

Mathematics Club at Unifesp: a collective teaching and research activity between the university and public schools¹

Clube de Matemática da Unifesp:
atividade coletiva de ensino e pesquisa entre
universidade e escola pública

Club de Matemáticas de la Unifesp:
actividad colectiva de enseñanza e investigación entre
la universidad y la escuela pública

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RESUMO

O artigo apresenta e analisa o Clube de Matemática da Universidade Federal de São Paulo, a partir de seus fundamentos teóricos, histórico, ações e parcerias que, ao longo dos anos, tem ampliado a formação matemática de professores e estudantes das escolas parceiras do projeto. Sua organização se dá em Ciclos de Atividade não lineares, retomadas à luz das necessidades que emergem na atividade coletiva. A metodologia de análise das pesquisas desenvolvidas nesse contexto é a análise semiótica multimodal, um instrumento potente para a compreensão da atividade humana. Evidenciando a potencialidade do Clube de Matemática como espaço formativo e investigativo e pontuamos os desafios institucionais para sua implementação. Defendemos que o Clube de Matemática é mais do que um espaço para a aprendizagem da matemática. Constitui-se um espaço vital para a produção de formas colaborativas, motivadoras e éticas, de se ensinar e aprender matemática e, de forma mais ampla, de ser humano na coletividade.

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Palavras-chave: Clube de Matemática; Atividade Pedagógica; Atividade Orientadora de Ensino; Análise multimodal da atividade humana.

ABSTRACT

The article presents and analyzes the Mathematics Club at the Federal University of São Paulo, grounded in its theoretical and historical foundations, as well as in the actions and partnerships that, over the years, have contributed to the expansion of mathematical education for teachers and students from the project's partner schools. Its organization is structured through non-linear Activity Cycles, revisited in light of the needs that emerge within collective activity. The methodological approach adopted for analyzing the research developed in this context is multimodal semiotic analysis, a powerful tool for understanding human activity. By highlighting the potential of the Mathematics Club as both a formative and investigative space, the study also identifies institutional challenges related to its implementation. We argue that the Mathematics Club goes beyond being merely a space for learning mathematics; rather, it constitutes a vital environment for fostering collaborative, motivating, and ethical ways of teaching and learning mathematics and, more broadly, of being human within a collective.

Keywords: Mathematics Club; Teaching Guiding Activity; Pedagogical Activity; Multimodal Analysis of Human Activity.

RESUMEN

El artículo presenta y analiza el Club de Matemáticas de la Universidad Federal de São Paulo, a partir de sus fundamentos teóricos, su trayectoria histórica, sus acciones y sus alianzas que, a lo largo de los años, han ampliado la formación matemática de profesores y estudiantes de las escuelas asociadas al proyecto. Su organización se articula en ciclos de actividad no lineales, que se reajustan en función de las necesidades que surgen en la actividad colectiva. La metodología de análisis de las investigaciones desarrolladas en este contexto es el análisis semiótico multimodal, un potente instrumento para la comprensión de la actividad humana. Al poner de manifiesto el potencial del Club de Matemáticas como espacio formativo e investigativo, señalamos los desafíos institucionales para su implementación. Defendemos que el Club de Matemáticas es más que un espacio para el aprendizaje de las matemáticas. Constituye un espacio vital para la producción de formas colaborativas, motivadoras y éticas de enseñar y aprender matemáticas y, de manera más amplia, de ser humano en la colectividad.

Palabras clave: Club de Matemáticas. Actividad Pedagógica. Actividad Orientadora de la Enseñanza. Análisis multimodal de la actividad humana.

1 Introduction

In recent decades, discussions and studies about the teaching and learning processes of mathematics have increasingly highlighted the limitations of traditional teaching practices, centered on the transmission of content and the fragmentation between theory and practice. Such practices have proven insufficient to meet the educational demands for a consistent mathematical training for teachers and students, one that deeply addresses mathematical concepts and their relations with reality, in the production of an autonomous and critical consciousness.

In the face of these demands, recent research in the field of Mathematics Education, grounded in Historical-Cultural Theory, has indicated the need for teaching and learning to be understood as a human activity guided by conscious, socially produced, and historically determined objectives (Lopes; 2004; Moretti, 2007; Vaz; Lopes; Silva, 2012; Moura, 2021; Moura, 2024). This understanding has implications for the pedagogical approaches to content, classroom organization, and collaborative work among the different participants in the educational process—teachers and students. In this context, the development of formative perspectives that articulate teaching, learning, research, and teacher training becomes imminent.

It is in this scenario that formative proposals emerge that seek to organize mathematics teaching, attributing centrality to pedagogical activity (Moura, 2016), to collective work, and to the production of new meanings about teaching practice. Among these proposals, the Mathematics Club stands out, a space for learning, training, research, and extension, guided by the need to dialectically articulate theory and practice in pedagogical activity. In this space, pedagogical activity is understood as the unity between the teaching activity—both of future teachers in initial training and of teachers in continuing education—and the learning activity—of students in Basic Education.

Taking the Mathematics Club proposal as an organizing axis, the intention of this article is to present and analyze the experience of its implementation in the context of the Federal University of São Paulo. To this end, we present the historical and theoretical principles that underpin the historical-cultural Mathematics Club proposal. Next, we present the Mathematics Club at the Federal University of São Paulo in a brief history, sharing actions and partnerships in the dimensions of teaching, research, and extension. In detailing the work methodology, we have developed, we provide an example of multimodal semiotic analysis of student learning activity. Finally, we defend the contributions of this proposal to the mathematical education of teachers and students.

2 Mathematics Club: historical genesis and theoretical principles

The formative space of the Mathematics Club seeks to overcome traditional practices through an organization of teaching based on the historical genesis of concepts and playfulness, with the aim of arousing students' interest by presenting mathematics as a human production in challenging proposals, such as games, triggering problems, and

virtual stories, etc. (Moura, 2016). As a result, we have that in the Mathematics Club, teaching, learning, and teacher training are constituted in an inseparable way (Moretti, 2014; Biella, 2018; Moura, 2021; Lopes; Borowsky; Cunha, 2024; Moura (2024).

The Mathematics Club has its genesis linked to the Faculty of Education of the University of São Paulo (FEUSP), where it was conceived in 1999, under the coordination of Professor Manoel Oriosvaldo de Moura, as an internship project for the Pedagogy and Mathematics courses, in which the training aimed to go beyond the mastery of content and achieve an understanding of the social role of teaching as an activity of human transformation. As Cedro (2004) points out:

The Mathematics Club arises from the need for a space where theory and practice could meet in a concrete way, creating conditions for the training of teachers who understand teaching as an activity” (Cedro, 2004, p. 53).

In the Mathematics Club, mathematical concepts take center stage as objects of knowledge historically produced, whose appropriation requires the conscious organization of teaching guided by the logical-historical movement of concepts (Kopnin, 1966), enabling pre-service teachers and students to engage with mathematical knowledge beyond procedures, attributing personal meaning to it in the process of developing theoretical thought (Moura, 2016; Lopes; Borowsky; Cunha, 2024). To this end, the Mathematics Club assumes human activity as intentional and socially mediated (Leontiev, 1978) and emerges as a space containing the necessary conditions for the objectification of pedagogical activity, based on the principles of the Teaching-Orienteering Activity (TOA) (Moura, 2016, 2023, 2024).

The TOA “it constitutes a theoretical-methodological orientation for carrying out pedagogical activity as a unit of teaching and learning activity” (Moura, 2024, p. 89) and has as its principles the elaboration and development, together with the students, of Learning Trigger Situations (LTS), which consider the historical synthesis of the concept, as well as the movement of evaluation aimed at reorganizing pedagogical actions (Lopes et al., 2024). The development of LTS aims to guarantee moments of collective work in small groups, socializations, analysis and synthesis of the collective solution (Moura, 2023).

The formative potential of the Mathematics Club results in its unfolding to other institutional contexts that preserve the theoretical-methodological principles and incorporate local specificities (Silva; Moura, 2024). Professors and researchers trained

within the context of the Mathematics Club at FEUSP have been working to consolidate this proposal in different universities and regions of Brazil, such as the Federal University of Goiás (UFG), the Federal University of Santa Maria (UFSM), the Federal University of São Paulo (Unifesp), the Federal University of Rio Grande do Norte (UFRN), the State University of Goiás (UEG), and the Federal Institute of Espírito Santo (IFES).

This expansion movement is not limited to the replication of practices and experiences; it implies the reworking of teaching, extension, and research projects that take the Mathematics Club as a field for teacher training, the organization of teaching, and the learning of concepts by all those involved, that is, students, teachers in training, and researchers.

The studies and research developed within the scope of the Mathematics Club have demonstrated that this space constitutes a complex and organized pedagogical activity based on multiple dimensions that favor the training of teachers who teach mathematics (initial and continuing), the organization of teaching, and the learning of students in Basic Education. More than being understood as an extension project or as a space where playful and intentional proposals for teaching mathematics are developed, the Mathematics Club emerges in studies and research as a privileged locus of human development, based on Historical-Cultural Theory and guided by the principles of the Teaching-Orienteering Activity.

Vaz, Lopes and Silva (2012) defend the Mathematics Club as a space structured from a collaborative dimension, in which Basic Education teachers, future teachers and trainers share objectives, responsibilities and pedagogical decisions. This collaborative dimension manifests itself, above all, in collective planning, in the joint realization of teaching actions and in the shared evaluation of the practices developed, configuring itself as a formative environment in which the learning of teaching occurs within the pedagogical activity (Moura, 2016) and in the relations among subjects with different levels of experience.

In the Mathematics Club, the pedagogical, social, collaborative, and formative dimensions are articulated, which give unity to the movement of teaching, learning, and becoming a teacher, since, as Moretti (2007, p. 101) states, “the teacher becomes a teacher in the activity of teaching. In particular, by aiming at their need to teach and, consequently, to organize teaching to favor learning.”

Based on this understanding, we present below the Mathematics Club of the Federal University of São Paulo (Unifesp), going through the initial proposal and its trajectory, the partnership between the university and public schools, as well as its current organization, related to funded longitudinal research.

3 The Mathematics Club at Unifesp and its aspects

The Mathematics Club at Unifesp was founded in 2011, under the coordination of Professor Vanessa Dias Moretti. Inspired by the experience initiated by Professor Manoel Oriosvaldo de Moura at the University of São Paulo, and developed by the *Grupo de Estudos e Pesquisas sobre Atividade Pedagógica - GEPAPe*⁵, the proposal at Unifesp initially stems from the effort to develop extension activities, focusing on Mathematics Education, with the community surrounding the Guarulhos Campus of Unifesp. It is worth highlighting that the Guarulhos Campus, which today houses the School of Philosophy, Letters and Human Sciences of Unifesp (EFLCH-Unifesp), began its classes in 2007 as a result of the expansion movement of federal universities in the context of REUNI⁶, created during the government of Luiz Inácio Lula da Silva (2003-2011). This extension program had significant impacts on the establishment of several federal university campuses in peripheral regions outside large urban centers, such as the outskirts of Guarulhos, more specifically in the Pimentas neighborhood.

At EFLCH, Mathematics Education takes place within the Pedagogy degree program, since the Mathematics degree program is offered on a different campus. Thus, from the beginning, the Mathematics Club/Unifesp's dialogue has been focused on the teaching and learning of mathematics in the Early Years of Elementary School and in Early Childhood Education.

The involvement of undergraduate students began through tutoring and extension scholarships. A major challenge, which persists to this day, is the presence of students on campus or in the vicinity of the University outside of class hours. This is because, precisely because it is a peripheral campus, many students travel long distances and for long

⁵ Research group coordinated by Prof. Dr. Manoel Oriosvaldo de Moura, based at the Faculty of Education of USP (University of São Paulo). More information can be found in the CNPq Research Group Directory: <http://dgp.cnpq.br/dgp/espelhogrupo/1737194701444929>.

⁶ REUNI - Program to Support Restructuring and Expansion Plans of Federal Universities. More information available at <https://portal.mec.gov.br/reuni>.

periods of time to get there. Another point is that the vast majority of students are workers who do not have time at the university beyond class time.

Thus, aiming to guarantee the participation of undergraduate students in Pedagogy, we sought a curricular space for the Mathematics Club. The path found was the Curricular Unit Programmed Pedagogical Practices (PPP), currently called Pedagogical Practices and Research (Unifesp, 2020). The discipline aims to explore the pedagogue's action in situations beyond the regular classroom and is organized into lines. These lines are offered by the course's professors, and undergraduate students enroll according to their interests. The Mathematics Club line has been offered since 2015 and is configured as a playful investigative space focused on Mathematics learning. From 2017 onwards, with the regulation of the curricularization of extension at Unifesp (UNIFESP, 2017), the PPP gained an explicit extension character, which reveals its vocation.

In this way, aiming to guarantee the participation of undergraduate students in Pedagogy, we sought a curricular space for the Mathematics Club. As Moretti (2014) points out, the structure of the curricular unit (CU) Pedagogical Practices and Research contributes to the development of training paths aligned with the academic interests of each participant, ensuring experiences of teaching practices intentionally mediated by theory, with moments of planning, execution and analysis of educational actions.

As a PPP line, the Mathematics Club has the partnership of public schools around the campus, partners of the Pedagogical Residency Program, an internship program of Pedagogy/Unifesp since 2009. The actions involve the study of mathematical concepts, in relation to their logical-historical movement; the study and experience of the Teaching Orienteering Activity - TOA (Moura, 2016); the experience, discussion and planning of Learning Trigger Situations - LTS, such as games, virtual stories, triggering problems or emerging situations from everyday life.(Moura, 2024); the development of the LTS (School Learning Assessment) together with the students of the partner school and, finally, the evaluation of the process and indication of aspects to be reworked in the LTS developed and implemented. This movement allows future teachers to understand teaching as an intentional human activity, learning to teach in the very process of organizing teaching.

In general, in addition to undergraduate students, graduate students participate in the PPP meetings in a monitoring capacity. Teachers from the schools participate by indicating needs, interests or suggestions in the proposals that are previously shared.

Thus, in this space, undergraduate students experience the practice of organizing the teaching of Mathematics in dialogue with the needs of Basic Education, always supported by theoretical-methodological principles that guide their training.

Still within the scope of the Mathematics Club's articulation with the Pedagogy curriculum at Unifesp, we highlight actions that occur in the context of the course Fundamentals of Mathematics Teaching I. In this discipline, after studying mathematical concepts and principles of teaching organization based on TOA and the development of LTS, students create triggering situations such as games or virtual stories. Over the years, these materials have been building a collection that contributes to the organization of training activities in the various dimensions that the Mathematics Club at Unifesp aims to achieve. Virtual games and stories are understood as mediating instruments for mathematical learning activities, both for students from participating schools and for the students of the Pedagogy course who develop, use, and analyze them. "When opting for the game as a teaching strategy, the teacher does so with an intention: to facilitate learning. And in doing so, the purpose is to teach content or a skill" (Moura, 1991, p. 45).

Despite a theoretical and methodological structure that has remained consistent over the years, the offering of the Mathematics Club as a line in the Curricular Unit Pedagogical Practices and Research has materialized in different editions with specific training demands that culminate in actions in partner schools. Thus, between 2015 and 2016, the PPP editions focused on the theoretical study of playful elements in mathematics learning within the context of TOA, associated with the analysis of the Mathematics Club's collection. From 2017 onwards, there has been a diversification of the themes addressed within the PPP/Mathematics Club, such as: Mathematics Education for Young People and Adults; Geometric Notions; African Games. The development of games of African origin involved studies and research that, by addressing aspects present in Law 10639 (Brazil, 2003), value the teaching of elements of African and Afro-Brazilian history and culture in schools and contribute to future teachers understanding the importance and possibilities of these practices.

Starting in 2021, the Mathematics Club, within the context of the PPP, began to more systematically consider the study of algebraic knowledge and thinking in the Early Years of Elementary School, including the development and analysis of learning-triggering situations focused on the development of algebraic thinking. This movement converges with the research interests that are being outlined in the Mathematics Club/Unifesp, which we will detail in the

next section. More recently, in 2023 and 2024, the curricular unit incorporated themes such as Children Literature as a mediation for the development of LTS in the organization of mathematics teaching and Computational Thinking in Basic Education, highlighting the potential of the Mathematics Club to engage with contemporary themes, in coherence with its theoretical and methodological foundations.

Beyond the curricular dimension, as a Pedagogical Project, the Mathematics Club has a teacher training dimension that takes place in schools, in the form of university extension, and that relates to the actions developed by undergraduate students with students in Basic Education. When faced with the ways of approaching mathematical concepts that are developed in the meetings with their students, many teachers and coordinators began to indicate an interest in moments of study and training in schools.

Although these teacher training moments are named in the context of GEPAPe as Pedagogical Workshops in Mathematics – PWM, in our reality they have become associated with practices of the Mathematics Club. Thus, at Unifesp we have the dimension of the Mathematics Club with undergraduates and with students from Basic Education and the dimension of teacher training with teachers. In daily life these dimensions' mix and often coexist, since in teacher training we focus on collective activity, mediated by TOA, in the elaboration and development of LTS with students.

Over the years, several outreach activities have been developed within the context of the Mathematics Club/Unifesp: “Mathematics Club” (2011, 2012 and 2013); “Mathematics Club in the Park” (2017), “Mathematics Club: African Games” (2018), “Mathematics Club - Geometric Concepts” (2019), “Mathematics Club at School” (2022); “Teachers who are friends of the Mathematics Club” (2017, 2023, 2024 and 2025), Research and Extension Colloquium of the Mathematics Club (2023, 2025). This set of actions demonstrates the consolidation of the Mathematics Club/Unifesp as a privileged space for the teaching and learning of mathematics through the articulation between the university and the public school, strengthening teacher training and the production of knowledge in mathematics education.

It is evident that, in its various aspects, the Unifesp Mathematics Club is not understood as a physical space, but as a space for teaching, learning, and teacher training, organized according to the principles of the Teaching-Orienteering Activity. The actions developed with undergraduate students, students, and teachers of Basic Education are not

limited to teaching or extension activities, but simultaneously engage with the investigative dimension. Thus, the Unifesp Mathematics Club integrates teaching, extension, and research in a unified way movement in which theory and practice are dialectically intertwined.

The monitoring of the actions of the different participants, the records of written productions and moments of collective synthesis become revealing elements of the training processes in motion in the Mathematics Club. Thus, the Mathematics Club assumes itself as a privileged space for the production of knowledge about the teaching and learning of mathematical concepts, while at the same time organizing conditions for the development of the subjects involved.

Research on the Mathematics Club/Unifesp has been developed by researchers from the *Grupo de Estudos e Pesquisa em Processos Educativos e Perspectiva Histórico-Cultural em Educação Matemática* - GeppedhMat⁷. The research of Andrade (2020); Ferreira (2024); Franco (2024) and Trindad (2024) used the Mathematics Club as a space for training and learning, corroborating with Moura, Lopes and Cedro (2018), who highlight how the functions of Mathematics Clubs refer to the organization of a space for study and discussion on classroom issues and theoretical and practical research related to mathematics education.

From 2023 onwards, the Mathematics Club/Unifesp strengthened its research dimension through funding from the *Fundação de Apoio à Pesquisa do estado de São Paulo* – FAPESP. In this context, in 2026 we have three master and three doctoral programs underway in GeppedhMat that investigate formative processes in the Mathematics Club.

In the following section, we describe and analyze the development of this research project, presenting its principles, organization, and theoretical and methodological contributions to mathematics education.

4 Collective Research Activity at the Unifesp Mathematics Club

As a way to objectify and create concrete conditions for the articulation between the dimensions of teaching, research and extension at the Unifesp Mathematics Club, GeppedhMat/Unifesp, with the support of researchers from Gepape/Usf, submitted a research

⁷ Research group coordinated by Professor PhD. Vanessa Dias Moretti, based in the Department of Education at Unifesp. More information at: <http://dgp.cnpq.br/dgp/espelhogrupo/2746415536287693>.

project to FAPESP, together with Proeduca⁸ - *Programa de Pesquisa em Educação Básica, na modalidade Programa Ensino Público*⁹. Proeduca is a partnership between Fapesp and the São Paulo State Department of Education (Seduc) and provides for partnerships between research institutions and public schools. In the Public Education Program, Proeduca finances the development of pedagogical practices capable of producing immediate impacts on daily school life, as well as the acquisition of permanent assets and infrastructure for participating schools. A very important point is that Proeduca allows granting scholarships to Basic Education teachers from public schools participating in the project.

Our project entitled "*O desenvolvimento do pensamento algébrico de estudantes do Ensino fundamental no contexto do Clube de Matemática: Contribuições da Teoria Histórico-Cultural*" was approved and it began in 2023, for a longitudinal study lasting four years. The overall objective is to investigate the development of algebraic thinking in students in the literacy and intermediate cycles triggered by the pedagogical activity developed in the context of the Mathematics Club.

The research is partnered with two municipal public schools: one in the Municipal Education System of Guarulhos and the other in the Municipal Education System of São Paulo. In both schools, there are scholarship teachers who dedicate a few hours a week to the project: EP¹⁰-1 (four hours a week) and EP-2 (eight hours a week). In addition, we have technical scholarship holders working in each of the schools, including undergraduate students (TT¹¹-1: 16 hours a week) and graduates in Pedagogy and/or Mathematics with experience in teaching and research (TT-4A: 40 hours a week).

It is worth noting that, in addition to the scholarship-holding teachers, other teachers from the schools have become increasingly involved with the activities of the Mathematics Club. These "Teachers Friends of the Club" teachers, who are not scholarship recipients, participate both in teacher training sessions and in planning and developing learning strategies with students.

Furthermore, the project funded the organization of the physical space for the development of the Mathematics Club's activities in the partner schools, such as the purchase

⁸ <https://fapesp.br/15317/chamada-fapesp-no-ambito-do-programa-de-pesquisa-em-educacao-basica-proeduca-fapespseduc>.

⁹ <https://fapesp.br/ensinopublico>.

¹⁰ EP Scholarships – Public Education, funded by Fapesp.

¹¹ TT Scholarships – Technical Training, funded by Fapesp.

of furniture and permanent materials. Although not the main focus of the project, the organization of the physical space aims to encourage the presence of the Mathematics Club in the school for both students and teachers, and we believe it will contribute to the continuation of the project, even after the completion of the project funded by FAPESP.

Figure 1 – Physical Spaces of the Mathematics Club/Unifesp in partner schools



Source: Photo collection of the Mathematics Club of Unifesp.

We understand that the concrete feasibility of carrying out this research project is very specific and does not necessarily reflect the possibility of dedication from teachers and researchers who have been involved in actions in the various Mathematics Clubs spread throughout Brazil. However, we believe that by organizing our actions with the concrete working and research conditions that Fapesp/Proeduca funding has allowed, we have the possibility of investigating the potential of the Mathematics Club proposal in the face of financial resources and public management favorable to the participation of teachers and researchers, which may imply recommendations and guidelines for public policies.

These material and human resource conditions in the Mathematics Club community have allowed us to develop systematic ways of investigating the human activity that gives life to this special context of teaching and learning. To understand this human activity, we have focused on the different semiotic registers produced by the participants of the Mathematics Club/Unifesp in their study processes, collective production of solutions to the proposed LTS, appropriation of concepts, syntheses of discussions, and objectification of knowledge in the activity. This is because, as Moura; Sforzi and Araújo (2011) indicates,

[...] the knowledge produced only effectively constitutes itself as such when inserted into human activity that confers social meaning and personal sense upon it. The natural object, imbued with the physical and mental activity of man, becomes objectified as a cultural element; that is, this is the process of objectification.

The analysis of human activity, considering the different semiotic registers produced by the participants in the objectification process, is what we call multimodal analysis of human activity (Moretti; Radford, 2023). In this process, written records, oral manifestations, gestures, expressions, silence, interjections, etc., become data for analysis. For this type of analysis, it is fundamental that data production be careful and permeate the different spaces of the collective.

In the research we develop at the Mathematics Club/Unifesp, this has only been possible through collective research activity, in which all participants understand the objective, visualize the need for specific data for analysis, and feel co-responsible for both the development of the pedagogical activity and the objective conditions for data production. This implies awareness of the entire research process, from planning to the positioning of cameras and microphones. Everyone is important, and all actions are essential for the smooth running of the research. In this way of working, research is an activity in which everyone is aware of the objectives, actions, and operations. Everyone envisions the product of this activity, so that collective research activity cannot occur in the Ford's model of the technical division of labor, in a way that is alienated from the production process and the product of the research being developed.

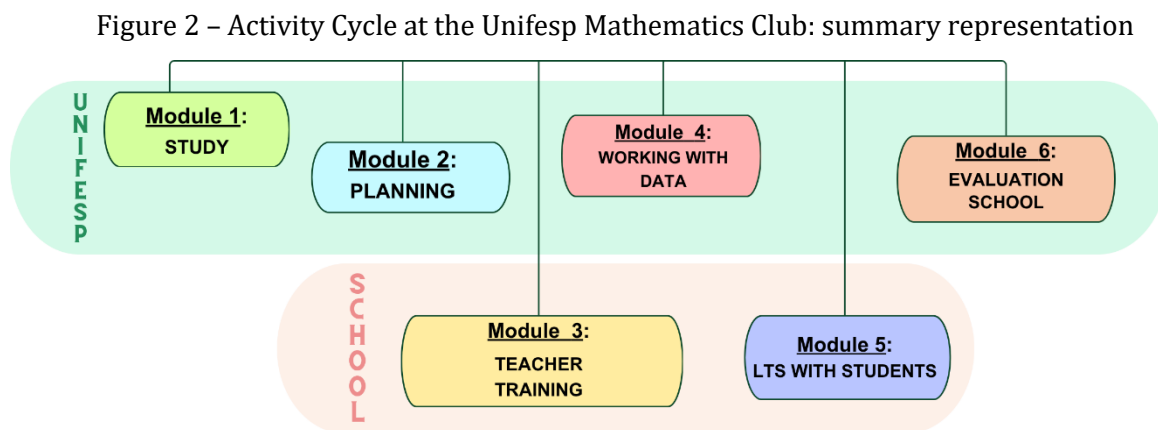
In addition to the general objective of collective research at the Mathematics Club/Unifesp, the selection of audience, school year, and appropriation and development processes has allowed the investigation of specific objectives through master's and doctoral research. Next, we present the work methodology we have developed.

4.1 Activity Cycles in the Unifesp Mathematics Club

Throughout the development of the different work fronts in the Unifesp Mathematics Club, with distinct objectives and groups of participants, there was a need for a visual organization of our work that would allow us to recognize ourselves during moments of collective activity.

To this end, we identified the "actions" that make up our collective research activity. Although they are actions of this main activity, these actions also constitute, in turn, activities. This is because, as Leontiev (1983) reminds us, there is a movement between actions and activity so that, when an action gains a motive, that is, when the object of the action begins to coincide with the motive of the activity, the action transforms into an activity.

Thus, we recognize the following as actions of the main activity: study, planning, teacher training, development of the LTS with students, work with data, and evaluation. Each of these actions, developed primarily at the school or at Unifesp and involving subgroups of participants (who overlap), is called a module. Figure 2 below summarizes the modules and the spaces in which they are primarily developed:

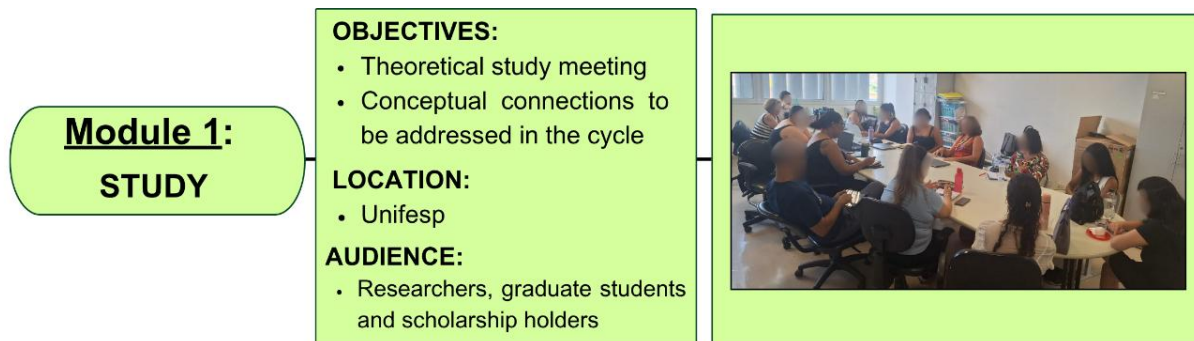


Source: GeppedhMat Collective and Unifesp Mathematics Club

At the University, doctoral researchers, graduate students, and TT and EP scholarship holders participate in the meetings (not all EP scholarship holders are available to travel to Unifesp). At the school, researchers, graduate students, and all EP scholarship holders from the school participate. During the development of the LTS with the students, the teachers from the respective classrooms also participate.

Module 1 (study) is dedicated to the study of the theoretical and methodological foundations of the research. At this time, considering the objective of the research, we have also been studying texts about algebraic thinking and algebraic conceptual nexuses (Sousa; Panossian; Cedro, 2014; Moretti; Virgens; Romeiro, 2021, Radford, 2014, 2018).

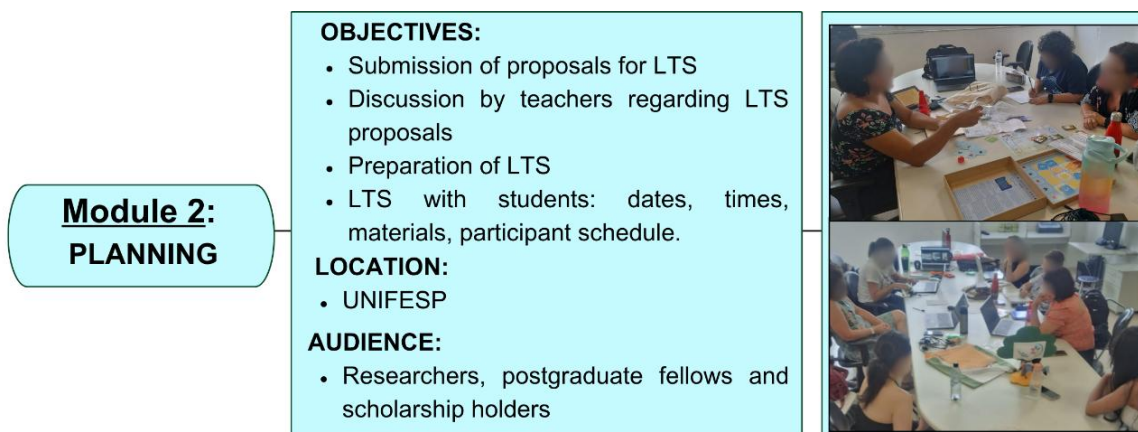
Figure 3 – Module 1 (Study)



Source: GeppedhMat Collective and Unifesp Mathematics Club

Module 2 (planning) is dedicated to the development, planning, and organization of the LTS. At this stage, the scholarship recipients present also introduce the proposals from the teachers of the partner schools for the development of the LTS. There is a collective discussion and development of the proposal to be implemented with the students (which takes place in Module 5), as well as the organization of practical aspects such as: dates, times, materials, and participant schedule.

Figure 4 – Module 2 (Planning)



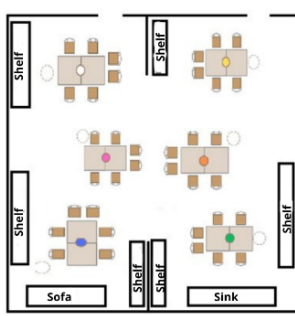
Source: GeppedhMat Collective and Unifesp Mathematics Club

As a product of Module 2, an Action Plan is developed to guide and systematize the information and operations necessary for the successful development of the LTS with the students (Module 5). This Action Plan includes: 1. Identification (school, date, class); 2. General data of the LTS (name, focused conceptual link, objective); 3.

Participants (researchers, scholarship holders, volunteers); 4. Data Collection (instruments, responsible parties); 5. Guiding script (times, planned actions, possible guiding questions); 6. Classroom Map (groups by color, equipment identification, responsible).

Figure 5 – Model of the Action Plan for the development of the LTS

Math Club		LTS 9: "Name from LTS"	
Responsible: Vanessa Moretti			
Research Collaborators: _____			
Scholarship holders: _____			
Day, Time: _____		School: _____	
MEETING: ____/____/____			
Objective to Investigate: _____			
ROOM ORGANIZATION: ✓ 6 groups organized according to badge colors. ✓ Organize one camera for general filming, one camera or notebook on each table, and one recorder on each table.			
REQUIRED MATERIALS/RESPONSIBILITY: ✓ F Camcorders, chargers, memory cards, power strips, batteries, notebooks, recorders (TT-1 scholarship holders) ✓ Tripods (TT-1 and TT-4 Scholarship Holders) ✓ Name badges: Scholarship-holding professors ✓ Cards (TT-4A scholarship holders) ✓ Sheets for individual and group record keeping (TT-4A scholarship holders)			
DATA COLLECTION: ✓ Recorders/Cameras: o Recorder 1/ Note 1 (researcher name or scholarship holder responsible) o Recorder 2/ Camera 1 (researcher name or scholarship holder responsible) o Recorder 3/ Note 2 (researcher name or scholarship holder responsible) o Recorder 4/ Camera 2 (researcher name or scholarship holder responsible) o Recorder 5/ Camera 3 (researcher name or scholarship holder responsible) o Recorder 6/ Note 3 (researcher name or scholarship holder responsible) o _____ / Camera 5: wide shot / _____ ✓ Sheet for individual registration ✓ 1 pen per student ✓ 1 sheet for group registration			
EXPECTED TIME		ACTION	
7h10		Organizing the room and materials (setting up tripods, video cameras, and laptops; separating the necessary materials for each group)	
08h10 / 09h45 / 13h25		Distribution of name tags and guidance for forming groups by color.	

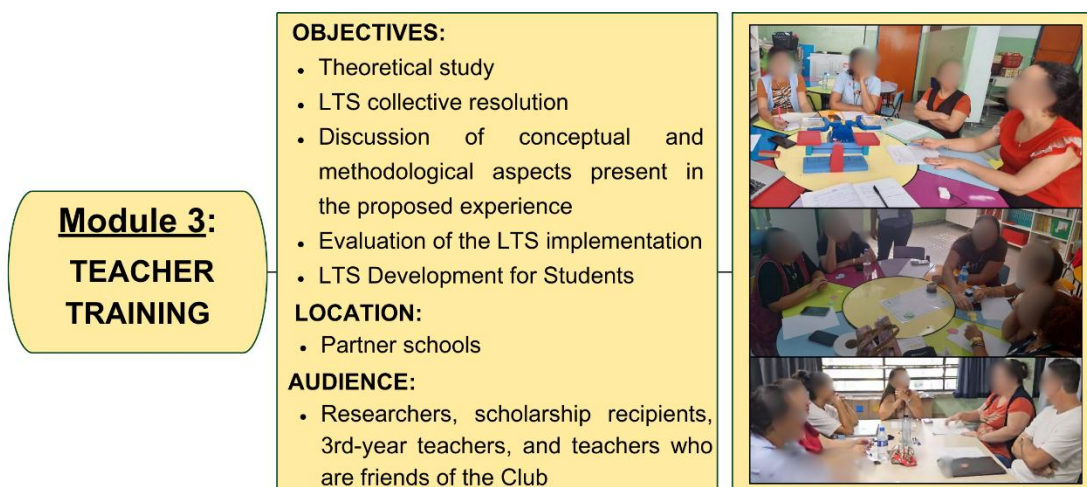


Identifying table groups and colors			
Group	Recorder	Camera	Responsible
Yellow	Recorder 1	Note 1	(researcher name or scholarship holder responsible)
Orange	Recorder 2	Camera 1	(researcher name or scholarship holder responsible)
Green	Recorder 3	Note 2	(researcher name or scholarship holder responsible)
Pink	Recorder 4	Camera 2	(researcher name or scholarship holder responsible)
White	Recorder 5	Camera 3	(researcher name or scholarship holder responsible)
Blue	Recorder 6	Note 3	(researcher name or scholarship holder responsible)
WIDE SHOT	Camera 5	_____	_____

Source: GeppedhMat Collective and Unifesp Mathematics Club

Module 3 (Teacher Training) involves periods of theoretical study, collective resolution of learning objectives, and discussion of conceptual and methodological aspects present in the proposed experience based on the TOA. In these meetings with teachers at the school, the development, organization, and evaluation of the learning objectives developed with the students also take place. The training sessions are sometimes aimed at the scholarship-holding teachers, and sometimes at the entire group of teachers at the school, in the collective we call "Teachers Friends of the Math Club".

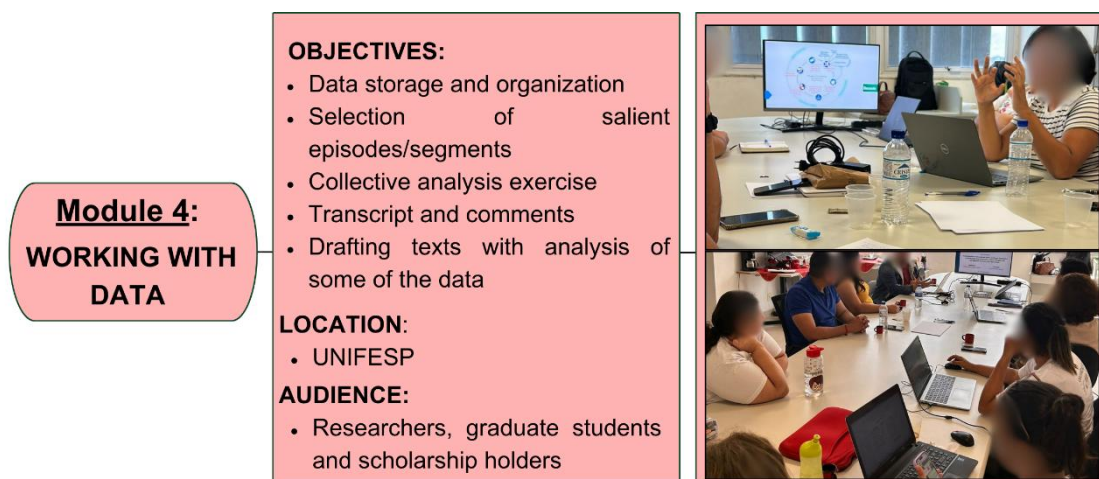
Figure 6 – Module 3 (Teacher Training)



Source: GeppedhMat Collective and Unifesp Mathematics Club

Module 4 (Working with Data) involves the entire process of: 1. data storage and organization; 2. selection of salient episodes/segments; 3. transcription and commentary on selected excerpts; 4. collective analysis exercise; and 5. initial drafting of texts with publication of partial research results. As the research activity is organized in cycles, in module 4 we focus on data from teacher training (module 3) or on student data from the previous cycle (module 5 of the previous cycle).

Figure 7 – Module 4 (Working with Data)

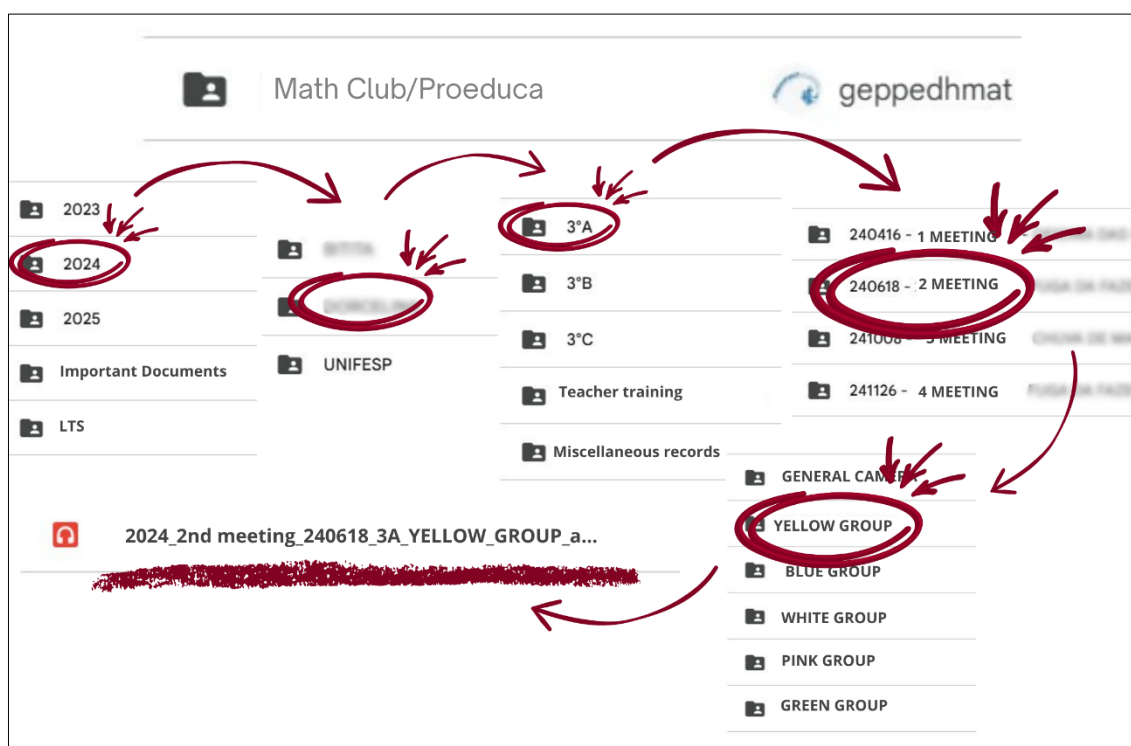


Source: GeppedhMat Collective and Unifesp Mathematics Club

The data collected and analyzed involves “written records, audio and video recordings, and field diaries to capture the participants' actions, organizing this data into episodes and

scenes to analyze the learning process” (Zeferino, 2024, p. 132). However, the methodology adopted for analysis is the multimodal video analysis approach (Moretti; Radford, 2023), based on the Theory of Objectification (Radford, 2021). This approach considers various semiotic means, “which includes the analysis of the sensory, kinesthetic, gestural, linguistic, and symbolic actions of the participants. This analysis allows us to understand how students become aware of culturally constituted mathematical meanings” (Zeferino, 2024, p. 132). Figure 8 below shows how the data is organized in the GeppedhMat drive:

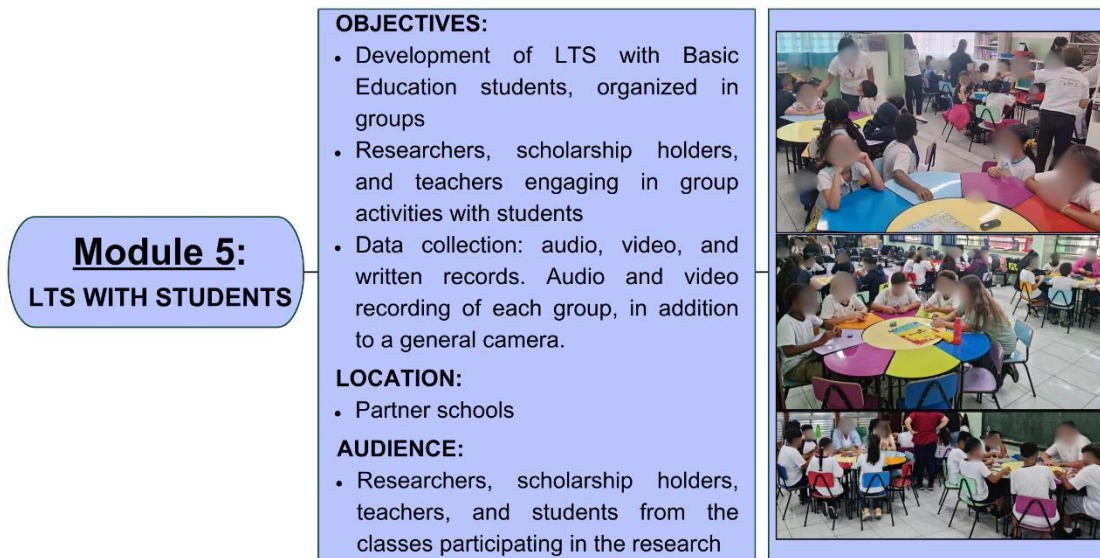
Figure 8 – Organization of the Mathematics Club Project Drive



Source: GeppedhMat Collective and Unifesp Mathematics Club

Module 5 involves the development of Learning Triggering Situations with students, based on TOA (Moura, 2016). The aim is to maintain the composition of the groups throughout the meetings. In order to foster the creation of affective bonds and enhance collective work, the researchers and/or scholarship holders accompanying each group also remain the same, as far as possible. At these times, careful attention to audio and video data capture is of great importance. Therefore, we have ensured a camera and an audio recorder for each group, in addition to a general camera (Radford, 2018).

Figure 9 – Module 5 (Development of LTS with students)



Source: GeppedhMat Collective and Unifesp Mathematics Club

Module 6 (Evaluation) assesses the activity cycle and involves: 1. participant reports on the development of the LTS, including notes made in field diaries and personal records; 2. evaluation by all participants of the developed proposal, the observed potential and limitations; 3. identification of needs for the next cycle. The evaluation guides the replanning and organization of the next activity cycle.

Figure 10 – Module 6 (Evaluation)

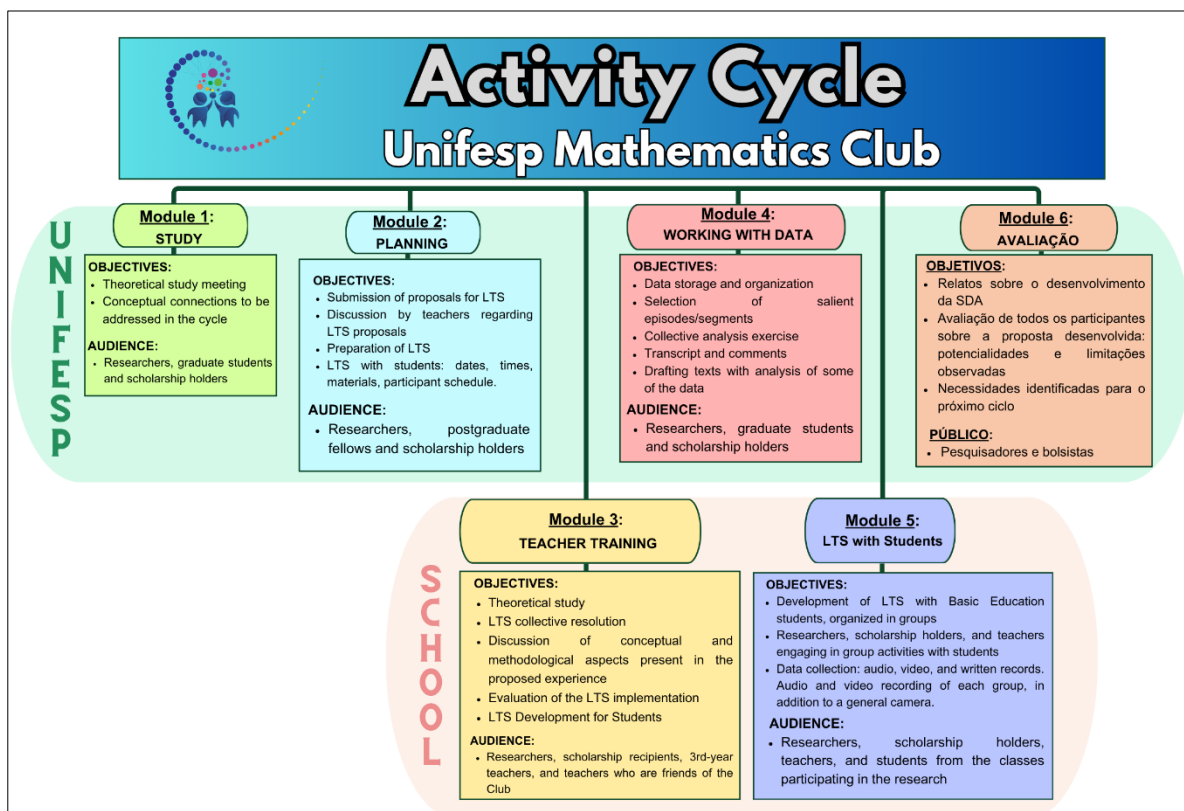


Source: GeppedhMat Collective and Unifesp Mathematics Club

In summary, as we stated earlier, the modules represent actions of the main activity and, when analyzed in focus, gain meaning and, in turn, constitute themselves as an activity (study activity, training activity, evaluation activity, etc.). Thus, the actions developed in all stages aim at both research activity and pedagogical activity. Therefore, they enhance the training of all those involved, which also gives them a formative dimension.

Each cycle lasts approximately two months, and the number of meetings per module varies according to the needs of the group, with actions from different modules and in different spaces taking place in the same week. In Figure 11, we revisit the representation of the Activity Cycle, now in its entirety, and include an estimate of the number of meetings for each stage, understanding that there is variation according to the needs of the group.

Figure 11 – Activity Cycle in the Unifesp Mathematics Club: complete representation



Source: GeppedhMat Collective and Unifesp Mathematics Club

Each semester, the research group, in partnership with the management of the partner schools, develops a calendar indicating the activity cycles and highlighting the reference color of the module on the respective day to facilitate the visualization of the different actions by those involved in each space.

In 2023 and 2025, we organized the two editions of the Unifesp Mathematics Club Colloquium, involving researchers, scholarship holders, and "Teachers Friends of the Club" teachers from the partner schools. In 2023, the event took place at the Federal Institute of São Paulo – São Paulo campus and, in 2025, at the Faculty of Education of the University of São Paulo – FEUSP, based on partnerships with researchers from these institutions.

Figure 12 – Mathematics Club Colloquium



Source: Photo collection of the Unifesp Mathematics Club Project.

The colloquia constitute an important space for all participants to glimpse the totality of actions developed in the different schools, as well as some of the results related to the learning of teachers and students that has been achieved by the project. It has also allowed the socialization of experiences with other groups of researchers who use the same theoretical or methodological research foundation. In 2025, colleagues from the UTFPR Pedagogical Workshop participated in the Unifesp Mathematics Club Colloquium.

4.2 A gaze at the analysis of movement in the Unifesp Mathematics Club

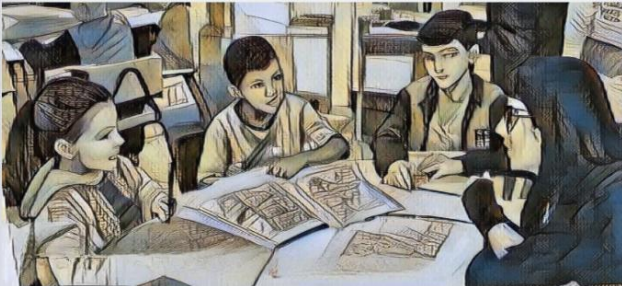
As we indicated earlier, the search for understanding the movement of formative processes that occur in the Unifesp Mathematics Club has been carried out through the multimodal analysis of human activity (Moretti; Radford, 2023).

The analysis process begins with the identification of so-called "salient segments," video excerpts that appear to contain evidence of the learning we intend to analyze (Radford, 2014, 2021). Next, we perform interpretive transcription (Radford, 2014) in three stages. In the first, we examine all speech and expressions comprehensively, without initial consideration of their contexts or intentions. In the second stage, the analysis is carried out in light of the theoretical framework and the research question, at which point the segments are organized into episodes (Moura, 2004). At this point, we place the temporal marker on the video, the transcription of the speech, the line numbering, and the interpretive comments (Zeferino, 2024). In the third stage, we insert the transcription of the dialogue sequence (Radford, 2014), including hesitations, pauses, gestures, and emotions, through a meticulous analysis of the video, carried out frame by frame.

In this section, we exemplify this form of analysis using excerpts from the collective research presented by Ribeiro et al (2025). In these excerpts, we follow the collective work of students in the Early Years of Elementary School solving the LTS called "*Chuva de Manga*" (2025), which problematizes the recognition of variable magnitudes and the first-degree functional relation, with an angular coefficient of three. In the salient segments that make up episodes 3 and 4, the semiotic means (such as speech, gestures, glances, and expressions...) are the corporeal marks that evidence the process of objectification of knowledge in the learning activity, in which the student thinks with their whole body (Radford, 2021).

Figure 13 – Episode 3: LTS The “*Chuva de Manga*” (2025)

Episode 3 (31'49" - 32'20")



Students and teacher collaboratively search for the solution to the same problem, adopting a common goal.

12 Helena: So it's three times two?

13 Teacher: If you do three times two, what will it be? I already have three times two here, right?

14 Diego: Nine!

15 Helena: Nine. Or it's two times three...

16 Diego: Nine.

17 Gilberto: Three times nine...?

18 Teacher: That's right, very good. How are you going to record it here?

Source: Ribeiro et al. (2025)

In the excerpt from Episode 3, the teacher's and students' dialogue indicates the mobilization of a functional relation among quantities. The children direct their gaze to the material and to the teacher, maintaining a posture of joint attention, demonstrating collective engagement. The analysis is not limited to the established dialogue, but also considers gestures, glances, and the participants' willingness to contribute to the collective work, highlighting the recognition of variable magnitudes and the functional relation that was emerging at that moment in the proposal.

Figure 14 – Episode 4: LTS The *Chuva de Manga* (2025)

Episode 4 (38'28" - 39'03")



The teacher presents different values for the total number of scraps, which reinforces the manifestation of a factual generalization among the group of students.

19 Teacher: Pay attention here, teacher. To use twenty-seven (19) scraps of fabric, you used nine rows, right? And to use thirty scraps... you said you would use ten rows... Right? And what if we had sixty scraps?

20 Helena: Sixty?

21 Teacher: That's it... How much would we use?

22 Diego: Twenty!

23 Teacher: Twenty... Twenty? How were we supposed to record that here?

24 Gilberto: Three times twenty?

25 Teacher: Very good!

Source: Ribeiro et al. (2025)

In the chosen segment of Episode 4, the teacher introduces new values, which causes a shift in the attention initially focused on the students. The teacher's mediation is expressed not only through speech but also through the way she guides the students' attention, whether by pointing to the record or by the intonation of her voice when emphasizing certain quantities. In the dialogue, expressions such as "twenty," "three times 20," and "sixty" appear, indicating an attempt to generalize the relation previously presented. The video analysis shows that the children follow this movement, responding promptly and maintaining focus on the discussion. The analysis as a whole reveals a movement of recognition of the relation between the magnitudes, albeit in a non-analytical way and supported by particular cases.

This proposed analysis shows that the production of meanings in collective activity does not occur only at the discursive level but emerges from the articulation between different semiotic means. In the excerpts presented, the researcher's perspective on the relation among speech, gestures, glances, and actions on the object allows us to understand how students collectively develop algebraic thinking through the recognition of variable quantities and functional relations.

5. Final Considerations

The Mathematics Club proposal reveals a unique way of organizing pedagogical activity based on the principles of the Teaching-Orienteering Activity, in the dialectical unity between the activity of the teacher and the students. In this context mediated by the intentional organization of teaching, the teaching work develops as a conscious and collective activity, favoring the articulation between theory and practice and the production of new forms of organizing mathematics teaching that are playful and motivating, committed to human development.

In line with this proposal, the current organization of the Unifesp Mathematics Club has been based on partnerships between researchers, graduate students, undergraduates, and teachers from the public education system, in a context of research, teacher training, and the organization of teaching that takes place around the collective processes of elaboration, development, and evaluation of Learning Trigger Situations designed for Elementary School students. In particular, we highlight in this text the actions of a research project focused on the development of algebraic thinking in the early years.

The reality in our historical, social, and geographical context means that the Club is organized into fronts that involve disciplines in the Pedagogy course, extension activities in schools, and collective research. As a result, over the years, we have expanded the presence in the mathematical training of teachers and students from the schools partnering with the project, the interest in the teaching and learning of mathematics, and the approach of Pedagogy students to research in this area. In line with research, the Unifesp Mathematics Club has disseminated its productions in events and journals, in addition to theses and dissertations. The identity of the Unifesp Mathematics Club, in addition to these areas mentioned, includes the organization into Activity Cycles and the multimodal semiotic analysis of human activity.

The Activity Cycle involves moments of study, planning, development, analysis, and evaluation that are not linear or watertight, but in them, the subjects revisit, rework, and produce new meanings about their actions in light of the needs that emerge in the collective activity. Teaching, learning, and research are articulated in a continuous and inseparable way, creating conditions for the development of the participants' theoretical thinking and for the collective production of knowledge about mathematics teaching.

Multimodal analysis has proven to be a powerful tool for understanding human activity in the context of research. In a concrete and dialectical way, it exposes movements and tensions that manifest themselves in different semiotic media, such as speech, gestures, glances, and actions, and that are not visible in analyses focused exclusively on discourse (oral or written). In this sense, this methodological approach to analysis contributes to the field of Mathematics Education by seeking to encompass the complexity of manifestations produced in pedagogical activity. Furthermore, it allows teachers and researchers to recognize the importance of considering the different semiotic resources produced by students when faced with mathematical problems.

It is important to point out that, although the results highlight the potential of the Mathematics Club as a formative and investigative space, challenges also arise related to the complexity of organizing collective work, the objective conditions of participation of the subjects, and the sustainability of these actions in institutional contexts marked by different demands and limitations. These factors indicate that the consolidation of proposals of this nature requires not only a consistent theoretical foundation, but also objective conditions that guarantee its continuity.

In times of reinforced individualism manifested in educational public policies that dehumanize teachers and students, the Mathematics Club is more than a space for learning mathematics. It constitutes a vital space for the production of collaborative, motivating and ethical ways of teaching and learning mathematics and, more broadly, of being human in collectivity.

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