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The Effect of The Deep Learning Approach in Learning the Game of Rounders on the Cooperative Character of Elementary School Students

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Abstract

Physical education in primary schools not only enhances motor skills and physical health but also significantly contributes to the development of student teamwork. Although team sports such as rounders can promote collaboration, traditional pedagogical methods sometimes emphasise performance at the expense of substantive social engagement, highlighting the necessity for more effective educational strategies. This study aimed to examine the effect of an immersive learning approach in the game of rounders on elementary school students' understanding of cooperation and to compare its effectiveness with that of conventional teaching methods. This study used a quantitative, quasi-experimental design with a non-equivalent control group. Participants were sixth-grade students divided into two groups: an experimental group that received immersive instruction and a control group that received traditional instruction. Data were collected using a cooperation questionnaire administered before and after the intervention. The instrument used a Likert scale and was tested for validity and reliability before use. Data analysis included descriptive statistics and inferential analysis to examine intra-group improvements and inter-group differences. Results showed that both groups improved their understanding of cooperation after the learning process; however, the experimental group showed significantly more improvement than the control group. Statistical testing confirmed a significant difference between the two groups after the intervention, indicating that the immersive learning approach was more effective in improving students' understanding of cooperation. The learning process, which incorporated reflection, discussion, and collaborative problem-solving, led to deeper, more meaningful student engagement. In conclusion, integrating an immersive learning approach into rounders instruction positively influenced students' understanding of cooperation. This can be considered an effective strategy to improve the quality of physical education teaching in elementary schools.

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INTRODUCTION

In addition to improving motor skills and physical fitness, elementary schools' Physical Education, Sports, and Health (PE) programs strategically cultivate the social character traits that kids require in their everyday lives. Physical education (PE) enhances motor skills and serves as a foundation for fostering engagement in the learning process (Fantiro et al. 2025). Cooperation is one of the most important qualities in primary school, as pupils begin interacting with peers more frequently, learn to share responsibilities, understand group norms, and resolve disputes amicably. Strengthening social values in primary school is linked to how well pupils adjust to collaborative learning environments (Sutarti and Ramli 2025). Collaboration is essential to creating a learning environment that fosters students' social and intellectual success (Dhakal et al. 2025). Moreover, physical education in elementary schools can significantly enhance students' social-emotional learning, as organised movement activities offer children opportunities to cultivate responsibility, mutual support, and positive peer interactions (Sindiani et al. 2025).

The character dimension, particularly cooperation, is often not measured and has not become a systematic learning objective, as PE learning in the field remains "centered" on achieving fundamental skills and physical accomplishments alone. There is a process of developing potential and shaping each student's character through educational synergy among schools, families, and communities (Suherman 2018). Traditional team sports like rounders, which often emphasize hitting, running, throwing, and catching without delving into coordination, communication, and teamwork, are a clear example of this. As a result, students typically play alone, engage in little tactical contact, and are unaware that a team's success depends on the contributions of all members (Jaiswal et al. 2022). These results emphasize the importance of meaningful learning research to improve cooperation through genuinely thoughtful, cooperative play experiences. This is consistent with action research demonstrating that purposefully planned physical education lessons can enhance character traits like collaboration (Supriyadi 2019).

When created with the appropriate pedagogical perspective, traditional games in physical education (PE) have substantial social potential, which makes them increasingly urgent. Traditional sports can be a powerful tool for developing students' character when the educational process requires social interaction, common rules, and shared ideals (Hananingsih, Isnaini, and Irmansyah 2024). A model-based approach and social pedagogy in team game activities can improve students' social engagement, interaction, and communication from the perspective of physical education pedagogy (Haneishi et al. 2024). As a result, rounders serves as both a motor game and a "social laboratory" where kids can practice teamwork through interdependent roles. However, this possibility does not naturally arise when educators rely solely on traditional teaching methods that prioritize technique and repetition, leaving no opportunity for game analysis or reflection on cooperative conduct. It is necessary to teach concepts that help students comprehend the "why" and "how" of collaboration in games rather than just the "what" strategies to use. Recent findings substantiate that cooperative learning in physical education consistently enhances students' engagement, involvement, and teamwork when learning activities are deliberately structured to necessitate interdependence and shared accountability (Cano-García and Rojas-Cazaluade 2022).

Deep learning, as a pedagogical framework rather than just a technical term, is one strategy considered pertinent to these objectives. According to Duan (2022), the difference between surface and in-depth learning, which emphasizes comprehension, conceptual connections, and critical thinking processes, is the foundation of the educational notion of deep learning, which was first proposed traditionally. According to Chen (2024), deep learning puts students at the center of learning through firsthand experience, problem-solving, and reflection in order to acquire meaningful understanding. Additionally, Gomes et al. (2025) integrate deep learning with 21st-century abilities, including critical thinking, creativity, communication, and teamwork, which are highly compatible with collaborative learning objectives. Because physical activity enables simultaneous cognitive, emotional, and social engagement, this method is becoming increasingly significant in the context of physical education and health. According to Botao and Yanpeng (2023), deep learning can raise educational standards by promoting an all-encompassing, long-lasting learning process. Deep learning enables students to assess game scenarios, collaborate on strategic decisions, assign roles, and use communication techniques in team games. This way, character development

goes beyond "advice" and becomes an experience lived and interpreted.

Directions for educational policy that promote meaningful learning and the growth of social competencies further bolster the topic's originality and significance. According to (Ding and Li (2024) deep learning is a strategy that promotes student participation, problem-solving, and introspection, which makes it ideal for character development through real-world learning opportunities. However, the use of deep learning in the game of rounders, with the explicit goal of understanding the nature of collaboration, is still rarely the subject of in-depth research at the implementation level of physical education and health in elementary schools. As a result, this research is crucial for bridging the gap between the requirement for learning designs that genuinely activate cooperation as a learning outcome and the promise of traditional games as a vehicle for character development.

Few studies have explicitly examined deep learning as a learning framework in rounders to enhance the comprehension of cooperation. Several prior studies have demonstrated that cooperative techniques and game-based learning can enhance student collaboration. In comparison to traditional learning. Created a game-based learning paradigm that was very successful in enhancing motor skills, cooperation, and discipline through group projects (Fizi et al. 2023). From the standpoint of sports technology and analytics, Wang et al. (2022) stressed the efficiency of deep learning-based heuristic teaching in improving the quality of children's motor learning, while Lian (2024) highlighted the use of deep learning for performance evaluation and for learning strategies for sports skills. Ji et al. (2025) even demonstrated how a deep learning-based motion detection system might enhance the quality of feedback in sports learning. These studies tend to focus on performance, technique, or overall learning quality, even while highlighting the importance of teamwork, game-based learning, and deep learning in physical education. Therefore, further study is needed to explicitly investigate how the deep learning approach in rounders games affects the perception of cooperation as a measurable, observable social achievement.

The goal of this study is to address this gap by integrating deep learning into rounders instruction to develop and evaluate elementary students' understanding of cooperation.

This study offers a novel contribution to physical education research. The novelty lies in positioning cooperation not merely as a behavioral outcome of team play but as a measurable cognitive understanding developed through deep learning-based instruction. While previous studies have primarily focused on motor skills, performance, or general collaborative behavior, this study explicitly integrates deep learning pedagogy with traditional games to examine students' conceptual understanding of cooperation as a structured learning objective.

This approach provides a new perspective by treating cooperation as both a measurable and teachable construct. Accordingly, this study aims to examine the effect of deep learning-based rounders instruction on students' understanding of cooperation and to compare it with conventional learning. The findings are expected to contribute theoretically to the development of deep learning in physical education and practically to the design of more meaningful and cooperative learning experiences.

METHOD

As suggested by Muse and Baldwin (2021) this study used a quantitative, quasi-experimental design using a Non-Equivalent Control Group Design. Because the research participants were in a pre-formed class, complete randomization was not possible; this approach was employed. In this study, two groups were used: the control group received traditional learning, while the experimental group received deep learning treatment in rounders. Pretests and posttests were used to assess participants' understanding of cooperation before and after the treatment.

The study was carried out for roughly four to five weeks during the even semester of the 2025–2026 school year at Babakan and Sukanegla Elementary Schools in Sumedang Regency. To avoid interfering with regular teaching and learning activities, the research was conducted in accordance with the school's physical education (PE) timetable.

Every sixth-grader at both schools made up the study population. About fifty male and female students between the ages of ten and eleven made up the sample. Sukanegla Elementary School served as the control group, and Babakan Elementary School as the experimental group. Purposive sampling was employed, taking into account student characteristics, school ambient factors, and curriculum equivalency.

This questionnaire comprises 13 Likert-scale items to evaluate student collaboration, covering communication, responsibility, invol-

vement, and teamwork in learning activities. Pearson's Product-Moment correlation with a significance level of 5% and degrees of freedom (n–2) was used to assess the instrument's validity, while Cronbach's Alpha was used to test its reliability. All of the statement items were deemed credible, as the Cronbach's Alpha value was higher than 0.70, and valid, as the calculated r value was higher than the r table value (0.361). To give evidence of student participation in the learning process, observations were made.

SPSS was used to analyze the data. The mean and standard deviation were determined using descriptive statistics. Prior to hypothesis testing, prerequisite analyses, such as homogeneity and normality tests, were conducted. A paired-samples t-test was used to test for improvement in each group, and an independent-samples t-test was used to compare the experimental and control groups at a significance level of 0.05.

The following formula is typically used to calculate the t-test for two independent samples:

$$t=(X_1-X_2)/\sqrt{((S_1)^2/n_1+(S_2)^2/n_2)}$$

Where X_1 and X_2 are the means of each group, $(S_1)^2$ and $(S_2)^2$ are the variances, n_1 and n_2 are the number of samples in each group. The formula is used to determine the significance of differences between groups.

This procedure can objectively and methodically assess the impact of deep learning on elementary students' understanding of cooperation.

RESULTS AND DISCUSSION

This study was conducted over approximately 4–5 weeks during the even semester of the 2025–2026 academic year at two elementary schools in Sumedang Regency. Participants consisted of 51 sixth-grade students aged 10–11, divided into an experimental group (21 students) and a control group (30 students). The experimental group received in-depth, learning-based instruction in rounders, while the control group received conventional instruction. Data were collected using a cooperation questionnaire administered before and after the intervention. The results of this study are presented in several stages, including descriptive analysis, normality testing, homogeneity testing, and hypothesis testing. Descriptive statistics of students' cooperation understanding scores before and after treatment are presented in **Table 1.**

Table 1. The results showed that both groups experienced improved scores. However, the experimental group showed greater improvement than the control group. This suggests that immersive learning-based instruction is more effective in improving students' understanding of cooperation.

Table 1. Descriptive Statistics of Pre-test and Posttest Scores

Group	N	Min	Max	Mean	Std. Deviation
Experiment Pre-test	21	43	62	51.38	4.759
Experiment Posttest	21	55	65	61.48	2.442
Pre-test Control	30	37	65	52.77	7.171
Posttest Control	30	46	65	56.07	4.828

The normality of the data was tested using the Shapiro–Wilk test as shown in **Table 2.** All significance values are greater than 0.05, indicating that the data are normally distributed and suitable for further parametric testing.

Table 2. Results of Normality Test

Group	Statistics	Sig.	Information
Experiment Pre-test	0.963	0.573	Normal
Experiment Posttest	0.933	0.157	Normal
Pre-test Control	0.966	0.442	Normal
Posttest Control	0.975	0.687	Normal

Homogeneity of variance was tested using Levene's Test as shown in **Table 3.** A significance value of less than 0.05 indicates that the data is not homogeneous. Therefore, an independent t-test was conducted using the "unequal variances assumed" approach.

Table 3. Homogeneity Test Results

Levene Statistic	df1	df2	Sig.
11.032	1	49	0.002

The improvement within each group was tested using paired sample t-test **Table 4.** Both groups showed significant improvement ($p < 0.05$). However, the experimental group showed greater improvement, indicating the effectiveness of the deep learning approach.

Table 4. Paired Sample t-Test Results

Group	Significant difference	t	df	Sig. (2-tailed)
Experiment	-10.095	-10.170	20	0.000
Control	-3.300	-2.780	29	0.009

The difference between groups was analyzed using an independent sample t-test **Table 5.** The results showed a significant difference between the experimental and control groups ($p <$

0.05), confirming that immersive learning delivered better results than conventional learning.

Table 5. Independent Sample t-Test Results

Mean Difference	t	df	Sig. (2-tailed)	Lower	Upper
5.410	5.252	45.297	0.000	3.336	7.484

These findings indicate that immersive learning significantly improves students' understanding of teamwork compared to conventional methods. This suggests that learning activities involving reflection, discussion, and decision-making processes are more effective in developing students' social character because they actively engage students in meaningful interactions and shared responsibility (Gomes et al. 2025).

From a theoretical perspective, these results align with the concept of immersive learning, which emphasises meaningful understanding, critical thinking, and conceptual connections (Duan 2022). Students engage not only in physical activity but also in cognitive and social processes, thereby developing a deeper understanding of teamwork and its role in achieving shared goals. This supports the view that learning is more effective when students are actively engaged in reflective and problem-based experiences (Chen et al. 2024).

In the context of physical education, teamwork is not only a behavioural outcome but also a conceptual understanding that can be developed through structured learning experiences. The immersive learning approach allows students to analyse game situations, communicate effectively, and reflect on their roles within a team. In rounders, this process is reinforced by the nature of the game itself, which requires coordination between the batting and fielding teams, role assignments, and ongoing communication between players. These characteristics create authentic situations in which students must rely on one another, fostering interdependence and teamwork (Haneishi et al. 2024). This aligns with previous research showing that cooperative and game-based learning enhance student engagement and collaboration (Cano-García and Rojas-Cazaluade 2022).

Furthermore, the greater improvement in the experimental group suggests that teacher facilitation plays a crucial role in shaping students' social learning outcomes. Unlike traditional methods that primarily focus on technical skills, immersive learning encourages directed interaction, problem-solving, and reflection. The teacher's role in structuring tasks, facilitating discussions, and encouraging student participation is crucial to helping students internalise the values of cooperation (Supriyadi 2019).

These findings also reinforce the notion that traditional games like rounders can serve as effective vehicles for character education when supported by appropriate pedagogical approaches. Through structured, meaningful activities, students not only practice physical skills but also develop communication, responsibility, and teamwork that extend beyond the classroom. This is consistent with previous research showing that traditional games, when integrated with appropriate learning strategies, can significantly contribute to students' social and character development (Hananingsih et al. 2024).

However, this study has several limitations, including its quasi-experimental design and relatively small sample size. Future research is recommended to involve larger samples and longer observation periods to test the sustainability of learning outcomes.

CONCLUSION

This study's findings demonstrate that employing an immersive learning technique in rounders instruction enhances elementary school pupils' comprehension of cooperation. This finding pertains to the initial research purpose, which was to investigate the impact of immersive learning on students' comprehension of collaboration. This finding pertains to the initial research purpose, which was to investigate the impact of immersive learning on students' comprehension of collaboration. Through significant learning activities that included discussion, reflection, and collaborative decision-making, students cultivated a profound understanding of cooperation as an essential component of the learning process. The essence of rounders as a team-oriented game that requires coordination, communication, role-sharing, and mutual support among participants enhances collaboration. When integrated with an immersive learning methodology, these attributes of the game are enhanced through structured opportunities for students to reflect on their responsibilities, cooperatively address challenges, and collectively make strategic decisions.The research indicated that students who engaged in immersive learning-based instruction exhibited superior comprehension of collaboration compared to those who received traditional training. This conclusion pertains to the second research objective, concerning the disparities in students' comprehension of collaboration between the two groups. Integrating an immersive learning approach into rounders instruction is an effective pedagogical

alternative in primary school physical education, as it engages students physically while fostering cognitive and social interactions. This transforms the game into a meaningful learning experience that reinforces cooperation and supports the development of students' social skills over time.

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