for those with lower academic confidence, and encourages equal participation. These findings align with constructivist learning theory, which emphasizes that knowledge is actively constructed through social interaction and collaborative learning processes.

Improved learning outcomes in this study are closely related to increased classroom interaction. When students actively engage in discussion, explain concepts to peers, and respond to different viewpoints, they develop deeper conceptual understanding [41], [42]. In the context of chemistry learning, especially abstract topics such as electrolyte and non-electrolyte solutions, peer interaction helps students connect theoretical concepts with observable phenomena and real-life examples. This supports previous research indicating that cooperative learning enhances both cognitive achievement and social skills in science learning.

Furthermore, the results suggest that Think–Pair–Share is particularly effective in addressing common challenges in chemistry classrooms, such as low student motivation, limited participation, and unequal involvement among learners. By emphasizing interaction rather than mere content delivery, Think–Pair–Share fosters a learning environment where students take responsibility for their own learning and contribute to group success. This shift from teacher-centered to student-centered learning is essential for developing active learning competencies required in contemporary science education.

Overall, the findings confirm that activating classroom interaction through the Think–Pair–Share model is not only effective in improving learning outcomes but also in cultivating a more engaging, inclusive, and collaborative chemistry learning environment [43], [44]. Therefore, Think–Pair–Share can be considered a practical and pedagogically sound strategy for chemistry teachers seeking to enhance both interaction and achievement in secondary school classrooms.

The improvement in student learning outcomes in this study is inseparable from the improved quality of classroom interactions during the implementation of the Think-Pair-Share model [45], [46]. The interactions established through pair discussions and sharing ideas in front of the class encourage students to actively process information, clarify understanding, and reconstruct chemical concepts through the exchange of ideas with peers. When students engage in the process of explaining and defending their opinions, they not only retain information but also build a deeper conceptual understanding. This indicates that classroom interactions play a crucial role as a mediator bridging learning activities with improved student chemistry learning outcomes.

These findings align with the constructivist theory perspective, which emphasizes that knowledge is not transferred directly from teacher to student but is actively constructed through learning experiences and social interactions [47], [48]. In the context of chemistry learning, the think stage allows students to construct initial understanding individually, the pair stage facilitates negotiation of meaning through discussion, and the share stage reinforces knowledge construction through reflection and class feedback. This process reflects the principles of social constructivism proposed by Vygotsky, which argues that effective learning occurs when students interact in a supportive social environment and within their zone of proximal development [49], [50].

Therefore, the improved learning outcomes achieved in this study were not solely due to the use of a new learning model, but rather to the optimization of interaction processes that enabled students to actively construct chemical knowledge. The Think-Pair-Share model serves as a systematic pedagogical framework to enable these interactions, making chemistry learning more meaningful, participatory, and student-centered. These findings strengthen the argument that social interaction-based learning strategies significantly contribute to learning success, particularly in the abstract nature of chemistry.

4. CONCLUSION

Based on the analysis of research results and discussions as previously described, it was concluded that the implementation of the Think Pair Share cooperative learning model can improve the chemistry learning outcomes of class X students at the Muallimin Muhammadiyah Bangkinang Islamic Boarding School. This is illustrated by the learning completion results obtained by students which are in accordance with the learning completion requirements set in the class. Further research is recommended to explore the application of the Think–Pair–Share model to other chemistry topics with a higher level of abstraction to determine the consistency of its effects on classroom interactions and student learning outcomes. Furthermore, future studies should incorporate quantitative approaches that more objectively measure the quality of student interactions to allow for a more in-depth analysis of the relationship between learning interactions and learning outcomes.

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