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Enhancing Collaboration and Science Learning Outcomes Using the Team Games Tournament Cooperative Learning Model Assisted by Wordwall Media among Seventh-Grade Students of SMPN 8 Magelang

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Abstract: Collaboration skills as one of the 4C skills emphasized in the 21st-century learning concept are crucial for students to interact positively, work in teams, take responsibility in completing task, and improves learning outcomes. This classroom action research conducted in two cycles, aimed to improve collaboration skills and science learning outcomes by applying the Team Games Tournament (TGT) cooperative learning model assisted by Wordwall media. The subjects of this study were 31 students from class VII A at SMPN 8 Magelang. The instruments used were a collaboration skills observation sheet and a pretest-posttest sheet. The data obtained were then analyzed using a descriptive quantitative method with score analysis, skill assessment criteria, and test analysis with N-Gain. The results showed that applying the TGT cooperative learning model with Wordwall improved students' collaboration skills across all aspects, including active contribution, productive work, responsibility, and mutual respect, with most aspects improving from the 'collaborative' to 'highly collaborative' criterion. Students' learning outcomes also improved, as shown by the increase in N-Gain scores from Cycle I to Cycle II for indicators C2 (from 0.75 to 0.76), C3 (from 0.72 to 0.74), and C4 (from 0.75 to 0.81).

Keywords: Collaboration skills; Learning outcomes; Team games tournament

Introduction

Advancements in science and technology today have given rise to an educational concept known as 21st Century Learning, which is characterized by an emphasis on developing innovation skills in the learning process. Students must possess several essential skills in the 21st century: the 4C skills, which consist of critical thinking, communication, collaboration, and creativity (Azis & Hasan, 2024). These skills will help students adapt to changes that will occur in the future (Mardhiyah et al., 2021).

Education plays a vital role in preparing the younger generation to face the challenges of the 21st century by developing collaboration skills. These skills not only train students in effective work sharing, but also shape their character, broaden their horizons, and foster responsibility and unity among students (Ulhusna et al., 2020). Students need to master collaborative skills to socialize easily, be sensitive to their environment, appreciate the competencies of others, communicate well, and be able to work together and be tolerant (Pujiati et al., 2022).

Collaborative skills play a role in building knowledge and skills through social interaction and serve to deepen understanding of the material. In the process, each group member interacts, reveals differences in understanding, and exchanges ideas, enriching their insights, improving mutual understanding, and supporting improved learning

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outcomes (Marita et al., 2023). Learning outcomes reflect students' abilities and behavioral changes after gaining learning experiences, as well as evidence of the success of the learning process (Awe & Benge, 2017; Khoerunnisa & Aqwal, 2020). Measuring learning outcomes is necessary to assess students' understanding of the material and ability to apply real-world concepts (Somayana, 2020; Yuwanita et al., 2020). This evaluation helps teachers evaluate learning effectiveness and identify aspects that need improvement or development.

Observations in class VII A at SMPN 8 Magelang and interviews with science teachers show that students' collaboration skills still need to be improved. In group discussions, many students joke around, do not understand the task, and only one or two are active. They also lack responsibility, find it challenging to work together, and tend to accept the opinions of friends who are considered smart without considering other ideas. Teachers hoped collaboration skills would improve, but students played more, were less involved, and did not complete their tasks. Without group work, they also got bored and sleepy easily while studying. This lack of collaboration skills impacted learning outcomes, as students had difficulty understanding the material, were less active, and were not accustomed to thinking critically and solving problems together. According to teachers, this happens because of their childish nature and lack of understanding of the importance of cooperation and responsibility in learning. Teachers hope that collaboration skills will improve, but students instead play more, are less engaged, and don't complete assignments. Without group work, they also easily get bored and sleepy while studying. This lack of collaboration skills impacts learning outcomes, as students have difficulty understanding the material, are less active, and are not accustomed to thinking critically and solving problems together. According to teachers, this occurs because they are childish and do not yet understand the importance of cooperation and responsibility in learning.

In light of these issues, there is a need for innovative learning models and interactive media that are suited to the characteristics of students, one of which is the Team Games Tournament (TGT) cooperative learning model. The cooperative learning model is designed to achieve three main objectives: improve academic achievement, foster tolerance and acceptance of diversity, and develop students' social skills (Luo et al., 2020). The TGT learning model is student-centered by creating a fun learning atmosphere and forming groups to encourage individual and group interaction. In addition, this model integrates elements of games and tournaments, making it more interesting and motivating for students (Khoirunnisa & Amaliyah, 2023). The games and tournaments designed are academic games that can increase learning motivation and encourage students to actively work together, thereby improving learning outcomes (Luarn et al., 2023; Sadera et al., 2020). As prior research has shown that the TGT cooperative learning model makes it easier for teachers to improve students' learning outcomes (Efendi et al., 2025; Fauzi & Masrupah, 2024; Karmila & Mawardi, 2020). In addition, prior research also shown that students' learning outcomes improve using the TGT learning model compared to conventional teaching methods (Saputri & Sukmawati, 2024).

The learning process runs optimally and successfully when supported by models and learning media that are suited to the characteristics of the students, which makes it easier to achieve learning goals (Alika & Radia, 2021; Febriyanti et al., 2023; Haerani et al., 2023). In this era of Industry 4.0, technology has become a primary focus in the teaching and learning process (Husna & Asrizal, 2025; Raudah et al., 2021). The TGT model also more effective and relevant to current technology developments, so it requires the support of interactive learning media. One of the medium, which is a digital platform, is Wordwall. Wordwall enables teachers to create various educational games for tournament sessions, such as quizzes, crossword puzzles, and wheels of fortune. The use of Wordwall in learning is urgent because it can increase student engagement, strengthen material comprehension, and provide a fun and meaningful learning experience (Cerón-García et al., 2022; Hadi et al., 2024; Saputri & Sukmawati, 2024). Wordwall also proven for effectively increases student activity and learning outcomes because it presents material in a visual form and through motivating games (Nissa & Renoningtyas, 2021).

Various studies have shown that the implementing of the Teams Games Tournament (TGT) learning model can enhance student motivation, learning outcomes, and interaction during the learning process. However, there are still research gaps that need to be addresed. First, most prior research has focused on improving students' cognitive aspects and learning outcomes, while research specifically examining the improvement of collaboration skills as one of the 21st-century 4C skills and learning outcomes through the integration of the TGT model with interactive digital media such as Wordwall remains relatively limited. Second, this research is expected to make a significant contribution to the field of education, particularly in developing innovative and effective learning methods to improve both students' collaboration skills and learning outcomes. Thus, this classroom action research was conducted to improve students' collaboration skills and cognitive learning outcomes, titled 'Improving Collaboration and Science Learning Outcomes Using the Team Games Tournament

Cooperative Learning Model Assisted by Wordwall Media in Grade VII Students at SMPN 8 Magelang'.

Method

Time and Place of the Research

This type of classroom action research (CAR) was conducted at SMP Negeri 8 Magelang in the even semester of the 2025/2026 academic year. The research lasted for three months, which included March, April, and May, covering the planning stage, the implementation of two CAR cycles, and the analysis and preparation of the research report.

Research Design

The research design flow chart can be seen in the figure 1. Based on Figure 1, it can be stated that the research began with 1) planning stage, 2) implementation of two CAR cycles, 3) analyze data that has been collected, and the last step is 4) writing the research report.

Figure 1. Research design flow

The research method in this study is descriptive quantitative. Descriptive quantitative is a method used to systematically compile and analyze numerical data in order to illustrate or summarize a population or phenomenon (Sudirman et al., 2023). The subjects of this study were 31 students from class VII A at SMPN 8 Magelang. There were 13 male students and 18 female students with varying levels of academic ability. The sampling technique used in this study was purposive sampling, in which participants were selected based on specific criteria (Etikan, 2016; Memon et al., 2025). This class was chosen because, based on initial observations, the students' collaboration skills were still low, which impacted their learning outcomes, so intervention through an innovative learning model was needed. The independent variable in this study is the TGT cooperative learning model assited by Wordwall and the dependent variable are students' collaboration skills and learning outcomes. The research was conducted using several data collection techniques and instruments, which are:

Observation

Using observation sheets, teachers and observers conducted observations to assess students' collaboration skills during learning in the application of the TGT cooperative learning model assisted by Wordwall media.

Test

Testing techniques are used to determine improvements in students' understanding of the material or to measure student learning outcomes. The tests are conducted using *pre-test* and *post-test* question sheets.

Research Procedure

This research was conducted in two cycles, with each cycle consisting of two meetings. Each cycle in this study was carried out through systematic stages. The research design followed the Kemmis and McTaggart model, which consists of four stages in each cycle: planning, implementation, observation, and reflection (Arikunto, 2017). Details of the classroom action research implementation are presented in Table 1.

Table 1. Stages of Classroom Action Research (CAR)

Stages	Activity
Cycle 1	Problem Identification
	Planning I
	Implementation of learning using the Cooperative Learning Model, Team Games Tournament, assisted by Wordwall media
	Observation
	Reflection
Cycle 2	Planning II (based on the reflection results from Cycle I)
	Implementation of learning using the Cooperative Learning Model, Team Games Tournament, assisted by Wordwall media
	Observation
	Reflection

This reserach measures learning outcomes in the domain of knowledge using indicators based on Bloom's taxonomy at levels C2 (understanding), C3 (applying), and C4 (analysing). In addition to learning outcomes, it

also measures improvements in student collaboration skills with five indicators, which are: active contribution, productive work, responsible attitude, flexibility and compromise, and mutual respect (Verawati et al., 2024). These indicators are described in Table 2.

Table 2. Collaboration Skills Indicator

Indicators	Description
Active contribution	Contributing ideas, integrating discussion results, and providing solutions to problems.
Productive work	Actively engaging in discussions, completing tasks effectively and efficiently, focusing on problem solving and maintaining clear communication during discussion
Responsible attitude	Responsible for the tasks assigned, completing tasks on time, and obeying instructions given.
Flexibility and compromise	Accepting criticism and suggestions, discussing differences of opinion and accepting assigned tasks.
Respectful attitude	Respect and value the opinions of friends, do not impose your own opinions, and accept joint decisions in resolving problems.

Research Data Analysis

The data obtained in the study will then be analysed descriptively, quantitatively, and qualitatively in the form of numbers, which will then be described in words. Data analysis techniques are used to answer the research questions and draw conclusions from the study. The data to be analysed in this study includes:

Analysis of Observational Data on Collaboration Skills

The data was obtained from observers while observing students' skills in learning. The calculation of collaboration skills was carried out using the following steps. First, each student's collaboration skill score was calculated using the following formula:

$$Score = \frac{number\ of\ scores\ obtaines}{maximum\ score}\ x\ 100 \quad (1)$$

Second, the average score of students' collaboration skills were then computed.

$$P = \frac{total\ score\ of\ all\ students}{total\ number\ of\ students}\ x\ 100 \quad (2)$$

Last, the average score of students' collaboration skills were categorized according to student activity level criteria, which are shown in Table 3.

Table 3. Criteria for Collaborative Activates (Herdiansyah et al., 2025)

Score	Criteria
>80	Highly collaborative
61 – 80	Collaborative
41-60	Moderately collaborative
21-40	Less collaborative
≤20	Not collaborative

Analysis of Learning Outcomes Data

Student learning outcome data was obtained through pre-tests and post-tests. The data was analysed using normality gain analysis. The average N gain value was calculated from the results of each cycle, and the increase was observed using the following formula:

$$g = \frac{S_{post} - S_{pre}}{S_{max} - S_{min}} \quad (3)$$

Explanation:
g = normalised gain
Spre = *pretest* score
Spos = *posttest* score
Smax = maximum score (100) (Wahab et al., 2021)

The results of the *N-Gain* calculation are categorised according to the criteria in Table 4.

Table 4. N-Gain Criteria (Hake, 1998)

N-Gain Score	Criteria
N-gain < 0.30	Low
0.30 ≤ N-gain < 0.70	Medium
N-gain ≥ 0.70	High

The indicators of success for this study are an increase in the average collaboration skills and an increase in the N- Gain value of students' cognitive learning outcomes from each cycle.

Result and Discussion

This study aims to improve students' collaboration skills and learning outcomes by applying the TGT cooperative learning model assisted by the Wordwall media. Based on the following results were obtained from 31 students in class VII A of SMP Negeri 8 Magelang.

Collaboration Skills

Improvements in collaboration skills were obtained from observations made by observers during cycles I and II of learning. In cycle I, learning was carried out using a WordWall 'Open the Box' media tournament. Each group had the opportunity to come forward and choose a numbered box. The numbered boxes provided

had the scores for the questions listed on them. If the group answered the question correctly, they would receive the score listed on the numbered box. If they answered incorrectly, the group's points would be reduced by 10; if they did not, they would be reduced by 5.

In cycle II, learning was carried out using a tournament that also utilized the WordWall 'Open the Box' media. The tournament was conducted using a group strategy. Each group could come forward and choose a numbered box in two rounds. The numbered boxes provided already had the scores for the questions listed on them. If the group answered the question correctly, they would receive the score listed on the numbered box. If they answered incorrectly, the group's points would be reduced by 10; if they did not answer, they would be reduced by 5.

Collaboration skills can be observed in LKPD completion activities, games, and tournaments in TGT cooperative learning. The improvement in cooperative skills assessment is presented in the graph in Figure 2.

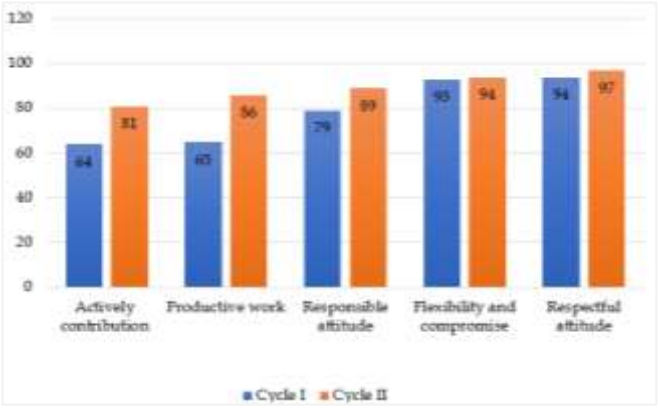

Figure 2. Results of the assessment of collaboration skills in cycle I and cycle II

The data in the graph in Figure 2 shows that students' collaboration skills improved in every aspect in cycles I and II. In terms of active contribution, the average score in cycle I was 64 with a 'collaborative' criterion, and this improved in cycle II to 81 with a 'highly collaborative' criterion.

The increase in students' active contribution in cycle II occurred due to improvements in the learning process that encouraged the involvement of each student in the group. In the TGT cooperative learning model, each student has a shared responsibility to ensure that all team members understand the material, because the tournament results are determined by individual performance in the context of the group. This encourages students to participate more actively in group discussions and try to help each other understand the subject matter. TGT model emphasizes positive interdependence, where each student's achievement is influenced by the success of the group (Luo et al., 2020). This condition encourages students to be actively involved, as they are not only responsible for their individual achievements but also contribute to the group's progress.

The aspect of working productively based on data also improved. In cycle I, the average score was 65, which met the 'collaborative' criterion, and in cycle II, it increased to 86, with a 'highly collaborative' criterion. This improvement occurred due to improvements in the learning strategies implemented by teachers, particularly in managing group dynamics. In cycle II, teachers assigned more structured roles and conducted more intensive monitoring, so that each student was encouraged to contribute according to their responsibilities and complete tasks on time. A clear role structure within the group and teacher involvement in facilitating the collaboration process are very important for creating a productive and supportive learning environment. This is in line with research conducted by Gillies (2016), which explains that the success of cooperative learning is greatly influenced by how teachers guide group interactions and distribute responsibilities fairly. In addition, Slavin (2018) explains that a clear group structure and active teacher involvement in monitoring student collaboration improve learning outcomes and strengthen students' social skills.

The aspect of responsibility within the group also improved. In cycle I, the average score was 79 with a 'collaborative' criterion, which in cycle II increased to 89 with a 'highly collaborative' criterion. The improvement in the aspect of responsibility within the group may also have occurred due to the formation of stronger social and emotional awareness among group members in cycle II. Students began to realize that the group's success was greatly influenced by the active and consistent contributions of each individual after going through a collaborative experience in cycle I. Cycle I was a process of adaptation, while Cycle II showed stability in interactions and increased commitment to shared tasks. The aspect of responsibility also increased due to the good division of tasks among each group member. This is in line with the research by Dewi et al. (2023), which explains that TGT cooperative learning can improve collaboration skills in terms of responsibility due to the tournament system that encourages each student to contribute optimally to achieve a high score for the group's victory. In addition, a clear division of tasks within each group fosters a sense of responsibility in each individual towards the team's success.

The increase in social-emotional awareness among students during the implementation of the TGT learning model can occur because this model is designed to encourage intensive interaction and close cooperation

among group members. In the TGT model, students not only work together to understand the material, but also engage in tournaments that require them to support and motivate each other in order to achieve the best results. This is in line with the research by Wulandari et al. (2024), which shows that TGT learning contributes to the development of social skills, such as listening, respecting opinions, and managing group conflicts. In this context, TGT not only builds cognition but also social awareness and emotional connection among students, which is important in creating a positive and collaborative learning climate.

The aspect of respecting others and cooperation skills also improved. In cycle I, the average score was 94 with a 'highly collaborative' criterion, and in cycle II, the average score increased to 97 with a 'highly collaborative' criterion. This improvement occurred because the learning design applied through the TGT model in both cycles encouraged active interaction and interdependence among group members, but with more mature social experiences in cycle II. This encouraged students to more appreciate their friends' decisions when making choices, strengthened trust, and formed a sense of emotional responsibility for the ongoing process. Thus, this learning trains critical thinking and deepens awareness to appreciate friends' roles, contributions, and courage in taking risks in answering questions. Gillies (2016) explains that task-based cooperative learning and interactions such as the TGT model can improve students' social skills in listening, respecting differences of opinion, and showing empathy in completing group tasks. Furthermore, in line with the research by Wulandari et al. (2024), which shows that the use of group-based games such as TGT, varied with digital media, has been proven effective in improving students' interpersonal skills, including mutual respect, through group dynamics that encourage cooperation, two-way communication, and joint decision-making.

Learning Outcomes

Improvements in learning outcomes were observed from the pretest and posttest in cycle I and cycle II in the cognitive domains C2 (understanding), C3 (applying), and C4 (analysing). After the pretest and posttest were completed, N-Gain was used to evaluate improvements in student learning outcomes. The results of the N- Gain analysis are shown in Table 5.

Table 5. N-Gain Learning Outcomes Indicator Result

Indicator	N-Gain	
	Cycle I	Cycle II
C2	0.75	0.76
C3	0.72	0.74
C4	0.75	0.81

Based on the data in Table 5, student learning outcomes increased from cycle I to cycle II in each cognitive domain indicator according to Bloom's Taxonomy in C2, C3, and C4. This can be seen in the C2 indicator in cycle I, which was 0.75 and increased in cycle II to 0.76. The C3 indicator in cycle I was 0.72 and increased in cycle II to 0.74. The C4 indicator in cycle I was 0.75 and increased in cycle II to 0.81.

In cycle I, learning focused on the material 'Biogeochemical Cycles' with most of the question indicators measuring C2 (understanding) skills, such as explaining the water, carbon, oxygen, and nitrogen cycles. Students began to be able to explain the flow and role of components in these cycles. C3 (applying) skills were also honed through questions that asked students to relate the cycles to ecosystem balance. However, C4 (analysing) skills were still limited, as seen in the students' difficulty in distinguishing the impact of a disturbance in one cycle on the ecosystem as a whole.

In cycle II, the material discussed was 'Natural Resource Conservation', which required students to not only understand the forms of conservation (C2), but also apply conservation principles in their daily lives (C3) and analyse the consequences of not conserving the environment (C4). In this cycle, students' abilities at levels C2, C3, and C4 showed improvement.

The C2 indicator improved, but not significantly. This was because, in terms of understanding, some students were still adapting to the game's rules and group division in the initial syntax of TGT, which is team (group formation). However, group discussion activities still helped students to exchange information with each other so that their understanding of the concept continued to improve, albeit not significantly. In line with the research conducted by Suandi (2022), group discussions have been proven to enhance students' understanding due to direct interaction, mutual correction, and clarification of concepts.

In indicator C3, there was an increase from 0.72 to 0.74. This increase was supported by the game's syntax in the TGT model. The game element in learning provides a healthy competitive atmosphere so that students are more motivated to think quickly, practise their understanding, and apply concepts in different situations. Educational games encourage students to think actively and discuss in groups, while tournaments spur more serious participation through a system of assessment and rewards. The game and competition elements in this model have proven to be effective in improving student learning outcomes (Luarn et al., 2023). This is in line with research conducted by Sadera et al. (2020) that competition in the form of games can increase students' intrinsic motivation because of the challenge to obtain the highest score for their group. Thus, game activities encourage skills in the application

domain to develop through direct practice and concept application.

Indicator C4 showed the highest increase, from 0.75 in cycle I to 0.81 in cycle II. This was greatly influenced by the tournament syntax in TGT. Competition between groups encouraged students to analyse questions more deeply in order to provide the correct answers and obtain the highest score for their team. The spirit of competition made students more skilled in analytical thinking. Khoirunnisa et al. (2023) emphasised that tournaments in TGT are designed to foster learning motivation through healthy academic competition.

In cycle II, teacher provided different treatments based on the results of the previous evaluation, which were to clarify the game's rules, provide more varied sample questions, and emphasise group strategies in preparing members before the tournament. This change in treatment proved to make students better prepared to face questions with a higher level of analysis. In an effort to contribute points to the group, students needed to master the material well so that they were trained to analyse each question in greater depth. The tournament element in the TGT model can also encourage students to study harder (Luarn et al., 2023).

Competitions and games as part of academic activities have been proven to increase student engagement and motivate them to actively participate in learning. This motivation is one factor that influences improved learning outcomes (Arip et al., 2024). Fitri et al. (2023) explain that applying TGT with Kokami media significantly enhances the critical thinking skills of primary school students in science lessons. In addition, research by Suseno et al. (2023) shows that the TGT model with a tournament table game format can improve high school students' critical thinking skills. Thus, both studies confirm that intergroup competition in TGT tournaments stimulates deeper analysis of problems and higher-order thinking skills.

The improvement in learning outcomes from cycles I and II shows that learning through the TGT model successfully strengthens conceptual understanding while training students to think critically and apply their knowledge per the objectives of science learning. This success cannot be separated from the role of teachers in choosing the appropriate learning model. According to Suseno et al. (2023), the selection of a learning model must consider the learning objectives, characteristics of the material, and the conditions of the students, including their interests, initial abilities, and learning styles.

The TGT model provides space for students to learn through group discussions, educational games, and tournaments that trigger active involvement. This is in line with Luo et al. (2020) explanation that the TGT type of cooperative learning model is student-centred and includes fun elements, such as group formation, individual and group interactions, as well as games and tournaments. Students who participate in TGT cooperative learning can achieve better results when working together. According to Jean Piaget's cognitive theory, social engagement with peers, debates, and argumentative assistance make reasoning appear more logical. Learning activities are the best method for children to learn, according to Piaget's theory (Santrock, 2021).

Conclusion

The implementation of the TGT cooperative learning model assisted by Wordwall media has been proven to improve students' collaboration skills and science learning outcomes. Based on the results of the study, it was found that the implementation of the TGT cooperative learning model assisted with Wordwall improved students' collaboration skills across all aspects, including active contribution, productive work, responsibility, and mutual respect, with most aspects improving from 'collaborative' to 'highly collaborative' criterion. Students' learning outcomes also improved, as evidenced by the increase in N-Gain scores from cycle I to cycle II for indicators C2 (N-Gain scores from 0.75 to 0.76), C3 (N-Gain scores from 0.72 to 0.74), and C4 (N-Gain scores from 0.75 to 0.81). Broadly, these results indicate that academic competition-based learning combined with interactive digital media can create a more engaging and meaningful learning atmosphere. These results can be a practical reference for teachers to implement TGT assisted by Wordwall, not only in science learning but also in other subjects as a digital learning innovation to develop 21st-century skills in students specifically one of the 4C skills, collaboration skills. However, this study has several limitations, such as the use of classroom action research limited to one class and two learning cycles in science subject. In line with this, future research is suggested to implement this model at other educational levels or subjects with a larger sample size to provide a more comprehensive overview and ensure higher generalizability.

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Author Contributions

Conceptualization, F.N. and R.R.; methodology, F.N. and R.R.; software, F.N.; validation, F.N. and R.R.; formal analysis, F.N;

investigation, F.N.; resources, F.N.; data curation, F.N. and R.R.; writing—original draft preparation, F,N. and R.R.; writing—review and editing, F.N.

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Conflict of Interest
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