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DETERMINING THE MOST EFFECTIVE STAGE OF THE THINK-PAIR-SHARE TEACHING STRATEGY

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ABSTRACT: *This investigation was carried out to examine the effect of think-pair-share on high school learners' academic attainment in fractions and the most effective stage of the think-pair-share. Two research questions and five hypotheses guided this study. An explanatory sequential mixed method design was used. Purposive and convenience sampling techniques were used to select the first-years and the 78 participants, respectively. Teacher-made fractions achievement tests and interviews were used as the data-gathering instruments. Students' academic achievement was analysed using independent and paired samples t-tests whilst the interview data was analysed thematically. The study found that learners who received fractions instructions using the think-pair-share model outperformed their colleagues who were taught fractions without think-pair-share. Also, the performance of students at the pair stage was higher than the performance of the same students at the think stage on the same test items. It was again found that intolerance, lack of self-confidence and inability to build consensus on the part of some students affected their performances at the pair stage. It was, therefore, concluded that Think-Pair-Share is effective in teaching fractions and that the most effective stage of the Think-Pair-Share strategy is the pair stage. It was therefore recommended that teachers be encouraged to use the think-pair-share teaching strategy in their teaching and that think-pair-share should be made to form an integral part of the Senior High School mathematics curriculum. Again, teachers and the Ghana education service should consider assessing students in pairs. Also, teachers should encourage students to be tolerant and confident in themselves.*

KEYWORDS: Think-Pair-Share, Students Performance, Fractions

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INTRODUCTION

The education of a country's population has a significant impact on its progress. Mathematics education is a cornerstone and an essential tool for a person's and the country's overall scientific and economic growth (Nyaumwe, 2013). Mathematics forms an integral part of our everyday lives, and it is a universal truth that development is hinged on it (National Council for Curriculum and Assessment & Ministry of Education [NaCCA & MOE], 2019). Mathematical knowledge is needed by every individual in society, and it is for this reason that the Ghanaian senior high school teaching syllabus for core mathematics is focused on helping all young Ghanaians to gain the mathematical skills, insights, attitudes and values they will need to succeed in their chosen occupations and daily lives (MOE,2010).

Ballard and Johnson, as cited in Darfour (2016), stated that parents begin teaching their children how to recite ABCD …and count 123… at an early age as soon as their children begin talking because parents now understand how crucial it is to educate their kids with the fundamentals of reading and doing mathematics before they start school. The daily use of mathematics in most social sciences, business, medical and management studies is mathematics essential function (Gitaari, Nyaga, Muthaa, & Reche, 2013). Mathematics has several benefits, and because of that, it enjoys some recognition and respect from policymakers in Ghana (Sokpe & Yarkwah, 2017.p1). The government of Ghana has recognised the role of mathematics in national development, making it a core subject in Ghanaian basic schools, high schools and a basic requirement for entering into any higher institution of learning in Ghana (Sokpe & Yarkwah, 2017). The topics in mathematics are such that knowledge in one leads to understanding of the other. One of such most important topics that run across the basic school curriculum in Ghana is fractions (NaCCA & MOE, 2019). Fractions is a foundational or fundamental topic frequently utilized in daily life and is crucial for the advancement of both mathematics and other disciplines (Bailey, Siegler & Geary, 2014; Janna & Prahmana, 2019). Understanding the concept of fractions is crucial for the formation and growth of mathematical ideas as well as for aiding in the understanding of other difficult mathematical ideas such as algebra (Booth, Lange, Koedinger & Newton, 2014; Zakiah, Norhapidah, Mohamad-Nizam, Hazaka & Effandi.,2013). Also, understanding the notion of fractions aids in problem-solving on a daily basis, particularly when percentages, ratios, rates and decimals are involved (Abdul-Halim, Nur-Liyana & Marlina, 2015; Booth, Newton & Twiss-Garrity, 2014; Ndalichako, 2013; Wijaya, 2017). Mathematics educators have realised the need to develop a conceptual understanding of fractions since it helps students develop the computational abilities necessary to complete tasks and solve problems in mathematics. (Agbozo, 2020; Andamon, & Tan, 2018; Aziz, Aktas & Safa, 2019; Mendezabal & Tindowen, 2018).

Despite the importance of mathematics (fractions) in other academic and professional domains, there is evidence that students in most nations continue to perform badly at the national level (Gitaari et al., 2013; Ali, 2013; Karue & Amukowa, 2013; Anghelache, 2013; Alotaibi, Khalil & Wardat 2021). For instance, studies by Ibanez and Pentang (2021) on the conceptual understanding of fractions revealed that preservice teachers' conceptual understanding of the five conceptions of fractions as part-whole, operator, measure, quotient and the ratio was not strong enough, leading to lower achievement in fractions. In addition, Trends in International Mathematics and Science Study (TIMSS, 2015) indicates that Malaysian pupils have difficulties in learning and mastering fractions which resulted in an average achievement score of 465 which is lower than the international average score of 500. In Ghana, students exhibited

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weaknesses in simplifying equations to the form $\frac{q}{p}$ (WAEC, 2019). Furthermore, WAEC (2020) reported that students exhibited weaknesses in solving problems involving ratio and proportions, geometry, mensuration and translating word problems into mathematical equations. All these topics mentioned are built from the concept of fractions (Ayvaz Can & Turer, 2018; Van de Walle, Karp & Bay-Williams, 2019). This means that for students to exhibit some strength and good performances in these areas, they need to have a good and solid understanding of fractions which serve as the basis for learning them. From the foregoing literature, it can be observed that fractions and their related concepts pose a lot of challenges to students at all levels of education across the globe, and it is a threat to students' success in mathematics; hence proactive, innovative and curative measures and strategies must be employed to improve students' performances in mathematics (Mills & Mereku, 2016). One such innovative way is the use of the Think-Pair-Share strategy (Rusman, 2011).

Some researchers attempted addressing these challenges students face in fractions using various approaches and models such as the butterfly method, fraction tiles, video conferencing, digitally enhanced tangible materials, Cuisenaire rods and number line (Bruce, Chang, Flynn & Yearley, 2013; Low, Shahrill & Zakir 2020; Ladin & Tengah, 2021; Fokides & Alatzas, 2022; Japar, Asamoah & Shahrill, 2022). Though these studies have contributed in a way to addressing students' poor performances in the topic in other geographical locations, little is in existence in terms of research in Ghanaian society; meanwhile, the problem still exists. Also, with the little that is done or in existence, not much attention has been given to the use of the think-pair-share strategy in dealing with the poor performances of students in content-specific areas such as fractions both internationally and in Ghana. Again, though several studies revealed that think-pair-share is a useful model in the teaching and learning process, there is limited research on the specific stage that is most effective.

Hence, it is against these backdrops that the current study was carried out to bridge the gaps in the literature by examining how the think-pair-share strategy could be employed to enhance students' academic performance in fractions and mathematics as a subject and also to determine the most effective stage of the teaching model. For the purpose of identifying the most effective stage of the think-pair-share, only the first two stages (think-stage and pair-stage) of the think-pair-share were considered since the third stage, which is the pair-stage is just the presentation of the solutions arrived at, at the pair-stage.

Think-Pair-Share Strategy is a learner-centred teaching and learning model/strategy developed by Frank Lyman in 1981 (Sokpe, & Yarkwa, 2015.p42). This strategy encourages and allows for individual thinking, collaboration and presentation on the same activity (Sokpe, & Yarkwa, 2015). This strategy consists of three steps or phases. First is the think phase. Here, the instructor asks a question or gives the students a task and encourages them to spend some time coming up with their own ideas on how to approach the task or what they think would be a practical solution to the issue. The second is the pair stage which involves pairing students with a partner to discuss each other's ideas. Students then choose the best, most compelling and most original response after they have discussed their think-stage responses (Sokpe, & Yarkwa, 2015). The last stage is the sharing phase, where learners share their pair-stage answers with the rest of the class. The teacher calls on each pair or takes their answers, record them on the board and randomly selects a member from each pair to present their solution to the class by outlining and resolving it on the board (Sokpe, & Yarkwa, 2015).

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The study was conducted to answer the following research questions;

1. What is the effect of think-pair-share on students' academic performance in fractions?
2. which stage of the think-pair-share is the most effective?

This study was also guided by five null hypotheses, where hypotheses one to four were used to answer research question one and hypothesis five provided an answer to question two.

1. Ho: There is no significant difference in the pre-test mean scores between the learners taught with think-pair-share and those taught without it.
2. Ho: There is no significant difference in the pre-test and post-test mean scores of the learners taught without think-pair-share.
3. Ho: There is no significant difference in the pre-test and post-test mean scores of the learners taught with think-pair-share.
4. Ho: There is no significant difference in the post-test mean scores between the learners taught with think-pair-share and those taught without it.
5. Ho: There is no significant difference in the performances of students at the think stage and the pair stage.

LITERATURE REVIEW

Theoretical Review

The social constructivist learning theory backs up this study. Lev Vygotsky's social constructivist learning theory, which was introduced in 1978, strives to foster an atmosphere that encourages active participation in learning. The social constructivist believes that knowledge is generated via the communication between learners and their environment and that learning is a collaborative process (McLeod, 2019). According to the social constructivist theory, students build knowledge and understanding of the universe via ongoing inquiry and questioning. The social constructivism idea generally entails encouraging learners to participate in active learning activities in order to expand their knowledge and to reflect on and discuss their actions and how their understanding is developing. In social constructivism, the instructor makes sure he or she is aware of the students' preconceived notions and then directs the activity to deal with students' preconceived notions and then expand on them. Instead of having students repeat a list of facts, social constructivism changes or reduces the position of the instructor to that of a resource person who assists learners in creating knowledge (Khalid & Azeem, 2012).

According to the constructivist philosophy, content should be based on students' past knowledge and should be arranged in a great deal so that students may readily understand it. In a constructivist learning environment, the teacher guides the students through problem-solving, cooperative learning and inquiry-based learning activities.

One of its most significant advantages is that the constructivist approach to instruction transforms the learner from a mere listener to a team player during instruction. Under the

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leadership of the instructor, learners actively enhance their knowledge instead of passively taking it from the instructor or reading materials. The instructor's job is to provide the material in a way that corresponds to the learner's current level of understanding (Khalid & Azeem, 2012).

In contrast to the old ways of instruction, where instructions are always instructor-centred, constructivist learning theory promotes a number of learner-centred approaches and strategies, such as think-pair-share; as such, it is the ideal theory underpinning this study (McLeod, 2019).

Empirical Review

Kerie et al. (2019) investigated the extent students compute fractions with a correct understanding of the concept of fractions in Ethiopia using 1159 grade 7 and 8 students from 16 schools in four regions. An achievement test was used to gather data. Mann-Whitney statistical test, wrong answer analysis of individual items and descriptive statistics were used to analyse the data. The results revealed that most students understood part-whole fractions wrongly, leading to lower performances. Also, the percentage of students who correctly calculated operations of fractions with correct understanding was less than those who correctly calculated operations of fractions without correct understanding. On the part of the literature on the effectiveness of think-pair-share, the following were reviewed;

A study by Chianson, O'kwu and Kurumeh (2015) on the same intervention as in this study reported that students who were taught using the intervention made progress in their academic attainment. Chianson et al. (2015) study is similar to the current study in terms of the intervention and the content area in which both studies were conducted. These two studies are different in terms of the location of the study, the participants and the sample for the studies as well as the type and number of research questions and hypotheses used.

In addition, Ahmad's (2016) investigation revealed that think-pair-share enhanced grade five pupils' academic progress and retention. The current study and Ahmad's (2016) both used the think-pair-share. The location of these studies, the subjects under which the studies were conducted, and the participants made the two studies different.

Also, Saleh and Ibrahim (2015) in their study found that think-pair-share was effective in teaching biology. Saleh and Ibrahim's (2015) study and the current study both employed the same intervention and used experimental and control groups, but these studies were conducted on different subjects using different participants. However, Marwan (2015) found the think-pair-share not to be effective.

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METHODOLOGY

Research Approach

The approach of this study is a mixed method. A mixed method approach which capitalises on the strengths of quantitative and qualitative approaches was required since using only one approach would not be appropriate and good enough to answer all the questions guiding this investigation.

Research Design

A research design is the overarching strategy behind a study. It provides a clear and systematic outline for addressing a predetermined set of research questions through data collection, examination and discussion. An explanatory sequential mixed method design was used in the study. This is because qualitative data was later collected and analysed to help understand an unexpected situation that emerged during the quantitative data analysis.

Though convergent parallel design and exploratory sequential design are designs that could be used in mixed method studies, they were not fit for this particular study per their mode of data collection. Convergent parallel design involves the simultaneous collection of both quantitative and qualitative data, exploratory sequential design involves collecting qualitative data first and subsequent collection of quantitative data, whilst the explanatory sequential design which is employed in this study involves the collection of quantitative data first and the subsequent collection of qualitative data which is used to explain an unexpected situation emanating from the analysis of the quantitative data (Creswell, 2018). The explanatory sequential mixed method design was suitable for this study because qualitative data was gathered after the quantitative data.

The explanatory sequential mixed method design aids researchers in developing a deeper comprehension of a topic, discovering the causes of a phenomenon and making predictions about the future. As in this study, the design provided insight into why students fared better working alone than in pairs on the same task. It is also suitable for cross-validation and confirmation of findings from the quantitative study.

It, however, presents a number of challenges, including the need for extensive time and resources to collect data in two distinct phases and the impossibility of obtaining full ethical approval for the thesis before beginning the study since the researcher may not know how the participants for the second phase of the data collection will be selected. The researcher will only know this after the first phase (quantitative aspect) is finished.

Population, Sample and Sampling Procedure

All first-year students in the senior high and technical institutions in the Kasena-Nankana Municipal made up the study's population, whilst all first-year students of the selected school made up the study's target population. Two intact classes were used in the study. This investigation was conducted in a normal school setting hence the need not to disrupt the school setting in the process of carrying out the study, and so intact classes were used instead of random assignments of students into groups (Creswell & Creswell, 2018: Bornaa, 2020).

The study actually started with a sample of 102 comprising 50 students from the experimental class and 52 students from the control class. As a result of the need to test hypotheses two and

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three, which sought to find out whether there was a significant improvement in students' performances in both groups after they had gone through their respective treatments, there was the need to analyse the data of students who took part in both the pre-test and post-test only and so data from students who did not take part in either the pre-test or post-test were excluded and the remaining ones analysed. After excluding data from students who could not take part in any of the tests, the remaining data that was analysed came from 78 of the participants, so in effect, these 78 students became the sample size for the study.

The selected school was conveniently chosen for the study because it was the only school in the municipality that had not treated fractions as a topic at the time of data collection, so the researcher had no option left but to use only that school which served as a neutral ground for this study. Also, year one was purposefully chosen since fraction is a first-year topic. After year one was chosen, two classes taught by the same mathematics teacher were considered. The two classes were considered using the convenience sampling technique since the teacher of those classes was the only teacher who agreed to release his classes to the researcher for the study to be conducted.

The participants from the two intact classes were given a pre-test to find out their entry behaviour (performances) as far as fractions are concerned and to assign them to control and experimental groups. Though the two classes did not differ from each other significantly in terms of performance, there was some slight difference between them per their mean scores in the pre-test, so the class with the lower mean score was used as the experimental group, while the class with the relatively higher mean score was used as the control. The experimental and control classes were taught fractions using a common lesson plan, with the only difference being the use of the think-pair-share strategy in the experimental class. Lessons were conducted based on the normal school timetable. Both classes were tested again after the lessons the data was analysed and compared.

The qualitative data was collected from three (3) students out of the 39 students from the experimental class who took part in the intervention test. These three students comprised two boys and one girl, all of which were coming from traditional, low-income earning homes and rural areas. The parents of these students did not get the opportunity to go through formal education and, as a result, became peasant farmers. One of the boys and the girl were both 16 years of age, whilst the other boy was 17 years.

Data Collection Instrument and Data Collection

Teacher-made fractions tests and interview schedules were used to gather data for this research. The teacher-made fraction test was used to gather data on students' performances in fractions, whilst the interview was used to collect data on the reason why some students rather performed better at the think stage as compared to their performances on the same test items at the pair stage.

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Three separate self-developed tests were used in this study. The pre-test consisted of fifteen (15) multiples choice items and five (5) open-ended questions. The pre-test lasted for sixty (60) minutes, and students were required to attempt all questions. The pre-test was conducted to determine students' entry behaviour. The intervention then followed, after which a post-test was conducted, and the results were analysed and compared to ascertain whether there were notable differences in performance between the experimental and control groups.

The intervention test was made of five open-ended questions purposely constructed for the experimental group only. Its goal was to ascertain whether there were any notable differences between the performance of students at the first two stages of the think-pair-share. It was administered during the intervention. The intervention questions were given to students for them to think through it and solve as individuals (think-stage), the scripts were taken, and students were paired to work on the same questions, and those scripts to taken (pair-stage). The students were given 30 minutes to think through and answer the questions at the think stage and another 30 minutes at the pair stage. The individual scripts and that of the pairs were marked, analysed, and the means compared to find out if significant differences existed between the think stage and pair stage. The post-test equally comprised fifteen (15) multiple-choice items and five (5) open-ended questions. Students were required to answer all questions in sixty (60) minutes.

Also, a scheduled interview was conducted to understand and to actually explain why some students performed better at the think stage than at the pair stage. A written interview was employed in this study. A single open-ended item, predetermined and set by the researcher, was used in this study to understand the situation that has emerged. The students responded to the interview item read to them by the interviewer in their own handwriting, explaining why their performances at the think stage were higher than their performances at the pair stage. The interview was conducted in a serene environment where interviewees could feel relaxed and respond to the interview item appropriately. Interviewees were given five minutes each to respond to the item.

Validity of Research Instruments.

Copies of the test items were given out to three experienced mathematics teachers in the municipality for scrutiny. Their suggestions and recommendations were incorporated and corrections were effected to improve the items' appropriateness.

The interview schedule was validated by giving out copies to peers for review and for scrutiny by experts (Cohen, Manion & Morrison, 2012).

Reliability and Trustworthiness of Research Instruments

The inter-rater reliability approach was used to determine the reliability of the test. Also, Cronbach alpha values were calculated to confirm the outcome of the inter-rater reliability and the reliability coefficients of 0. 74, 0.81 and 0.76 were obtained for the three types of tests, confirming that the instruments were reliable. The Cronbach's alpha values obtained indicated that the instruments were reliable since high alpha coefficients of 0.70 and above are typically believed to indicate strong internal consistency of the scores (Bryman &Cramer, 2012; Bornaa, 2020).

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The interview schedule was made dependable and trustworthy by ensuring that the wording, format and question for each interviewee were the same (Silverman, 1993, as cited in Atepor, 2020). The dependability and trustworthiness of an interview are meddled with when the wording, context and emphasis on the item(s) are not the same for all interviewees (Oppenheim, 1992: p. 147 as cited in Atepor, 2020).

Again, strict criteria (Credibility, Dependability, Confirmability and Transferability) developed by Lincoln and Guba (1985) adhered to guarantee the trustworthiness of the qualitative component. The credibility of the data was assured by a process called "member-checking," in which participants were given access to the transcribed data and asked to verify its accuracy and consistency with their own experience. Having a qualitative specialist take part in the data analysis process helped guarantee is dependability. The data were double-checked at every stage of the collection and processing to ensure confirmability, and it was made easy to be replicated by giving a thorough account of the study's setting, participants and data-gathering process.

Method of Data Analysis

Fraction achievement scores were analysed using a statistical package for social sciences. The data analyses used statistical methods with parametric properties. The class that was taught fractions using think-pair-share and the class taught without think-pair-share were compared using independent samples t-test to ascertain whether there were any notable differences in their mean scores. Paired samples t-test was used to determine whether or not there were notable differences in the pre-test and post-test mean scores of the experimental group as well as the control group. Parametric test statistics were used because the basic assumptions were satisfied. Interview data were analysed thematically.

RESULTS AND DISCUSSIONS

1. What is the effect of a think-pair-share teaching strategy on students' academic performance?

The null hypotheses one to four were tested at 0.05 confidence level, and the results were used to provide answers to research question one:

Ho1: There is no significant difference in the pre-test mean scores of students who were taught fractions using think-pair-share and those who were taught using the conventional approach.

This hypothesis was developed and tested to determine the entry behaviour of students. Since the data satisfied the three basic assumptions of the parametric test statistics, an independent samples t-test was run to compare the performances of students in the pre-test for the two groups. The hypothesis was tested at a 5% confidence interval.

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Table 1: Independent Samples t-Test for Pretest Scores

Group	N	Mean	SD	t	df	Sig	95% CI of Diff	
							Lower	Upper
Experimenta l	39	26.38	15.14	.252	76	.802	-5.67	7.31
Control	39	27.20	13.58					

Source*: Field data, 2022.*

Table 1 revealed that the pre-test scores of the control group with mean and standard deviation (M = 27.20, SD =13.58) were a bit higher than that of the experimental group with mean and standard deviation (M = 26.38, SD =15.14). The cognitive entry behaviour of the class taught without think-pair-share was a bit higher than the class taught with Think-Pair-Share. The result further revealed no notable differences (t (76) = .252, p = .802) in scores between the class taught without think-pair-share and the class taught with think-pair-share. The differences in the means (mean difference = 0.82, 95% CI: -5. 67 to 7.31) were very small. Also, since the lower and upper bounds of the 95% confidence interval of the difference are at both sides of zero (one being negative and the other being positive), it indicates that there was no statistically significant difference (Todd, 2017). Hence the researcher failed to reject the null hypothesis.

Ho2: There is no significant difference between the pre-test and post-test mean scores of the class taught without think-pair-share.

This null hypothesis was tested to find out whether there was a statistically significant difference in performance after students had gone through instruction in fractions using the conventional method.

Table 2: Paired Samples t-test for The Class Taught Without Think-pair-share

Test	N	Mean	SD	t	df	Sig	95% CI of Diff	
							Lower	Upper
Posttest	39	28.51	13.03	-.042	38	.677	-7.605	4.990
Pretest	39	27.20	13.58					

Source: Field data, 2022

Table 2 indicate that the post-test mean score of the class taught without think-pair-share (M =28.51, SD = 13.03) is relatively higher than the pre-test mean score of the same class (M =27.20, SD = 13.58). This means that there has been some improvement in performances after students had gone through fraction instruction in the conventional method class but this difference in the mean scores was not statistically significant (t (38) = -.042, p = .677). The difference in the means (mean difference = 1.31, 95% CI: -7.605 to 4.990) was very small. Also, the lower and upper bounds of the confidence interval are at both sides of zero; hence the change was not statistically significant (Todd, 2017). The researcher, therefore, failed to reject the null hypothesis two.

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Ho3: There is no statistically significant difference between the pre-test and post-test mean scores of the class taught with think-pair-share.

This hypothesis aimed to determine if there was a significant change in students' performance after they had gone through fraction lessons using think-pair-share.

Table 3: Paired Samples t-test for The Class Taught with Think-pair-share

Test	N	Mean	SD	t	df	Sig	95% CI of Diff.	
							Lower	Upper
Posttest	39	49.72	14.04	-7.05	38	.000	-30.04	-16.63
Pretest	39	26.38	15.14					

Source: *Field data, 2022.*

From Table 3, the pre-test mean score (M = 26.38, SD = 15.14) is much lower than the post-test mean score (M = 49.72, SD = 14.04). This also suggests an improvement in the scores of students after they were taught fractions using think-pair-share. It was again revealed that the difference in the mean scores was statistically significant (t (38) = -7.05, p < .001). The differences in the means (mean difference = 23.34, 95% CI: -30.04 to -16.63) were high. Also, since the lower and upper bounds of the 95% confidence interval of the difference were at one side of zero, it indicated that the change was statistically significant; hence, the null hypothesis three was rejected (Todd, 2017). This means that think-pair-share has a positive effect on learners' academic attainment in fractions.

Also, the difference between the means of the pre-test and post-test scores in both groups made the situation clearer. Whilst the difference between the means in the control group was 1.31 (28.51-27.20), the experimental group was 23.34(49.72-26.38). The larger mean difference in the experimental group provided further evidence of their higher achievements. It should, however, be noted that these same students who now performed better than their counterparts in the control group after the intervention were considered the low achievers in the pre-test.

Ho4: There is no significant difference between the control and experimental groups' post-test mean scores.

This hypothesis aimed at finding out if there was any statistically significant difference in the post-test scores between students who were taught fractions using think-pair-share and students who were taught fractions without the think-pair-share teaching strategy.

Table 4: Independent Samples Test of Posttest Scores

Group	N	Mean	SD	t	df	Sig	95% CI of Diff.	
							Lower	Upper
Experimental	39	49.72	14.04	-7.05	76	.000	-30.37	-16.63
Control	39	28.51	13.03					

Source: *Field data, 2022.*

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From Table 4, the post-test mean score of the experimental group (M = 49.72, SD = 14.04) was greater than the post-test mean score of the control group (M = 28.51, SD = 13.03). This means that there has been more improvement in the experimental group than in the control group.

The difference in mean scores between the experimental and control groups was statistically significant (t (76) = -7.05, p <.001). The difference in the means (mean difference = 21.21, 95% CI: = -30.37 to -16. 63) was significantly high. Also, since the lower and upper bounds of the 95% confidence interval of the difference are at one side of zero, it provided further confirmation that the difference was significant. Also, an Eta-Squared of 0.3954 was obtained, which means that 39.54% of the variations in the means were explained by the independent variable (Think-Pair-Share). Hence, the researcher rejected the null hypothesis that no significant difference exists between the post-test mean scores of students taught using the Think-Pair-Share and those taught using the conventional teaching approach.

The results of the four null hypotheses tested above indicate that there was a statistically significant difference in the performance of students in favour of the class that was taught fractions using think-pair-share. Since these two groups of students were similar in characteristics at the beginning of the study but later became different at the end of the study, with the experimental group performing better than the control group, it means that the intervention (think-pair-share) has impacted positively on the student's academic attainment.

This means that when mathematics teachers cooperate with think-pair-share in the teaching of mathematics, performances in the subject will be improved. This finding supports the findings of Ahmad (2016), Saleh and Ibrahim (2015) and Salman (2015), all of which found think-pair-share to be effective in their respective studies. It also agrees with the findings of Awaid and Abood (2014), Althelab and Omar (2013) and Gafoor (2012) though this current study and that of Awaid and Abood (2014), Althelab and Omar (2013) and Gafoor (2012) were all conducted in different locations using different participants, grade levels and content areas. The finding here, however, contradicts the findings of Marwan (2015), who found think-pair-share not to be effective in enhancing the academic attainment of undergraduate students in educational psychology courses.

Research question two;

2. Which stage of the Think-Pair-share is the most effective?

The null hypothesis, there is no significant difference in the performances of students between the first two stages of the think-pair-share, was tested at a .05 confidence interval.

Table 5: Test for Significant Difference in The Intervention-Test

Stage	N	Mean	SD	t	df	Sig	95% CI of Diff.	
							Lower	Upper
Pair	38	11.74	4.20	-7.15	55	.000	-10.35	-5.65
Think	19	4.34	4.41					

Source*: Field data, 2022*.

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From Table 5, it was observed that students' mean score at the pair stage (M =11.74, SD = 4.20) was different from the students' mean score at the think stage (M = 4.34, SD =4.41). The table further showed that the difference was statistically significant ($t(55) = -7.15$, $p < .001$) in favour of the pair stage. As a result, the researcher rejected the null hypothesis that there is no significant difference in the performances of students between the first two stages of the think-pair-share. This implied that when students are assessed in pairs or groups, their performance will be better than when they are assessed as individuals. This actually confirms the popular assertion that two good heads are better than one. However, no empirical literature was found either confirming or contradicting this finding.

Though students' performance at the Pair-stage was significantly better than their performances at the Think-stage in general, an unexpected event occurred during a critical examination of students Think-stage and Pair-stage marked scripts where some three students rather performed better at the Think-stage than at the Pair-stage on the same test items. This was a surprising experience for the researcher and other mathematics teachers in the study centre, so the researcher went back and conducted an interview with those three students to find out the reason behind that perplexing situation. The interview was both oral and written. The oral interview data were transcribed, coded and analysed in themes. The written interview was also coded and analysed.

From both written and oral interviews, it was realised that three themes (intolerance, lack of confidence and inability to build consensus) which emerged from the codes made the three students perform poorly at the pair-stage as against the think-stage. For instance, K-1, K-25 and K-35 responses showed that their views and understanding were not being tolerated by their pairs. The pairs (those who hijacked the work) have it in their minds that they are good than their colleagues, and so at all times, their solutions will always be the best; as a result, they decided not to listen to their pairs (the so-called inferior colleagues) voices in solving the questions.

Again, on the part of confidence, the responses of K-1 and K-25 demonstrated that they were not confident enough in their own solutions to the questions and, as a result, coiled up when their pairs argued that they (the respondents) solutions were not correct. If the respondents were confident enough in themselves and their solutions, they could have argued cogently to defend their answers which would have earned them good marks than what they had.

Also, the responses from all three respondents revealed that none of the three pairs was able to build consensus or come to an agreement zone on which of the solutions was the correct one at the pair stage. If students had reasoned together, scrutinised each other work and tried to reconcile the individual works, there was the possibility that they could have identified the most appropriate response, but as it was, some of the students believed that they were good at mathematics than their pair hence need not reason or reconcile their works with the so-called inferior students and this attitude has led them to score lower marks at the pair-stage.

Below are the individual responses of students:

K-1: When I gave my answer, K-4 said it was not correct and didn't also allow me to explain, so I decided to keep quiet for him to do what he thought was right. I was not also sure of my answer too, and that was why I decided not to insist on my solution.

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K-25: The work was hijacked and solved by K-26 only. She didn't give me the chance to even share my thoughts and understanding of the question with her just because she believe she is good at mathematics than me. I was afraid that my answer would be wrong.

K-35: I didn't agree with the approach K-8 wanted to use, and he too didn't agree with mine, so we were still arguing as to which way to go, and the teacher announced that two minutes was left. So, I allowed him to write his solution as our answer, but I was not happy. That is why we got that mark.

From the students' responses, it was clear that the views of K-1, K-25 and K-35 were not accepted by their pairs. Also, the pairs (K-1, K-4) (K-25, K-26) and (K-35, K-8) could not reason together and build consensus on the way forward in order to find a reasonable or the most appropriate answer to the question. K-1 and K-25 were not confident in themselves and their solutions. These three themes (intolerance, lack of confidence and students' inability to build consensus) were the reason for the unexpected event which emerged from the Think-stage and Pair-stage results. This finding serves as a wake-up call for teachers to ensure that these negative attitudes are dealt with or discouraged in their students for success in group work and to foster teamwork.

IMPLICATION TO RESEARCH AND PRACTICE

The findings of the study suggests that think-pair-share is a better approach to teaching fractions and that students benefit more at the pair-stage. It again implied that when students are encouraged to tolerate one another views and develop confidence in themselves and their peers, it will help them to learn from one another even more than they learn from their teachers.

CONCLUSIONS

The research's findings led to the following conclusions;

Think-pair-share is a useful and effective teaching strategy for teaching fractions per the outcome of this investigation.

The most effective stage of the Think-Pair-Share teaching strategy is the pair-stage. However, intolerance, lack of confidence and inability to build consensus on the part of students can affect performance at that stage.

RECOMMENDATIONS

The researcher made the following recommendations to the Ghana education service, curriculum developers, instructors and teacher education institutions in light of the study's findings;

Seminars, workshops and other in-service training on think-pair-share should be organised regularly for teachers to enhance and update their pedagogy, especially on how to effectively implement some of these cooperative teaching strategies. Also, in-service and pre-service

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teachers should be well educated on the positive impact of the think-pair-share on learners' academic progress. The think-pair-share strategy ought to be included in every lesson that is taught in schools. Teacher education institutions should in-cooperate a think-pair-strategy into their methodology courses for pre-service teachers to have exposure.

Teachers and the major stakeholders in education, such as the Ghana education service, should consider small group (pairs) assessment of students since it produced better results than when the students were assessed individually.

Also, teachers should always encourage students to be confident in themselves and ensure that the views and opinions of each student are respected in class, especially when students are made to work in groups.

SUGGESTIONS FOR FUTURE RESEARCH

The researcher offered the following suggestions for future research;

Further studies be carried out on the usefulness of think-pair-share in teaching mathematics in different grade levels, schools, districts, and regions as well as different topics using a much larger sample for better generalisation.

Studies be conducted on the influence of think-pair-share on different variables such as self-esteem, knowledge retention and attitudes towards mathematics.

Studies could also be conducted on the attitudes of instructors and learners towards the think-pair-share teaching strategy.

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