

## Editorial

Saddo Ag Almouloud<sup>1</sup>

Universidade Federal do Pará

<https://orcid.org/0000-0002-8391-7054>

Ana Lucia Manrique<sup>2</sup>

Programa de Estudos Pós-graduados em Educação Matemática

Pontifícia Universidade Católica de São Paulo

<https://orcid.org/0000-0002-7642-0381>

The journal *Educação Matemática Pesquisa* publishes a new issue! This year, we are editing the issues of volume 23, sharing with our readers the results of scientific research in mathematics education. The articles published in this first issue of volume 23 disseminate results from scientific investigations of researchers from different regions of Brazil and other countries, revealing a plurality of national and international research groups and institutions.

We believe that the scientific debate that will be fostered by the sharing of these articles will contribute to the construction of new knowledge for the area of mathematics education. In addition, the articles published in this issue present a plurality of theoretical and methodological references that also strengthen scientific research in our area.

Volume 23.1 presents 28 articles dealing with state of knowledge and mapping, problem solving, ethnomathematics, mathematical modeling, assessment, history of mathematics education, teacher training, and teaching materials, considering different levels of teaching.

Below, we present briefly the texts that are part of this issue of our journal.

The first article, entitled *Perceptions of a group of basic education mathematics teachers in relation to the teaching strategy application of models*, is authored by Emerson Silva de Sousa, and Isabel Cristina Machado de Lara. The article aims to present perceptions of a group of basic education mathematics teachers in relation to the teaching strategy called

---

<sup>1</sup>, [saddoag@gmail.com](mailto:saddoag@gmail.com)

<sup>2</sup> [manrique@pucsp.br](mailto:manrique@pucsp.br)

application of models, in addition to highlighting their relationship with mathematical modelling in the educational context. The authors found that there is a relationship between the application of models and mathematical modelling, and this relationship can favour the practice of modelling in class.

The article *The teaching of probability in the mathematics teaching degree: considerations for an epistemological model of reference* is authored by José Luiz Cavalcante, Anna Paula Avelar Brito Lima, and Vladimir Lira Vêras Xavier de Andrade. The authors discuss a proposal for a reference epistemological model (REM) for teaching probability in a mathematics teaching degree. During the analysis, a proposal based on the epistemological, didactic, and psychological issues that involve the concept of probability in teacher education was built.

The third article, by Luciana Ferreira dos Santos and Rosinalda Aurora de Melo Teles, is entitled *Teachers' knowledge of geometry in the early years of elementary school: a state of the art*. The study considered the period from 2000 to 2019, and 31 studies at the master's and doctoral level were selected. The authors point out weaknesses in teachers' conceptual and practical geometry knowledge and discuss that the formative processes can enable changes in conceptual knowledge and educational practice based on the reflection of this practice and the construction of learning.

Rafaela Silva Rabelo is the author of the article *Transnational perspectives in the history of mathematics education: entanglements with the new education fellowship*. The author discusses cases of educators linked to the *new education fellowship* who published on the teaching of mathematics in the first half of the 20th century and mobilises the concept of networks to identify connections. The discussion articulates three axes (subjects, spaces, and artefacts) and highlights new research questions that emerge when considering the circulation of ideas/subjects/objects and its interlacing results.

The fifth article, *In search of understanding about learning objects in mathematics education through a systematic literature review*, is authored by Marcelo Souza Motta and Marco Aurélio Kalinke. The period considered in the study was from 2013 to 2018, and the authors used a systematic literature review as an inventory procedure. The results indicate teachers' possibility to build their own digital artefacts to adapt to their specific pedagogical contexts.

The article *Professional practice of teachers of the early years and algebraic thinking: contributions from continuing education*, by Miriam Criez Nobrega Ferreira, Alessandro J. Ribeiro and João Pedro da Ponte, presents an analysis of aspects of algebraic thinking from an exploratory teaching approach, taking into account the participation of teachers from the first years in continuing education. The results show that the teachers' actions when planning and conducting classes considered the phases of exploratory teaching and aspects of algebraic thinking.

The seventh article, authored by Alice Bohrer and Douglas da Silva Tinti, is entitled *Mapping of studies on the quadratic function in contexts of mathematics teaching and/or learning*. The authors explored research available at the Bank of Dissertations and Theses of the Coordination for the Improvement of Higher Education Personnel (CAPES), considering the period from 2013 to 2019 and the descriptor "Função Quadrática". As a result, the authors indicate that the qualitative approach predominates, that most of the investigations were carried out in the 1st grade of high school, and that the GeoGebra *software* was the most used teaching resource for research.

João Pedro Piccoli and Edvonete Souza de Alencar are the authors of the article entitled *Brazilian handbook for the second year of elementary school: the specialised knowledge of the teacher who teaches mathematics*. The research sought to identify how the textbook improves the specialised knowledge of the teacher who teaches mathematics and what his

methodological guidelines for teaching are. As a result, they point out that the knowledge of mathematics structure and the knowledge of mathematics teaching are the most outstanding ones.

The ninth article, *Engineer education: the vector concept in the curriculum of a civil engineering undergraduate course*, is authored by Viviane Roncaglio, Isabel Koltermann Battisti and Cátia Maria Nehring. The analysis was based on activity theory, and the methodological approach used is the discursive textual analysis. As a result, the authors point out that, in the mathematical context, a vector is treated as a free vector, in the context of physics or specific disciplines, a vector is mobilised through the vector quantity force, or else in calculations involving vector equations, which can be divided into two types, fixed vector and sliding vector.

The article *Mathematical modelling and computer programming: a possibility for the construction of knowledge in basic education*, written by Felipe José Rezende de Carvalho and Tiago Emanuel Klüber, presents the results of a research carried out with a group of high school students involved in a mathematical modelling activity that was to be explored and solved in a computer programming environment. As a result, the authors point out that the task of mathematical modelling guided the development of computational thinking in a dialogical environment, in which learning with others was valued based on the synergy between mathematical modelling and computer programming.

The eleventh article, by José Milton Lopes Pinheiro, César Osvaldo Vásquez Flores, Giovana Alves and Juscimar da Silva Araujo, is entitled *The movement and its implications in mathematics learning: a phenomenological look*. The authors seek to present comprehensions about how the perception of *movement* can direct thinking and contribute to mathematics learning. The analyses allowed the understanding that *movement* is related to a subject that moves and learning occurs in the movement-perception-knowledge unit.

Sarah S. dos Santos, Aleandra da S. Figueira-Sampaio and Eliane E.F. dos Santos are the authors of the article *Didactic-methodological strategies for teaching and learning Cartesian quadrants using GeoGebra*. The research was developed with middle school mathematics teachers (from 6th to 9th grade) from public schools, and the results show that the strategies used can add innumerable possibilities to the repository of mathematics teaching practices.

The thirteenth article, *From world-places to world-mathematics: Mr. João's world-mathematics- knowledge-place*, by Maria Carolina Machado Magnus and Silvio Domingos Mendes da Silva, aims to draw a parallel between the concepts of ethnomathematics and place. For the study, the discourses of a farmer about his practices in the field and his ways of dealing with them mathematically were considered. The authors conclude that when looking at practices of subjects in the field and understanding them from their ways of dealing mathematically with the world, the existence of different mathematical rationales is evidenced, which are intrinsically linked to culture, history, race, ethnicity, economy, diversity and heterogeneity of each people.

Cleide R.M. Arinos, José L.M. de Freitas and Mustapha Rachidi are the authors of the article *A semiotic and cognitive analysis of the learning of triangle and quadrilateral areas*. The purpose of the text is to analyse changes in representation and registration in the calculation of areas of triangles and quadrilaterals. The authors found that solving activities through heuristic exploration of figures, dimensional deconstruction, and non-iconic look, moving through different representations, favoured students to give different solutions. This approach also contributed to students overcoming difficulties and developing autonomy in geometry, providing an opportunity for a new way of learning, reasoning and, above all, looking at a geometric figure.

The fifteenth article, *Brazilian theses regarding the teaching of linear functions from the perspective of the theories of the didactics of mathematics*, by Suzana Domingues da Silva and Clélia Maria Ignatius Nogueira, aimed to carry out a bibliographic survey to identify studies that used some theory of didactics of mathematics as theoretical and/or methodological subsidies for the teaching and learning of the related function. The authors concluded that it was possible to identify the number of works that dealt with theories of mathematics didactics and how the teaching and learning of the related function were approached. Also, the analyses indicated that the theory of registers of semiotic representation was the most used in the masters' theses.

*The role of cooperation in collective problem solving processes* is the title of the article by Núbia Lúcia Cardoso Guimarães, Jéssica Adriane de Mello, Luciana Sandrini Rocha, Márcia Rodrigues Notare, and Marcus Vinícius de Azevedo Basso. In this article, the authors investigated the mechanisms through which cooperation helps solve problems and how it is done. As a result, they pointed out that cooperative work makes important contributions to solving problems, especially open-ended ones, not only as a product of the process but also in the cognitive and affective development of those involved.

The seventeenth article, *Statistical literacy in basic education: the challenges of teaching an in-context box-plot diagram*, is authored by Carolina Ribeiro de Almeida, Helenita de Jesus de Sousa, and Irene Mauricio Cazorla. They sought to analyse and reflect on the results of the implementation of a sequence of teaching statistics involving quantitative variables and the role of representation records in the transnumeration of raw data in the box-plot diagram. The authors concluded that the complexity of working with quantitative variables, the construction of the box diagram with real data in the classroom, and the strategies adopted contributed to understanding data and statistical concepts in context.

Paula Tamyris Moya and Silvia Pereira Gonzaga de Moraes are the authors of the article *Organisation of teaching the concept of number in the first year of schooling*. The authors sought to investigate the process of appropriating the concept of number by students who attended the first grade of elementary school. The authors assessed that in learning the concept of number, students initially performed actions based on the sensory perception of reality. After the intervention, the children began to understand that the essence of the concept of number does not exist without the relationships between discrete and continuous quantities.

The nineteenth article, *Mathematics in the community: an educational context for the social learning and development of algebraic thinking*, by Neura Maria De Rossi Giusti, and Claudia Lisete Oliveira Groenwald, investigated the integration and dissemination of mathematical knowledge in the community, based on an educational context for the socialisation of basic education concepts. The authors show that knowledge related to algebraic thinking offered difficulties in interpreting and understanding algebraic symbology, since operating with letters and other symbols requires knowledge of algebraic language to establish generalisations, analyses, and resolutions.

The article *Arguments presented by students of Calculus in an exploratory task*, by André Luis Trevisan and Eliane Maria de Oliveira Araman, sought to recognise mathematical concepts that were used by students of Differential and Integral Calculus in the elaboration of arguments when solving a task of exploratory nature involving graphic representations. The authors conclude that students mobilised some reasoning processes (identify a pattern, conjecture, compare, and justify) when elaborating the description of the function graph, using mathematical concepts such as function decrease, growth rate variation, concavity of a graph, and horizontal asymptote.

The twenty-first article, *Benefits and challenges of collaborative work in the teaching of mathematics in the Pedagogical Residency programme*, is authored by Irene Castro Pereira,

Paulo Vilhena da Silva, and Cristiane Ruiz Gomes. The authors investigated contributions and challenges of collaborative work within the scope of the Pedagogical Residency programme from the perceptions of one preceptor and three residents. They point out that the Pedagogical Residence contributes to new ideas for the teaching activities of the field school and reveals the difficulty of the actors in understanding their roles, considering that it is a new programme developed in Brazil.

*Evidence of 4<sup>th</sup>-grade student's learning about rational numbers involving the quotient meaning*, article by Grace Zaggia Utimura and Edda Curi, presents evidence of learning by students attending a 4<sup>th</sup>-grade class of elementary school about the meaning of quotient of rational numbers. The authors conclude that pictorial representation is the basis for solving activities with a quotient meaning and is used to represent what was proposed. Moreover, students worked with more than one representation at the same time and related them to the solution of the activity.

The twenty-third article, *Afro-Brazilian culture in ethnomatematics works: a systematic review of national academic research*, by Nickson Deyvis da Silva Correia, and Viviane de Oliveira Santos, presents a systematic review of the literature on the productions made in Brazil that deal with ethnomathematics in an Afro-Brazilian cultural context. The authors conclude that the selected investigations address life in a quilombola community, its handicrafts, African games, and the samba association.

The article *When fractions are not just part of a whole...!*, is written by Sofia Graça, João Pedro da Ponte, and António Guerreiro. The authors aimed to analyse the knowledge of 5<sup>th</sup>-grade students regarding the meanings of fractions before and after a teaching experience that follows an exploratory approach with an emphasis on problem solving. They conclude that after the teaching experience, the students showed some flexibility with all the meanings.



The twenty-fifth article, *Integrating financial and socioemotional education to discuss psychological pitfalls in financial decisions*, is authored by Luciene dos Santos Silva, and Diva Valério Novaes. The authors describe the development of a didactic sequence designed to present concepts of financial education and socio-emotional education to students in the first grade of high school. They conclude that the students showed that they perceived the main financial errors and acquired criticality in the economic aspects.

*A systematic review addressing Tangram, GeoGebra and options of the isometry of the plane*, article by Robério Pereira Rocha, and Maria Deusa Ferreira da Silva, mapped and analysed research published from 2015 to 2020, carried out at the basic education level on the use of Tangram, GeoGebra and plane isometry options in the teaching of mathematics. The authors indicate the importance of varying methodologies and using resources such as GeoGebra and Tangram to enhance mathematics teaching.

The twenty-seventh article, by Ousmane Alpha and Saddo Ag Almouloud, entitled *From proportions to proportionality: the crucial impact or hegemony of the rule of three*, brings a theoretical and documentary study with the results of a research on proportionality, based on ecological and praxeological approaches, carried out in textbooks and curricula of the Republic of Mali. The authors conclude that once the definition is mastered, by solving problems of proportionality and non-proportionality, it can be concentrated on tables, coefficients, additivity, and linear aspects.

And the last article, *Dissemination of the study of mathematical analysis and the repercussion of the work *Instituzioni Analitiche* by Maria Gaetana Agnesi*, by Maria Gaetana Agnesi, authored by Roseli Alves de Moura and Fumikazu Saito, presents some developments regarding the dissemination and repercussion of the work *Instituzioni Analytiche ad uso della gioventu italiana*, on the occasion of its publication in Milan, in 1748, and in the fifty years that followed, mainly due to the direction given by Agnesi, whose work was based on a

documentary analysis, based on the articulation of the epistemological, historiographic and contextual spheres. The authors present evidence that the author was interested in and committed to having her treaty publicised, which gave it extensive repercussion.