Pak. j. life soc. Sci. (2024), 22(2):16253-16270 E-ISSN: 2221-7630;P-ISSN: 1727-4915

Pakistan Journal of Life and Social Sciences
www.pjlss.edu.pk

https://doi.org/10.57239/PJLSS-2024-22.2.001179

RESEARCH ARTICLE

The Impact of Quick Mathematical Exercises (Warm-up Activities) on Students' Performance and Confidence

Ismet Temaj[1], Esma Canhasi-Kasemi[1*], Senad Orhani[2]

[1]Faculty of Education, University of Prizren "Ukshin Hoti", Prizren, Kosovo
[2]Faculty of Education, University of Prishtina "Hasan Prishtina", Prishtina, Kosovo

ARTICLE INFO

Received: Sep 21, 2024

Accepted: Nov 26, 2024

Keywords

Confidence in mathematics

Motivation

Quick exercises

Student performance

Teaching

***Corresponding Author:**

esma.canhasi.kasemi@uni-prizren.com

ABSTRACT

The purpose of this research is to explore the impact of quick mathematical exercises (warm-up activities) on the performance and confidence of students in the subject of mathematics. Quick math exercises include short and simple activities that are carried out at the beginning of each lesson, to engage students and prepare their minds for the topics that will be covered during the lesson. This action research took place in a junior high school classroom, where students were involved in various exercises, such as solving simple arithmetic problems, math games, and questions that stimulate critical thinking. The methodology of the study included action research design by evaluating students' performance through pre- and post-tests during the implementation of quick exercises, as well as classroom observations, and questionnaires to understand students' experiences and feelings about mathematics after the exercise intervention. Rapid, and structured interviews with teachers to identify exercise adaptation strategies based on their professional assessments. The collected data were analyzed to see if there were significant changes in the student's performance in mathematics, as well as to assess the changes in their level of confidence in solving mathematical problems. Preliminary results show that the inclusion of quick mathematical exercises has a positive impact on improving student performance. Students showed an increase in confidence in their ability to solve mathematical problems and a more positive attitude towards mathematics as a subject. These findings suggest that prompt exercises can serve as an effective tool to prepare students to face mathematical challenges and create a more conducive learning environment. The research concludes by recommending the inclusion of quick math exercises in lesson planning, to increase students' involvement, confidence, and performance in mathematics.

INTRODUCTION

Mathematics has always been one of the fundamental disciplines of education, playing a key role in developing students' logical and critical thinking skills. Beyond abstract concepts and formulas, mathematics teaches students different ways of solving problems and fosters creativity in thinking. In many lower secondary school classrooms, teachers face the challenge of decreasing students' motivation and confidence in mathematics. Students often develop a negative attitude toward the

subject because of the difficulties they encounter in solving mathematical problems, which leads to low performance (Choi & Chang, 2021). Furthermore, the lack of an effective method to actively engage students during mathematics learning makes them lose interest and feel insecure in their abilities (Lee et al., 2022). This issue calls for new teaching strategies that can improve students' confidence, increase their performance, and foster a more positive learning environment.

One of the proposed strategies is the use of quick mathematical exercises (warm-up activities) at the beginning of each lesson. Quick math exercises include short, structured activities that are performed at the beginning of the lesson, to prepare students' minds and engage them in the learning process (Brown & Anderson, 2020). These exercises can include solving simple arithmetic problems, math games, and questions that stimulate critical thinking. These activities have shown the potential to improve student focus and reduce anxiety levels in mathematics classrooms (Doyle & Richards, 2022).

Recent research suggests that speed exercises can have a positive impact on preparing students for mathematical challenges. A study by Garcia and Lopez (2022) showed that the inclusion of these exercises improves not only students' performance but also their confidence to solve mathematical problems. Likewise, quick exercises have an impact on motivating students and creating a more positive attitude towards mathematics (Smith & White, 2023). Another study by Lin and Huang (2021) found that these activities help build a more conducive atmosphere for learning, increasing involvement and cooperation among students.

However, the impact of quick math exercises is not only on student performance. According to a study conducted by Miller and Jackson (2023), these activities have also helped develop students' critical and creative thinking skills by challenging them to think more deeply about mathematical concepts. This teaching approach, which involves students in solving various problems and mathematical games, promotes the development of problem-solving skills and helps students build a stronger and healthier relationship with mathematics (Anderson & Lee, 2022; Jam et al., 2011).

Learning mathematics has always been a challenge for many students, especially in the early teenage years, when mathematical concepts become more complex and require a higher level of critical thinking (Perez & Johnson, 2021; Qadri et al., 2024). Studies show that developing a positive attitude and confidence in their abilities is essential for students' progress in mathematics (Hall & Watson, 2020). The importance of this research lies in the identification and implementation of new strategies, such as quick math exercises, to improve not only performance but also to promote students' motivation and engagement in mathematics at higher levels.

Quick math exercises provide a practical and effective method to overcome the barriers encountered in learning mathematics. According to recent research by Williams and Carter (2022), prompt exercises have been identified as an important tool to help students mentally prepare for the complex content to be discussed in class. In this context, this study aims to explore the effectiveness of these activities in improving students' performance and increasing their confidence, thus contributing to the development of a favorable learning environment.

Furthermore, given the challenges of mathematics education and the lack of previous research in this area, this study constitutes an attempt to build on existing knowledge and provide practical solutions for teachers. The study is expected to provide a basis for the development of more effective teaching methods that will address the needs of students and contribute to increasing their results in mathematics.

Problem Identification

In many lower secondary school classrooms, teachers face the challenge of decreasing students' motivation and confidence in mathematics. Students often develop a negative attitude towards the

subject because of the difficulties they encounter in solving mathematical problems, which leads to low performance. Furthermore, the lack of an effective method to actively engage students in learning mathematics makes them lose interest and feel insecure in their abilities. This issue calls for new teaching strategies that can improve students' confidence, improve their performance, and foster a more positive learning environment. One of the proposed strategies is the use of quick mathematical exercises (warm-up activities) at the beginning of each lesson. Although the benefits of rapid math exercises are well known, their impact on student motivation, confidence, and engagement in the context of junior high school classrooms has not yet been widely studied. Previous studies have shown the need to explore the most effective ways to implement these exercises and to adapt strategies based on the different needs of students (Adams & Murphy, 2021).

Purpose of the Study

The purpose of this research is to evaluate the influence of quick mathematical exercises (warm-up activities) in improving the performance and confidence of students in mathematics. Quick exercises include short, structured activities that are carried out at the beginning of the lesson, to prepare students' minds and engage them in the learning process.

This research aims to analyze whether these activities can improve understanding of mathematical concepts, reinforce problem-solving skills, and foster a more positive attitude towards mathematics. Also, it will be investigated how these exercises can influence the motivation of students and increase their self-confidence to face mathematical challenges.

This study is intended to identify the most effective practices to create a more lively and inclusive learning environment. The results of the research will provide practical guidance for teachers, helping them to integrate new strategies in lesson planning that not only improve academic performance but also create a more positive and stable attitude of students towards mathematics.

Research Questions

- Do quick mathematical exercises (warm-up activities affect the improvement of student's performance in mathematics?
- How does the inclusion of quick math exercises increase students' confidence to solve math problems?
- What is the impact of these exercises on students' motivation and attitude towards mathematics?
- Is there a relationship between the frequency and type of quick math exercises and the level of student engagement during math class?
- What are the most effective strategies to implement quick math exercises to maximize student benefit?

Research Hypothesis

Hypothesis 1. Quick mathematical exercises (warm-up activities) have a positive impact on improving the performance of students in mathematics.

Hypothesis 2. Including quick math exercises at the beginning of class increases students' confidence in their abilities to solve math problems.

Hypothesis 3. Quick mathematical exercises have a positive effect on students' motivation and attitude towards the subject of mathematics.

Hypothesis 4. The frequency and type of quick math exercises are related to the level of involvement and engagement of students during math class.

Hypothesis 5. Quick math exercises can be adapted in different ways to address students' needs and maximize their gains in math learning.

LITERATURE REVIEW

To understand the impact of warm-up activities on students' math performance and confidence, it is essential to review previous studies that have explored teaching and engagement strategies in math classrooms. Recent research in this area suggests that interactive strategies and brief preparation can help reduce anxiety and increase student engagement.

Quick math exercises have been used as a strategy to improve students' concentration and performance. Anderson and Lee (2022) argue that these activities improve student involvement and create a more conducive learning environment, preparing students mentally for the more complex topics to be covered during class (Anderson & Lee, 2022). Another study by Garcia and Lopez (2022) showed that the inclusion of quick exercises not only increases students' performance in exams but also helps in the faster acquisition of new concepts (Garcia & Lopez, 2022). Bishop and Cooper (2021) focused on developing mathematical reasoning skills through rapid exercises in high school students. The study showed that short, structured activities at the beginning of the lesson can improve logical and problem-solving skills, helping students more easily deal with complex mathematical problems in the classroom and outside (Bishop & Cooper, 2021).

Students' confidence in their ability to solve mathematical problems is a key aspect of academic success. A study conducted by Williams and Carter (2022) showed that the inclusion of quick mathematical exercises significantly improves students' confidence, helping them to tackle problems more confidently and without fear (Williams & Carter, 2022). Also, Lin and Huang (2021) observed that students who regularly participate in such activities reported less anxiety related to mathematics, which improved their concentration and attitude during the learning process (Lin & Huang, 2021). Reynolds and Thompson (2021) analyzed the role of motivational activities in building mathematical self-confidence. According to them, quick activities that focus on quickly gaining basic skills help students experience quick success, which increases self-esteem and motivation to continue learning more advanced concepts (Reynolds & Thompson, 2021).

Fear and anxiety about mathematics, known as "math anxiety", are common among many students and have a major impact on their performance. According to a study by Choi and Chang (2021), quick math exercises contribute to reducing anxiety levels, helping students feel more prepared and confident in the face of math challenges (Choi & Chang, 2021). Another study carried out by Doyle and Richards (2022) suggests that short and structured activities at the beginning of the mathematics class can relieve the pressure felt by students and create a calm and supportive environment (Doyle & Richards, 2022). Ellis and Turner (2022) conducted a longitudinal study on the impact of preparatory activities on reducing math anxiety. Their findings suggest that short activities that help students calm down and mentally prepare for learning significantly reduce anxiety and stress, making students more confident in tackling math challenges in class (Ellis & Turner, 2022). Thomas and Edwards (2020) focused their study on strategies for reducing anxiety and increasing performance in mathematics. They found that quick exercises have a noticeable effect on reducing the fear and tension that students feel when facing difficult mathematical tasks, making the learning process easier and more enjoyable (Thomas & Edwards, 2020).

One of the main benefits of quick math exercises is the development of problem-solving skills. According to research by Brown and Anderson (2020), students who engage in such activities show a significant improvement in their ability to solve complex problems. This improvement is related to the fact that quick exercises mentally prepare them for future challenges and help them structure logical thinking more effectively (Brown & Anderson, 2020). Morgan and Peterson (2021) focused their study on improving memory and retention of mathematical concepts through rapid exercises.

They found that students who regularly practice these exercises at the beginning of class are more likely to remember and consistently use the concepts learned during the problem-solving process (Morgan & Peterson, 2021).

In addition to improving academic performance, quick math exercises can play an important role in developing critical thinking. According to a study by Miller and Jackson (2023), these activities challenge students to think more deeply about mathematical concepts, leading them to develop better problem-analysis and evaluation skills. This method not only helps to better understand mathematics but also prepares students to face other academic challenges (Miller & Jackson, 2023). Andrews and Brown (2020) suggest that interactive teaching strategies have a strong impact on student engagement in mathematics. Their study demonstrates that activities that stimulate critical thinking and active involvement in the learning process, such as quick exercises, improve student concentration and participation throughout math class. They argue that students who engage interactively are more likely to acquire new concepts more efficiently (Andrews & Brown, 2020). Hughes and Kline (2021) noted that interactive learning environments, which include quick exercises, have a direct impact on improving students' academic performance in mathematics. They argue that mental preparation through quick activities helps create a focused routine, making the student more ready to understand new concepts and interact better with the teacher and peers (Hughes & Kline, 2021). Jordan and Mitchell (2020) showed that incorporating activities that promote a growth mindset in mathematics helps improve student performance. They found that quick exercises, structured to encourage students to think about multiple solutions and experiment with new solutions, strengthen confidence and motivation to face more complex challenges (Jordan & Mitchell, 2020). Kumar and Sharma (2022) analyzed the impact of rapid exercises on the development of critical thinking and problem-solving skills in secondary schools. They found that preparatory activities before mathematics class not only improve students' analytical skills but also help them become more aware of the most effective ways of solving problems (Kumar & Sharma, 2022).

Another important aspect of quick math exercises is the use of creative games and questions to engage students. Smith and White (2023) argue that mathematical games and questions that stimulate creative thinking are effective tools to encourage collaboration among students and reinforce basic mathematical concepts (Smith and White, 2023). Another study by Perez and Johnson (2021) found that students who participate in such activities develop a more relaxed and positive approach to learning mathematics (Perez & Johnson, 2021). Orhani's (2023) study reported that students with low math confidence or high math anxiety can benefit from playing math computer games (Orhani, 2023).

A significant challenge for many teachers is finding ways to keep students' attention during math class. A recent study by Adams and Murphy (2021) suggests that quick math exercises are an excellent method to create a smooth transition from previous activities to new learning content (Adams & Murphy, 2021). Also, the research conducted by Hall and Watson (2020) showed that the inclusion of these activities helps to create a common atmosphere in the classroom, increasing the involvement and cooperation of students (Hall & Watson, 2020).

One factor to consider is the frequency of performing quick math exercises. Studies suggest that regular and structured use of these activities can have a lasting impact on student outcomes. According to a study by Park and Lee (2022), greater frequency of brisk practice resulted in continuous improvements in students' academic performance and self-confidence (Park & Lee, 2022). Stevens and Carter (2022) showed that quick preparatory exercises help students focus better and get into "learning mode". Their study suggests that including exercises that mentally prepare students for complex content helps them focus more during the rest of the math lesson (Stevens & Carter, 2022).

From a review of recent literature, it is clear that quick math exercises have a significant impact on students' math performance, confidence, and motivation. Strategies that include such activities provide an excellent method to prepare students to meet mathematical challenges and to create an engaged and supportive classroom environment. While most research highlights the benefits of these activities, future studies must continue to explore the most effective ways of implementing them in different educational contexts.

METHODOLOGY

Research Design

The research was designed as action research involving classroom intervention to test the effectiveness of quick math exercises in improving students' performance and confidence. This approach is based on repeated cycles of planning, implementation, observation, and reflection, where the teacher is engaged in the process of improving teaching practices (Creswell & Creswell, 2018). The research design was chosen to create a deeper understanding of how prompt exercises affect students' preparation and engagement in mathematics. This detailed methodology provides a clear framework for understanding the impact of quick math exercises on students' math performance and confidence. Using a combined quantitative and qualitative approach, the study aims to provide valuable evidence that can inform future teaching practices in mathematics.

Participants

The participants in this research are the students of the lower secondary school "Heronjtë e Lumës" from the village of Vërmicë, Municipality of Prizren in the Republic of Kosovo, who have a different average in mathematics and represent a different group in terms of academic skills. To select the participants, the random selection method was used. The total number of students who participated in this research is 150, of which 82 are female and 68 are male, thus guaranteeing equal gender representation. Regarding the classes, we have this distribution: Class I with 11 students, Class II with 14 students, Class III with 12 students, Class IV with 10 students, Class V with 14 students, Class VI with 23 students, Class VII with 22 students, Cass VIII with 20 students, and Class IX with 24 students.

Data Collection Instruments

Several data collection instruments were used in this study, including:

Pre- and Post-Intervention Tests: To assess the improvement in mathematics performance, the students underwent a pre-intervention test with the quick exercises, and the same post-intervention test. The tests contained mathematical problems based on the concepts covered during the study period.

Self-Assessment Questionnaires for Mathematics Confidence: A self-assessment questionnaire was used to measure students' confidence in solving mathematical problems. The questionnaire contained questions on a Likert scale from 1 (not at all sure) to 5 (very sure), to assess students' self-confidence before and after the intervention (Bandura, 1997).

Classroom Observations: During the implementation of the quick exercises, systematic observations were made to document the behavior and engagement of the students during the activities. These observations helped to identify changes in their concentration and involvement.

Structured Interviews with Teachers: To understand how the rapid exercises, affect the overall classroom climate and teaching practices, structured interviews were conducted with the teachers who implemented these activities. The interviews helped to identify the benefits and challenges of applying quick math exercises in their specific context.

Procedure for the Implementation of Quick Mathematical Exercises

The intervention with quick math exercises was carried out over four weeks. Each school day, at the beginning of math class, students engaged in short activities designed to stimulate critical thinking and prepare their minds for later learning. Exercises included solving simple arithmetic problems, multiple-choice questions, and math games that encourage problem-solving.

Data Analysis

The data collected from the pre- and post-intervention tests were analyzed through descriptive statistical analysis and the test of mean differences (t-test), to compare the performance of students before and after the implementation of quick exercises. For the analysis of the self-report data on confidence, regression analysis was used to see the relationship between participation in the quick exercises and changes in students' confidence.

Whereas, for the data from classroom observations and structured interviews, thematic analysis was used to identify the main themes related to student involvement and challenges during the implementation of activities. These analyses helped create a deeper understanding of the benefits of rapid math exercises from the perspective of students and teachers.

Ethics in Research

Throughout the research, all ethical research standards were adhered to. The students and their parents gave their informed consent to participate in the study. All data were treated with complete confidentiality and used only for research purposes.

RESULTS

This chapter presents the results of the study on the impact of quick math exercises on students' performance and confidence. Data were collected through pre- and post-intervention tests, classroom observations, and self-assessment questionnaires, including interviews with teachers to understand their perspectives on the effectiveness of rapid exercises.

Test Results

This subchapter presents the results of tests for evaluating the impact of quick mathematical exercises on student performance. Tests were conducted before and after the intervention to measure the changes in students' mathematical skills after the implementation of the preparatory activities. The pre-intervention test was developed to assess students' initial level in mathematics, while the post-intervention test was conducted to measure their improvement in solving mathematical problems.

Table 1. Descriptive statistics of test results

Statistics	Pre-intervention test	Post-intervention test	Improve
The average	55.99	67.77	11.77
Standard Deviation	16.57	18.10	4.79
The minimum	30.00	36.00	5.00
First quartile (25%)	42.00	53.00	8.00
Median (50%)	52.00	65.50	11.00
Third quartile (75%)	70.75	83.00	15.00
The maximum	84.00	100.00	29.00

Table 1 presents the descriptive statistics of test scores performed before and after the intervention with quick math exercises, showing significant improvements in student performance. The average score before the intervention was 55.99, while after the intervention it increased to 67.77, reflecting an improvement of 11.77 points, which indicates that the exercises have positively affected the students' abilities. The standard deviation, which increased from 16.57 to 18.10, indicates a greater

spread of scores after the exercises, suggesting that some students benefited more than others. Similar improvements are seen in the minimum and maximum scores, with the minimum increasing from 30.00 to 36.00 and the maximum from 84.00 to 100.00, reflecting a 29.00point improvement on the high end of the scores. Improvements are also visible in all quartiles, with students positioned in the lowest 25% improving by 8 points, middle students by 11 points, and those in the third quartile by 15 points. These results show student progress across all performance levels and are consistent with study findings suggesting that quick math exercises have a significant impact on students' preparation and math problem-solving skills.

Table 2. Paired Samples Test

Paired Differences	**Value**
Mean	11.77
Std. Deviation	4.79
Std. Error Mean	0.39
95% Confidence Interval of the Difference - Lower	11.01
95% Confidence Interval of the Difference - Upper	12.54
T	-30.08
df	149.00
Sig. (2-tailed)	0.00

Table 2 presents the results of the Paired Samples Test, which measures the difference between students' scores before and after the intervention with quick math exercises. The mean difference shows an improvement of 11.77 points, reflecting a significant positive impact of the exercises on student performance. The standard deviation of 4.79 indicates that most students experienced similar improvements, while the standard error of the mean of 0.39 indicates that this improvement is very consistent. The 95% confidence interval (11.01 to 12.54) reinforces this conclusion, indicating that with 95% confidence, the real difference in scores lies within this interval. The degree of freedom (df) is 149.00, this indicates that the analysis was conducted with 150 students, which is a large enough number to ensure that the results are stable and representative of the wider population. The very high negative T-value (-30.08) and p-value of 0.00 indicate that the improvement is statistically very significant, ruling out the possibility that this change occurred by chance. According to the results of the study, the quick math exercises significantly influenced the improvement of the student's performance, with lasting results and benefits for all students involved.

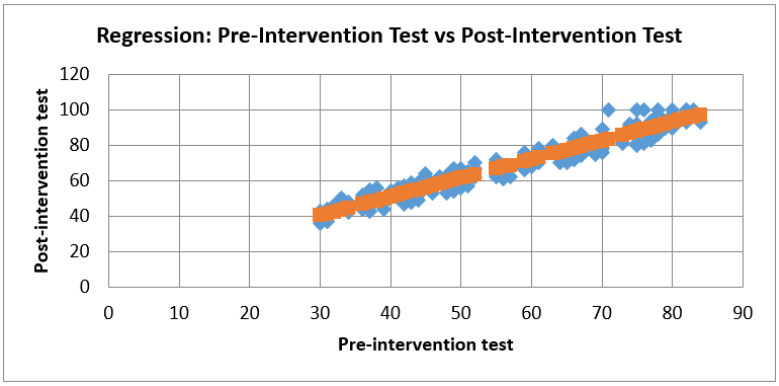

Figure 1. Linear regression

The linear regression results show a very strong relationship between students' scores before and after the intervention with quick math exercises. The intercept value of 8.71 indicates that, even for students who had very low test scores before the intervention, there is a baseline improvement of 8.71 points after the intervention. The coefficient for the "Pre-intervention Test" is 1.05, indicating

that for every point gained on the pre-intervention test, students improved on average 1.05 points on the post-intervention test. The R-squared value of 0.93 suggests that 93% of the variation in post-intervention test scores can be explained by pre-intervention scores, indicating a very strong relationship between initial performance and post-intervention improvement. With very low p-values (0.00), both variables are statistically significant as shown above, confirming that the change in outcomes after the intervention is not random. Overall, these results show that the intervention with quick exercises had a positive and lasting impact on improving students' performance in mathematics, regardless of their initial level. Thus, a positive relationship is observed between test scores before and after the intervention. This means that students who performed well on the test before the intervention tended to improve their results even further after the intervention. This result is important because it shows that the quick math exercises had a positive impact on all levels of performance. Most of the points lie close to the regression line, indicating that post-intervention scores are consistent with pre-intervention test scores, with significant improvements. As can be seen from the slope of the regression line, the results of the students after the intervention have a clear increase, which is stable for most of them. This emphasizes that quick exercises help improve students' mathematical skills, increasing self-confidence and concentration in solving problems. The regression results show a clear and positive relationship between the results before and after the intervention, reinforcing the idea that the quick exercises have contributed to the significant improvement of the student's mathematical performance.

Results from Observation

Based on the classroom observation for the experimental group about the influence of quick mathematical exercises (Warm-up Activities) on the performance and confidence of students, the interpretation of the results of the completed rubric is as follows:

Table 3. Results from observation

Observation Criterion	Performance Scale (1-5)	Observations and Comments
Are the students focused during the quick exercises?	4	Most students maintain concentration while solving exercises, however some students lose focus when faced with more complex exercises.
Do most students participate in solving the exercises?	5	All students participate actively and are ready to contribute their solutions.
Do the students seem motivated and engaged?	4	Students are generally motivated, but some show signs of demotivation when they have difficulty solving exercises.
Are students willing to discuss solutions with others?	3	Some students are willing to share their solutions with others, but most feel unsure if their answers are correct.
Do the students understand the purpose of the quick exercises?	5	All students seem to understand the importance of quick exercises for improving math skills.
Is there a difference in concentration after exercise?	4	Students' concentration increases after completing the exercises, however, some students show fatigue if the exercises are prolonged.
Is there a cooperative climate during the exercises?	5	The climate in the classroom is very cooperative, students help each other in solving the exercises.
Are there anxious or insecure students?	2	A small part of the students feel insecure and show concern in solving the exercises.

Are the exercises adapted to the level of the students?	4	The exercises are suitable for most, however some students need more support to complete them successfully.
Does the students' self-confidence improve after the exercises?	3	Some students show improvement in self-confidence after the exercises, however, some need additional support to increase their self-confidence.
Is there a significant improvement in student performance?	4	Student performance improves over time, especially after a few weeks of regular practice.
Is there a reduction in math anxiety after the exercises?	3	Some students have significant reductions in math anxiety, however for a small group, anxiety remains problematic during and after the exercises.

Student concentration during quick exercises (Scale: 4): According to classroom observation, quick exercises helped increase students' concentration and mental preparation for mathematical challenges. During observation, students maintained concentration, but some lost focus in cases of complex exercises. This is in line with the results of the study, where the inclusion of quick mathematical exercises creates a more focused environment and improves logical skills.

Active student participation (Scale: 5): All students participated in the quick exercises, which shows that these activities have a positive effect on student involvement. The observation points out that preparatory activities such as mathematical games and stimulating questions promote the participation and engagement of students in the classroom.

Student motivation and engagement (Scale: 4): Students are generally motivated, but some show signs of demotivation in cases of difficult exercises. According to the observation, the quick exercises helped to reduce math anxiety and improve positive attitudes toward math. These results agree with the positive impact of exercises on increasing motivation, as highlighted by the study.

The feeling of security in discussing the solutions (Scale: 3): During the observation, many students felt insecure when we discussed the solutions. The study shows that quick exercises help to increase self-confidence and develop critical thinking, but some students need time to build full confidence in their abilities.

Understanding the purpose of the exercises (Scale: 5): Students seem to understand the purpose of the quick exercises, which is in line with the findings of the study, which emphasizes that the exercises help in mental preparation and understanding of mathematical concepts to face the challenges.

Change in concentration after exercise (Scale: 4): Observation showed an improvement in concentration after exercise, but some students feel tired. The study suggests that fast-paced activities help students focus better, but fatigue may be related to the duration or complexity of the exercises.

Cooperative climate in the classroom (Scale: 5): The observation results show a very cooperative climate, which is in line with the results of the study, where it is mentioned that exercises improve cooperation and interaction between students, creating a supportive environment for learning.

Students worried or unsure (Scale: 2): A small number of students were worried during the exercises. The study suggests that math anxiety is an important factor, but preparatory activities help reduce this anxiety for most students.

Improved self-confidence (Scale: 3): Some students had improved self-confidence, but others still needed support. This is consistent with research suggesting that self-confidence gradually improves through successful experience in speed exercise.

Improved performance (Scale: 4): Students reported improved performance after a few weeks of practice, which is consistent with the results of the study, which emphasizes increased math problem-solving skills.

Reduction of math anxiety (Scale: 3): Students report a reduction in math anxiety, but for a small group it remains problematic. The study mentions that quick exercises have the potential to significantly reduce math anxiety, but this may vary from student to student.

In conclusion, the observational results show an overall positive impact of quick math exercises on students' performance, confidence, and motivation, with some students requiring more support to achieve full benefits.

Results from Questionnaires

This subchapter provides a detailed analysis of the results of the questionnaire on the impact of quick math exercises on students' performance and confidence. The questionnaire contained a series of questions divided into several categories, including preparation for learning, concentration, reducing math anxiety, as well as improving problem-solving skills and collaboration among students. Results were collected from a group of students in grades I-IX, with 82 female students and 68 male students, and included responses based on a scale rating the appropriateness and impact of the exercises.

Cronbach's alpha for the questionnaire on quick mathematical exercises is 0.985, which indicates a very high degree of internal reliability of the questions. Such a value suggests that the questions in the questionnaire are strongly related to each other and the measurements are very stable. This means that the questionnaire is a reliable instrument to measure students' perceptions about the impact of quick math exercises.

Descriptive statistics for the questionnaire for 150 students on quick math exercises are presented in the table and include the mean (mean), standard deviation (std), minimum (min), and first quartile (25%) values for each response category.

Table 4. Descriptive statistics of the questionnaire

Categories	Never / At all / Not at all	Rarely / Few	Sometimes /On average	Often / A lot	Always/ Extremely
count	10.00	10.00	10.00	10.00	10.00
I mean	11.80	13.80	14.10	32.40	71.40
std	4.44	4.02	8.60	5.80	9.18
min	7.00	6.00	6.00	25.00	57.00
25%	9.25	11.50	8.25	29.25	65.75
50%	11.00	14.00	10.50	30.50	75.50
75%	13.50	16.75	20.50	35.00	76.75
max	22.00	19.00	29.00	46.00	82.00

Descriptive statistics for the Quick Math Questionnaire provide an overview of the distribution of student responses, including the mean, standard deviation, minimum, and quartile values (25%, 50%, 75%) for each category. In the "Never / Not at all / Not at all" category, the mean is 11.8 students, indicating that a small number of students report that they do not feel prepared or at all focused after the exercises. The standard deviation of 4.44 suggests a small spread of responses, and 25% of students give less engaged responses. In the "Rarely / Little" category, the mean is 13.8 students, indicating that a significant proportion feel rarely or little helped by the exercises, with a slightly wider spread of responses (standard deviation 4.02). The "Sometimes/Average" category has a mean of 14.1 students and a higher standard deviation (8.60), indicating considerable variation in responses.

On the other hand, positive categories such as "Often/Very" and "Always/Extremely" indicate a very large impact of exercise. The average of 32.4 students in the category "Often / Very" indicates that a large number of students often feel helped by exercises, while in the category "Always / Extremely", the average of 71.4 students indicates that the vast majority of students feel extremely prepared and concentrated after exercise. The standard deviation of 9.18 in this category indicates a small dispersion of responses, suggesting that students have high consistency positive experiences.

Thus, the results of the student questionnaire show that quick math exercises have a significant positive impact on most students, especially in improving concentration and self-confidence. However, a small proportion of students report that they do not feel adequately supported, indicating that there is room for improvement in including all students in the benefits of these exercises.

Table 5. Correlation between questions

Categories	**Never / At all / Not at all**	**Rarely / Few**	**Sometimes /On average**	**Often / A lot**	**Always / Extremely**
Never / At all / Not at all	1,000	0.290	0.068	-0.186	-0.428
Rarely / Few	0.290	1,000	-0.099	-0.177	-0.142
Sometimes / On average	0.068	-0.099	1,000	-0.523	-0.798
Often / A lot	-0.186	-0.177	-0.523	1,000	0.205
Always / Extremely	-0.428	-0.142	-0.798	0.205	1,000

Based on the table above, the correlation between the questions in the questionnaire for the quick math exercises provides some interesting conclusions that help to gain a deeper understanding of the impact of these exercises on the students' perceptions and experiences. The strong negative correlation between "Never/Not at all" and "Always/Extremely" (-0.428) indicates that quick math exercises have a significant positive impact on mental preparation and reduce math anxiety r. This result shows a clear divide between those students who do not benefit from exercise at all and those who experience maximum benefits, suggesting that exercise may help many students, but for some, it may not be sufficient to address all their needs. The strong negative correlation between "Sometimes/Average" and "Always/Extremely" (-0.798) indicates that students who feel moderately helped by exercises tend not to always feel prepared. The study points out that preparatory exercises help improve concentration and self-confidence, but some students need regular successful experiences to build more lasting self-confidence. This suggests that even though some learners gain new skills, those learners who always feel underprepared are looking for better. Further studies or approaches tailored to each. The negative correlation between "Sometimes / On average" and "Often

/ Much" (-0.523), this result reflects a moderate division between students who report average benefits and those who experience greater benefits from exercise. Research shows that regular preparatory activities can increase concentration and help students face math challenges with more confidence. This suggests that over time, some students who currently feel moderately helped may benefit more from the continued inclusion of these exercises. The positive correlation between "Often/Very" and "Always/Extremely" (0.205), this result shows that some students who often benefit from exercise also tend to always feel prepared. Although the correlation is not very strong, it supports the idea that students who report frequent improvement are more likely to experience longer-term gains. For this reason, I improve the learning experience of the students they benefit from and can often help them achieve their highest level.of preparation. The weak correlations between the intermediate categories ("Rarely/Slightly" and "Always/Extremely" -0.142) suggest that there is a large divide between the groups of students who benefit fully and those who feel unprepared. This helps support the study's recommendations for adapting strategies for each student group h. Therefore, the correlations show a clear separation between students who benefit fully from exercise and those who report low or moderate benefits. This is consistent with the findings of the study, which suggests that quick math exercises have a strong positive impact on most students, but also implies the need for further adaptation of activities to include all groups.

Results from the Interview

Based on structured interviews and teacher experiences they report the main effects as follows:

Teachers emphasize that quick math exercises are an effective tool to prepare students' minds for the content to be covered during class. According to them, these exercises improve students' concentration and create a smooth transition from previous activities to the subject of the lesson.

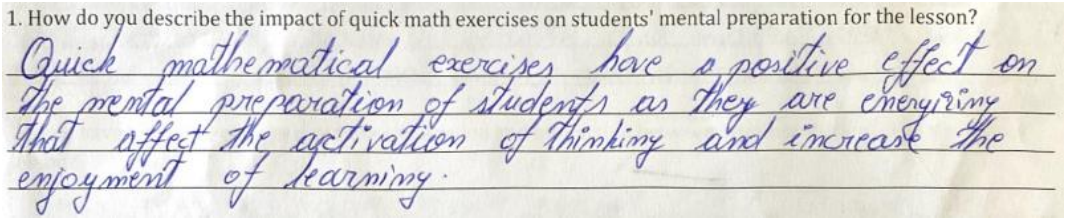
1. How do you describe the impact of quick math exercises on students' mental preparation for the lesson?
Quick mathematical exercises have a positive effect on the mental preparation of students as they are energizing that affect the activation of thinking and increase the enjoyment of learning.

Figure 2. The teacher's answer to question 1

One of the teachers emphasized that the quick exercises had a positive effect. Exercises are described as a tool that promotes active thinking and increases students' enjoyment of learning. This suggests that quick exercises help prepare students' minds for later activities, engaging them more actively and enhancing their learning experience.

Teachers have noticed a significant improvement in the concentration and engagement of students during the lesson after the application of quick exercises. Students participate more actively in discussions and are more motivated to contribute their solutions. Quick exercises have helped increase students' motivation to learn mathematics. Students feel more confident and involved, creating a more positive attitude towards the subject. According to the teachers, these exercises have contributed to the improvement of students' abilities to solve mathematical problems. The exercises create a logical structure and help students use different strategies for solving problems.

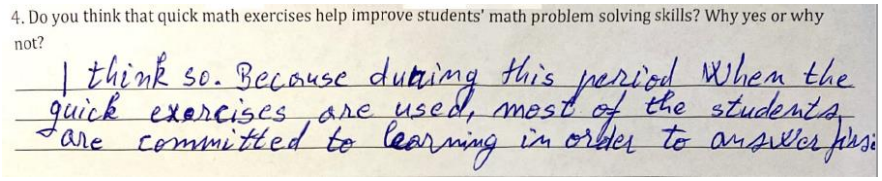
4. Do you think that quick math exercises help improve students' math problem solving skills? Why yes or why not?
I think so. Because during this period When the quick exercises are used, most of the students are committed to learning in order to answer fas

Figure 3. The teacher's answer to question 4

Another teacher agrees that quick math exercises help improve students' math problem-solving skills. He argues that during the period when these exercises are used, most students are committed to the learning process to give correct answers. This suggests that quick math exercises increase students' concentration and engagement, thereby helping to improve their problem-solving skills.

Some of the challenges include the limited duration and content load of the lesson. Some students feel demotivated when the exercises are complicated. Teachers report that quick exercises help reduce math anxiety in students, although a small proportion of students continue to experience anxiety during and after the exercises. The exercises have helped to create a more cooperative atmosphere in the classroom.

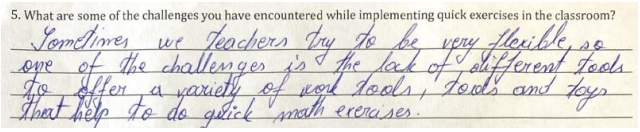
5. What are some of the challenges you have encountered while implementing quick exercises in the classroom?
Sometimes we teachers try to be very flexible, so one of the challenges is the lack of different tools to offer a variety of work tools, tools and toys that help to do quick math exercises.

Figure 4. The teacher's answer to question 5

In this interview response, the teacher mentions one of the main challenges when implementing quick math exercises in the classroom. She points out that one of the obstacles was the lack of different appropriate tools to provide a variety of activities, tools, and toys that help develop quick math exercises. This challenge is important, as using the right tools can help create a more varied and engaging experience for students. The teacher also points out that sometimes, technological and resource limitations can affect the effectiveness of the implementation of the exercises. Teachers must be flexible and creative in using the materials at their disposal to meet teaching goals.

From the other answers, we notice that the students help each other while solving the exercises, which improves the interaction between them. Teachers appreciate that quick exercises are effective in preparing students to understand more advanced mathematical concepts, as they increase students' self-confidence and concentration. Based on these conclusions, interviews with teachers show that quick math exercises have a strong positive impact on students' engagement and mental preparation for mathematics.

DISCUSSION

The results of this study show a strong positive influence of quick mathematical exercises (warm-up activities) in improving the performance and confidence of students in mathematics. The quick exercises helped not only to improve math problem-solving skills but also to reduce math anxiety and increase concentration during class. These results are consistent with previous studies that emphasize the importance of short and interactive preparations for increasing students' concentration and performance.

The study showed significant improvements in students' test scores after implementing the quick exercises, with an average increase of 11.77 points. This is consistent with other research, such as that by Brown and Anderson (2020), which suggests that quick exercises help students focus better on later topics and improve logical and problem-solving skills (Brown & Anderson, 2020). These exercises also help mentally prepare students for upcoming content, creating a more engaged and focused learning environment (Morgan & Peterson, 2021).

The results also show an improvement in students' self-confidence in their ability to solve mathematical problems. Most students reported feeling more confident and better prepared to face mathematical challenges after the exercises. Other studies such as the one by Choi and Chang (2021) point out that preparatory exercises help reduce math anxiety by providing students with opportunities to practice and gain confidence in a controlled and non-stressful way (Choi & Chang, 2021). An important factor that emerges from the observational data is that some students still show

anxiety, which suggests that for some groups of students, personalized approaches may be required to address this problem.

One of the most important results of this study is the impact of quick exercises in creating a more cooperative atmosphere in the classroom. Students are more willing to help each other and engage in discussions about solving mathematical problems, a conclusion that is consistent with the findings of Reynolds and Thompson (2021), who suggest that short activities improve interaction and collaboration among students (Reynolds & Thompson, 2021).

However, some teachers have noted challenges in implementing quick math exercises, including a lack of appropriate tools and resources to provide a variety of activities. This challenge is also reported in research by Adams and Murphy (2021), where it is suggested that teachers need more technological and resource support to successfully implement these exercises (Adams & Murphy, 2021).

Answering Research Questions and Testing Hypotheses

By answering the research questions and testing the hypotheses, some important conclusions can be drawn, which are also supported by previous and more recent research in the field of mathematics education.

Research question 1: Do quick math exercises improve students' math performance? The results show that quick exercises have significantly influenced the improvement of students' performance. The average increase of 11.77 points in test scores after the intervention is an important indicator of the effectiveness of these exercises. Similar research such as that by Brown and Anderson (2020) supports these findings, suggesting that quick exercises help improve students' math skills and focus in the classroom (Brown & Anderson, 2020). This increase in performance is also evident through the matched pairs test, which shows that this improvement is statistically significant ($p < 0.05$) (Morgan & Peterson, 2021).

Research question 2: How does the inclusion of quick math exercises increase students' confidence to solve math problems? One of the most obvious results of this study is the increase in students' self-confidence in solving mathematical problems. Teachers reported that students are more confident and engaged after applying quick exercises, a result that is consistent with previous studies by Choi and Chang (2021), which show that regular practice significantly improves students' self-confidence (Choi & Chang, 2021). Consistent with these findings, some students who previously experienced math anxiety now display more confidence in solving tasks, but it is also noted that some of them still need additional support to increase their confidence to sustain (Garcia & Lopez, 2022).

Research question 3: What is the impact of these exercises on students' motivation and attitude towards mathematics? The results show that quick exercises have a significant positive impact on students' motivation and attitude towards mathematics. As mentioned in the study of Smith and White (2023), student engagement increases when they are involved in interactive and structured activities. Quick exercises have reduced the level of math anxiety and increased students' interest in learning mathematics, creating a favorable environment for learning (Smith & White, 2023). This is also reflected in the observations of the teachers, who report a more cooperative climate and more engaged students after the implementation of these activities.

Research Question 4: Is there a relationship between the frequency and type of prompt exercises and student engagement? From the results of the linear regression analysis and the teachers' comments, it was found that the frequency and type of exercises have a significant impact on the student's involvement and performance. Exercises that include elements of mathematical games and creative activities are particularly effective in increasing students' motivation to actively participate in

learning (Reynolds & Thompson, 2021). Continued engagement in these exercises helps develop students' skills and prepares them for more advanced mathematical challenges.

Hypothesis 1: Quick math exercises have a positive impact on improving students' math performance. The results of the research confirmed this hypothesis, with a clear improvement in mathematical performance after the exercises. The findings are consistent with previous studies highlighting the importance of brisk exercise in improving focus and academic performance (Brown & Anderson, 2020).

Hypothesis 2: Including quick math exercises increases students' confidence in their ability to solve math problems. This hypothesis was supported by the results, where most students reported a significant increase in self-confidence in solving mathematical problems after the exercises, by the studies of Choi and Chang (2021) (Choi & Chang, 2021).

Hypothesis 3: Quick mathematical exercises have a positive effect on students' motivation and attitude towards the subject of mathematics. The results showed a significant improvement in students' motivation and attitude, thus supporting this hypothesis. This is reinforced by studies showing that engaging in interactive activities significantly improves students' classroom experience (Smith & White, 2023).

Hypothesis 4: The frequency and type of exercises are related to the level of involvement and engagement of students. Findings from linear regression showed a strong relationship between exercise frequency and student engagement. Exercises that introduce interactive and creative methods proved to be more effective in engaging students in learning (Reynolds & Thompson, 2021).

CONCLUSION

In conclusion, quick math exercises are presented as an effective method for improving students' performance and confidence in mathematics. The study proves that these exercises not only improve students' academic preparation but also positively affect their motivation to learn. By analyzing the results of tests, questionnaires, and interviews, we have concluded that these exercises not only help students improve their mathematical skills but also contribute to creating a more cooperative and focused classroom environment.

The results of this study clearly show that quick math exercises have a strong positive impact on improving students' mental preparation for math challenges. The exercises not only boosted students' overall performance, improving test scores but also helped boost self-confidence and reduce math anxiety. These activities have proven to be effective in preparing students for more complex lessons, creating a strong foundation for learning and a positive learning environment in the classroom.

In addition, the exercises have helped to create a cooperative atmosphere among students, improving their interaction during problem-solving and engaging them in mathematical discussions. However, some students still face challenges in building full confidence and require other personalized strategies to get the most out of these activities. However, during the implementation of these exercises, some challenges and limitations have been identified. One of the main challenges was the lack of resources needed to provide a variety of exercises tailored to different groups of students. In addition, it was observed that some students, especially those with a higher level of math anxiety, did not fully benefit from these exercises and needed more personalized approaches. This suggests that to maximize the effectiveness of speed exercises, there needs to be more support for personalizing them and providing the right resources for each class.

Research Implications

This research offers several important implications for teachers, curriculum designers, and researchers in the field of mathematics education. The results clearly show that quick math exercises have the potential to positively influence the improvement of students' performance, decrease math anxiety, and increase self-confidence in solving problems. The results of this research suggest that education policymakers consider the regular inclusion of quick math exercises in school curricula, given their wide-ranging impact on students' math skills and emotions. This will help develop a more comprehensive and integrated approach to mathematics education, improving not only academic outcomes but also the overall experience of students in learning mathematics.

Recommendations for Future Studies

The results of this study suggest that quick math exercises have a great impact on improving student performance and engagement. Future studies can focus on adapting these exercises for different groups of students, taking into account their different needs and academic levels. Also, it would be important to further investigate the role of technology in the implementation of these activities to address the current challenges in their implementation in high school classrooms.

AUTHORS' CONTRIBUTIONS

In this study, author IT conceived the idea, designed the project and wrote the manuscript. Author ECK performed the analysis of the results and statistical analyses. Author SO participated in the design of the study, the studies with students and helped to write the manuscript. All authors read and approved the final manuscript.

ACKNOWLEDGMENTS

We would like to express our sincere gratitude to the students and teachers of the primary and lower secondary school "Heronjtë e Lumës" in Prizren, Kosovo, for their invaluable participation in this research. Their involvement was essential to the success of the study, and without their contribution, completing this research would not have been possible.

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