

# Abstracts Convidados – Math. Education - XII Summer Workshop

## Alcione Marques Fernandes

**Title of the Talk:** Mathematics and Art: dialogues under construction

**Short Abstract:** This lecture aims to present the initial research on the possibilities of intersection between mathematics and art as a way to combine the rational and logical learning of mathematics with the sensitive aspects of art. The research is being carried out based on a pertinent bibliographic reference based on the proposal of Herbert Read (2013) that points to the Platonic perspective that Education and Art must go hand in hand in order to allow the full development of sensitivity. In addition, the research proposal uses the historical approach of Mathematics and Art presented by Zaleski Filho (2013), going deeper into the work of the artist Piet Mondrian (1872-1944). As a specific objective in the construction of this dialogue between Mathematics and Art, there is a confluence with Ethnomathematics, through the work of Paulus Gerdes (2010) addressing the construction of drawings called “sonas” by the Cokwe people of Angola.

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## Alessandro Jacques Ribeiro

**Title of the Talk:** Developing mathematical knowledge for teaching algebra: an innovative approach for teacher education courses

**Short Abstract:** Recent literature indicates the need for research about the genesis of professional learning of mathematics teachers for teaching mathematics topics at school. In order to investigate this problem, we have been organizing teacher education courses focused on algebra, aiming to develop and expand teachers’ mathematical and didactical knowledge regarding school algebra. These courses have been carried out during ten to fifteen 4 hours weekly meetings, composed of moments of (i) individual work, (ii) work in small groups, and (iii) plenary collective discussions. The participants, pre-service and in-service mathematics teachers, developed hands-on activities, which were mediated by tasks elaborated by teacher educators. The main goal of the research is to understand how the professional learning of the mathematics teacher to teaching school algebra is developed. These courses are innovative, first, because it creates opportunities for teachers to learn from each other, thus breaking the traditional isolation of their work and expanding their opportunities to learn collectively; second, because it allows teachers to experience an exploratory learning environment built from classroom practice and mediated by (i) professional learning tasks, (ii) collective mathematical discussions, and (iii) the role and actions of the teacher educator. The theoretical

framework is supported by the concept of didactical knowledge, and from a methodological point of view, this research follows a qualitative-interpretive perspective, through design-based research (DBR). Data are collected using participant observation with audio and video recording and document collection. The results show teachers (i) reorganizing their knowledge of algebraic concepts (e.g. functions) and expanding their capacity of representing and articulating different forms of representing these concepts; (ii) deepening their reflection about difficulties that the students find, for example, with the concept of a function and about teaching resources and strategies to overcome those difficulties; and (iii) being aware of their own difficulties regarding the concept of a variable, what could implicate the recognition of patterns and regularities and the formulation of algebraic expressions to represent complex mathematical sequences. We expect that this research will contribute to mathematics education by (i) favoring the presence and interlocution of practice as an essential component in teachers' mathematical and didactical knowledge to teaching algebra and (ii) rethinking approaches for teacher education courses.

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## **Aluska Dias Ramos de Macedo Silva**

**Title of the Talk:** Contributions of Lesson Study and Didactical Engineering for the Education and Professional Development of Preservice Math Teachers

**Short Abstract:** This project is a research proposal that is being developed in the doctorate and has as general objective to analyse the contributions between elements of Lesson Study and Didactical Engineering (MIYAKAWA; WINSLØW, 2009), adapted to the Brazilian institutional context, to foster the professional development of teacher education in relation to the field of Quantities and Measures (LIMA; BELLEMAIN, 2010). Didactical engineering (DE) (ARTIGUE, 1994) is a methodology for experimental research in mathematics education, with a strong root and base in the Theory of Didactic Situations (BROUSSEAU, 1997). Collaborative LS has been achieving positive results in several places in the world, and involves three to four phases: lesson planning, research-lesson, reflect phase, and in some cases the revision of the lesson plan (BAPTISTA et al., 2012). It can be used with teachers and/or pre-service teachers. Then, the field of Quantities and Measures was chosen for its potential to connect with social practices, other Mathematics contents as well as with other disciplines. Some results will also be presented.

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## **Ana Cristina Ferreira**

**Title of the Talk:** Inclusive Mathematics Education and professional development: building school-university partnerships

**Short Abstract:** Inclusive mathematics education acknowledges human diversity and involves supporting the diverse learning needs of all students in general mathematics classrooms. But, in the teacher education rarely opportunities exist for the understanding and development of the inclusive mathematical practices. I describe here some projects that intend create a school-university partnership in which teachers, future

teachers and researchers together build alternatives and teaching proposals aimed at a mathematical education that includes everyone.

### **Berlane Silva Martins**

**Title of the Talk:** Ethnomathematics in the School Curriculum

**Short Abstract:** From the socio-historical-cultural, theoretical-philosophical and political-educational perspectives of the Program Ethnomathematics an analysis of Basic Education Curricula of Public Schools in the Federal District – High School stage, from 2000 to 2018, is performed. Using the dimensions of Program Ethnomathematics as investigative object and the concepts of *Curriculum Trivium* to inform characteristics and contributions of the epistemological-cognitive conception of this Program to the Curricular Proposals of Public Schools in the Federal District.

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### **Brigitte Lutz-Westphal & Raquel Carneiro Dörr**

#### **Minicourse**

**Title:** Exploring Mathematics through dialogic and investigatory learning

**Short Abstract:** Mathematics can be an exciting and mind-opening topic in the classroom. The concepts of Dialogic and Investigatory Learning enable teachers to create mathematical activities in which the students could get in touch with specific mathematical thinking and problem solving. In the workshop we will present some theoretical framework related to the theme and give practical examples for different education levels.

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## **Carl Emanuel Bach Winsløw**

### **Plenary**

**Title of the Talk:** Lesson Study as a Paradidactic Infrastructure for Development of Mathematics Teacher Knowledge

**Short Abstract:** Lesson Study is a format for teachers work outside the classroom which originated in Japan, in which a group of teachers, often guided by a university researcher, designs and experiments a “research lesson” in view of gaining knowledge about the teaching of a specific mathematical subject, as well as on more general aspects of teaching. It has since been transposed to other countries. In my talk, after a general introduction to the nature and characteristics of this format, I will report on results from research on cases from Japan, Denmark and Brazil, drawing on joint works with T. Miyakawa, J. Bahn and A. Dias, respectively

## **Carlos Miguel da Silva Ribeiro**

**Title of the Talk:** Mathematics Teachers Interpretative Knowledge and its specificities for teaching – a need for a change of focus in teacher education

**Short Abstract:** Mathematics teachers' Education (teachers initial and continuous training) needs to focus on the particularities of teachers practices when compared with others that use mathematics as a resource (e.g., engineers). In that sense there is the need for specific focus of attention when discussing the mathematical topics in order to contribute for the development of teachers knowledge related with the work of teaching they are expected to perform. Such mathematical knowledge – which is considered Specialized – grounds the knowledge that will allow them to effectively have the students own reasoning, knowledge and abilities as a starting point for the mathematical discussions to occur in the classroom. Such knowledge is termed Interpretative Knowledge. Grounded in some examples from school mathematics I will discuss the specialized nature of such Interpretative Knowledge and some dimensions of its relationship with the more advanced mathematical knowledge typically discussed at a more “advanced” level but usually without connections with the future teachers mathematical practices. Such discussion aims at problematize also our own knowledge as teacher educators (including all of us who teach some courses in the degree to become mathematics teachers) and the need for a change of focus in teacher education and in our own practices as teacher Educators.

## **Cleyton Hércules Gontijo & Mateus Gianni Fonseca**

**Title of the Talk:** Critical and creative thinking in mathematics: a concept under construction in the Brazilian context

**Short Abstract:** The development of critical and creative thinking is increasingly emphasized on the international stage as a necessary skill for the 21st century. In Brazil, this subject is still something new. Based on the literature review, the Brazilian curriculum standards and the results of some empirical research, we will present a theoretical framework related to critical and creative thinking and ways to stimulate this type of thinking in the field of mathematics.

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## **Dario Fiorentini, Regina da Silva Pina Neves & Janaína M. Pereira da Silva**

**Title of the Talk:** The Lesson Study (LS) in mathematics licentiate degree: initial studies at the University of Brasilia (UnB)

**Short Abstract:** The Mathematics Licentiate Degree, in Brazil, coexist, on the one hand, with the lack of perspectives for the teaching career due to the pauperization, prevarication and proletarianization of the teaching work and, on the other hand, with the classic dichotomy between disciplinary knowledge and pedagogical knowledge, in the training processes. Facing historical adversities in the formation of the Mathematics Licentiate Degree of UnB, and in search for knowledge and dialogues in favor of its (re)construction and, consequently, of its practice of training mathematics teachers. The learnings coming from the Institutional Program of Teaching Initiation

Scholarships (PIBID/Mat/UnB) through the construction of Mathematics Learning Notebooks and the studies in Hybrid LS (HLS) on professional development of teachers and/or future teachers collective training constructs motivated us in the development of the current study. Thus, the objective is to understand the training processes and the learning for the teaching of mathematics licentiate undergraduate when coursing the discipline of Supervised Internship in Middle School (MS), having as methodology the glocal LS. To this end, twelve undergraduate licentiate, two training professors of UnB, two mathematics teachers of Secretary of State for Education of the Federal District (SEEDF), one Federal Public School teacher and two private school teachers, composed, by consensus, four subgroups for studies and completion of a HLS cycle. The curricular topics worked embraced a significant part of Middle School from sixth to ninth grade, ranging from equivalent fractions to trigonometry in the right triangle. All performed the following actions: choice of curricular topic, studies, initial planning, collective planning, teaching among the undergraduate licentiate, class analysis, (re)planning for teaching with the students from MS, teaching with the students of MS, class analysis, critical discussion of the classes and produce narrative analysis. The actions were documented through written register, audio recording and video recording of the work meetings at both school and university. For the recording, we had the technical support of professionals of the area, what allowed the team to dedicate themselves fully to the pedagogical actions. As partial results, we observed: 1/ the widening of the dialogue among all the participants in the planning, analysis and (re)elaboration of classes; 2/ the production of oral reports by all involved about theoretical and methodological aspects observed during the classes; 3/ the expansion of studies in mathematics teaching, especially, on the National Curriculum Common Core (BNCC) and the conceptual domains in focus; 4/ difficulties in defining the role of the observer during classes; 5/ preference for oral reports to written narratives, among other aspects. In addition, in both subgroups, the identification by some undergraduate licentiate of different mathematics reasoning among the students stands out, and the differentiation between mathematical and didactic pedagogical objective in the context of developed tasks. As difficulties, were identified: the inexperience of the group in collective actions; the specificities of constructing investigative tasks in the curricular topics in focus and the mediation of specific conceptual demands of MS students.

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## **Edda Curi**

**Title of the Talk:** Lesson Study: Contributions to Teacher Education

**Short Abstract:** The text deals with the contributions and challenges of using the Lesson Study in the Brazilian teachers' setting. It reflects on the main stages of this methodology, and how it has been adequate in the development of teacher training projects, according to the specificities of each project. It discusses the possibilities of using this methodology at the micro level, but argues about possibilities of use at the macro level.

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## **Eliane Matesco Cristovão**

**Title of the Talk:** Reflections on the teaching of mathematics in the context of interdisciplinary projects

**Short Abstract:** For 20 years I worked as a mathematics teacher and sought to innovate through the use of technologies, investigative classes and various manipulative materials. In 2005 I also started to work on teacher training. At the Federal University of Itajubá, since 2013, I have been coordinating projects for the Teaching Initiation Scholarship Program (PIBID) and Pedagogical Residence (PRP), in addition to



coordinating an Interdisciplinary Studies and Teacher Training Group (GEIFOP). In 2017 I also got involved with an Interdisciplinary Teaching Practice for the four university degrees, in which we approach the concept of interdisciplinarity (LAVAQUI; BATISTA, 2007) and some approaches. The programs, the discipline and the group bring together trainers from different areas, teachers of basic education and undergraduate students interested in discussing and developing innovative projects, of an interdisciplinary nature, to be developed at primary and secondary level. Realizing the wealth of projects developed in these areas, I have sought to investigate (CRISTOVÃO et. Al, 2018, CRISTOVÃO, 2019) the potential and limits of mathematics teaching in this context. In this presentation I will highlight two projects, one involving Mathematics and Dance (SANTOS, 2019) and the other Photography and Mathematics (in progress). Both were developed under the PRP, with support from Geifop.

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### **Fredy Enrique González**

**Title of the Talk:** Sources of Information in Research on the History of Mathematical Education: A Pentadimensional Approach

**Short Abstract:** In the present work, reflections related to the five dimensions about Mathematics Education Research: Ontological (What is called Historical Sources?). Epistemological (What is the relationship that the historian of Mathematics Education establishes with its sources as evidences that support their claims, working hypotheses, conjectures, conclusions, etc.? Teleological (What is the purpose of having sources of reliable information in the studies of History of Mathematical Education?); Axiological (What is the value that should be attributed to the sources of information in the studies of History of Mathematical Education?) And Methodological (What strategies are suitable to form Corpus -based on reliable sources of information- in the research on the History of Mathematics Education? What are the most appropriate techniques for analyzing content of research sources in research on History of Mathematics Education?)

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## Jhone Caldeira Silva

**Title of the Talk:** Reflections on Mathematics PIBID: its potentialities and its challenges in face of teachers formation

**Short Abstract:** The basic formation of math teachers and their teaching practice has uneasy the community of mathematical educators and has been widely investigated, generating substantial debates and many publications. In D'Ambrósio (1993), Fiorentini and Cristovão (2006), Ponte, Quaresma and Branco (2012) we found examples of studies on this movement that contribute to the understanding the possibilities, difficulties and challenges related to this formation. In this sense, programs as PIBID are initiatives for the improvement and the valorization of training of basic education teachers. The subproject "PIBID Matemática Goiânia-UFG" is developing collective, theoretical and practical actions that improve formative experiences for the graduates and others involved people, based on the dialogue and permanent exchange between graduates, teachers and schools students. Our actions promote the effective and intense contact of graduates with the school reality and its specificities, and the expansion and consolidation of mechanisms and competencies inherent to the performance and training of math teachers. On the one hand, the subproject is characterized as a single opportunity for the formation of new teachers (graduates), besides for the continuing education of school teachers and undergraduate teachers (tutors); on the other, promotes the development of spaces for active reflection and upgrading of teaching practice, culminating in the awakening of school students to enjoy math and understand that it interacts with their lives. In view of this, we propose some reflections, which refer to: i) the need to promote formative actions for the insertion of graduates in the school environment parallel to their theoretical-practical formation in the university; (ii) the possibilities and potentialities of investigative practices; iii) the maintenance of projects like PIBID and the survival of these in face of the limitations faced.

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## **Jorge Cássio Costa Nóbriga**

### **Minicourse**

**Title:** Responding to some “mathematical whys” through Dynamic Mathematical Demonstration

**Short Abstract:** Mathematical proof is essential to the mathematical understanding process. In general, in Basic Education, although textbooks contain mathematical proofs and suggestions for formula deductions, they are still little used by teachers. Perhaps because for them the evidence of understanding is more related to the ability to solve exercises or problems, using mathematical properties. In that case, students may find it sufficient to memorize the formula or property in order to solve the problems. In many cases, failure to understand the deduction or demonstration process may lead the student to not know how it applies to properties or theorems. In this sense, the objective of the mini-course is to explore Dynamic Mathematical Demonstrations (NÓBRIGA, 2019) to explain some “mathematical whys”.

**Keywords:** GeoGebra, Dynamic Mathematical Demonstrations

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## **Josinalva Estacio Menezes & Antônio Luís Oliveira Batista**

### **Minicourse**

**Title:** The SAIAM method of mathematical applications: multiplication, percentage, potentiation and division

**Short Abstract:** The SAIAM MATHEMATIC APPLICATIONS method is a method of building tables that was created and developed by a self-taught scholar and researcher

author of this work. This method was designed to enable an individual to learn, more briefly, from the 3rd and 4th years of elementary school, the operations of multiplication, division, potentiation. Still based on the construction of tables, the method also works as an auxiliary tool to solve problems with these operations, percentage, positive integers and decimals. The table-building method is considered to differ for the better from the traditional one by having only 32 characters, two operators and an algorithm while the traditional one has 270 characters, which can make your learning traumatic. In this work, we will show how the method works, its advantages and the results of the research done so far about it. Motivating results will also be presented, such as the possibility of reducing the time required for learning the cited content and the positive responses of those who participated in previous research, ie children and teachers. We will also present some examples of building tables and also some resolutions of the operations and applications mentioned.

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## Maria Célia Leme da Silva

### Minicourse

**Title:** School Geometry For Elementary Course: Knowing The Past, Reflecting On The Present

**Short Abstract:** The workshop aims to present and discuss tasks adapted from manuals for teaching geometry in the early years (which were the subject of research for the production of a history of school geometry) over the years. Different authors, with different backgrounds and from several countries, developed and produced textbooks in order to drift apart from the formal approach of Euclidean Geometry, searching to elaborate an intuitive and experimental geometry to lead teachers in their pedagogical practices. For this workshop, four manuals were selected, two from the 19th century and two from the early 20th century to analyze different approaches and proposals for teaching a particular topic: the square. Participants are invited to solve the proposed exercises (adaptations of the textbooks in question) and to analyze the pertinence or not of inserting such tasks in their classrooms. The teachers are supposed to make a reflexion about the creation and reformulation of knowledge in schools over the years, due to the pedagogical movements that circulate internationally. Reflecting on the past allows that teachers have a more critical overview of the current reality.

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### **Marli Duffles Donato Moreira**

**Title of the Talk:** CINEMAT: mathematics through cinema lenses

**Short Abstract:** This communication aims to foster a reflection on the cinema's potential as an instrument of mediation for a mathematical enculturation of the 21st century youth. We present our findings regarding the research project *CINEMAT: mathematics through cinema lenses* which has been taking place at Federal University of Viçosa involving undergraduate students. The project is based on the Theory of Activity (1978) which sustains that learning happens through actions and interactions within a given culture. Real world activity is the means by which man develops his psychic abilities. The development of individuals' abilities and skills happens through the appropriation of the historical-cultural legacy of the preceding generations, through a social and communicative process, mediated by relations with others. Mathematics occupies a prominent place in human history and culture and, this way, mathematical learning becomes a necessity for the full exercise of citizenship in our days (Moreira, 2016). On the other hand, Bishop (1991) argues that mathematics is a cultural phenomenon that transcends the boundaries of society analogously to music or sport. In this sense, cinema allows us to use image for a historical, sociocultural and personal reconstruction of mathematical objects. Audiovisual language favors the approach of mathematical knowledge while culture portrays its social function. It enables the comprehension of societies through expressions and it creates a track record for the posterity of their social practices, modes of thinking, values, symbols, feelings, behaviors, tendencies, expectations and fears (Carvalho, 1998). Cinema acts as a mediating instrument for a mathematical enculturation of students by stimulating positive attitudes on mathematics, making learning more dynamic, interesting and attractive. Some selected films were exhibited. Each session was followed by discussion dynamics about the mathematical and cultural strategies covered in the film. As sources of data, questionnaires were answered by participants. Results indicate that cinema favors the appropriation of mathematical objects and a perception of mathematics as part of human culture.

**Keywords:** cinema; mathematical enculturation; theory of activity.

### **Sérgio Carrazedo Dantas**

**Minicourse**

**Title:** Technology to Learn Study Teach Apply Mathematics

**Short Abstract:** In this lecture I present some possibilities of using technology in Mathematics Education. I approach the solving of real problems presented in papers and textbooks in which I use GeoGebra and/or Scratch. In resolutions are mobilized arithmetical, algebraic and geometrical knowledge, exploring ways of mathematical and computational thinking based on what is proposed in the problems' statements. In addition, I propose a way of using GeoGebra/Scratch to unfold the problems addressed into more complex ones.

### **Ulisses Dias da Silva**

**Title of the Talk:** Active Methodologies in Mathematics Class: theoretical and methodological aspects

**Short Abstract:** The rapid technical and technological development has raised questions on the role and importance of the school, as well as teacher in this “new context” of “ultra-connected society”. Contrary to what it may seem, recent research shows that the relevance of the teaching professional has been increasing, precisely because the teacher has a multiplicity of specialized knowledge that are necessary for quality pedagogical results. The question then is not the importance of the school and the teacher, but to understand how it can be provided in the continuous teaching professional development to work in the context of permanent change. In this workshop, we will work with two teaching methodologies: specialized groups with rotation of stations, developed by the author, and project-based learning. In both cases, we will address the potentials and limitations of these methodologies, based on the reflections provided by their application with the group.

### **Minicourse**

**Title of the Talk:** Mathematics for life

**Short Abstract:** “But teacher, what am I going to use this for in my life?” You probably have heard, or asked, this question. Truth is that this often has no easy answer. In this workshop, we will work specifically with High School content that are considered by students to be hard and show why these themes are part of basic education, how they can be fundamental for scientific/citizen formation and how they are applied in academic and professional contexts. With this, we want to help the participants to understand the importance of mathematics in their lives, making them autonomous in the search for these answers and authors to share questions, hypothesis and their own answers to the initial questions.

### **Victor Augusto Giraldo**

**Title of the Talk:** Teachers Education to Teach Mathematics from a Decolonial Perspective

**Short Abstract:** In recent decades, several Latin American authors in the field of social and human sciences have referred to coloniality as a pattern of power that emerged and survives from modern colonialism, operating through the naturalization of racial and social dichotomies and hierarchies, on three interconnected axes: power, knowledge and being. Decoloniality then emerges as an epistemological and political position that shapes postures and projects of resistance, transgression, intervention and insurgency against coloniality. In this talk, I propose some reflections on how this decolonial perspective can contribute to push the debate on teachers' education, in particular teachers who teach mathematics, to a political terrain, seeking to reveal traces and effects of colonial relationships that are mobilized within contexts of teachers' education and practices. In particular, I highlight three intertwined dimensions for this discussion: relational, ideational, material and cultural references; intersubjective relationships and micro-politics; methodologies and epistemologies.

**Minicourse**

**Title:** Towards a Teachers Pre-Service Education Built from within the Profession

**Short Abstract:** In this workshop, I present and discuss some curricular components from an institutional policy currently conducted at the Federal University of Rio de Janeiro (UFRJ), designed for pre-service mathematics teachers' education at undergraduate level, from a conception of teachers' education as a professional education. This conception is grounded on a political stance of teaching at school level as a professional activity, with its specific knowledge and practices, which must be integrated with but cannot be subordinated to academic mathematics knowledge and practices. Therefore, undergraduate teachers' education is regarded as a professional education, in which knowledge emerging from practice is formally incorporated, and above which school teachers' authority is formally acknowledged.