SEVEN
publicações acadêmicas

EQUITY IN THE MATHEMATICS CLASSROOM: REFLECTIONS ON INCLUSION AND TRANSFORMATIVE PEDAGOGICAL PRACTICES

EQUIDADE EM SALA DE AULA DE MATEMÁTICA: REFLEXÕES SOBRE INCLUSÃO E PRÁTICAS PEDAGÓGICAS TRANSFORMADORAS

EQUIDAD EN EL AULA DE MATEMÁTICAS: REFLEXIONES SOBRE LA INCLUSIÓN Y PRÁCTICAS PEDAGÓGICAS TRANSFORMADORAS

https://doi.org/10.56238/sevened2025.030-050

Valéria Souza Matos dos Santos[1], Cleusa Vieira da Costa[2], Susana Aparecida da Veiga[3], Kátia Celina da Silva Richetto[4], Willian José Ferreira[5], Tiemi Aline Silva[6], Samyra Faria Fontes Aljbaae[7]

ABSTRACT

This study investigates the dynamics of social status in heterogeneous classrooms, focusing on the interactions that emerge during group work activities. The research is part of a master's dissertation developed within the professional master's program at the University of Taubaté (UNITAU), under the research line "Pedagogical Practices for Equity." It adopts a qualitative approach and aligns with Sustainable Development Goal (SDG) 4, aiming to promote quality education, especially for those who require the most support. The methodology involves the intentional formation of classroom work groups to reveal the nuances of social status among students. Inspired by the reflections of the Teacher Specialization Program (PED Brasil), the formation of random groups was designed as a methodological strategy to uncover different manifestations of social status within the school environment. During data analysis, significant dilemmas related to social status emerged, offering valuable contributions to the development of more equitable pedagogical practices. Through the proposed group work, students recognized the importance of collaboration and role-sharing, taking on responsibilities that fostered equitable participation. This allowed all students to contribute with their skills and knowledge, promoting the recognition of diversity as a pedagogical value.

Keywords: Equity. Social Status. Group Work. Pedagogical Practices.

[1] Master's student in Education. Universidade de Taubaté (UNITAU).
E-mail: valeria.psicopedagoga@outlook.com Orcid: https://orcid.org/0009-0008-3183-5365
Lattes: https://lattes.cnpq.br/4506793156373506
[2] Dr. in Education. Universidade Estácio de Sá. E-mail: cleusa.vcosta@unitau.br
Orcid: https://orcid.org/0000-0003-3836-9017 Lattes: https://lattes.cnpq.br/2669978900817039
[3] Master in Production Engineering. Universidade Federal de Santa Catarina (UFSC).
E-mail: susana.aveiga@unita.br Orcid: https://orcid.org/0009-0007-3284-3650
Lattes: https://lattes.cnpq.br/5266609304114292
[4] Dr. in Materials Engineering. Universidade de São Paulo (USP). E-mail: katia.csrichetto@unitau.br
Orcid: https://orcid.org/0000-0002-7368-1973 Lattes http://lattes.cnpq.br/0847868784035006
[5] Dr. in Space Geophysics. Instituto Nacional de Pesquisas Espaciais (INPE).
E-mail: willian.jferreira@unitau.br Orcid: https://orcid.org/0000-0003-4636-868X
Lattes: http://lattes.cnpq.br/8363816769933785
[6] Master's student in Education. Universidade de Taubaté (UNITAU). E-mail: silvatiemi@yahoo.com.br
Orcid: https://orcid.org/0009-0000-2363-7352 Lattes: https://lattes.cnpq.br/0127668975544354
[7] Master in Education. Universidade de Taubaté (UNITAU). E-mail: samyffontes@gmail.com
Orcid: https://orcid.org/0009-0009-5385-5348 Lattes: http://lattes.cnpq.br/0181444435327686

RESUMO
Este trabalho investiga a dinâmica do status social em salas de aula heterogêneas, com foco nas interações que emergem nas atividades de trabalho em grupo. A pesquisa, vinculada à dissertação de mestrado, desenvolvida no programa de mestrado profissional da Universidade de Taubaté (UNITAU), na linha em Práticas Pedagógicas para Equidade, adota uma abordagem qualitativa e se alinha ao Objetivo de Desenvolvimento Sustentável (ODS) 4, ao buscar uma educação de qualidade voltada especialmente àqueles que mais necessitam de apoio e adota uma metodologia qualitativa, em que a formação dos grupos de trabalho em sala de aula foi planejada para revelar as nuances do status social entre os estudantes. Inspirada pelas reflexões do Programa de Especialização Docente (PED Brasil), a formação de grupos aleatórios foi planejada como estratégia metodológica para revelar diferentes manifestações de status social no ambiente escolar. Durante a análise dos dados da pesquisa destacaram-se dilemas relevantes relacionados ao status social, oferecendo contribuições importantes para a construção de práticas pedagógicas mais equitativas. A partir do trabalho em grupo proposto, os estudantes compreenderam a importância da colaboração e da divisão de papéis, assumindo responsabilidades que favoreceram a participação equitativa entre todos, permitindo que todos contribuíssem com suas capacidades e saberes, promovendo o reconhecimento da diversidade como valor pedagógico.

Palavras-chave: Equidade. Status Social. Trabalho em Grupo. Práticas Pedagógicas.

RESUMEN
Este trabajo investiga la dinámica del estatus social en aulas heterogéneas, centrándose en las interacciones que surgen durante las actividades de trabajo en grupo. La investigación, vinculada a la disertación de maestría desarrollada en el Programa de Maestría Profesional de la Universidad de Taubaté (UNITAU) en Prácticas Pedagógicas para la Equidad, adopta un enfoque cualitativo y se alinea con el Objetivo de Desarrollo Sostenible (ODS) 4 al buscar una educación de calidad específicamente dirigida a quienes más necesitan apoyo. Adopta una metodología cualitativa, en la que la formación de grupos de trabajo en el aula fue diseñada para revelar los matices del estatus social entre los estudiantes. Inspirada en las reflexiones del Programa de Especialización Docente (PED Brasil), la formación de grupos aleatorios fue diseñada como una estrategia metodológica para revelar diferentes manifestaciones del estatus social en el entorno escolar. Durante el análisis de los datos de la investigación, se destacaron dilemas relevantes relacionados con el estatus social, ofreciendo importantes contribuciones al desarrollo de prácticas pedagógicas más equitativas. A través del trabajo grupal propuesto, los estudiantes comprendieron la importancia de la colaboración y la división de roles, asumiendo responsabilidades que favorecieran la participación igualitaria entre todos, permitiendo que cada uno aportara sus habilidades y conocimientos, promoviendo el reconocimiento de la diversidad como valor pedagógico.

Palabras clave: Equidad. Estatus Social. Trabajo en Grupo. Prácticas Pedagógicas.

1 INTRODUCTION

The Brazilian educational scenario faces a persistent and complex challenge: Mathematics, although essential for intellectual development and social insertion, is still mistakenly labeled as the "villain" of basic education. This negative perception, added to the results of evaluations such as the School Performance Assessment System of the State of São Paulo (SARESP) and the Program for International Student Assessment (PISA), highlights a worrying picture: for many students, the discipline is an almost insurmountable obstacle. However, when approached with appropriate pedagogical strategies, Mathematics can become a powerful instrument for mobilization, reflection and overcoming.

The most recent PISA data corroborate this reality. According to the National Institute for Educational Studies and Research Anísio Teixeira (INEP) 2023, in 2022, 73% of Brazilian students performed poorly in Mathematics, 50% in Reading, and 55% in Science. These rates, practically unchanged since 2018, reinforce the urgency of reformulating pedagogical practices, prioritizing approaches that promote more meaningful, contextualized, and inclusive learning. Added to this is the recurrent report of the students themselves, who describe Mathematics as a set of rigid contents, far from reality and unattractive.

In this context, the present research is born from the desire to resignify the teaching of Mathematics, making it more accessible, pleasurable and stimulating. It is recognized that traumatic experiences with the discipline tend to distance students from deep learning, while positive experiences enhance cognitive development. The literature points out that well-designed and meaningful mathematical tasks stimulate engagement and the construction of meanings. As Boaler (2017) points out, such tasks "can make the difference between inspired and happy students and unmotivated and distant students", reinforcing the central role of teaching practice in the elaboration of proposals that arouse curiosity, creativity and critical thinking.

The school environment, therefore, plays a decisive role in this process. Safe, welcoming, and intellectually challenging spaces favor active participation, overcoming historical barriers, and valuing individual contributions. The way mathematical problems and challenges are presented can radically transform the classroom experience, creating meaningful connections with everyday life and expanding the meaning of learning.

It is in this scenario that the proposal of Numerical Conversations (NC), developed by Humphreys and Parker (2019), is inserted. This approach encourages the collective construction of strategies through mental calculations and verbal exchanges between

students, favoring active listening, valuing error, critical thinking, and the understanding that there are multiple ways to solve the same problem. Integrated with problem solving and the formation of heterogeneous groups with defined roles, the proposal seeks to develop, in an equitable way, both mathematical thinking and number sense.

> This skill is important not only for learning mathematics, but also for developing its potential in terms of intelligence and cognition. Therefore, we believe that problem solving should be present in the teaching of mathematics in all school grades, not only because of its importance, because of the way of developing various skills, but especially because it allows the student the joy of overcoming obstacles created by his own curiosity, thus experiencing what it means to do mathematics (Smole; David; Cândido, 2000, p. 13).

By considering these elements, it becomes evident that the promotion of equity in the teaching of Mathematics requires intentional, continuous and sustained actions in the school routine. Thus, the present investigation is justified by the urgency of overcoming the challenges that compromise learning and result in low performance in external evaluations. Therefore, it seeks to reflect on methodological alternatives capable of making classes more meaningful and inclusive, strengthening the active participation of students, within a collaborative environment. As Bozzi and Sofiato (2024) state, in inclusive educational spaces, collaboration emerges as a possibility to remove barriers to learning.

The central objective of this research is to investigate how the articulation between problem solving, the formation of heterogeneous groups with defined roles (Cohen; Lotan, 2017) and the holding of Number Conversations (Humphreys; Parker, 2019) can boost mathematical thinking and contribute to the development of number sense in students in the 6th grade of Elementary School. This methodological choice responds to the challenge identified in the introduction, the persistent low performance in Mathematics and the barriers to participation generated by *social status*, seeking to understand how intentional pedagogical practices can promote more equitable interactions, in which all students have a voice and the opportunity to contribute effectively to the construction of knowledge.

2 MATHEMATICS, PEDAGOGICAL PRACTICE AND EQUITY – DIALOGUING WITH LITERATURE

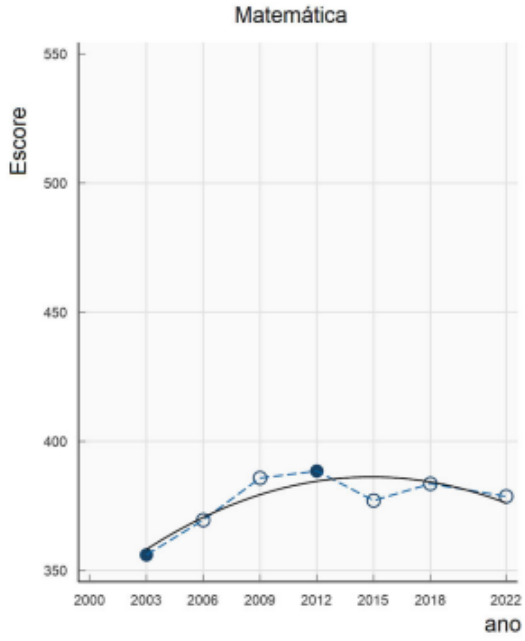
In everyday school life, it is common to notice the distance between students and the Mathematics component. This difficulty is not limited to students, but also extends to

teachers, especially pedagogues (Santana, 2023), who, because they work in a multipurpose way, often do not feel like experts in the field. Data from external evaluations, such as SARESP and PISA, reveal an unsatisfactory performance of Brazilian students in Mathematics, with significant weaknesses, a scenario that is also confirmed in the daily experience of schools.

According to the latest PISA, applied in 2022 (postponed from 2021 due to the COVID-19 pandemic) (Brazil, 2023), the performance of Brazilian students was alarming, as illustrated in Figure 1.

Figure 1

Procedural performance

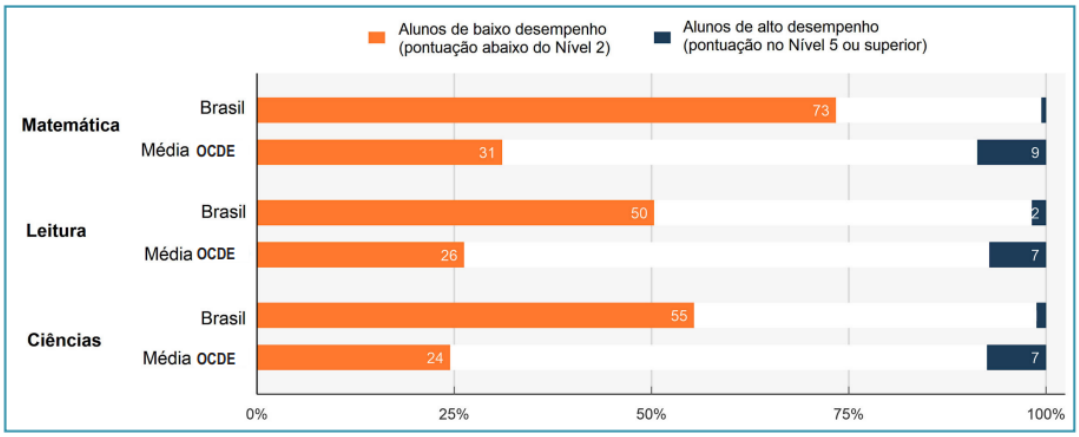


Source: Brazil (2023). Available at: https://download.inep.gov.br/acoes_internacionais/pisa/resultados/2022/pisa_2022_brazil_prt.pdf.

Also according to the results, only 1% of Brazilian students demonstrated high performance, in contrast to the average of the Organization for Economic Cooperation and Development (OECD), of 9%, as shown in Figure 2.

Figure 2

Poor performance 2022



Source: Brazil (2023). Available at: https://download.inep.gov.br/acoes_internacionais/pisa/resultados/2022/pisa_2022_brazil_prt.pdf.

Figure 1 shows that, in relation to the low performance of students, between 2003 and 2012, there was significant progress in the consolidation of learning. However, from the following evaluation, the results declined again, remaining in decline with little significant advances until the most recent edition.

In view of this situation, we need to take into account several factors, from social issues, to how mathematics is conceived by society, as a science for geniuses and the distancing from it as an almost genetic factor, in which it is placed as a hereditary difficulty, but it is also necessary to think about the teacher's practice. There is no denying that there is a fragility in learning, but there is also in teaching.

> From this perspective, social representations and beliefs about the ability to learn mathematics can influence relationships with the discipline/area of knowledge. Learning is affected by the way the subject conceives his or her competence or self-efficacy, as highlighted by Tolentino, Ferreira, and Torisu (2020), on the relationship of pedagogy students with school mathematics and the variables of negative and positive aspects, among which the former stand out (Santana, 2023, p. 58).

The classroom should be a safe, welcoming space that favors interaction and trust among peers, especially through the teacher's didactics. This space needs to promote the exchange of knowledge, valuing everyone's knowledge and preventing the teacher's knowledge from overlapping that of the student.

> The classroom should be an environment where doing math is not threatening and where all students are respected for their ideas. Students should be comfortable taking risks and know that they will not be ridiculed for making mistakes (Van de Walle, 2009, p. 33).

It is in the relationship with the other that learning happens, Vigotski (2000) states that teaching enables an awakening of internal development processes. The students of the initial years are at the beginning of this academic coexistence, however, they are active and open to the proposed activities. Thus, it is of paramount importance that learning and mathematics education are presented in a light, relaxed, accessible and especially collective way, to students, from the early years, so that they learn with meaning.

According to the ideas of Boaler, Munson and Williams (2018), Mathematics is a beautiful discipline, with inspiring ideas and connections and accessible to everyone. It is in the early years that the enchantment for Mathematics needs to happen; It is the significant pedagogical experiences and interventions that will enable learning the discipline at great levels, stimulating and exploring visual and connective mathematical thinking, sharing knowledge, validating and refuting hypotheses, understanding error as part of the process. "We want students to be excited and interested in their learning. When students develop an interest in the ideas they are learning, their motivation and performance increase" (Boaler, Munson, and Williams, 2018, p. 129).

With a focus on meaningful learning with a student-centered approach, Humphreys and Parker (2019) disseminated a look with a new perspective on Mathematics. The authors created the Number Conversations (NC) in the 1990s. NC is an essential approach to the development of number sense, with daily practices of a few minutes, in which students solve mental calculations and have the opportunity to develop the ability to organize thought to share their calculation strategies, exploring mathematical thinking in a light and relaxed way, so that everyone realizes that there are different strategies or ways of thinking.

> When students sit on the edge of their chairs, eager to share their ideas, diving deep into the reasons why mathematical procedures work, they start to like mathematics and know that they can understand it (Humphreys; Carther, 2019, p.1).

By providing this environment for collective reflection, we make the space more inclusive and prone to equity, since students, although they are shy and insecure due to

weaknesses in their learning, begin to believe in themselves, enhancing their knowledge and seeing themselves as learners with their full potential.

Another important point to be explained is that, when a student is sharing his calculation strategy, verbalizes a result and perceives a possible procedural error, he "recalculates his route" through reflection, considering his mistake as an opportunity to reframe learning.

> When students are working on open-ended math tasks, they are not only encouraged to view math as a growth discipline, they are also placed in the role of investigator. They are no longer looking for an answer; they are exploring ideas, making connections, and valuing growth and learning (Boaler, 2017, p. 155).

The resolution of problem-situations is a central point in the teaching of Mathematics, as it develops reflective skills, exploring mathematical thinking through differentiated strategies. This strategy, as a focus, shows that the objective of mathematics is to develop the ability to learn to solve through understanding. As Van de Walle (2009) states, this occurs when students solve well-chosen tasks, which promote engagement in reflective actions and thinking.

In this sense, problem solving is a powerful tool that enables the mobilization of knowledge, in addition to the development of basic analysis skills. Being stimulated to understand, elaborate, execute and analyze the problem brings to light a teaching in which the student is the protagonist and co-responsible for the construction of his knowledge.

The choice of the task is as important as the work strategy. In this way, to encourage students to share ideas, through respectful dialogue between peers, working in collaborative groups has stood out as a possibility, promoting the feeling of belonging to the group, in addition to stimulating and engaging students in tasks that they would solve on their own. According to Cohen and Lotan (2017):

Group work is also a strategy to face common problems in conducting the classroom, such as keeping students engaged with their activity. Most importantly, group work makes learning tasks more accessible to a larger number of students in classrooms with a wide diversity of academic skills and language proficiency. Productive group work increases and deepens the opportunity to learn content and develop language, and therefore has the potential to form equitable classrooms. (Cohen and Lotan, 2017, p. 7).

Group work enables the construction of a multi-cooperative environment, as it provides opportunities for the development of skills that go beyond the cognitive process, such as contributing to and strengthening a learning community in the classroom.

It is possible, in the classroom, for group work to happen by affinity, that is, there is a group of students for the development of pedagogical proposals. However, the relationship with learning with this type of grouping can become secondary, since the students who master the subjects or have greater ease in understanding the commands tend to be the leaders, not allowing the others to contribute to the group, or even that there is a grouping only of students with pedagogical weaknesses. For the authors, it is necessary to understand the real meaning of group work:

> [...] Students working together in small groups so that everyone can participate in an activity with clearly assigned tasks. [...] group work is not the same thing as grouping by skill, in which the teacher divides the room by academic criteria so that he can teach more homogeneous groups (Cohen; Lotan, 2017, p.1)

The authors' proposal aims to develop the work with heterogeneous groups, in which all students can contribute, without being dominated by a single member. It is important to verbalize that not everyone in the group has all the skills, but that each one has at least one skill to add to the group. According to Van de Walle (2009), students will discover that everyone has ideas to contribute.

The teacher's planning and intentionality are built in the formation of groups and in the distribution of roles. It is also opportune to decentralize responsibilities, in which students assume delegated authority with responsibility for their own learning and co-responsibility with the learning of their peers in the group, with the teacher being the mediator and guide of the process, defining the conditions for productive collaboration.

> The desired interaction in the work groups when the learning objectives are more conceptual does not consist of academically stronger students helping the weaker ones. Instead, it is desirable to have an exchange, in which students engage with each other's ideas and in which each other's contribution becomes meaningful information for any other member of the group (Cohen; Lotan, 2017, p. 60).

It is worth mentioning that, as much as there is encouragement for students to be autonomous, the role of the teacher is fundamental in establishing clear goals for learning, in addition to providing a safe environment, where mistakes are valued and seen as

opportunities to learn. This environment of trust is essential to promote a culture of active listening, respect for error and freedom to question, fundamental elements for the construction of knowledge.

3 METHODOLOGY

The article is based on a research of the practice itself, aligned with the area of knowledge Teacher Training for Basic Education, within the scope of the Professional Master's Degree in Education (MPE) of the University of Taubaté (UNITAU), and is developed under the line of investigation Pedagogical Practices for Equity. The theoretical basis of this research was built from the works of Cohen and Lotan (2017) and Boaler (2018), whose contributions are recognized as fundamental for the promotion of educational equity in the teaching of Mathematics.

Developed within the classroom, the highlighted activity was carried out with a class of the 6th grade of Elementary School, composed of 32 students aged between 11 and 12 years, in a private school in the interior of São Paulo. It was planned with an estimated time of 100 minutes, with pedagogical intentions defined *a priori*. The learning objective was to investigate the dynamics of the *status* of heterogeneous classrooms, focusing on the formation of groups and interactions during collaborative work activities. The activity was motivated by the intention of exploring the understanding of fractions as parts of a whole and the identification of equivalent fractions, through the organization of students into groups, using Tangram as a didactic resource.

Inspired by the proposals of Cohen and Lotan (2017), the small group activities were planned to foster collaborative learning and promote greater equity in student participation. This methodological option was adopted precisely because it dialogues directly with the problem pointed out in the introduction: the tendency to form affinity groups, which reinforces the preexisting status that limits the participation of some students. By structuring the division of roles for the development of the activity in an intentional way, it was sought to create conditions so that everyone could contribute in a meaningful way, regardless of their performance or social position in the class.

The distribution of roles contributed to the development of students' social and academic skills, also promoting a more equitable participation during the activities. Materials such as the activity card containing the instructions for development, the resource card offering complementary information and the Tangram kit were used.

In order to explore mathematical thinking during problem-solving activities, it was decided to carefully record the students' feedback, as well as their behavior in the group. For this, photographic records and videos were used, which made up the digital field diary on the *Padlet platform*. To investigate the formation of social and academic status in the class, an initial group formation activity was carried out, as proposed by Cohen and Lotan (2017). The groups, composed of four students, received the activity cards and resources, and their interactions were observed to analyze the division of roles and the status dynamics.

4 ENGAGEMENT AND PARTICIPATION

In the search to understand the interpersonal relationships in the investigated class and the theory of *social status*, considering the assumptions of Cohen and Lotan (2017), the first activity was carried out in a group by affinity, although the assumptions presented by the authors are the formation of random groups. The proposal was made to observe how the groups would be formed by the students. During this work, four students were observed during the activities and were named Student 1 (E1), Student 2 (E2) and so on.

At the time of the formation of the groups, students E1, E2, E3 and E4, who sat in the chairs at the end near the teacher's table, watched the groups being formed, staying only at their desks without having been grouped. When they realized that the groups were already formed in quartets, they joined together forming a group at the back of the room. Among the students was E1, a student who in a previous activity had asked not to be filmed.

E1, according to the rules, was the facilitator of the activity (she read the activity card, checking if everyone had understood). As I approached, positioning the camera to record the activity, E1 pulled the hood of his uniform blouse in order to hide. I verbalized that I would not record his face, positioning the camera to the group. As the authors point out:

> Those who have a lower status occupy a low position in the same hierarchy. Steele and Aronson (1995, p. 809) argue that low internalized expectations based on stereotyped perceptions about a group "{...} can play a role of threatening effects in mediation", that is, they confirm negative stereotypes about the group. (Cohen and Lotan, 2017, p. 60).

While the activity was taking place, I was mediating in the groups, problematizing each question from the students. This posture is in line with Vygotsky (2000), who understands the role of the teacher as a mediator of internal development processes, awakening learning through interaction.

E4 led the group, reflecting and making notes to solve the problem.
What's up? What did you achieve, did you discover? (Researcher)
This one (referring to a triangle and a parallelogram), has two, but if you separate the middle one you will have four. (E4)
Four little ones. But in this size, the smaller triangle, is there? (Researcher)

At this moment, the collective construction of reasoning is observed, in which the researcher's mediation opens space for students to test hypotheses and advance in mathematical reasoning. This dynamic highlights what Boaler (2017) defends when he considers that open and challenging tasks promote engagement, allowing different voices to express themselves in the resolution process.

He placed a smaller triangle on top of the parallelogram. E2 and E3, realize that two smaller triangles fit in the parallelogram. E2 positions the piece, while E1 only observes. (Researcher)
You are coming on the right path, my loves. Let's think... And in the larger triangle? (Researcher)

At this point, E1 takes the larger triangle to participate in the discussion, takes smaller triangles and positions it on top of the larger triangle, leaving anonymity. E1 starts to dialogue with her colleagues at the table, seeking to support the solution of the problem. This transformation can be understood in the light of the reflections of Cohen and Lotan (2017), who explain how social status influences the willingness to participate and how the assignment of roles can redistribute the power of speech in groups.

After going through other groups, I returned to the focus group, asking if they had managed to solve the problem. I was surprised to see E1 with the resource card in her hand, signaling that she was involved. When I directed myself to E1, asking that they need to register, E4 took the sheet saying that she knew what she had to do, because she was the reporter and had to do the registration. E1 resisted a little, but gave in and spontaneously began to organize the Tangram pieces, to visualize what was on the resource card, followed by E2 and E3. This growing engagement of E1 dialogues with Van de Walle (2009), when he highlights that in heterogeneous groups each student can recognize that he or she has the skills to contribute, strengthening the feeling of belonging.

I realized that E1 was no longer worried about being filmed, behaving naturally with the camera facing the table, even at one point she looked at the camera. This movement confirms the importance of intentional mediation, because when the student engages in the

task, the focus shifts from her position of invisibility to her active participation, which is also reinforced by Boaler (2017) when relating motivation and engagement in collaborative environments.

When socializing, only the reporters went to the room, but the other members of the group mobilized in front of the room to support the reporter. However, in the observed group, E1 and E2 asked to stay in their seats, going ahead of E3 as support for E4's reporter. This mobilization highlights the potential of collaborative learning, in which, according to Cohen and Lotan (2017), valuing collective contribution strengthens opportunities for engagement and reduces the effects of status hierarchies.

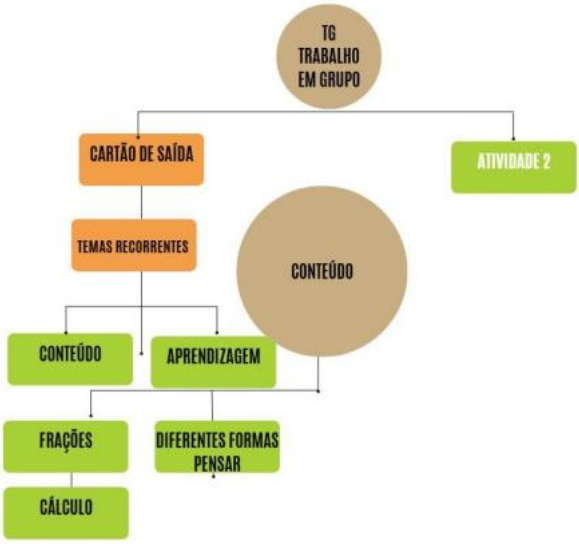
In this pedagogical practice, the focus was to provide students with the opportunity to experiment with a different approach to solving mathematical problems involving fractions, encouraging collaboration, in favor of inclusion (Bozzi and Sofiato, 2024) and the development of critical thinking. This proposal was conceived as a direct response to the research question, as it articulated strategies aimed not only at favoring conceptual understanding, but also at reducing inequalities of participation resulting from social status, creating an environment in which voices that were previously little heard could manifest themselves safely. This approach, according to Schön (2000), favors reflection-in-action, as students reevaluate their procedures as they interact with the problem and with their colleagues.

The students engaged with the proposed activity, asking for the others, which would be presented in the research, to be as challenging as the one they were doing. The activity allowed them to reflect on their learning, developing awareness about their own advances and difficulties. This process refers to the concept of metacognition, as described by Flavell (1979), when it indicates that learning is strengthened when subjects monitor and regulate their cognitive processes, recognizing what they have learned and what they still need to develop.

As an integral part of the research, after the activity, the students filled out the exit card, a form containing questions such as: What do you leave knowing today, that you didn't know before? What worked? What didn't work? Want to leave a comment? These data allowed us to observe the main learning of the students, as well as gaps to be filled in the next activity. When analyzing the answers on the exit card, recurring themes became evident, according to the organizational chart in Figure 3.

Figure 3

Recurring Output Card Themes



Source: Prepared by the authors (2025).

The students pointed out on the exit card the difficulties in consolidating the concepts of fraction, as well as in the interpretation of slogans to develop the resolution of problem-situations. They also described the importance of group work to promote learning, focusing on different ways of thinking. This movement confirms what Boaler (2017) and Van de Walle (2009) point out about the relevance of inclusive environments, which favor multiple strategies and expand equitable participation.

5 PEDAGOGICAL PRACTICES – PATHS TO EQUITY

In the process of the activity with the students, the difficulties foreseen by the anticipation arose, especially the simplistic counting of the pieces, at which time the teacher carried out the interventions with guiding questions, encouraging reflection and the rereading of the activity card. Gradually, the students began to use the correct strategy of decomposition and recomposition, understanding the part-whole relationship and the equivalence of fractions. Participation was active and engaged in all groups, including socialization in which the members of the group supported the reporter at the time of explaining the activity developed by the group.

The final discussion addressed the challenges faced, the strategies used and the connections with everyday life. The closing questions stimulated metacognitive reflection on learning.

The manipulation of the Tangram made of EVA facilitated visualization and experimentation, making the activity more concrete and engaging. The guiding questions were fundamental to direct the students' reasoning and overcome the initial tendency to simplistic counting. The biggest challenge was to overcome the students' initial view (repetition) regarding the fraction. Tangram gave meaning to the activity, allowing it to relate it to fractions. The simple counting strategy, 1/7 per piece, was predicted and confirmed, demonstrating the need for intervention to deepen the understanding of the part-whole relationship.

The assertive strategy of decomposition and recomposition, also foreseen, emerged gradually, demonstrating the students' ability to develop logical and spatial reasoning.

The class achieved the proposed learning objective, demonstrating conceptual understanding of fractions, ability to compare and identify equivalent fractions, and ability to connect representations to concrete situations. Despite the initial difficulties, the students were able to develop their own strategies, and understand the part-whole relationship of the fractions. The final discussion and the students' records evidenced the construction of a deeper and more meaningful understanding.

Regarding the formation of affinity groups, the influence of social status was evidenced , resulting in the exclusion of some students, demonstrating the need for the teacher to be attentive to carry out specific interventions in order to ensure equitable learning opportunities for all. The relationship between self-concept and self-esteem are directly linked to the pedagogical development of students, given the influence that emotional issues cause in academic performance. It is essential for the teacher to be aware of the particularities of the class, in order to intervene in the various types of statuses that generate blocks in students. In this sense, "[...] low internalized expectations based on stereotyped perceptions about a group [...] can play a role of threatening effects in mediation", that is, they confirm negative stereotypes about the group (Steele and Aronson, 1995, *apud*, Cohen and Lotan, 2017, p. 33).

The present study revealed important nuances about the interactions and participation of the students, showing that some students had low interaction with the group, having their participation little perceived in the collective socializations. Sitting in the same row, in the corner of the room, in front of the others, their presence seemed to go unnoticed, which reinforces the need for strategies that guarantee inclusion and visibility to all subjects in the educational process.

The search for more equitable pedagogical practices, motivated by the reflections of PED Brasil and aligned with the theories of Cohen and Lotan (2017) and Boaler (2018), demonstrated the complexity of *social status* and its influence on student engagement. The findings of this research confirm these references, showing that the formation of heterogeneous groups with defined roles, combined with challenging tasks and intentional mediation, can partially neutralize the exclusionary effects of social *status*, strengthening both mathematical thinking and equitable participation.

The importance of cultivating a healthy space, open to dialogue, based on mutual respect, attentive listening and valuing the voices of students was found. The experience of observing the formation of affinity groups showed how the preexisting social status in the class can lead to exclusion and lower participation of certain students, as illustrated by the initial hesitation of the group in which the students were excluded. However, the planned pedagogical interventions, with the assignment of specific roles and the use of concrete materials, such as Tangram, brought opportunities for students with lower *social status* to engage more actively, as demonstrated by the increasing participation of student E1.

This evidence reinforces the importance of educators being aware of the dynamics of *status* in the classroom and of implementing strategies that promote equitable participation and appreciation of all students. The analysis of the activity with Tangram suggests that the combination of challenging tasks, defined roles and the attentive mediation of the teacher can contribute to the resignification of *status* and to the construction of a more inclusive learning environment.

6 FINAL CONSIDERATIONS

This study sought to investigate how the articulation between problem solving and working in heterogeneous groups with defined roles can boost mathematical thinking and promote equity in the classroom. The analysis of the data obtained, from the observations, records of activities and exit cards, showed that the strategies applied favored the participation of students with different levels of performance, expanding the opportunities for interaction and collective construction of knowledge.

In summary, the investigation showed that the articulation between problem solving, Numerical Conversations and work in heterogeneous groups with defined roles promoted not only advances in mathematical thinking, but also greater equitable participation among students, with a noticeable reduction in the effects of *social status* on interactions. These

results answer the central question of this study and reinforce the potential of these strategies to create more inclusive and intellectually stimulating learning environments.

Consistently, it was noticed that this methodological integration helped to reduce the effects of social *status* on the dynamics of the class, creating conditions for voices that were previously little heard to start to contribute more actively to the discussions. There were also clear signs of progress in the understanding of the concepts worked on, especially when the students were able to rely on the interactions to build and revise their reasoning.

Still, the phenomenon of silent exclusion has not completely disappeared. At times, certain students maintained a more reserved posture, which highlights the need for constant adjustments in the conduct of activities and in the distribution of roles within the groups.

Because this is an investigation situated in a specific context, with a limited number of participants, it is not possible to extend conclusions broadly. It would be useful for future studies to examine, in different school realities, how practices of this nature behave and what adaptations can enhance their effects. This continuity of research can contribute to consolidating approaches that, at the same time, strengthen mathematical learning and combat subtle but persistent inequalities that cross daily interactions at school.

ACKNOWLEDGMENTS

The authors would like to thank the Canoa Institute, the Lucia and Pelerson Penido Foundation (FLUPP), the study group Pedagogical Practices in Mathematics (PPMat) and the Professional Master's Degree in Education at the University of Taubaté for the technical and institutional support offered.

REFERENCES

Boaler, J. (2017). Mentalidades matemáticas: Estimulando o potencial dos estudantes por meio da matemática criativa, das mensagens inspiradoras e do ensino inovador. Penso.

Boaler, J., Munson, J., & Williams, C. (2018). Mentalidades matemáticas na sala de aula: Ensino fundamental. Penso.

Bozzi, R. A., & Sofiato, C. G. (2024). A educação inclusiva e ensino colaborativo: Documentos do Brasil e de Portugal. Revista Lumen, 33(2), 23–39. https://doi.org/10.34019/1981-4070.2024.v33.42003

Brasil, Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira. (2023). Notas sobre o Brasil no Pisa 2022. Inep.

Cohen, E. G., & Lotan, R. A. (2017). Planejando o trabalho em grupo: Estratégias para salas de aula heterogêneas (3rd ed.). Penso.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive–developmental inquiry. American Psychologist, 34(10), 906–911. https://doi.org/10.1037/0003-066X.34.10.906

Humphreys, C., & Parker, R. (2019). Conversas numéricas: Estratégias de cálculo mental para uma compreensão profunda da matemática. Penso.

Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira. (2019, December 3). Pisa 2018 revela baixo desempenho escolar em leitura, matemática e ciências no Brasil. http://inep.gov.br/artigo/-/asset_publisher/B4AQV9zFY7Bv/content/pisa-2018-revela-baixo-desempenho-escolar-em-leitura-matematica-e-ciencias-no-brasil/21206

Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira. (2023, December 5). Divulgados os resultados do Pisa 2022. https://www.gov.br/inep/pt-br/assuntos/noticias/acoes-internacionais/divulgados-os-resultados-do-pisa-2022

Santana, M. L. S. (2023). Representações sociais da matemática escolar e as trajetórias formativas de licenciandos em pedagogia [Doctoral dissertation]. Universidade Estácio de Sá.

Schön, D. A. (2000). Educando o profissional reflexivo: Um novo design para o ensino e a aprendizagem. Artmed.

Smole, K. S., Diniz, M. I., & Cândido, P. (2000). Brincadeiras matemáticas na educação infantil. Artmed.

Van de Walle, J. A. (2009). Matemática no ensino fundamental: Formação de professores e aplicação em sala de aula (P. H. Colonese, Trans., 6th ed.). Artmed.

Vigotski, L. S. (2000). A construção do pensamento e da linguagem. Martins Fontes.