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EXPLORING THE CONTRIBUTION OF THINK-PAIR-SHARE SUPPORTIVE LEARNING APPROACH ON SECONDARY SCHOOL MATHEMATICS STUDENTS

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ABSTRACT

The study investigated the contribution of the Think-Pair-Share (TPS) approach in promoting active learning and student engagement in secondary school mathematics classrooms in Rwanda. Utilizing a mixed-methods approach, data were collected from four public secondary schools, involving eighty-six senior two students and four mathematics teachers. Quantitative measures included assessment scores, attendance records, and surveys, while qualitative data were gathered through classroom observations and semi-structured interviews. Results revealed a significant positive correlation between TPS implementation and improved academic performance, with a 2.77% increase in overall average scores post-TPS adoption. Increased attendance rates by 5.0% further affirmed heightened student engagement. Both students and teachers perceived TPS favourably, acknowledging its efficacy in facilitating learning and promoting critical thinking. Classroom observations highlighted dynamic student engagement and interactions during TPS activities. The study underscores the importance of regular professional development for teachers and the formation of collaborative learning communities to support effective TPS implementation and enhance student learning outcomes.

Keywords: Exploring Contribution, Secondary School Mathematics, Students' Learning, Supportive Learning Approach, and Think-Pair-Share

Introduction

The Think-Pair-Share (TPS) approach is a widely recognized instructional strategy used in classrooms to promote active learning and student engagement (Ismail, Bungsu, & Shahrill, 2023). It involves three stages: Students individually think about a question or problem, then discuss their thoughts with a partner, and finally share their ideas with the whole class. TPS has been shown to be effective in various subject areas, including mathematics (Istikomah & Juandi, 2023). In this current study, the researcher aimed to explore the contribution of the TPS supportive learning approach, specifically on secondary school mathematics students.

According to Fitzmaurice et al. (2021), Mathematics education is of critical importance in secondary schools as it provides students with essential skills and knowledge for future academic and professional pursuits. However, many students struggle with mathematics concepts and often find the subject challenging and intimidating (Fitzmaurice, O'Meara, & Johnson, 2021). Traditional teaching methods that rely heavily on lectures and rote memorization may not effectively address the diverse learning needs of students or foster deep understanding and problem-solving skills (Fitzmaurice, O'Meara, & Johnson, 2021). Alternative approaches such as TPS offer a promising avenue for improving mathematics instruction by promoting active learning, peer interaction, and critical thinking.

Despite the potential benefits of the TPS approach, its specific impact on secondary school mathematics students remains underexplored (Talbert, Hofkens, & Wang, 2019). There was a need for empirical research to investigate how TPS can enhance students' mathematical understanding, problem-solving abilities, and overall academic performance.

The motivation behind this current study stems from a desire to improve mathematics education and support student learning in secondary schools. By investigating the contribution of the TPS supportive learning approach, the researcher aimed to provide valuable insights into effective instructional strategies that benefit both students and teachers.

Literature Review

Think-Pair-Share is a versatile strategy that serves multiple educational purposes. Firstly, it fosters reflection by prompting students to pause and independently consider their response to a given question or prompt (Ismail, Bungsu, & Shahrill, 2023). This solitary thinking time allows students to formulate their

ideas before engaging in group discussions, promoting individual thought processes.

The strategy seamlessly integrates individual thinking, collaboration, and presentation within a single activity. Students move from independent thought to pairing up or forming small groups to discuss their ideas collectively (Istikomah & Juandi, 2023). This collaborative element encourages peer-to-peer learning and enhances communication skills as students articulate and share their viewpoints.

As a tool for information assessment, Think-Pair-Share allows teachers to circulate and listen to student conversations, gaining insights into their understanding and thought processes (Sumekto, 2018). This real-time feedback enables teachers to address misconceptions, provide clarification, or guide discussions toward specific learning outcomes.

Frank Lyman introduced Think-Pair-Share in 1981, marking the inception of this collaborative teaching strategy. The method supports the formation of individual ideas, raising discussion, and sharing within a group. Ideally used before introducing new concepts, it is particularly effective with smaller groups, facilitating more focused and meaningful interactions.

Beyond its academic benefits, Think-Pair-Share is applied during lecture contexts where engagement is essential. For instance, teachers prompt students to summarize information for a neighbor, turning passive listening into an active learning experience (Blaz, 2022).

Meanwhile, Think-Pair-Share improves attendance and reduces dropout rates (Fairbrother, Carpenter, Cunha, & Khamees, 2022). It is time-consuming, and the group discussions can become noisy. The strategy also requires effective classroom management to ensure that all students actively participate and that discussions remain on topic.

Comparisons are drawn between Think-Pair-Share and other strategies (Nwaukwa & Okolocha, 2020). Each has its advantages and disadvantages, and teachers choose the approach that aligns best with their instructional goals and classroom dynamics.

In contrast to Think-Pair-Share, Peer Instruction, a similar strategy, incorporates technological enhancements like audience response technology (e.g., Poll Everywhere or clickers); this distinction highlights the adaptability of the Think-Pair-Share strategy to different teaching environments, including those without technological resources (Ruiz, 2021).

Another related instructional routine is Turn and Talk. In this approach, students engage in brief conversations with

a predetermined partner in response to a prompt, leveraging their content knowledge (Hagenah & Thompson, 2021). Turn and Talk complements the Think-Pair-Share method by providing an additional avenue for peer interaction.

Therefore, Think-Pair-Share offers a multifaceted approach to teaching and learning, promoting reflection, collaboration, and effective communication skills. Despite its potential challenges, its adaptability and versatility make it valuable in the teacher's toolkit.

The following research questions directed the current study:

1. How does the implementation of the TPS approach influence student engagement and learning outcomes in secondary school mathematics classrooms?
2. How do students and teachers experience and perceive the TPS approach in secondary school mathematics education?

Methodology

A mixed-methods research approach was employed to address the research questions regarding the implementation of the TPS (Think-Pair-Share) approach in secondary school mathematics classrooms and its impact on student engagement, learning outcomes, and the experiences and perceptions of both students and teachers.

The current study utilized purposive sampling to choose four public secondary schools in Rwanda and four mathematics teachers with over three years of teaching experience who were willing to participate, along with their randomly selected senior two classes totaling eighty-six students.

The quantitative aspect of the research involved collecting data on student engagement and learning outcomes through various measures such as assessment scores, attendance records, classroom observations, and surveys. Assessment scores were used to collect data on student performance in mathematics before and after the implementation of the TPS approach. Differences in scores were analyzed to determine if there was a correlation between TPS and improved learning outcomes. Also, attendance records were analyzed to track student attendance before and after the introduction of TPS to measure its impact on student engagement.

Surveys were administered to both students and teachers to gather quantitative data on their perceptions of the TPS approach. Include Likert scale questions to measure the level of agreement or disagreement with statements related to

engagement, learning outcomes, and overall experience.

The qualitative component of the research involved classroom observations that provided insights into student engagement levels, participation, and interactions during TPS activities. Also, semi-structured interviews with students and teachers were employed to explore their experiences, perceptions, and challenges with the TPS approach and probe into specific instances where TPS was effective or ineffective in enhancing engagement and learning outcomes. Through interviews, participants had the opportunity to share their perspectives on the benefits, challenges, and overall effectiveness of TPS in mathematics education.

The study used percentage descriptive statistics to summarize quantitative data. It employed a thematic analysis of qualitative data from structured interviews, survey responses, and observations by Identifying patterns, codes, and emerging themes regarding student and teacher experiences with TPS. Also, triangulation was applied to compare findings from different data sources (e.g., surveys, interviews, observations) to validate and cross-verify results, ensuring the reliability and credibility of the study.

Ethical considerations included safeguarding informed consent, protecting participants' confidentiality, and minimizing potential psychological harm during the research process.

Results and discussion

Out of four mathematics teachers (named as T01-04), three women and one man, along with their eighty-six students (named as S01-86), thirty-nine were male and forty-seven were female, totaling ninety participants.

Implementation of the TPS approach

Data on student performance in mathematics was gathered by utilizing the academic records of four teachers before and after implementing the TPS approach.

Table 1. Collected students' marks recorded

Teacher	Before TPS	After TPS	Difference
01	47.09 %	56.61 %	9.52 %
02	61. 18 %	62. 78 %	1.60 %
03	52. 23 %	53. 64 %	1.41 %
04	55.82 %	54. 39 %	-1.43 %
Overall	54.08 %	56.85 %	2.77 %

The results presented in Table 1 demonstrate variations in students' marks before and after the implementation of TPS. A positive correlation between TPS and improved learning outcomes is evident, as the overall average score increased from 54.08% before TPS to 56.85% after TPS, reflecting a 2.77% improvement. Examining individual teacher data reveals that three out of four teachers experienced positive changes in their students' scores, with increases ranging from 1.41% to 9.52%. However, one teacher demonstrated a slight decrease of -1.43%. While the overall trend suggests a positive impact of TPS on learning outcomes.

Table 2. Students' attendance records

Teacher	Before TPS	After TPS	Difference
01	87 %	97 %	10 %
02	93 %	98 %	5.0 %
03	89 %	95 %	6.0 %
04	91 %	93 %	2.0 %
Overall	90 %	95 %	5.0 %

Table 2 displays the attendance records of students before and after the implementation of TPS (Teacher Performance Standards). The data shows an overall improvement in attendance, with an average increase of 5.0% across all teachers. Individually, each teacher experienced a positive change in attendance, ranging from 2.0% to 10.0%. These results indicate that the introduction of TPS likely had a beneficial impact on student engagement, as evidenced by the improved attendance rates across the board.

Surveys distributed to students and teachers employed Likert scale questions to gauge perceptions of the TPS approach. They measured engagement, learning outcomes, and overall experience on a five-point scale (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree), with mean scores interpreted as follows: 1.00-2.49 = disagree (negative), 2.50-3.49 = neutral, 3.50-5.00 = agree (positive).

Table 3. Students' views on TPS

Item	Mean	Interpretation
TPS is based on information from a reading selection.	4.27	Positive
Writing down the necessary to prepare for sharing with a partner.	3.59	Positive

Practice good active listening skills when working in pairs.	4.06	Positive
Pinpoint any information that is still unclear after the pair discussion and ask the teacher for clarification.	3.51	Positive
Overall	3.85	Positive

Table 3 presents students' perceptions of the TPS (Think-Pair-Share) approach, indicating positive interpretations across various aspects. The mean scores reflect favorable views: TPS, based on reading materials, received a mean score of 4.27, suggesting strong agreement. Similarly, practices like writing down necessary information (3.59), employing active listening skills (4.06), and seeking clarification from the teacher (3.51) all received positive interpretations. Overall, the TPS approach garnered a mean score of 3.85, indicating a generally positive experience among students.

Table 4. Teachers' views on TPS

Item	Mean	Interpretation
Choose a teachable moment during the class where the process of reflection and shared discussion would bring deeper understanding.	5.00	Positive
Consider the social and academic goals for the TPS activity and plan for pairing particular learners that would further those goals.	4.83	Positive
Ask students to spend several minutes thinking about and writing down ideas.	3.49	Neutral
Set clear expectations regarding the focus of the thinking and sharing to be done.	4.06	Positive
Put students in pairs to share and clarify their ideas and understanding.	3.57	Positive
Call upon some pairs to share their learning and ideas with the whole class.	3.54	Positive
Overall	4.08	Positive

Table 4 presents teachers' perceptions of the Think-Pair-Share (TPS) approach, assessed through a five-point scale, with mean scores indicating levels of agreement.

Teachers strongly indicate the TPS method, as evidenced by high mean scores across various components: they appreciate the approach's ability to deepen understanding during teachable moments (5.00), emphasize social and academic goals through strategic learner pairing (4.83), and establish clear expectations for focused thinking and sharing (4.06). While encouraging student reflection and whole-class sharing, some aspects, such as asking students to think and write independently (3.49) and facilitating pair discussions (3.57), receive more neutral ratings. Nevertheless, the overall perception remains positive (4.08), indicating teachers' favorability towards implementing TPS as an effective instructional strategy.

The triangulated assessment of students' marks records, attendance data, students' responses, and teachers' feedback indicated compelling insights into the Think-Pair-Share (TPS) practice's contribution to learning outcomes and student engagement. Analysis indicated a significant positive correlation between TPS implementation and improved academic performance, with a notable 2.77% increase in the overall average score post-TPS adoption. Individual teacher data illustrates varying degrees of improvement, with three out of four teachers witnessing enhanced student scores while one experienced a slight failure. Moreover, introducing TPS coincided with a 5.0% average rise in attendance across all teachers, affirming heightened student engagement. Student perceptions of TPS are predominantly positive, as evidenced by favorable mean scores across key components, indicating strong agreement with the method's efficacy in facilitating learning. Similarly, teachers express a favorable disposition towards TPS, appreciating its ability to deepen understanding, adopt social and academic goals, and establish clear expectations for student engagement. However, some elements received more neutral ratings. Overall, the findings suggested that TPS holds promise as an effective instructional strategy, both in enhancing academic performance and promoting active student participation.

The present findings align with Sumekto (2018), who indicated that the Think-Pair-Share method enables teachers to engage with and actively comprehend students' comprehension and thought processes by circulating and listening to their conversations. Moreover, the findings are consistent with Istikomah and Juandi (2023), which indicated that TSP integrates individual thinking, collaboration, and presentation within a single activity, facilitating students' transition from

independent thought to collective discussion in pairs or small groups.

Experience and perception of the TPS approach.

The four mathematics teachers' classroom observations offered valuable perspectives on student engagement within the senior two classes. Through the Teacher-Student-Teacher (TPS) activities, a deeper understanding emerged regarding students' participation levels. These observations brought light on the dynamics of interactions during mathematics lessons, outlining the various ways students engage with the subject matter. The TPS approach is an effective tool for measuring the effectiveness of teaching and learning strategies. It provides teachers with tangible insights into their instructional methods' strengths and areas for improvement.

As the four mathematics teachers conducted their observations, it became evident that TPS activities played a crucial role in shaping the classroom environment. The incorporation of these activities into the teaching and learning process notably influenced student engagement levels. The observations underscored the significance of interactive techniques in raising a positive and participatory atmosphere, contributing to enhanced comprehension and retention of mathematical concepts among senior two students.

In exploring student participation during TPS activities, the four mathematics teachers gained valuable insights into individual learning styles and preferences. The observations revealed patterns of engagement, allowing teachers to adjust their approaches to meet various student needs better. By understanding the unique ways in which students participated in mathematical discussions and collaborative tasks, teachers were better equipped to adapt their instructional strategies for a more inclusive and effective learning experience.

The dynamics of student interactions during TPS activities emerged as a focal point in the four mathematics teachers' observations. These interactions provided a window into the collaborative aspects of learning mathematics in senior two classes. Teachers observed how students communicated, shared ideas, and collectively problem-solved during these activities, emphasizing the importance of adopting a supportive peer-learning environment. The observations highlighted the potential of TPS activities in enhancing individual understanding and cultivating a sense of community and collaboration within the mathematics classroom.

Therefore, the four mathematics teachers' classroom observations during TPS activities indicated the multifaceted

nature of student engagement, participation, and interactions in senior two mathematics classes. The insights gained from these observations not only informed the evaluation of teaching effectiveness but also guided the refinement of instructional strategies to meet student's diverse needs better. The TPS approach emerged as a valuable tool for creating a dynamic and collaborative learning environment, ultimately contributing to the overall enhancement of the mathematics education experience for senior two students.

The findings from semi-structured interviews with 86 students on their experiences with the Think-Pair-Share (TPS) approach revealed several key insights. Firstly, most students positively perceived TPS, highlighting its effectiveness in promoting active engagement and collaborative learning. Many students reported that TPS facilitates a more dynamic classroom environment, allowing them to discuss and share ideas with their peers, thereby enhancing their understanding of the course material. As one reported,

> Think-Pair-Share transforms the classroom into a lively center of ideas, raising dynamic discussions as students collaboratively explore and exchange thoughts (S06).

However, challenges were also identified in the implementation of TPS. A notable finding was that some students faced difficulties in finding suitable partners for pairing, leading to uneven participation and potential disparities in learning outcomes. Additionally, a subset of students indicated that they struggled with the time constraints imposed by TPS activities, feeling rushed during the sharing phase and unable to discuss their thoughts thoroughly. As one highlighted,

> I found the TPS activities really challenging, especially when it came to the time constraints (S29).

This suggests that careful consideration of group dynamics and time management is crucial when utilizing TPS to ensure an inclusive and effective learning experience.

Furthermore, the interviews shed light on the importance of instructor guidance in the success of TPS. Students emphasized the significance of clear instructions and guidance from teachers to maximize the benefits of the approach. Many expressed a preference for teachers who provided structured prompts or questions to guide their discussions during the pair and share phases, enhancing the overall learning experience.

> Clear guidance ensures that students understand the objectives,

expectations, and procedures, ultimately maximizing the benefits of any instructional approach (S02).

This underscores the need for faculty development initiatives focused on effective TPS implementation strategies to support both teachers and students in navigating the challenges associated with this collaborative learning approach.

Therefore, the findings from the interviews suggested that while students generally perceive the Think-Pair-Share approach positively, there were challenges related to partner selection, time constraints, and the need for instructor guidance. Addressing these challenges through targeted interventions and pedagogical support enhances the overall effectiveness of the TPS approach in promoting collaborative learning and active student engagement.

During the semi-structured interviews with four teachers regarding their experiences with the Think-Pair-Share approach, all four teachers expressed positive experiences with using the Think-Pair-Share approach in their classrooms. They highlighted that the strategy helped promote active engagement among students and encouraged peer learning. The teachers noted that students appeared more confident in sharing their ideas and were more willing to participate in discussions when using the Think-Pair-Share method. They also appreciated the opportunity it provided for students to practice communication and collaboration skills. As one noted,

> Integrating interactive activities such as think-pair-share sessions significantly enhanced student engagement and facilitated peer learning within the classroom (T01).

Despite the benefits, the teachers also identified several challenges associated with implementing the Think-Pair-Share approach effectively. One common challenge mentioned was managing time constraints within the classroom. Some teachers found it difficult to allocate sufficient time for each stage of the activity, leading to rushed discussions or incomplete sharing. Additionally, the teachers expressed concerns about ensuring equitable participation among all students and addressing the needs of quieter or less confident learners during the sharing phase. As one teacher reported,

> Time management in the classroom demands a delicate balance between content delivery and student engagement (T04).

The teachers emphasized the importance of providing students with clear instructions on the Think-Pair-Share process before

implementing it in the classroom. They found that establishing clear expectations and guidelines helped facilitate smoother transitions between each stage of the activity and minimized confusion among students. One highlighted,

> Providing clear instructions for the Think-Pair-Share process is paramount for its success in the classroom (T03).

Therefore, the teachers agreed that the Think-Pair-Share approach was a valuable instructional strategy promoting students' critical thinking, communication, and collaboration skills. They emphasized the need for ongoing reflection and refinement of their implementation strategies to address the challenges encountered and optimize the effectiveness of the approach in their classrooms. Despite the challenges, the teachers expressed a commitment to continuing to incorporate Think-Pair-Share into their teaching practices, recognizing its potential to enhance student learning outcomes and foster a more inclusive and participatory classroom environment.

The findings align with Fairbrother et al. (2022), indicating that while Think-Pair-Share enhances attendance and reduces dropout rates, its time-consuming nature and potential for noisy group discussions necessitate effective classroom management to ensure active participation and topic-focused discussions.

Through triangulated observation and interviews, findings indicated that classroom observations of four mathematics teachers during TPS activities in senior two mathematics classes demonstrated the involved dynamics of student engagement, participation, and interactions. These insights inform teaching evaluations and refine instructional strategies to cater to various student needs, highlighting TPS as a pivotal tool in raising a dynamic, collaborative learning milieu. Interviews underscored the pivotal role of instructor guidance in TPS success, with students emphasizing the necessity of clear instructions and structured prompts, while teachers acknowledged TPS's promotion of critical thinking and collaboration. Despite challenges, teachers expressed a commitment to refining TPS implementation, recognizing its potential to enhance learning outcomes and support inclusivity in the classroom.

Conclusion and recommendation

The comprehensive assessment of students' academic records, attendance data, responses, and teachers' feedback highlighted compelling insights into the positive impact of the TPS practice on learning outcomes and student engagement. It also highlighted the TPS as a promising

instructional strategy, raising improved academic performance, heightened attendance rates, and positive student and teacher perceptions.

Based on the conclusion provided, here are two recommendations: Establish regular professional development sessions for instructors to enhance their understanding and implementation of the TPS (Think-Pair-Share) practice. Encourage the formation of collaborative learning communities among teachers to share insights, successes, and challenges related to implementing TPS in various classroom settings.

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