International Research Journal of Educational Research Vol. 14(1) pp. 1-6, January, 2023
Available online https://www.interesjournals.org/educational-research.html

Research Article

Enhancing Elementary Pre-service Teachers' Efficiency in Mental Mathematics through Think-Pair-Share Approaches

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Received: 12-Oct-2022, Manuscript No. ER-22-76990; **Editor assigned:** 19-Oct-2022, PreQC No. ER-22-76990 (PQ); **Reviewed:** 15-Nov-2022, QC No. ER-22-76990; **Revised:** 29-Nov-2022, Manuscript No. ER-22-76990 (R); **Published:** 02-Jan-2023, DOI: 10.14303/2141-5161.2023.250

Abstract

Though it is simple using a think-pair-share approach in any teaching space environment, we should consider thinking through other aspects to determine how best this technique can be implemented to achieve a particular instructional goal line. This training system improves mental mathematical efficiency, nurtures cooperative learning, and increases students' engagement levels besides giving learners chances to practice problem-solving and communication abilities. This research particularly seeks to appraise the impact of think-pair-share strategies in learning mental mathematics. In this assessment, students were initially allowed to work on activities independently also in pairs after a reasonable interval. To conclude, the whole class discussed the activities as a large set after teams have had ample time to relate their ideas. With qualitative also quantitative approaches, the study examined the students' scores and opinions of their learning understanding with the TPS practices. Research results specify that the trainees showed an improvement during and after the application of the think-pair-share activities. However, for the approach to be more effective, it necessitates thoughtful planning. Hence, a backward strategy is favourable when crafting inquiries for the think-pair-share to support the desired learning objective.

Keywords: Think-pair-share strategies, Mental mathematics, Mathematical efficiency

INTRODUCTION

Think-pair-share approaches are applicable in any education setting in a diversity of methods to support the students' cognitive skills (Arreguín-Anderson et al., 2011). TPS approach is extensively used to inspire collaboration, intellectual also quality engagement in discussions (McTighe et al., 1988). The technique has worked appropriately at the intermediate school levels by testing learners to list before sharing concepts they recall from works they had read before (Fernsten L et al., 2007). For such an approach's success, the mentor needs to agree on interacting with their learners in the sharing process. However, this resolution is directed by the discussion questions' ground of difficulty. A stricter interrogation involves extra participation by the tutor. Nevertheless, linked learning materializes when the teacher takes the role of a discussion partner (Li S et al., 2010).

Furthermore, think-pair-share queries need to line up with the instructional objective. According to (Wiggins G et al., 1998) a backward plan methodology can simplify this alignment. In this design, the teacher must initially consider the instructional goals, scheme the tests, and develop training tactics built on the chosen learning results. Since the team up haring part of the TPS takes in discussions, aspects contributing to good talks should be well-thought-out when writing the mathematical problems. While applying the think-pair-share in a classroom context, learners' issues have to have several right answers (Barkley EF et al., 2005). Open-ended interrogations are deemed fit for such discussions. Such inquiries do not look for a single particular response (Ritchhart et al., 2011). Rutherford, H.

(2011) states that a stimulating adaptation associated with think-pair-share is to integrate the TPS techniques as an observation station's part. Essentially observation stations comprise science-related objects that learners make observations. Finally, learners share their opinion in class. Although this exceptional tactic is applied at the basic levels in combining science with writing instructions, the system can indeed be reformed for application past the primary stage.

BACKGROUND

Think-Pair-Share is a collaborative conversation approach that Frank Lyman first launched in association with his colleagues in 1981. Since then, the tactic has been accepted by several scholars in supportive learning fields. The approach got its designation from the three steps of student's activity, with much weight on what scholars undertake in every stage (Marzano RJ et al., 2005). Confirmation from New Zealand's teaching spaces has raised anxiety that some apprentices' understanding levels do not match their interpretation points (National Education Monitoring Project). (Lai MK et al. 2004). This indication has resulted in a transformed concentration on the necessity for clear discussions also instructions in the line of cognitive purposes involved in understanding. A significant investigation body has explored instructional approaches that raise supportive education. These tactics enable trainees to work jointly, cultivate interactive and intellectual abilities as per (Stevens RJ et al., 1995) declares.

Think Pair Share coaching plan encourages students' team-work as well as problem-solving capabilities. (Lochhead et al., 1987) termed this approach as thinking aloud kind of paired problem-solving abilities. These scholars defined this cooperative problem-solving structure as an avenue to boost problem-solving skills by articulating to an audience one's problem-solving views. The impression behind this plan is that logical skills can be enhanced by presenting the ideas loudly as Kaddoura, Mahmoud (n.d) affirms.

Through this tactic, the apprentices are paired then given some problems to handle. The two learners are given precise parts that shift with the respective problem; problem solvers and listeners. In this approach, the problem-solvers read through the questions loudly then talk through the solutions to the queries. On the other hand, the listeners follow all of the problem-solvers stages to identify errors that are likely to occur. For the listeners to become more effective in this plan, they must appreciate every step's perception (Whimbey et al., 1986).

Considering (Marzano et al., 2005), the think-pair-share strategy renders the following benefits to learners: the tactic is fast; it does not require much time for preparation; the individual interface inspires many learners. It involves the whole class. Similarly, the learners become more enthusiastic about participating in the think-pair-share process due to a lack of peer influence while answering interrogations before the entire class (McKeachie et al., 2010). This dynamic teaching-learning plan nurtures apprentices' engagement in learning and stimulates them to contemplate quickly then share their views, hence developing their critical thinking processes as Robertson, K. (2006) claims.

There is a general settlement that tactic instructions should comprise clear explanations of the approach's use, followed by the teacher's model, and finally, a period of assistance. Throughout this period, learners' run-through the plan as support is given step by step to develop independence (RAND Reading Study Group. 2002) (Kragler S et al., 2002). This type of program does not yield immediate effects. (Trabasso T et al., 2002) (Duffy et al., 1986) agree on the requirement for prolonged instruction stages, providing opportunities for practice and development of flexibility and independence while applying the tactics.

(Whimbey et al., 1986) highlighted that this kind of instructive process could be a dynamic substitute for the old-style teaching models generally applied by instructors through educational classes. The scholars emphasized that TPS instructions are tremendously suitable every time there is a need for a profound understanding of some analysis forms. They claimed that this strategy would inspire students to think cautiously and offer them and their teachers' opportunities to listen and discover sources of the most thoughtful problems.

Despite the prospect that the think-pair-share approaches could boost apprentices' critical thinking skills, there are very few investigations into this plan's enactment. Patently, very few studies could be traced on TPS on mental mathematics, precisely enhancing efficiency in mental mathematics through the think-pair-share. Thus, this study's objective was to explore the impact of the TPS approaches in enhancing elementary pre-service teachers' efficiency in mental mathematics. The study's conclusions would apprise trainers on instructive tactics in their courses that might endorse the learners' critical thinking while handling mental mathematics.

METHODS

The study was piloted in three cycles in examining the impact of TPS approaches in learning mental mathematics. This teaching line of attack was established to work in three levels:

Think Cycle

At this stage, the instructor incited learners' thinking with questions, prompts, or observations. The students are then allowed to THINK through the problems. In this phase, the learners were exposed to learning experiences of mental math techniques using a guided approach.

Pair Cycle

The pattern was shifted to a paired environment. The learners PAIRED up with a desk-mate to discuss the answers each arrived at during the initial phase. At this stage, they were allowed to compare their notes and pinpoint the thought answers, most unique or conclusive.

Share Cycle

After students discussing in pairs for a reasonable duration, the trainer called for the teams to discourse their concepts with the rest of the class concurring with a strategy adopted by Robertson (2006). As the training progressed, the students got involved in the discussions and inquiry. They exchanged their ideas, and they developed confidence in handling mental mathematics.

DATA COLLECTION TOOLS

With qualitative also quantitative approaches, the study examined the students' scores and opinions of their learning understanding with the TPS practices. The teacher essentially guided the modules to facilitate in-depth learning while investigating different ways of solving mathematical problems. A classroom observation checklist provided information on students' level of confidence, pace, accuracy, and engagement before and after the TPS application. The learners were also subjected to math assessment before introducing the TPS, during the application phase and post TPS stage, to evaluate their progress at periodic intervals. Finally, the researchers surveyed establish students' perceptions of their learning understandings in applying different TPS tactics while solving mathematical problems. The results were yet quantified through frequencies as well as percentages.

RESULTS

Analysing students' performance before and after TPS

Figure 1. illustrates a linear improvement in the students' mean scores during the TPS mode (mean 11.48) compared to the test taken before presenting the TPS model (Mean Score 9.51). The students recorded the highest mean score in a post-test after introducing the TPS approaches (Mean Score 15.10). It is also evident that the least marks scored significantly improved across all the tests, with the least score being 6.00 and 8.00 during and after applying TPS, respectively, from 3.0 during the trial before introducing the TPS model. Similarly, the study records a maximum score of 20.0 after the introduction of TPS.

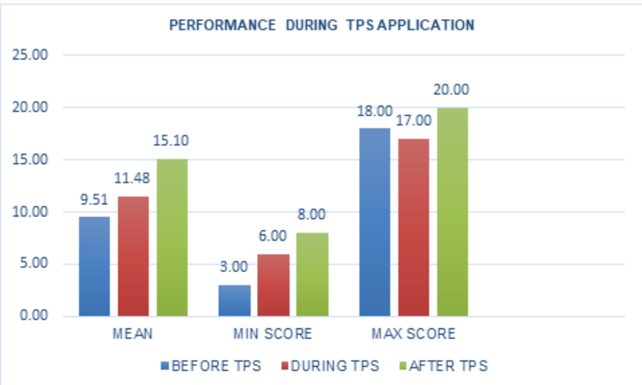

Figure 1. Comparing performance before, during, and after the introduction of TPS.

Classroom Observation Checklist

Figure 2. summarizes the outcome of classroom observation before and after applying TPS gauged on a scale of 0-3, where (0-none of the students, 1- a few of them, 2-most of them, and 3- all of them). The students' level of confidence improved the most from an average score of 2.0 to 2.9. This means that almost all the students were confident enough to handle any mathematical problem after the model. The students also showed a significant improvement in the level of classroom engagement (2.1 to 2.7). The student's accuracy level shifted from 1.9 to 2.4, while the pace was the least improved throughout the model (1.4 to 1.5).

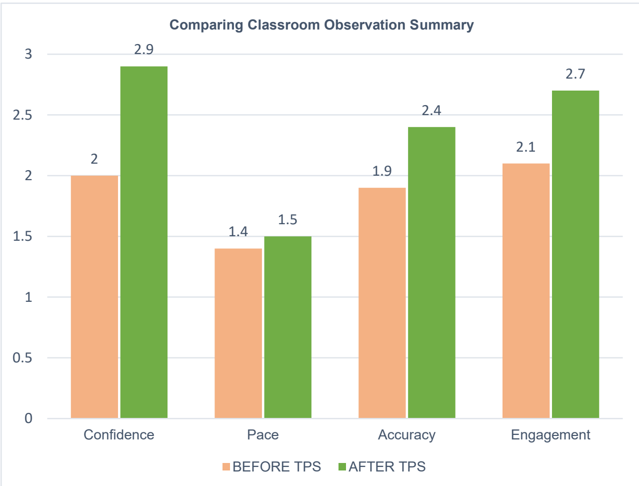

Figure 2. TPS classroom observation summary.

Analyzing Student Interviews

Table 1. Gives a descriptive summary of a survey on students regarding the application of the TPS model. On average, almost all the students agree that discussing their solutions with partners and brainstorming about mathematical problems, and writing the answer throughout the pair stage helped them learn mental mathematical perceptions. Also, the apprentices attest that they found working in pairs beneficial than working individually. Most students also reported that listening to their colleagues' solutions and discussions in the pair phase made them successfully learn mental mathematical concepts. Interestingly, many students agree that TPS increased their motivation in learning mental math strategies and fostered their communication and interaction with other peers. To conclude, students suggest that they would not have gained as much from their lecture had it not have been through the think-pair-share events.

Table 1. Descriptive Statistics for TPS Survey.

	N	Minimum	Maximum	Mean	Std. Deviation
Brainstorming about mathematical problems and writing the result throughout the thinking stage helped me gain mental math perceptions	61	1	5	3.97	1.251
discoursing my solutions with my partners during the pair stage helped me gain mental mathematical concepts	61	1	5	4.05	1.175
Listening to my colleagues' explanations and discussions through the pair phase helped me learn mental mathematical concepts	61	1	5	3.85	1.223
I would not have gained as much from the sermon had it not have been for the think-pair-share actions	61	1	5	3.28	1.306
It increased my motivation in learning mental math strategies	61	1	5	3.67	1.261
This technique increased my communication and interaction with my peers	61	1	5	3.62	1.306
I found working in pairs beneficial than working individually.	61	1	5	3.84	1.368
Valid N (listwise)	61				

DISCUSSION

This study established that TPS as a plan contributed to the students' argument, cognitive thinking, problem analysis, prioritization, determination skills, and problem-solving. These outcomes fit in conclusions by Robertson (2006), who affirmed that the approach targets to engage the scholars in their education, focused on thinking about the responses before discussing with their peers. The further commends the TPS model as an active teaching-learning line of attack. Similarly, the results agree with the outcome of Ledlow (2001), who acknowledged that application of TPS by asking queries throughout the lesson is the best way of involving students' active engagement in critical thinking, allows the teacher to evaluate learners' understanding, also students get to apply different acquaintance. Therefore, TPS is a low-risk approach to having many apprentices engaged in thoughtful developments connected to their learning.

This study validated that TPS tactics enhance participants' critical thinking. This observation is consistent with Nelson (1994), who recommended that active learning approaches stimulate crucial thinking due to their intellectual prompting processes. Supportive learning helps scholars' advance superior academic skills besides the ability to consider others' perspectives (McKeachie & Svinicki. 2010). This research shows that students' cooperative learning resulted in better scores academically in most students. With team-work, trainees become more enthusiastic about paying attention to other people's observations, sharing concepts, clarifying variances, and making innovative considerations.

Supportive learning is essentially an operational, informative tactic that heightens upper-level intellectual abilities while encouraging constructive intellectual, emotional, and social outcomes (Nagel, 2008). Therefore, this approach promotes individual answerability, equivalent involvement also detailed peer interactions.

As a supportive educational approach, the TPS tactic is correspondingly quantified as an operative training style. The success attached to this plan is usually directed by the enactment events that mostly emphasize the students' ability to perform their classroom activities to enhance their competence in mental mathematics. This approach allows students to improve their abilities as it gives them a chance to reason, ask also answer interrogations, share concepts, and enables them to help each other successfully.

The think-pair-share plan enhances some individual communication. This is compulsory for apprentices to organize, retain, and process concepts internally. In sharing their thoughts, trainees take proprietorship of their education also exchange connotations instead of relying exclusively on their instructor's ideas (Lyman, F., 1987).

The think-pair-share plan's effectiveness has similarly been applied in the training of interpretation. One study concluded that the TPS approach could meaningfully advance the scholars' interpretation skills by scheduling, using, and assessing this plan's phases (Siwu, M. M.E. 2005). Safarudin (2004) pointed out that team-work is very significant. It empowers the scholars to provide their intellectual skills, creativity, personal answerability, equal involvement, and synchronized interactions in the public setting.

The results show that there was a substantial enhancement in elementary pre-service teachers' performance regarding this study. Evaluating the apprentices' scores in the primary survey (before the trainees were introduced to the think-pair-share plan), a significant score improvement can be noted after the think-pair-share scheme was introduced. However, the results did not meet all the conditions of accomplishment. After implementing the TPS plan, the students registered better scores, showed higher confidence levels, and became more engaged and accurate in their responses than on the first test. (See figure 1).

The TPS approach's execution employed classroom achievement research and scheduling, using, perceiving, and replicating the actions. The implementation of the think-pair-share plan procedures was similarly useful during the training and learning process. Based on the students' success, we can conclude that the TPS approach was convenient for elementary pre-service teachers to enhance their learning mental mathematics efficiency.

CONCLUSION AND RECOMMENDATIONS

It can be settled that the TPS approaches are effective in enhancing elementary pre-service teachers' efficiency in mental mathematics. Even though the trainees' pace of handling mental mathematics after the think-pair-share plan did not meet the success' conditions, research results specify that the trainees showed an improvement during and after applying the think-pair-share activities. Therefore, it can be concluded that this tactic is operative. The trainees' noteworthy improvement in scores, confidence, accuracy, and classroom engagement indicated the strategy's success criteria.

This research determined that positive learning developments also critical thinking skills are closely related. Therefore, with the inquiry-based logic behind all activities and strategies, trainers should help apprentices make their thinking line evident, collect, prepare, scrutinize, and apply facts. The students can as well improve their intellectual capacity by working in supportive education groups.

Furthermore, encouraging students to find illustrations while communicating mathematical concepts has proved to be a successful way of helping scholars understands mental mathematics. The application of representation by learners makes mathematical thoughts more actual also supports the students to solve problems that are considered complex. The study suggests the TPS approaches involve abstract mathematical objects, including concepts, facts, skills, and principles, to achieve adequate representation skills in the learning process.

From my estimation, it can be resolved that the TPS supportive learning model involves the students' activities in learning since trainees are made to practice independently. They are called to practice in pairs by encouraging the learners to learn and make depictions. Finally, the outcomes of the discussions are presented in class. Therefore, TPS supportive learning helps improve learners' mathematical illustration and self-efficiency capabilities, communicate their mathematical concepts, better identify the connections amid mathematical perceptions, or apply mathematical problems through modelling.

However, I would wish to highlight that it necessitates thoughtful planning to be more effective. Hence, a backward strategy is favourable when crafting inquiries for the TPS to support the desired learning objective. Applying an appropriate training method could act as an alternative to overcoming lower rates of students' absorption, particularly in mathematics. Therefore, it is necessary to assess the application of instruction approaches in terms of the suitability, efficiency, and effectiveness of the topic and the students' state, including the speed of learning, students' interests, capability, and time.

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