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Problem-solving mathematical ability in statistics courses: The impact of the Think–Pair–Share strategy assisted by R software

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Abstract
Problem-solving ability has been recognized as a key competency in 21st-century learning, particularly in statistics education, where students are required to analyze data and interpret results accurately. Integrating digital tools such as R software is considered essential for supporting these competencies, as they enable students to explore data, perform computations, and visualize outputs effectively. This study aimed to examine the effectiveness of the Think–Pair–Share model assisted by R software (TPS-R) in improving students' problem-solving abilities in statistics courses. A quantitative approach using a quasi-experimental design was employed, involving two groups: an experimental class applying TPS-R and a control class applying the Think–Pair–Share model without R software (TPS-WR). The results showed a significant difference in problem-solving abilities between the two groups, with the TPS-R class demonstrating higher performance (Mann–Whitney U = 215.0, Z=–2.428, p = 0.017). These findings indicate that integrating TPS with R software serves as an effective instructional strategy in statistics courses, provided that instructors manage class time efficiently and guide students' learning processes appropriately.

Keywords: Problem solving, R-software, Statistics, Think Pair Share

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Introduction

Higher education, particularly in the field of statistics, requires effective teaching methods to help students understand complex concepts. Statistics, as a discipline focused on the collection, analysis, and interpretation of data, is often perceived as a challenging subject by many students (Hasim et al., 2024). One of the major challenges in teaching statistics is developing students' problem-solving abilities, which are crucial for the practical application of statistical concepts in real-world situations (Hariyanti et al., 2025). To address this challenge, an effective approach is the implementation of active learning models that encourage collaboration among students, such as the Think-Pair-Share (TPS) model.

The Think-Pair-Share (TPS) model is a cooperative learning method that encourages students to first think individually (think), then discuss with a partner (pair), and finally share ideas with a larger group (share). This approach is grounded in social constructivist theory, which emphasizes the importance of social interaction and collaboration in knowledge construction (Vygotsky, 1978). According to Vygotsky's theory, learning occurs through interactions with others and through engaging in problem-solving tasks in a social context, which can help enhance cognitive development. By fostering collaboration, TPS aims to improve students' problem-solving abilities by providing them with opportunities to discuss, reflect, and refine their ideas in a supportive environment. Previous studies have shown that cooperative learning models, including TPS, improve students' understanding and learning outcomes across various disciplines (Mesghina et al., 2024; Si et al., 2022; Mardika et al., 2020; Sukmawati et al.,2017), including statistics courses. However, while these studies primarily emphasized general academic outcomes, fewer studies have explored the specific effects of TPS on higher-order problem-solving skills, particularly in statistical contexts, where structured problem-solving is essential for interpreting data and drawing conclusions.

In addition, the integration of technology in education has become increasingly important. One of the software tools that support statistics learning is R, a widely used statistical software for data analysis. The integration of technology in education is supported by the Technology Integration Theory, which posits that the effective use of technology enhances learning by facilitating access to information, improving engagement, and promoting higher-order thinking skills (Kim & Hong., 2020). R not only assists students in performing statistical analysis but also equips them with practical skills in programming and data visualization. According to Lortie (2022), Cuadrado-Gallego et al. (2023) and Tucker et al. (2023), the use of R in statistics learning allows students to engage more deeply with data analysis while simultaneously enhancing their technical competence for professional contexts. Furthermore, R's open-source nature and its robust capabilities in handling large datasets make it a valuable tool in both academic and professional settings. While the majority of research on R-based learning focuses on students' individual use of the software, limited attention has been given to how R can be integrated into collaborative learning models, such as cooperative learning, to promote conceptual understanding and problem-solving processes. The choice of R, compared to other statistical software such as SPSS or SAS, was motivated by its flexibility, widespread use in academia, and its capacity to integrate easily into interactive learning environments, fostering collaborative problem-solving among students.

The combination of the Think-Pair-Share (TPS) model and R software (TPS-R) offers an innovative approach to teaching statistics. This model allows students not only to understand fundamental statistical concepts but also to develop problem-solving abilities through active collaboration with their peers. Research indicates that collaboration and problem-solving abilities are core competencies needed in the professional world, as they promote critical thinking, decision-making, and the ability to work effectively in teams (Rakhmawati & Syahputra, 2020; Alsmadi et al., 2023; Li & Tu.,2024). Studies have shown that technology-enhanced cooperative learning environments, such as those integrating statistical software, can effectively shape students' cognitive processes by engaging them in more interactive, deeper, and meaningful learning experiences (Johnson et al., 2014; Vygotsky, 1978). For example, the use of tools like R in cooperative settings encourages students to actively engage with data, apply statistical concepts, and collaboratively solve complex problems, thereby improving both their conceptual understanding and computational skills. Despite the promising potential of this approach, empirical evidence on the integration of TPS with specialized analytical tools like R remains scarce. Few studies have specifically examined how such technology-enhanced cooperative learning environments influence students' cognitive processes in solving statistical problems, particularly those that require both conceptual reasoning and computational accuracy.

Although numerous studies had demonstrated the effectiveness of the TPS model across various disciplines, its application in statistics learning supported by R software remained limited. Previous research had often focused on the use of software in individual learning contexts rather than within collaborative settings. This indicates a clear research gap: prior studies have not explored how cooperative structures such as TPS can be systematically combined with data-analysis software to enhance analytical problem-solving in statistics education. Therefore, it was necessary to further explore how the integration of cooperative learning models and statistical software could enhance students' problem-solving abilities in statistics courses.

Based on this rationale, the present study aimed to analyze the extent to which the application of the TPS model assisted by R software could improve students' problem-solving abilities in statistics. In addition, this study sought to examine how peer interaction within groups could deepen students' understanding of statistical concepts and foster the development of their analytical abilities. The novelty of this study lies in its focus on the TPS-R integration as a pedagogical innovation that bridges cooperative learning theory with computational statistical practice—an aspect that previous studies have not explicitly investigated.

Methods

This study employed a quantitative approach with a quasi-experimental design to examine the effect of implementing the Think-Pair-Share (TPS) model assisted by R software (TPS-R) on students' problem-solving abilities in statistics courses. The quasi-experimental design was chosen because it allowed for a comparison between two groups receiving different treatments without random assignment, which was appropriate given the field conditions that did not permit strict random selection of participants (Sukmawati et al., 2020; Muse et al., 2021). Consideration was also given to specific factors that might have disrupted the validity of the experiment (Slocum et al., 2022). In conducting the study, new class groups were not created. Instead, existing class groups were utilized, with one designated as the experimental group and the other serving as the control group. Both groups were selected based on having relatively similar characteristics to ensure comparability.

Research Design

The research design involved two groups of students divided according to the instructional model applied. The experimental group was taught using the Think-Pair-Share model assisted by R software (TPS-R), while the control group was taught using the Think-Pair-Share model without the assistance of R software (TPS-WR). The statistics topics covered in the course included descriptive statistics, hypothesis testing, and regression analysis. The teaching process was divided into three stages, corresponding to the Think-Pair-Share model. In the first stage (Think), students were asked to individually analyze a statistical problem related to the topic of descriptive statistics. In this phase, they used R to perform initial data analysis, including generating summary statistics and visualizations. In the second stage (Pair), students worked in pairs to discuss their findings and compare their results. At this stage, R was used collaboratively to explore different approaches to the analysis, such as comparing data visualizations and performing hypothesis tests. In the final stage (Share), groups presented their solutions to the class, demonstrating how they used R to analyze and interpret the data. The integration of R software in the TPS-R group allowed students to engage with statistical problems in a hands-on manner, enhancing their problem-solving abilities by providing them with the tools needed to perform detailed data analysis efficiently (Cooper et al., 2021; Mundelsee & Jurkowski, 2021). In contrast, the TPS-WR group followed the same sequence but relied on traditional methods, such as manual calculations and basic discussions, without using any statistical software (Lortie et al., 2022; Jiang et al., 2022). This combination of collaborative learning and technological support was expected to enhance students' problem-solving abilities in statistics courses, particularly in solving more complex statistical problems.

Sample of the Study

This study was conducted at a private university located in the Banten region, Indonesia. The sample consisted of two classes: the experimental group (TPS-R), comprising 28 students, and the control group (TPS-WR), comprising 25 students. The decision to use two separate classes was made to enhance the external validity of the study by comparing the effects of the treatments (TPS-R vs. TPS-WR) on different groups of students. This design allowed for a more robust comparison of learning outcomes between the groups, minimizing potential biases that could arise from using only one class. Additionally, using two classes with relatively similar characteristics in terms of their basic knowledge of statistics ensured that the observed differences in outcomes could be more directly attributed to the treatments applied, rather than to pre-existing differences in student performance (Campbell et al., 2020; Creswell & Creswell, 2017). While using a single class and comparing its learning outcomes before and after the experiment could be a valid design, this approach may not account for the variability between individuals in a single class, and it could introduce a risk of confounding variables. By using two groups, the study could better control for these factors, providing more reliable and generalizable results.

Research Instruments

The primary instrument used in this study was a problem-solving test specifically developed for the statistics course. The test consisted of several items designed to assess students' abilities in identifying, analyzing, and solving statistical problems relevant to the topics covered in class. The test was composed of essay-type questions, which allowed students to explicitly demonstrate their reasoning processes. In addition, classroom observations were conducted to evaluate the extent to which the TPS model and the use of R software were implemented during learning activities. The observations focused on student interactions during the Think, Pair, and Share stages, as well as the application of R software in problem-solving tasks.

Data Collection Technique

The data were collected using a problem-solving test in the form of essay questions designed to assess students' abilities in learning statistics. Two types of tests were administered: a pre-test and a post-test. Both instruments underwent trial testing to ensure validity, reliability, item difficulty, and discrimination index. The test consisted of four problem-solving essay questions, which were developed based on a test blueprint, indicators, and levels of difficulty, accompanied by a scoring rubric. The test items were identical for both the experimental and control groups. A sample of the test items includes questions such as: "Calculate the mean, median, and mode for the following data set," and "Perform a hypothesis test to determine if there is a significant difference between two given data sets." The indicators assessed in the tests included the ability to calculate measures of central tendency, perform hypothesis testing, and interpret statistical results. The scoring rubric consisted of four levels: 4 for excellent answers with full understanding and correct reasoning, 3 for good answers with minor errors, 2 for fair answers with significant errors, and 1 for poor answers that lacked clarity and understanding. The pre-test was administered prior to the treatment to assess the initial conditions of the students in both the experimental and control groups, while the post-test was given after the treatment to assess the final outcomes, allowing for a comparison of learning progress.

Data Analysis Technique

The data were obtained from the problem-solving tests, which consisted of both pre-test and post-test assessments of students' mathematical problem-solving abilities. Prior to administration, the test items were examined for several quality measurements, including validity, reliability, difficulty index, and discrimination index. The reliability of the tests was measured using Cronbach's alpha, which indicated that the test items were sufficiently consistent to assess students' abilities accurately. Once the criteria for validity, reliability, difficulty, and discrimination were met, the items were used in both the pre-test and post-test.

In addition to the problem-solving tests, classroom observations were conducted to gather supplementary data on student interactions and engagement during the learning process. The observations were analyzed qualitatively, using a coding system to categorize behaviors and interactions observed during the TPS and TPS-R sessions. These coded data were then analyzed to identify patterns of collaboration, problem-solving strategies, and the use of R software in the classroom.

The data from the tests were analyzed through several statistical procedures. First, normality and homogeneity tests were conducted to determine whether the data met the assumptions for parametric analysis. If the assumptions were satisfied, an independent sample t-test was employed to examine whether there were significant differences between the experimental and control groups in both the pre-test and post-test scores. If the assumption of normality was not met, the non-parametric Mann–Whitney U test was used as an alternative to determine whether there were significant differences in the mean scores between students taught with the TPS-R model and those taught with the TPS model without R software (TPS-WR).

Results

This study used a quantitative approach with a quasi-experimental design to assess the effect of implementing the Think-Pair-Share (TPS) model assisted by R software (TPS-R) on students' problem-solving abilities in statistics courses. The quasi-experimental design was chosen because it allowed for a comparison between two groups receiving different treatments without random assignment, which was appropriate given the field conditions that did not permit strict random selection of participants (Creswell & Creswell, 2017).

Research Question 1: Was there a significant difference in problem-solving ability between the TPS-R and TPS-WR groups?

This study aimed to assess the impact of implementing the Think-Pair-Share model assisted by R software (TPS-R) and TPS-WR on students' problem-solving abilities in statistics courses. The research sample consisted of two groups of students: the experimental group using the TPS model assisted by R software (TPS-R) and the control group using the TPS model without R software (TPS-WR). The experimental group included 28 students, while the control group comprised 25 students. Based on the data analysis conducted, the research findings showed a significant difference in problem-solving abilities between the two groups.

Before the treatment, both groups were tested to determine their initial problem-solving abilities through a pre-test. In the pre-test, the experimental group (TPS-R) achieved a mean score of 5.4 of 29 total ideal maximum scores (SMI) with a standard deviation of 3.7, while the control group (TPS-WR) achieved a mean score of 6.5 of 29 total ideal maximum scores (SMI) with a standard deviation of 2.9. The pre-test results were analyzed using the Mann-Whitney U test to compare the initial statistical abilities of both groups before the treatment, ensuring that both groups had similar baseline abilities. Since the data were not normally distributed, as indicated by the results of the normality test, the non-parametric Mann-Whitney U test was chosen as an appropriate alternative to compare the pre-test scores between the experimental and control groups. The pre-test results indicated Mann-Whitney U = 253.5, Z = -1.740, and Sig = 0.083 (Table 1), suggesting that there was no significant difference between the two groups at the initial stage. Subsequently, the treatment was administered and a post-test was conducted. The first research hypothesis aimed to determine whether there was a significant difference in problem-solving abilities between the TPS-R and TPS-WR classes.

Table 1. Pre-test Scores of Problem-Solving Abilities

Class	Pre-Test			
	$\bar{x}$	N	SD	Sig
TPS-R	5.4	28	3.7	0.083
TPS-WR	6.5	25	2.9	

After the pre-test, both groups received different treatments. The experimental group participated in learning using the TPS model assisted by R software, which integrated a collaborative learning approach with the use of technology. Students in this group worked through three stages: first, they thought individually (think), second, they discussed in pairs (pair), and third, they shared their thoughts and discussion outcomes with a larger group (share).

In each stage of the statistics learning process using the TPS approach, students were given the opportunity to use R software to visualize data, analyze statistics, and solve more complex data-driven problems. In contrast, the control group followed the TPS model without the assistance of R software. Although the TPS model still maintained elements of collaboration and student interaction, without the use of R software, students had to rely on manual methods to solve statistical problems, which could have reduced the effectiveness and speed in solving the problems.

Table 2. Problem-Solving Ability Post-Test Score

Class	Post-Test			
	$\bar{x}$	N	SD	Sig
TPS-R	17.5	28	3.9	0.017
TPS-WR	14.9	25	3.8	

The post-test results showed that Mann-Whitney U = 215.0, Z = -2.428, and Sig = 0.017, indicating a significant difference between the two groups in the post-test (Table 2). This suggested that the experimental group performed better in problem-solving abilities compared to the control group after the learning intervention ($\bar{x}$= 17.5, 14.9) (Figure 1).

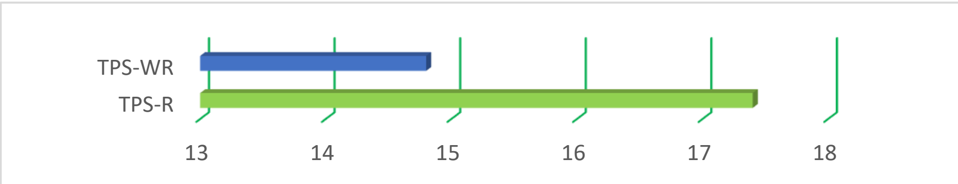

Figure 1. Average Problem Solving Ability of TPS-R and TPS-WR Classes.

Research Question 2: Was the improvement in problem-solving abilities in the TPS-R class greater compared to the TPS-WR class?

After conducting the statistical test, the results in Table 3 showed the descriptive statistics for the problem-solving ability gain index for the TPS-R and TPS-WR classes. This was done after the learning intervention and the administration of both pre-tests and post-tests for the two groups. The problem-solving ability gain index results indicated that the scores for the control and experimental groups were 0.39 and 0.53, respectively, with an improvement quality in the middle category (Sukmawati et al.,2017), and standard deviations of 0.13 and 0.12. The N-Gain scores showed that the TPS-R group (0.53) achieved a higher score than the TPS-WR group (0.39).

Table 3. N-Gain Problem Solving Ability

Class	$\bar{x}$	N	SD	Quality Improvement
TPS-R	0.53	28	0.13	Middle
TPS-WR	0.39	25	0.12	Middle

The N-Gain results were analyzed using the Mann-Whitney U test to assess the improvement in problem-solving abilities after the treatment. This was done to test the second research hypothesis, which aimed to determine whether the improvement in problem-solving abilities of the experimental group (TPS-R) was greater than that of the control group (TPS-WR). Despite the expectation that the TPS-R group would show a greater improvement due to the integration of R software, both groups were found to have similar N-Gain scores, which led to their categorization in the same quality improvement category. This result suggests that, although the TPS-R group benefited from the additional technological support provided by R software, the overall improvement in problem-solving abilities for both groups was comparable. Potential factors contributing to this outcome could include the effectiveness of the collaborative learning process in both groups or the fact that both groups were taught using the same TPS model, which emphasized interaction and problem-solving strategies. Further analysis and possible refinement of the experimental conditions could provide more insights into why these results.

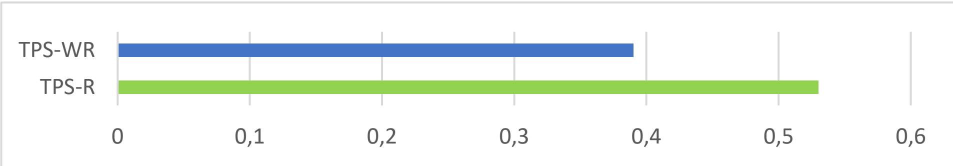

Figure 2. N-Gain Problem Solving Ability of TPS-R and TPS-WR Classes.

Table 4. N-Gain Improved Problem Solving Ability

Mann-Whitney U	*Z*	Asymp. Sig. (1-tailed)
101.000	-4.47	0.000

The N-Gain results showed that Mann-Whitney U = 101.0, Z = -4.47, and Sig = 0.000 (Table 4). This indicated that the improvement in problem-solving abilities for the TPS-R class was greater than that of the TPS-WR class ($\bar{x}$ = 0.53, 0.39) (Figure 2). One of the key findings from this study was the role of R software in assisting students in solving statistical problems. Students in the experimental group showed greater improvement in problem-solving abilities, particularly in visualizing and analyzing statistical data (Figure 3). With the assistance of R software, they were able to access various statistical features and tools that facilitated the handling of more complex data. With the assistance of R software, students were able to access various statistical features and tools that facilitated the handling of more complex data. This technological support proved particularly beneficial in solving problems that required advanced statistical analysis, such as hypothesis testing and regression analysis. The integration of R software allowed students to perform these analyses more efficiently, enhancing their ability to tackle sophisticated statistical tasks and deepen their understanding of the subject. This finding aligns with previous research that highlights the benefits of using statistical software in enhancing students' problem-solving skills, particularly for complex data sets (Lortie et al., 2022; Jiang et al., 2022).

Figure 3. TPS-R Classroom Learning Environment.

In addition, the classroom observation results showed that students in the experimental group were more active in discussing and collaborating during the Pair and Share stages. The discussions facilitated by the use of technology enhanced interaction among students and allowed them to share their understanding and discover more creative solutions to the problems presented. Students in the experimental group also appeared to be more confident in solving problems and more open to using technology in the process of learning statistics (Figure 3).

Discussion

This study aimed to examine the effect of implementing the Think-Pair-Share (TPS) model assisted by R Software (TPS-R) on students' problem-solving abilities in statistics courses. Based on the results obtained, the group of students using the TPS model with R Software assistance showed a more significant improvement in problem-solving abilities compared to the group using the TPS model without R Software assistance (TPS-WR) (Figure 2). In this discussion, the findings of this study were related to previous research results, and a further analysis of the role of technology in statistics learning was provided.

The TPS approach consisted of three main stages: first, students thought individually (Think) to solve the problem, then they paired up to discuss their thoughts (Pair), and finally, they joined a larger group (Share) to share their understanding and the solutions they had found. With this model, students not only learned independently but also benefited from discussions and collaboration with their classmates, which deepened their understanding of the material being taught (Figure 3). This study supported the findings presented by (Alsmadi et al., 2023; Rahmadani et al., 2023), who explained that the TPS model could enhance students' critical and collaborative thinking abilities. In mathematics or statistics education, which often involved abstract concepts, discussion and collaboration became key to clarifying understanding. Students were able to explain difficult concepts to each other and offer different perspectives that enriched the learning process. Therefore, the TPS model played a significant role in enhancing students' problem-solving abilities. The study by Li & Tu (2024) showed that the use of collaborative learning models, such as TPS, could improve problem-solving abilities across various disciplines. Students who were involved in group discussions tended to think more actively and were more motivated to understand the topics being studied. Therefore, the TPS model implemented in this study proved effective in encouraging students to think actively and collaborate in solving statistical problems.

In addition to the TPS model, this study revealed that the use of R Software (R) had a significant impact in helping students solve statistical problems (Table 3). R software (R) is a statistical software widely used in academia due to its ability to process data and perform statistical analyses quickly and efficiently. By using R software (R), students could access various statistical analysis tools, such as hypothesis testing, regression, and data visualization, which greatly assisted them in understanding the real-world applications of the theories they had learned in class. Tucker et al. (2023) found in his study that R software (R) could improve students' understanding of statistical material. With the help of R software (R), students not only studied statistical theory conceptually but also applied it to real data, providing them with a deeper and more practical experience. Therefore, the use of R software (R) in this study helped students understand statistical material better and improved their ability to solve data-related problems. The study by Cuadrado-Gallego et al. (2023) and Finch (2021) reinforced these findings, as they reported that the use of statistical software could enhance the quality of learning in statistics. By utilizing R software (R), students not only learned to compute or solve problems manually but also learned how to analyze data more systematically and efficiently. The use of this technology facilitated students in gaining a better understanding of statistical concepts, which, in turn, improved their problem-solving abilities.

The results of the study showed that the experimental group using the TPS model assisted by R (TPS-R) experienced a significant improvement in problem-solving abilities compared to the control group, which only used the TPS model without (TPS-R). The experimental class had a higher post-test mean score than the control class (Figure 2). This difference clearly indicated that the use of R software (R) in statistics learning provided greater benefits for students in understanding and solving statistical problems. These results were consistent with the study by Sohil et al. (2022) and Pujiastuti & Pambudi (2025), which demonstrated that the integration of technology in mathematics and statistics learning could enhance problem-solving abilities. By utilizing technology, students were able to understand complex concepts more easily, and they were better prepared to apply the theory they had learned to real-world problems. The use of R software (R) in this study helped students conduct deeper analyses and visualize the results in a way that was easier to understand. Previous research conducted by Alsmadi et al. (2023) dan Arifin et al. (2021) also showed similar results, where the use of software in mathematics learning improved students' problem-solving skills. In that study, the use of technology enabled students to solve statistical problems more quickly and accurately, while also providing them with the opportunity to explore more creative solutions.

In addition to the use of technology, the TPS model played an important role in improving students' problem-solving abilities. The TPS model encouraged students to engage in discussions and share their thoughts, which provided them with the opportunity to refine their understanding of the material being studied. Group discussions allowed students to express their ideas, correct mistakes, and receive feedback from their peers (Figure 3). The study by Engels et al. (2022) also showed that discussion-based and collaborative learning could enhance students' understanding of difficult material, such as statistics. By discussing problems in groups, students were able to help each other and learn from each other's experiences, which made them more prepared to face academic challenges. In this study, the Pair and Share stages in the TPS model allowed students to further develop their ideas, share solutions, and gain new insights from their classmates.

Although the results showed that the integration of the TPS model and R software (TPS-R) was effective in improving problem-solving abilities, there were some challenges in its implementation, particularly in terms of time management. The use of R software (R) required extra time for students to learn how to use the software, especially for those who were not familiar with the technology. Therefore, lecturers needed to ensure that students were given enough time to practice and understand how to use the R software (R) before applying it in the learning context. Jiang (2023) also noted that the use of technology in education required special attention in terms of time management and training. Lecturers had to provide sufficient guidance on how to use the software so that students could use it effectively in the learning process.

This study showed that the implementation of the TPS model assisted by R Software (TPS-R) had a significant impact on improving students' problem-solving abilities in statistics courses. The use of R software enabled students to conduct data analysis more efficiently, while the TPS model encouraged collaboration and discussion, which deepened their understanding. The results of this study were consistent with previous research that showed that the use of technology in education could significantly improve students' problem-solving skills. Therefore, the integration of the TPS model and R software (TPS-R) could be an effective strategy to enhance the quality of statistics learning in higher education. Further research could explore the long-term effects of using the TPS-R model on students' problem-solving abilities and retention of statistical knowledge. Additionally, comparing the TPS-R model with other technology-enhanced cooperative learning strategies across various disciplines could provide deeper insights into its broader applicability. Future studies might also examine how the model impacts students with varying levels of prior knowledge in statistics, allowing for more tailored teaching approaches.

Conclusion

The TPS-R and TPS-WR learning models were able to improve problem-solving abilities, although to different extents. The findings showed that: 1) there was a significant difference in problem-solving abilities between the TPS-R and TPS-WR groups; and 2) the improvement in problem-solving abilities for the TPS-R group was better compared to the TPS-WR group. Another finding from the teaching and learning process was that the stages of the TPS-R learning model had a significant contribution to enhancing students' competencies, while the lecturer also contributed by detecting, discussing, and guiding students to overcome the difficulties they encountered.

The TPS-R learning approach could be used as an alternative learning method to train students' cooperation skills. In implementing the TPS-R learning model, lecturers had to pay attention to time allocation, guide and direct students' activities, and manage the stages of learning so that the learning objectives could successfully enhance students' competencies in learning statistics.

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Declarations

Author Contribution	:	SS: Conceptualization, Methodology, Formal Analysis, and Resources. RKN: Validation, Investigation, Formal Analysis, and Resources.
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Additional Information	:	Additional information is available for this paper.

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