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THE INFLUENCE OF PEER TUTORING ON IMPROVING MATH LEARNING

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ABSTRACT

Given the state of stagnation in Mathematics proficiency in the main external assessments, national (Saeb) and international (Pisa), in recent years, the teaching of this discipline presents the challenge of diversifying its methodologies to enable advances in Mathematics learning. Given this situation, the guiding question of this research is: How can Tutoring among Equals contribute to the improvement of Mathematics learning? The objective of this study is to evaluate the influence of Peer Tutoring on the improvement of Mathematics learning in 5th-grade elementary school classrooms of a public school in Fortaleza - CE. The research was mainly based on the theoretical contributions of Boaler (2019), Brown, Roediger, and McDaniel (2018), Cohen and Lotan (2017), Coll (2004), Colomina and Onrubia (2004), Duran and Vidal (2020), Tapia and Montero (2004) and Zabala (2014). The research was carried out involving two 5th-grade classes: one as an experimental group, which used Tutoring among Equals, and another as a control group, without the use of this methodology. After applying a pre-test in both rooms, the experimental class underwent six weekly formative evaluations and, in the end, a post-test was applied to both classes. From the results of the pre-tests and post-tests, used as evaluative parameters of the methodology used in the research, it was possible to evaluate the influence of Tutoring among Equals in the improvement of Mathematics learning. The results obtained, such as the increase of 66.6% in the average of the experimental room in the pre-test/post-test ratio, against 27% of the control room, evidenced the effectiveness of the Tutoring among Equals methodology. The application of the cooperative method demonstrated advantages in teaching and learning, both in terms of the objects of mathematical knowledge worked on and in the development of social skills. The research revealed that Peer Tutoring is a valuable complement to traditional teaching, with the establishment of a collaborative learning environment and the personalization of teaching, enhancing the learning of mathematical content.

Keywords: Tutoring among Equals. Mathematics Teaching. Active learning.

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INTRODUCTION

The process of teaching and learning Mathematics in Brazil is going through a significant crisis, reflecting serious problems that have impacted the quality of basic education. Proficiency in this discipline has been considered critical, with alarming results at various levels of education. This unsatisfactory performance is attested by the results of the main external evaluations, both national, such as the Basic Education Evaluation System (SAEB), and international, such as the Program for International Student Assessment (PISA). These tests, applied over the last few years, show that most Brazilian students do not reach the minimum levels of competence in Mathematics, which highlights the urgent need for more effective educational reforms and interventions to reverse this situation.

According to Smole (2019), only five out of every 100 Brazilian students complete elementary school with adequate knowledge in Mathematics, at this school stage, based on the SAEB - 2017.

The results of the 2021 SAEB (Inep, 2022) reveal a significant disparity in the learning of Mathematics and Portuguese Language among public school students. While only 5% of students complete high school with adequate mathematical knowledge, the proficiency rate in Portuguese is significantly higher, reaching 31.3%.

The Program for International Student Assessment (PISA), considered the largest global study on education, revealed that Brazil has low proficiency levels in Reading, Mathematics, and Science, compared to 78 other participating countries. According to the 2018 edition, 68.1% of Brazilian 15-year-old students do not reach the basic level in Mathematics, considered essential for the full exercise of citizenship. In Science, this percentage is 55%, and in Reading, 50%. These rates have been stagnant since 2009 (Brasil, 2019).

According to the release of the results of Pisa 2022 (Inep, 2023), 73% of Brazilian 15-year-old students performed below level 2 in Mathematics, while in Reading this percentage was 50%. The OECD considers level 2 as the minimum necessary for young people to be able to fully exercise their citizenship. Only 1% of Brazilian students achieved a high performance in Mathematics, corresponding to level 5 or higher.

One of the reasons that contributes to the negative results in mathematics education is the predominance of passive learning, a teaching method that is still widely used in classrooms. According to Boaler (2019), this approach, which is characterized by the unidirectional transmission of knowledge, with the teacher as the central figure and the

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students as passive receivers, limits the engagement of students and their ability to develop a deep understanding of mathematical concepts. The consequence is a superficial understanding of the discipline, which does not prepare students to apply knowledge in real contexts, exacerbating the crisis faced by mathematics education. For Frison (2016):

> At the various levels of schooling, however, traditional pedagogical practices continue to be adopted, based on conceptions of learning that privilege the transmission of knowledge. These approaches are configured as mere reproductive routines without much meaning for the development of the basic and specific skills that are intended (Frison, 2016, p. 135).

Given this scenario, the teaching of Mathematics faces the challenge of diversifying its methodological approaches to improve the learning of the subject. Active methodologies emerge as alternatives to traditional teaching, which is mainly based on lectures and summative assessments and often does not provide adequate support for students with learning difficulties. In the words of Bacich and Moran (2018):

Current research in the areas of education, psychology, and neuroscience proves that the learning process is unique and different for each human being and that each one learns what is most relevant and makes sense to them, which generates cognitive and emotional connections. Active methodologies encompass a conception of the teaching and learning process that considers the effective participation of students in the construction of their learning, valuing the different ways in which they can be involved in this process so that they learn better, at their own pace. (Bacich and Moran, 2018, p. xv).

Among the active methodologies, Tutoring among Equals stands out as a significant strategy to improve the teaching and learning process in Mathematics. The International Academy of Education, a non-profit organization that promotes research, dissemination, and implementation of educational practices that improve education, through UNESCO, disclosed that Tutoring among Equals is among the 10 most effective educational practices (Duran and Vidal, 2020).

Peer Tutoring is an educational approach that seeks to optimize the learning of all students in a class, considering the capabilities of each one. This methodology uses mechanisms that encourage cooperation and mutual support among students. It is an inclusive strategy, in which students who face difficulties receive individualized help from more skilled peers (Duran and Vidal, 2020).

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In this context, we sought to investigate the use of Tutoring among Equals as a methodological strategy to improve the learning of Mathematics in classes in the 5th year of elementary school.

This research has the following objectives: to evaluate the influence of Peer Tutoring on the improvement of Mathematics learning in 5th-grade elementary school classrooms. And to ascertain the effectiveness of a teaching and learning strategy based on Peer Tutoring about traditional methodologies in learning Mathematics.

THEORETICAL SCENARIO

Peer Tutoring is anchored in some educational theories that support its effectiveness in the academic and socio-emotional development of participants. In this theoretical framework, four theories stand out, namely: Vygotsky's Sociocultural Theory, which emphasizes the importance of social interaction and cultural context in the learning process (Cubero and Luque, 2004). The Theory of Social and Dynamic Interdependence, by Koffka and Lewin, emphasizes the importance of social interactions through positive interdependence, a mechanism of mutual dependence existing among the participants of learning cells, providing a solid basis for understanding the dynamics of Mentoring among Equals (Queiroz, 2008). Decy and Ryan's Theory of Self-Determination, whose central pillars are the importance of autonomy, competence, and social relationships in awakening students' intrinsic motivation (Guimarães and Boruchovitch, 2004). Bandura's Self-Efficacy Theory is based on the belief that the perception of one's ability to perform a task significantly influences the performance and motivation of individuals (Oliveira; Silva; Bardagi, 2018).

Based on the theoretical framework researched and on the observation of the classroom during the application of Tutoring among Equals, we infer that the satisfactory results achieved in the study are the product of the synergy between the following factors: *attention to diversity*, with the idea of individualization of teaching (Coll and Miras, 2004); *formative evaluation*, which stops focusing on the mere quantification of results and focuses on monitoring the teaching and learning process (Zabala, 2014); *reward structure*, one of the motivational keys to cooperative work (Colomina and Onrubia, 2004); *social interaction*, Peer Mentoring, and the Zone of Proximal Development are closely related concepts that, when combined, can significantly enhance the learning process (Duran and Vidal, 2020); *positive interdependence*, a mechanism that is based on the principle that the success of the group depends on the success of each member (Miranda; Barbosa; Moisés, 2011);

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intrinsic motivation, which drives students to learn for pleasure and interest (Guimarães and Boruchovitch, 2004); and *perception of competence*, where as the student feels capable of learning, he awakens interest in learning (Zabala, 2014).

All these mechanisms, acting together, provided the necessary conditions for the results achieved, improvement in mathematical learning, and development of social skills.

CONTEXT OF THE RESEARCH AND METHODOLOGICAL FIELD

CONTEXT OF THE RESEARCH

The present research is a field study, involving the collection of data at the place where the phenomenon occurs, with a mixed approach, combining qualitative and quantitative elements. According to Ferreira (2024), this methodology allows for a deeper analysis of the topic by integrating numerical and descriptive data. When applied, the research seeks to solve a specific problem.

The research techniques adopted included non-participant observation, in which the implementation of Tutoring among Equals was planned and conducted in collaboration with the teacher of the experimental class, without direct involvement in the process. In addition, a documentary analysis of the weekly evaluations made by the students was carried out, which allowed the identification of both the advances and the difficulties faced by the students.

The study was conducted in a public school in the municipal network of Fortaleza (CE), involving two teachers and 54 students from two 5th grade classes, during Mathematics classes. The objective of the research was to examine whether Peer Tutoring can contribute to the improvement of Mathematics learning among students in the 5th grade of elementary school. Data collection took place between March 25 and May 23, 2024.

The analyzed population included 5th-grade students from the school chosen for the study. The morning shift group (5 AM) was designated as the **experimental group**, while the afternoon shift group (5TA) served as the **control group**. The samples were formed by the grades obtained in the evaluations carried out.

DATA COLLECTION

Initially, the research project was presented to the school's management team and the teachers responsible for the two classes researched. Subsequently, the students of the

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two classes were duly informed about the research and received a formal invitation to participate. The detailed exposition of the objectives, stages, and procedures of the investigation aimed to ensure the student's understanding of the functioning of the project. In addition, ethical aspects were addressed, ensuring participants total autonomy to decide whether to remain in the research and the confidentiality of their data.

The procedures adopted to carry out the methodology used in this research were based on the work developed by Duran and Vidal (2020) in the work *Tutoring among Equals – from theory to practice*, which consists of the following methodological path: pre-test; selection of tutors and formation of groups; structured relationship between tutor and mentee, with the delineation of the role of each one; teacher monitoring about the performance of tutors; continuous evaluation, where weekly tutor and mentee evaluate your academic progress; Test. The instruments used were:

– **Pre-test**: composed of ten questions prepared from the school's annual planning, during the two months of the research. Applied in both rooms;

– **Weekly evaluations**: applied only in the experimental room, with eight questions, addressing the same objects of knowledge contained in the school's annual planning;

– **Intermediate test**: consisting of ten questions, with the same pattern as the pre-test, used only in the experimental room;

– **Post-test**: in the same way as the pre-test, with the same number of questions and level of difficulty, with all students in both rooms, including tutors;

– **Data collection form**: where the groups were launched with their respective components, pre-test scores, post-test goals, post-test scores, averages of each group, and the room about the pre-test and post-test;

In the control room, there was only the application of the pre-test and the post-test, since the methodological strategy of Tutoring among Equals was not used in this class, thus enabling the comparison of proficiency in the experimental room.

Application of the pre-test, selection of tutors, and formation of groups

Initially, there was a pre-test with the students of the two classrooms participating in the research. Grades were entered on data collection sheets, one for each class. This evaluation served as the basis for the teacher's choice of the experimental room, the tutors, as well as the formation of the groups.

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Calculation of the means of the groups, based on the pre-test scores, in the experimental room; establishment of goals to be achieved by the groups and definition of awards

Initially, we calculated the average of the pre-test scores for each group of the experimental class. Next, we established a goal to be achieved in the average of each group in the post-test, considering the initial performance. These objectives were noted for follow-up.

For the experimental room groups, we established improvement goals that varied between 1.5 and 2.5 points in the averages verified in the post-test, about the results of the pre-test. This strategy of setting goals based on group performance is in line with the studies of Marzano, Pickering, and Pollock (2008), who defend the importance of linking rewards to academic performance standards.

The defined award was the delivery of school medals to the groups that reached the goals.

Training of Tutors

To ensure a more structured interaction between the students participating in the research, the researcher offered training to the tutors. This training included a script that detailed the steps and procedures to be followed during interactions (Duran and Vital, 2020).

Application of Weekly Evaluations

Each week, the students were divided into groups of four who sat next to each other. The evaluations, answered individually, were corrected by the teacher, who explained the errors to the tutors. Then, the tutor corrected and explained the errors to his group mates. After the analysis of the evaluations by the researcher, the teacher addressed the content that generated the most doubts. From the third week on, observing that many students were prepared to act as tutors, it was decided to form study pairs within the groups, with a tutor for each student-tutor.

Application of the post-test

After the completion of the six weekly assessments, a post-test was administered, with the same number of questions and difficulty level equivalent to that of the pre-test, to

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all participants of the two classes. The scores obtained were recorded in individualized data collection forms by class.

Using the data obtained in the tests applied before and after the intervention, we compared the academic performance of the experimental class with that of the control class.

The evaluative instruments, pre-test, post-test, and weekly evaluations, were built based on the SAEB descriptors and school planning.

Feedback on pre-post-test, award and closure

At the end of the activities, the students were informed about their progress through the pre-and post-test averages of the experimental room as a whole and by group. On the occasion, the teacher praised the progress in the performance of each group, to improve the students' academic self-concept. According to Zabala (2014), the best incentive to be interested is to experience that one is learning, that is, the perception of the feeling of competence on the part of the learners.

At the end of the project, all groups that achieved the proposed goals were awarded medals, in a demonstration of recognition and appreciation of their achievements. This practice, according to Zabala (2014), is essential for building positive self-esteem in students, as it demonstrates that their efforts have been recognized and valued.

The grades of the pre-tests and post-tests were used to evaluate the academic performance of the experimental class, comparing it with the control class. These data, organized in graphs, charts, and tables, as suggested by Ribeiro (2007), allowed us to analyze the effectiveness of the Tutoring among Equals methodology in the learning of Mathematics.

DATA ANALYSIS

The scores obtained by the students in the pre-and post-tests were tabulated in an Excel spreadsheet, allowing a detailed descriptive statistical analysis of the data.

To analyze the evolution of the student's performance, measures of central tendency (mean) and dispersion (standard deviation) were calculated for the pre-and post-test data. In addition, a comparative table was constructed, showing the absolute and relative increases in the average proficiencies of the two rooms.

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Once the study data description stage was completed, statistical tests were used to compare the variables. As the sample size was small, a non-parametric test was used – Mann-Whitney. Minimum significance was accepted when $p \leq 0.05$.

According to Almeida et al (2022), the Mann-Whitney test, also known as the Mann-Whitney U test, is a non-parametric statistical test used to compare two independent samples. It is based on the ranks of the values obtained, combining two samples. If the p-value is less than or equal to the significance level (0.05), the null hypothesis is rejected and it is concluded that the difference between the means of the population is statistically significant. This test is appropriate when measurements are performed on the same groups of subjects at two different times, as is the case of this study. The purpose was to determine whether there was a relevant difference between the means at the two times analyzed, taking into account the correlation between the two samples, thus increasing statistical accuracy.

The significance of the results was calculated using the Mann-Whitney test. All analyses were performed using the Prism software (Version 8.4) and in all tests used, the minimum significance accepted was $p \leq 0.05$.

ETHICAL PRECEPTS

There was no discrimination in the selection or exposure of the individuals participating in the research to unnecessary risks, as well as the preservation of data, confidentiality, and anonymity of the individuals researched. All occurred by the rules and guidelines in force, especially Resolution No. 466/12 of the National Health Council. The research was approved by opinion No. 6,717,470, of March 21, 2024, issued by the Research Ethics Committee (CEP).

The risks were minimal, such as some discomfort due to the application of a teaching and learning methodology (Tutoring among Equals) not experienced by the students. However, the participant had support to overcome this initial phase, as well as all the freedom to interrupt his participation in the research, if he felt better.

The research brought contributions to the teaching and learning process of Mathematics for the researched school, since cooperative educational situations, especially Tutoring among Equals, stimulate course corrections, while the school year develops, with the offer of individualized monitoring to student-tutors with learning deficits, taught by the tutors themselves.

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PRESENTATION AND DISCUSSION OF RESEARCH FINDINGS

Here the results of the research on the implementation of Tutoring among Equals in the discipline of Mathematics in classes of the 5th year of Elementary School will be exposed and discussed. The findings derived from the statistical analysis of the collected data will also be presented.

APPLICATION OF TUTORING BETWEEN EQUALS

The project was presented and discussed with the management team and teachers of the classes involved in the research, 5 AM and 5AT. After that, the researcher and the teacher of the experimental room (5 AM) aligned the methodological intervention to be applied to the annual school planning, without prejudice to the programmatic content of the class.

To map the students' previous knowledge, we carried out a pre-test, which was applied to all students in the two classrooms, 5 AM and 5AT, with a time of 35 minutes available for the students to complete the activity.

This evaluation allowed us to compare the performance of the classes and assist the teacher in the selection of tutors for the experimental room. The formation of groups, according to Miranda, Barbosa, and Moises (2011), should be planned and intentional, aiming to optimize the learning process.

The choice of tutors and the formation of groups prioritized heterogeneity but with balance. Each group had a tutor and three student-tutors, who were selected considering their cognitive level and discipline. The intention was to avoid overloading tutors and ensure a more collaborative learning environment. In choosing the tutors, academic performance, commitment, and attendance were taken into account. Thus, the students with the greatest aptitudes to work with groups of three student tutors during the proposed activities were selected.

Unlike the experimental room, in the *control room,* there was no group formation, and the traditional teaching method was applied: the teacher assumed the central role, demonstrating mathematical methods step by step on the whiteboard, while the students copied the algorithms in their notebooks. Then, individual practice takes over the room. Students solve almost identical sets of questions, which faithfully reproduce the examples

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demonstrated, without the opportunity to deepen learning through interaction and knowledge exchange (Boaler, 2019).

The proficiency of the two rooms in the pre-test is shown in Tables 1 and 2 below.

Table 1: grades and an average of pre-experimental room test.

Experimental Room - 5 AM	
Pupil	Pre-Test Note
Student E1	6,0
Student E2	2,0
Student E3	0,0
Student E4	1,0
Student E5	1,5
Student E6	8,0
Student E7	9,0
Student E8	0,0
Student E9	6,0
Student E10	6,5
Student E11	0,5
Student E12	1,0
Student E13	2,5
Student E14	8,0
Student E15	5,0
Student E16	6,5
Student E17	0,0
Student E18	3,0
Student E19	6,0
Student E20	6,0
Student E21	2,5
Student E22	5,0
Student E23	7,0
Student E24	6,0
Student E25	5,0
Student E26	7,0
Student E27	3,5
Average	**4,2**

Source: prepared by the researcher.

Table 2: grades and an average of pre-Control room test.

Control Room – 5 AT	
Pupil	Pre-Test Note
Student C1	1,5
Student C2	5,0
C3 Student	1,5
Student C4	4,0
Student C5	5,0
Student C6	0,0
Student C7	3,0
Student C8	7,0
Student C9	10,0
Student C10	0,0
Student C11	1,0
Student C12	2,0
Student C13	4,0
Student C14	5,5
Student C15	3,0
Student C16	4,0
Student C17	4,5
Student C18	4,0
Student C19	1,0
Student C20	2,5
Student C21	8,0
Student C22	2.0
Student C23	6,0
Student C24	3,5
Student C25	3,0
Student C26	1,0
Student C27	8,0
Average	**3,7**

Source: prepared by the researcher.

The comparison of the pre-test scores between the students in the control and experimental rooms did not reveal statistically significant differences (control room = 3.7; experimental room = 4.2; p = 0.42). The results, presented in Figure 1, indicate that the groups were equivalent at the beginning of the research, which reinforces the validity of the comparison between the interventions.

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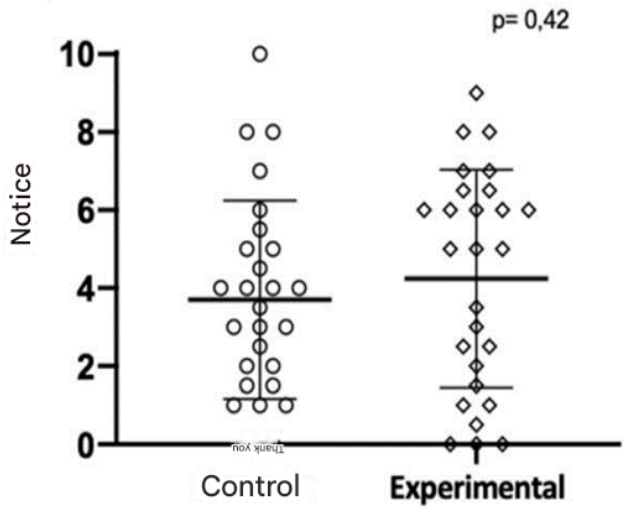
Figure 1 – Analysis of the scores obtained in the pre-test evaluation of the control and experimental groups, with representation of the mean and standard deviation.



Source: prepared by the researcher.

With the results of the pre-test, the arithmetic mean of each group in the experimental room was calculated. Soon after, a goal to be achieved in the post-test average was agreed between the teacher and each group, about the average obtained in the pre-test. These academic objectives were recorded in the data collection form.

> Social research has gathered impressive evidence showing that people working together and aiming for goals/objectives for the group have an impact on a person's feelings towards another. When groups engage in cooperative tasks, bonds of friendship, trust, and influence are more likely to be created than when the activity simulates competition (Cohen and Lotan, 2017, p. 17 and 18).

To value the effort of each team, personalized performance goals were defined, with an increase ranging from 1.5 to 2.5 points in the post-test averages. These academic objectives were adjusted according to the potential of each group and established together with the teacher, ensuring the equity and motivation of the participants. The groups that reached the stipulated goals would receive as a prize the delivery of school medals. It is important to emphasize that this increase served only as a goal to be achieved in the post-test, not interfering with the actual measurement of the grades obtained.

In the control group room, there was no goal setting or award setting.

Next, to guide the tutors of the experimental room, a workshop was held in the school library. On this occasion, the researcher addressed topics such as the correction of activities, the motivation of the student tutors, and the appropriate posture of the tutor. This initiative, based on the studies of Cunha Jr. (2017), aims to ensure that tutors are prepared to perform their duties effectively.

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In the following week, the application of weekly *evaluations began*, only in the experimental room.

At the beginning of the activity, the groups, composed of a tutor and three student-tutors, were strategically positioned in the room. Each team occupied two desks side by side, allowing the tutor to attend to each student-tutor individually, on a rotating basis.

Weekly *Assessment 1* was distributed among all students for individual resolution. As the tutors finished their tests, they went to the teacher, one by one, for correction and explanation of the questions answered incorrectly, by the class leader. Then, they returned to their teams, where they assisted their colleagues in correcting and understanding the questions. This dynamic allowed tutors to use a language closer to their peers, facilitating learning. Students with difficulties benefit from heterogeneous groups, with the use of methodologies in which the students themselves become resources for the exchange of knowledge. (Cohen & Lotan, 2017).

The *first weekly assessment* did not go as planned, as the students had not yet mastered the new work routine. There were difficulties during the rotation of the student-tutors to be attended by their tutor and excessive noise at the end of the activities. To solve the problem of noise, the teacher suggested distributing alternative activities, such as games, coloring pages, textbook activities, etc., to students who completed the assessment more quickly.

After the conclusion of the work, the evaluations were collected and analyzed by the researcher to identify the points that generated the most doubts among the students. This information was passed on to the teacher, who, before starting the new assessment, carried out a brief review of the content with the lowest rate of correct answers. This practice, according to Brown, Roediger, and McDaniel (2018), allows the teacher to adjust their pedagogical approach and meet the specific needs of the students.

In *the second week of evaluation*, the process has already flowed a little better, with an advance in the students' understanding of the dynamics of Tutoring among Equals. The distribution of playful activities such as coloring pages and games after the completion of the assessments also contributed to a calmer environment in the classroom.

From the *third week of evaluation*, a significant improvement was observed in the functioning of the tutoring process. The tutors started to perform their functions more efficiently, while the student-tutors were more concentrated and motivated, as a result of the advances obtained in their learning. As highlighted by Cunha Jr. (2017), the immediate

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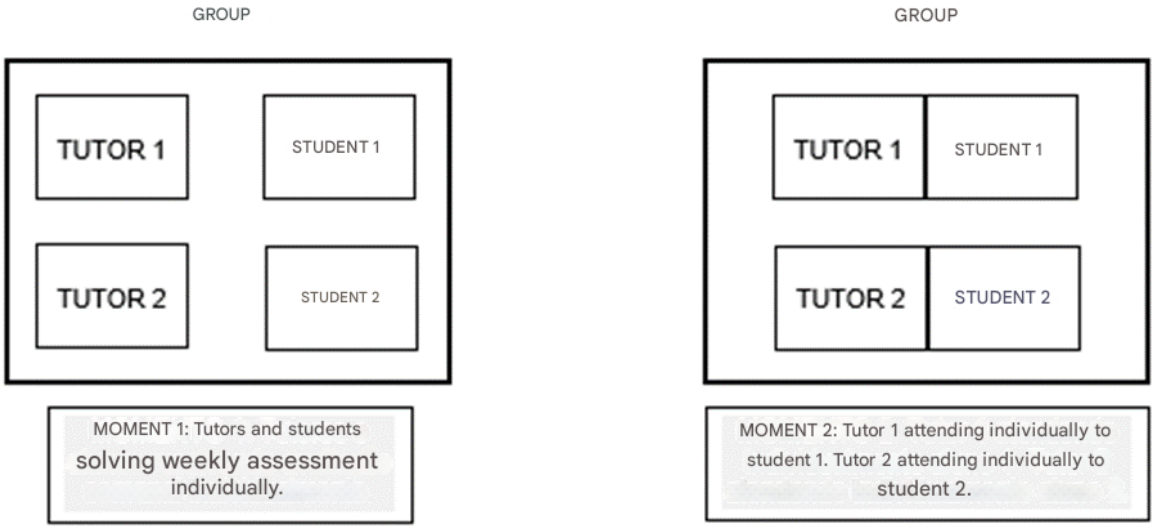
resolution of students' doubts is crucial to avoid loss of focus and interest, contributing to greater engagement in the proposed activities.

When analyzing the answers to the third weekly evaluation, we noticed that many student-tutors were able to perform the role of tutor. Thus, together with the teacher, we chose to reorganize the study groups. The new structure provides for the formation of tutoring pairs within each original group. Thus, each group, previously composed of a tutor and three student-tutors, now has two pairs, each with a tutor and a student-tutor, as shown in the figure below.

Figure 2: method of monitoring in pairs, one tutor for one student-tutor.



Source: Prepared by the researcher.

Before applying *the weekly assessment* 4, we instructed the tutors to praise their student-tutors as they showed learning progress. It is necessary to redefine the purpose of assessment, directing it towards the recognition of the student's progress, and not only towards the identification of their learning gaps (Zabala, 2014). At the end of the application of the evaluation activity,

We observed efficiency gains with the new process of distributing students in pairs.

To closely monitor the student's progress, we applied an intermediate test between weekly assessments four and five. This evaluation allowed us to identify significant advances in the initial knowledge, measured by the pre-test. In addition, the teacher took the opportunity to review the content that still presented greater difficulty for the students.

The *fifth weekly assessment* demonstrated advances in learning achieved by the students, thanks to the motivation and commitment of all those involved. The effort of the

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tutors and the interest of the student-tutors in the process of Tutoring among Equals was evident.

The results of the *sixth weekly assessment* were very positive, with most students showing significant progress, except only three students. Of these, two have incomplete literacy, according to the teacher's report, as well as the researcher's findings.

EVALUATION OF PEER MENTORING

The post-test evaluation was applied to all students in the two classrooms participating in the research, and a time of 35 minutes was made available for the students to complete the activity. From there, with the results of the pre-test and post-test, it was possible to compare the academic performance of the experimental room with that of the control room.

The pre-test, post-test, and weekly evaluations were developed considering the objectives established in the school's annual planning and the descriptors of the SAEB Mathematics reference matrix.

The proficiency of the two rooms, in the post-test, appears in the tables below:

Table 3: Post-test grades and average of the experimental room.

Experimental Room - 5 AM	
Pupil	Post-Test Note
Student E1	8,0
Student E2	4,0
Student E3	7,0
Student E4	1,5
Student E5	5,5
Student E6	10,0
Student E7	10,0
Student E8	0,0
Student E9	10,0
Student E10	10,0
Student E11	3,0
Student E12	3,5
Student E13	5,0
Student E14	10,0
Student E15	9,5
Student E16	9,0
Student E17	1.0
Student E18	6,0
Student E19	9,0
Student E20	10,0
Student E21	6,5
Student E22	9,0
Student E23	10,0
Student E24	9,0
Student E25	8,0

Table 4: Post-test grades and average of the control room.

Control Room – 5 AT	
Pupil	Post-Test Note
Student C1	5,0
Student C2	6,0
C3 Student	2,5
Student C4	5,0
Student C5	4,0
Student C6	4,0
Student C7	5,0
Student C8	7,0
Student C9	10,0
Student C10	0,0
Student C11	2,0
Student C12	1,0
Student C13	4,0
Student C14	7,0
Student C15	3,0
Student C16	4,0
Student C17	5,0
Student C18	4,0
Student C19	3,0
Student C20	5,0
Student C21	9,0
Student C22	4,0
Student C23	6,0
Student C24	6,0
Student C25	6,0

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Student E26	10,0
Student E27	4,5
Average	**7,0**

Source: prepared by the researcher.

Student C26	2,0
Student C27	8.0
Average	**4,7**

Source: prepared by the researcher.

In **the control group**, when the mean of the pre-test (μ = 3.7) was compared with that of the post-test (μ = 4.7), p = 0.086, it was observed that there was no significant difference in learning in the post-test. This room also presented a critical performance ststandardshof evaluations. The **experimental group, on the other hand,** presented the mean of the pre-test (μ = 4.2) and the post-test (μ = 7.0), p = 0.001, and it was found that there was a very significant difference in learning between the two assessments, in addition to this room going from a critical performance standard1 to an intermediate performance standard[3]. These findings demonstrate the relevance of Peer Tutoring as an excellent teaching methodology (figure 3).

Figure 3 – Comparative evaluation of the pre-test and post-test of the control and experimental groups
CONTROL GROUP EXPERIMENTAL GROUP
Pre-Test X Post-Test Pre-Test X Post-This
Source: prepared by the researcher.

Table 5 below shows the comparison between the mean proficiency and the growth of the mean of the two rooms, experimental and control, using the pre-test and post-test as parameters.

Table 5: Comparative Average Proficiency Pre/Post-Test and Average Growth Experimental Room vs. Control Room

Living room	**Pre-Test Average**	**Post-Test Average**	**Absolute Growth**	**Relative growth**
5 AM (experimental)	4,2	7,0	+ 2,8	+ 66,6%
5 AT (Control)	3,7	4,7	+ 1,0	+ 27,0%

Source: prepared by the researcher.

It was possible to verify that the growth of the experimental room was much higher than that presented by the control room, both in the absolute increase of the means (2.8 points versus 1.0 points) and in the relative (66.6% versus 27.0%). These results corroborate what was exposed by Cohen and Lotan (2017): group work is the most effective resource for obtaining results that are both equitable and rigorous, that is, in

[3] According to classification criteria used by SPAECE (Permanent System for the Evaluation of Basic Education of Ceará).

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heterogeneous classrooms, both students with difficulties benefit from having permanent monitoring by tutors, as well as students with higher performances, since they have the support of the teacher at their disposal. Unlike the traditional methodology applied in the *control room*, where the passivity and lack of collaboration of students can lead to demotivation and difficulty in understanding mathematical concepts.

Duran and Vidal (2020) argue that Tutoring among Equals enhances the learning of all students, as long as there is adequate support. This methodology, by offering individualized and continuous monitoring, allows even the most difficult students to achieve good results. Unlike the traditional approach, Peer Mentoring adapts teaching to individual needs, promoting mutual learning and the collaborative construction of knowledge.

PEER TUTORING AND IMPROVEMENT OF MATHEMATICAL LEARNING

The findings obtained indicate that the use of student tutors can be an effective tool in the classroom routine, to improve the teaching-learning process of Mathematics in the 5th year of elementary school. According to Cunha Jr. (2017), developing collaborative work that gives students the possibility to act actively makes them feel like co-authors of the process and consequently more responsible for the activities developed.

The results also suggest that the implementation of tutoring activities among students has the potential to improve learning. The importance of group work for learning Mathematics is highlighted by Boaler (2018). The author argues that several scientific studies corroborate the idea that collaboration between students is an indispensable strategy to achieve good results in this discipline.

FINAL CONSIDERATIONS

The process of teaching and learning Mathematics, due to a sum of factors, currently faces many difficulties and the public education networks, as a rule, do not have efficient compensation mechanisms for students with learning gaps, who are abandoned to their fate: those who learned, learned, who did not learn, are left without learning. As a result, learning gaps accumulate year after year, until reaching the point that in the 3rd grade of high school, only 5% of students reach the appropriate level of Mathematics proficiency, according to the results of the 2021 SAEB.

During the realization of this research, a relevant aspect regarding mathematical learning was evident, about the need for support that students require during their learning,

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exemplarily described by Tapia and Montero (2004): at the beginning of the activities, most students are attentive and perform tasks, but as they encounter difficulties, A significant contingent of students is progressively becoming demotivated and abandoning school work. To reverse this situation, it is necessary to provide help to apprentices with difficulties, throughout the school year. From the results obtained by the research, we can say that Tutoring among Equals can be a viable alternative to meet this demand.

According to Pinho, Ferreira, and Lopes (2013), the main difficulties for its implementation, based on a survey carried out with teachers, the main difficulties for its implementation: lack of time due to extensive programs, loss of control of the class, need to prepare materials, break in the classroom routine, students not used to working in groups in a cooperative way, among others.

In this work, we sought to develop an implementation model that would minimize the main obstacles mentioned above, such as:

- All the material used in the research, pre-test, weekly evaluations, intermediate test, data collection form, and post-test, was prepared by the researcher;
- The training of the tutors was given by the researcher;
- The time for the application of the *weekly assessments* started at around 60 minutes, but as the routine was assimilated by the participants, this period was reduced to something around 30 - 35 minutes per week, not compromising the teacher's class time;

The approach used in the research presented some differentials about other studies already published, such as:

- Correction and explanation, by the teacher, of the questions incorrectly answered in the *weekly evaluations* by the tutors. This prevent the tutor from not detecting errors by the student-tutors, as well as giving mistaken information that reinforces errors;

- Analysis of *weekly evaluations* to discover the object of knowledge with the lowest rate of correct answers each week and subsequent review by the teacher the following week. This procedure, as far as we could observe, brought learning gains, since the same content presented a significant increase in the number of correct answers in the evaluation following the presentation of the *feedback*. That is, the objects of knowledge that the tutors could not explain satisfactorily were reviewed by the teacher;

- Application of an intermediate test, between the 4th and 5th *weekly assessments*, to more accurately assess the progress of students and identify the main difficulties they still face;

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- Conducting a review, by the teacher, of the subjects that presented the lowest number of correct answers in the intermediate test;

- On the initiative of the school where the research was developed, the tutors were invited to participate, in the after-school shift, for two days a week, in monitoring activities, assisting 5th-grade students with learning difficulties in Mathematics.

The present research, by investigating the dynamics of Tutoring among Equals in the context of Mathematics teaching, revealed a transformative potential for pedagogical practice. The results obtained throughout this study were consistently promising: the absolute difference between the experimental room and the control room in the means of post- and pre-test was around 1.8 points, while the relative difference was 39.6%, evidencing the fundamental role of this methodological strategy in improving the mathematical learning of the students involved.

The results of this research point to the need for a greater appreciation of Tutoring among Equals as a pedagogical strategy. Schools can implement tutoring programs in their practices, offering students the opportunity to develop essential skills for life and for learning Mathematics.

Tutoring among Equals, as long as it is properly planned and implemented, has proven to be a promising methodology, as it transcends the mere transmission of content. This active and differentiated approach provided students with significant gains in terms of mathematical learning, as well as the development of valuable social skills such as communication, cooperation, and teamwork.

We hope that the present study can contribute to future investigations on this research object, with more comprehensive works, considering the current challenges faced by the teaching of Mathematics and the potential represented by Peer Tutoring for the improvement of Mathematics learning in basic education. This methodological strategy proved to be, during the research, a valuable complement to traditional teaching.

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