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PEER TUTORS AS CATALYSTS FOR BIOLOGY LEARNING

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ABSTRACT

This study aims to examine the role of peer tutors as a catalyst in improving Biology learning. The background of this study is the low level of student engagement and conceptual understanding in conventional Biology learning. Peer tutoring is a collaborative learning strategy that encourages interaction and communication between students. This study used a quantitative method with a quasi-experimental design involving an experimental class and a control class. The experimental class implemented peer tutoring, while the control class used conventional learning. Data were collected through learning outcome tests, observations, and student response questionnaires. The results showed that peer tutoring significantly improved student engagement and learning outcomes. Thus, peer tutoring is effective as a catalyst in Biology learning.

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INTRODUCTION

Education is a crucial process in developing quality human resources capable of adapting to developments in science and technology. Biology is one subject that significantly contributes to the development of students' scientific thinking skills , as it studies life phenomena and their relationship to the environment. However, in practice, students often find biology challenging due to its many abstract concepts and complex scientific terms (Dewi, Ramli, & Rinanto, 2023). This leads to some students lacking motivation for in-depth study.

These conditions require teachers to innovate in implementing effective, interactive, and contextual learning strategies. One strategy that can be used is cooperative learning with the peer tutoring method , *where* students with better understanding help their peers who are having difficulties. According to Ullah, Iqbal, and Kaleem (2018), the peer tutoring method has been shown to significantly improve biology learning outcomes due to the social interaction that encourages students to help each other understand concepts.

Peer tutoring not only facilitates conceptual understanding for the tutee *but* also strengthens the understanding of the student acting as the tutor. Research by Hakim et al. (2020) explains that "through peer tutoring activities, students learn to restructure their own knowledge so they can explain it more simply and effectively to their classmates." Thus, this method provides dual benefits in the learning process.

Furthermore, in the context of Biology learning, peer tutoring can act as a catalyst — accelerating and strengthening the process of conceptual understanding through active collaboration between students. Jibrin and Zayum (2012) found that students who participated in Biology learning using peer tutoring achieved higher grades than those who learned using conventional lecture methods. These results indicate that peer tutoring can significantly improve the effectiveness of Biology learning.

In addition to improving learning outcomes, the peer tutoring method also plays a role in fostering student motivation and self-confidence. According to Kalu-Uche and Ogbonna (2021), students are more confident in asking questions and expressing their opinions when learning with peers than with a teacher. This occurs because interactions between peers feel more equal and free from the fear of judgment. A more relaxed and collaborative atmosphere makes the learning process more enjoyable and meaningful.

Research in Indonesia also shows similar results. Lalin, Namakule, and Elly (2021) reported that the use of the Discovery Learning model combined with peer tutoring can significantly improve Biology learning outcomes. Furthermore, Nur, Irfan, and Alfiani (2023) found that the combination of peer tutoring and *mind mapping* can improve students' critical thinking skills and understanding of Biology concepts. This demonstrates that peer tutoring can be combined with various learning models to achieve optimal results.

Although numerous studies demonstrate the effectiveness of peer tutoring, its implementation in schools still faces several challenges. Some teachers remain skeptical about the effectiveness of this method due to concerns that not all students are capable of being good tutors, or due to limited time for tutor training. However, as Siswanto and Romadlon (2022) note, "the active involvement of students as tutors and tutees in collaborative learning systems can increase their responsibility for learning and strengthen their social skills."

Based on this description, it can be concluded that peer tutoring has great potential to be a catalyst for biology learning by strengthening conceptual understanding, increasing motivation, and fostering student learning engagement. Therefore, further research is needed to analyze how peer tutoring can be effectively implemented in the context of biology learning in schools, so that this strategy becomes not only an alternative method but an integral part of active learning in the modern education era.

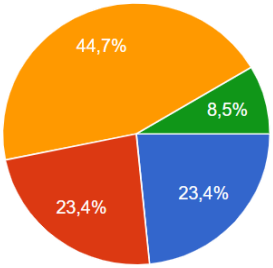
RESEARCH METHODS

This study uses a quantitative research method with a descriptive approach implemented on grade X students of SMA Al-Wasliyah 1 Medan. Data collection was carried out to determine the application and student responses to peer tutoring in Biology learning. Data collection was carried out using a questionnaire instrument. The questionnaire was compiled in the form of closed statements with several answer choices that reflect the level of agreement or frequency, then distributed to all respondents. The data obtained from the questionnaire were then analyzed descriptively using percentages to describe the tendency of student attitudes, behaviors, and experiences towards the implementation of peer tutoring in the Biology learning process.

RESULTS AND DISCUSSION

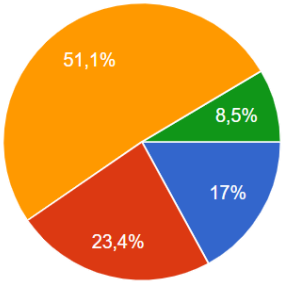
RESULTS

Data shows that most students feel helped Studying Biology with friends who have a better grasp of the material is evident from the percentage of responses *"always"* and *"often* " which each reached 23.4%. This indicates that peer tutors play a positive role in helping students understand the material through peer interaction. However, the highest percentage in the *"sometimes" category* , at 44.7%, indicates that the benefits of peer tutoring have not been consistently felt by all students. The relatively small percentage of *"never"* at 8.5% indicates that only a small proportion of students have not yet felt the help of peer tutoring.



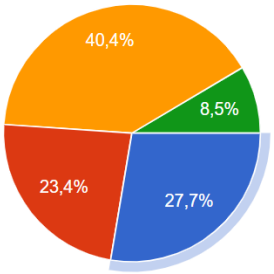
Graph 1.

The data shows that most students feel they receive respect from their peers in learning Biology**,** as seen from the percentage of *"always"* and *"often" responses* , which reached a total of 40.4%. This indicates a mutual respect in learning with peer tutors. However, the relatively high percentage of *"sometimes* " (51.5%) indicates that mutual respect is not consistently felt by all students. Meanwhile, the response of *"never* " (8.5%) indicates that a small number of students still do not feel respect from their peers in learning.



Graph 2.

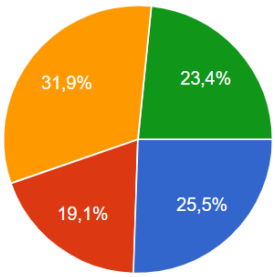
The data shows that the majority of students find it easier to understand Biology lessons when asking friends , as seen from the percentage of responses *always* at 27.7% and *often* at 23.4%. This confirms that interaction between friends in peer tutoring learning plays an important role in helping understanding Biology material. The percentage of *sometimes* is still quite high at 40.4% indicating that the effectiveness of peer tutoring is not felt evenly by all students. Meanwhile, the response *never* at 8.5% indicates that only a small number of students have not benefited from asking friends in Biology learning.



Graph 3.

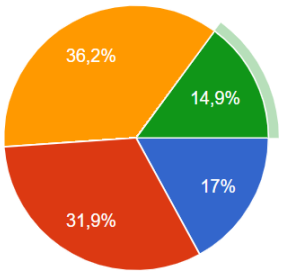
The data shows that some students consider their peers to be able to explain Biology material well , as seen from the response percentages *of always* 25.5% and *often* 19.1%. This indicates that peer tutors have the potential to help deliver Biology material more easily understood. However, the percentages *of sometimes* 31.9% and *never* , which are quite high at 23.4%, indicate that

the ability to explain the material is not evenly distributed among students. This finding indicates the need for coaching and the selection of appropriate peer tutors to improve the effectiveness of Biology learning.



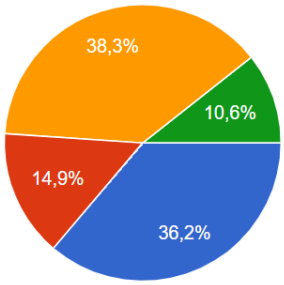
Graph 4.

The data shows that most students rate Peers explained the biology material well , as seen from the response percentages *of always* 17% and *often* 31.9%. This indicates that peer tutors play a fairly effective role in helping students understand biology material. However, the percentages *of sometimes* 36.2% and *never* 14.9% indicate that the ability to explain the material is not yet consistent across all students. This finding emphasizes the need for further coaching for peer tutors to ensure equitable explanation skills and optimize biology learning.



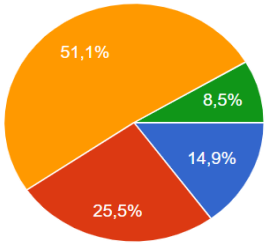
Graph 5.

The data shows that the majority of students are willing to help friends who do not understand the Biology material, as seen from the response percentage *of always* 36.2% and *sometimes* 38.3%. This indicates a caring and collaborative attitude among students in the learning process. The percentage of *often* (14.9%) and *never* (10.6%) indicates that there is still a small number of students who are not consistent in providing assistance to peers. This finding confirms that peer tutoring plays an important role not only in understanding the material, but also in building a culture of cooperation and mutual support in the Biology classroom.



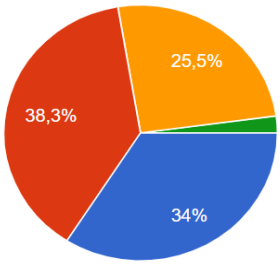
Graph 6.

The data shows that most students feel happy when friends help them when they experience difficulties learning Biology material, as seen from the percentages of *always* 14.9% and *often* 25.5%. The relatively high percentage *of sometimes* , at 51.1%, indicates that the experience of getting help from friends is not consistently felt by all students. Meanwhile, the response of *never* at 8.5% indicates that only a small portion of students rarely or never experience help from friends. These findings demonstrate the important role of peer tutors in creating a supportive learning environment and increasing student comfort in learning Biology.



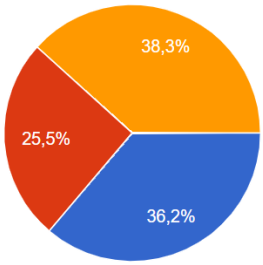
Graph 7.

The data shows that the majority of students feel proud of their work in Biology , as seen from the percentage of *always* 34% and *often* 38.3%. This indicates a high level of self-confidence and satisfaction with their learning achievements. The percentage of *sometimes* at 25.5% indicates that some students still do not consistently feel proud of their work. Meanwhile, the response of *never* only 2.1% indicates that very few students do not feel proud of their achievements, demonstrating the positive influence of peer tutors in building motivation and learning independence in Biology.



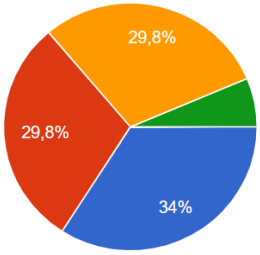
Graph 8.

The data shows that most students tend to complete Biology assignments on time , as seen from the percentage of *always* 36.2% and *often* 25.5%. However, the percentage of *sometimes* 38.3% indicates that consistency in completing assignments on time is not entirely evenly distributed among students. This finding indicates that although most students are motivated, additional encouragement, such as guidance from peer tutors, is still needed to improve discipline and regularity in completing Biology assignments.



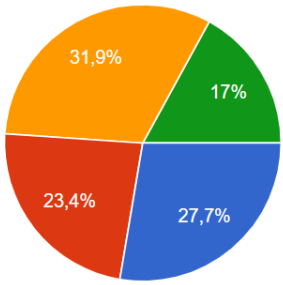
Graph 9.

The data shows that the majority of students are serious about doing their assignments. Group participation in Biology is seen from the percentage of *always* 34% and *often* 29.8%. The percentage *of sometimes* 29.8% indicates that some students are still not consistently serious about group assignments. Meanwhile, the response of *never* 6.4% indicates that only a few students do not participate seriously. This finding confirms that peer tutoring can encourage better motivation, responsibility, and cooperation in Biology learning in groups.



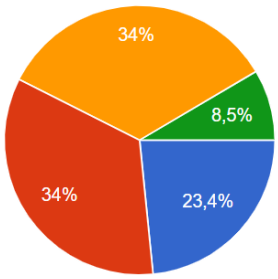
Graph 10.

Most respondents showed a fairly good level of familiarity with new friends in the group in the Biology subject. The highest percentage was in the category of *sometimes* at 31.9%, followed by the category of *always* at 27.7% and *often* at 23.4%, which indicates that many students often enough to always easily establish familiarity. Meanwhile, there were 17% of respondents who stated *never* , indicating that there are still a small number of students who experience difficulties in getting close to new friends in Biology group activities.



Graph 11.

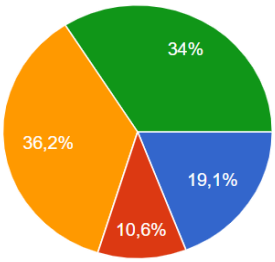
The attitude of mutual assistance between students and their peers in completing Biology assignments is quite good. The highest percentages are in the *often* and *sometimes categories* , each at 34%, indicating that most students are quite consistent in working together. Furthermore, the *always category* reached 23.4%, indicating that almost a quarter of students always help each other. Meanwhile, only 8.5% of students stated *never* , so it can be concluded that the behavior of mutual assistance in Biology learning has been quite developed among students.



Graph 12.

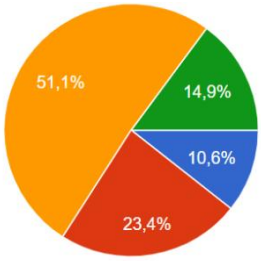
Most students still exhibit playful behavior with friends during Biology lessons**.** The highest percentage is in the category *of sometimes* at 36.2%, followed by the category *of often* at 34% and *always* at 19.1%, which indicates that playful activities occur quite frequently in the learning process. Meanwhile,

only 10.6% of students stated that *they never do so* , so it can be concluded that playful behavior in Biology classes is still quite dominant and needs attention so that the learning process can run more effectively.



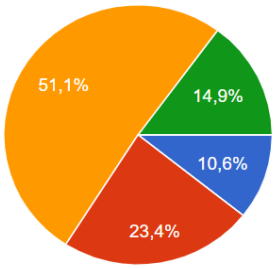
Graph 13.

The attitude of mutual assistance between students and their peers in completing assignments is considered good. The highest percentage is in the *often category* at 51.1%, indicating that more than half of students frequently work together. Furthermore, the *sometimes category* at 23.4% and *always* at 10.6% indicate consistent cooperation, although it is not evenly distributed. Meanwhile, the *never category* also at 10.6%, indicating that there is still a small number of students who are not involved in mutual assistance in learning Biology.



Graph 14.

Most students experience difficulty concentrating while studying . This is evident from the highest percentage in the *"often"* category at 51.1%, indicating that more than half of students frequently experience concentration problems. Furthermore, the *"sometimes" category* at 23.4% and " *always* " at 10.6% further reinforces the fact that concentration problems are quite dominant. Meanwhile, only 10.6% of students stated *they never did* , thus concluding that difficulty concentrating on learning remains a challenge for most students.



Graph 15.

Table 1. Peer tutors on various indicator components

No	Indicator	always	often	Sometimes	Never
1	Helped by friends who master the material	23.4%	23.4%	44.7%	8.5%
2	Friends appreciate learning the material	17%	23.4%	51.1%	8.5%
3	I felt my friend's explanation made it easier to understand.	27.7%	23.4%	40.4%	8.5%
4	Friends help explain well	25.5%	19.1%	31.9%	23.4%
5	Most students think their friends explain things well.	17%	31.9%	36.2%	14.9%
6	Willing to help friends who don't understand	36.2%	14.9%	38.3%	10.6%
7	Feel happy to be helped by friends when in trouble	14.9%	25.5%	51.1%	8.5%
8	Feel proud of the results of learning work	34%	38.3%	25.5%	2.1%
9	Complete the task on time	36.2%	25.5%	38.3%	0%
10	Be serious in doing group assignments	34%	29.4%	29.8%	6.4%
11	The ability to get along well with new friends in a group	27.7%	23.4%	31.9%	17%
12	Students' attitude of helping each other in completing assignments	23.4%	34%	34%	8.5%
13	Play behavior during learning	34%	19.1%	36.2%	10.6%
14	Help each other in completing tasks	10.6%	51.1%	23.4%	10.6%
15	Having difficulty concentrating	10.6%	51.1%	23.4%	10.6%

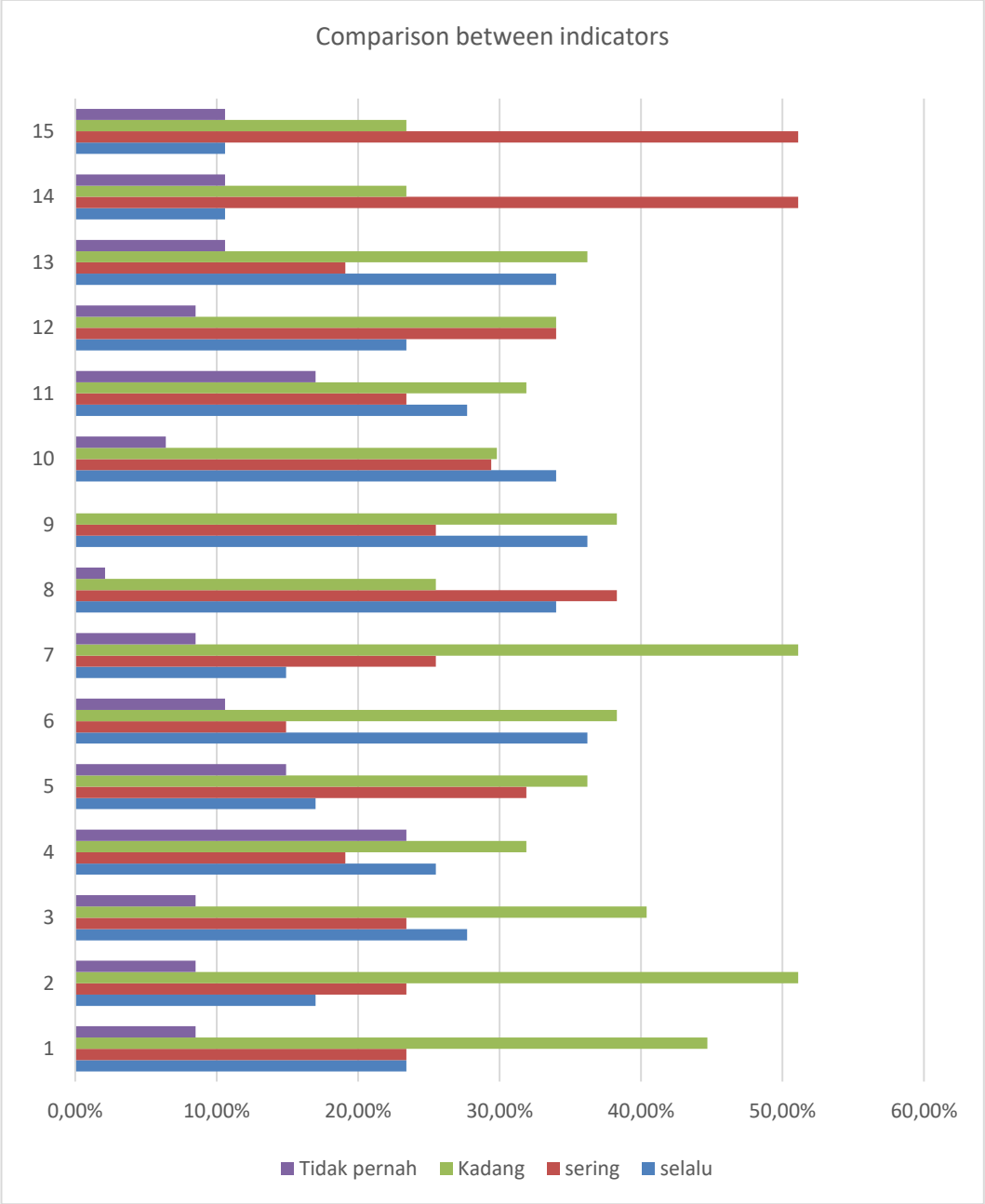


Figure 1. Comparison Chart between Indicators

DISCUSSIONS

The role of peer tutors in understanding the material: Data analysis shows that 23.4% of students always feel helped by learning Biology with a friend who has a better grasp of the material, while 27.7% always believe that their friend's explanations make it easier to understand concepts. This finding confirms that peer tutors serve as learning catalysts thru peer interaction, enabling collaborative concept clarification (Topping, 2005). Additionally, 25.5% of students reported that their peers always helped explain the material well, and 17% stated that their peers valued their learning process, indicating that the quality of interpersonal interaction is an important factor in the effectiveness of peer tutoring (Falchikov, 2001).

Social Support and Learning Motivation: Peer tutors not only facilitate understanding of the material but also strengthen social support and learning motivation. 36.2% of students are willing to help classmates who don't understand the material, while 14.9% feel happy when helped by classmates during difficulties. This phenomenon aligns with Vygotsky's (1978) concept of the zone of proximal development, which emphasizes that interaction with more competent peers can enhance cognitive achievement. Furthermore, 34% of students felt proud of their work, and 36.2% completed their assignments on time, indicating that peer tutors also contribute to increased academic responsibility and commitment to learning.

Collaboration and social competence: The research findings also highlight the role of peer tutors in building social competence and cooperation. 34% of students always put their best effort into group assignments, while 27.7% demonstrated good ability to get along with new friends. Additionally, 23.4% of students reported a helpful attitude toward each other in completing tasks, confirming that collaborative learning thru peer tutoring fosters positive interaction and the development of a prosocial academic culture (Johnson & Johnson, 2009). This behavior supports the creation of an inclusive and collaborative learning environment, which is crucial for the success of Biology education.

Implementation challenges and recommendations: While peer tutoring has a positive impact, there are several challenges in its implementation. 10.6% of students experienced difficulty concentrating, and 10.6% only sometimes helped each other in group tasks, indicating that the effectiveness of peer tutors was not fully distributed among all students. This finding aligns with the literature emphasizing that the success of peer tutoring is influenced by individual motivation, group dynamics, and teacher supervision (Topping, 2005; Slavin, 2018). Therefore, peer tutoring strategies need to be accompanied by appropriate supervision and activity designs that consider students' cognitive and social needs so that the benefits can be consistently realized. The use of peer tutors can be an effective strategy in Biology learning because it has been shown to help students understand the material, increase motivation, and encourage cooperation among peers (Topping, 2005; Johnson & Johnson, 2009).

Peer tutoring allows for collaborative clarification of concepts and fosters a helping attitude in completing tasks, thereby strengthening students' understanding of the material and their social skills (Falchikov, 2001). To optimize benefits, the implementation of peer tutoring needs to be accompanied by appropriate group arrangements and teacher guidance so that every student can consistently experience the advantages of this learning interaction (Slavin, 2018). Thus, peer tutors not only serve as facilitators of conceptual understanding but also as a medium for developing social skills and collaborative learning culture.

Figure 2. Research Team and Principal

Figure 3. Data collection in class

CONCLUSION

Based on research results, the implementation of peer tutoring has been proven to have a positive impact on the process and outcomes of Biology learning. Students who participate in learning with peer tutors show significant improvements in learning outcomes compared to students who learn using conventional methods. Furthermore,

student activity, participation, and interaction among students during learning also increase. Peer tutors are able to create a more communicative and collaborative learning environment, making it easier for students to understand Biology concepts.

In addition to improving cognitive aspects, the implementation of peer tutoring also positively contributes to students' attitudes and motivation to learn. Students become more confident in expressing opinions, asking questions, and helping peers understand the material. Cooperation and a sense of responsibility within the study group also develop well. Thus, peer tutoring can be concluded as an effective learning strategy and is recommended for implementation as a catalyst for Biology learning in schools.

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