Abstracts for poster presentations

Monday July 14

17:30-18:00: Poster presentations in five parallel sessions,

Room A200

Miglena Asenova and Giorgio Bolondi: *Title and abstract follow shortly*

Room A210

Davidson Paulo Azevedo Oliveira, Milton Rosa and Marger da Conceição Ventura Viana (Brazil): *The Contributions of Funds of Knowledge and Culturally Relevant Pedagogy as methodologies for the Development of Sociocultural Perspective of History of Mathematics in Mathematics Classrooms*

This study is grounded in the Sociocultural Perspective of History of Mathematics, Funds of Knowledge (FoK), and Culturally Relevant Pedagogy (CRP) theories. It was conducted with the purpose of seeking contributions to activities based on gaining insight into parts of students' culture, specifically, their FoK. The other purpose is to understand the role of History of Mathematics (HM) that can help teachers to comprehend students' questioning and reasoning about mathematics. The population was composed of 72 students from two classes in a first year of a technical course in a public technical high school in Ouro Preto in the state of Minas Gerais, Brazil. The researcher collected information that could answer the research question: *What are some of possible contributions that activities based on students' funds of knowledge and anchored in sociocultural perspective of History of Mathematics can bring to teaching and learning functions through the use of Culturally Relevant Pedagogy approach?* Two questionnaires, two focus groups, field notes, interviews and informal conversations with participants, and three documental records containing mathematics activities related to *functions* content were used. HM was applied in both implicit and explicit ways, which served as an orientation guide so that the researcher-teacher could develop the proposed activities by applying the FoK of participants, which helped in the analyses of the students way of represent and/or write functions concepts. We highlight the use of History of Mathematics in high school context in explicit and implicit ways. The implicit way let the teacher-researcher guide some activities and understand some of students' answers. On the other hand, the explicit way was used as problems taken from historyto be worked out by the students.It was found that the acquisition of mathematical knowledge and algebraic symbolic language in the classroom is related to students' cultural experiences. This approach allowed us to use some propositions of CRP, which is defined as a critical pedagogy that is committed to collectivity and is based on a tripod composed by critical awareness, cultural competence, and academic success. For data collection, analysis, and interpretation of qualitative and quantitative data, a mixed methods study *QUAN + QUAL* and content analysis were used. Data were collected and analyzed concurrently in all phases of thestudy. Thereafter, the results were analyzed, discussed, and interpreted in order to be addressed as part of the research. The interpretation of the results showed that the majority of participants learned and improved their knowledge in relation to

symbolic algebraic notation by highlighting the importance of rhetoric stage of algebra in order to understandsymbolism and academic development of symbolic algebraic language. Besides that, we drew attention to the fact that History of Mathematics used in explicit way cannot be applied as a teaching methodology for high school teachers in all mathematical content. However, it can be used in an implicit way to help teachers to understand students' reasoning even though the sociocultural context is very important in this understanding.

Julio Corrêa (Brazil/Denmark): *Mathematics, education and war*

In this work we present some ideas related to a PhD project started in 2011 where we try to problematize some relations between mathematics, education and war. More precisely we have been trying to understand the modifications in the field of mathematics education in the context of Cold War. Here we try to problematize the enigmatic phrase of Jean Dieudonné: "Euclid must go!". For a long period in the history of mankind the Euclidian geometry played an important role not only in the warfare, but at the schools and in science in general. So, why, in a context where the "Western" headed by United States seemed to be losing the conflict capitalism versus communism, Euclid must go? Tracing some relations between the development of disciplines as Operational Research, Game Theory, Linear Programing, the emergence of computer sciences and the structuralist mathematics proposed by the Bourbaki group, we shall enlighten the so called "modern mathematics movement" and its relation with the Cold War. Apparently there is no explanation available for the demise of Euclidian geometry and the predominance of "New Math" solely in terms of mathematics neither in terms of society neither of mathematics education, then we need to look for fields of human activities and its relations to explain this event. Based on a post-structuralist theoretical approach, mainly on the works of the "second" Wittgenstein, Jacques Derrida and Michel Foucault, we try to develop a *grammatical deconstructive therapy* of mathematics, education and war in the specified context. We believe that such kind of historic-philosophical problematization could help teachers to understand the relations between the field of mathematics and other fields of human activity which may help them to show to students the role of mathematics in different contexts of socio-cultural practices.

Room A212

Michela Maschietto (Italy): *From history to primary classrooms with B. Pascal: approaching place value and arithmetical operations with pascaline and e-pascaline*

Le poster concerne des expérimentations didactiques centrées sur l'utilisation d'artefacts matériels et virtuels dans la construction de significations mathématiques à l'école primaire (Bartolini Bussi & Mariotti 2008), suivant la méthodologie du laboratoire de mathématiques (Maschietto & Martignone 2008). En particulier, ce poster présente l'utilisation d'une machine arithmétique (Zero+1), construite en plastique à fonctionnement mécanique, et sa version numérique. Ces machines évoquent la fameuse machine Pascaline réalisée par Blaise Pascal. Pour cette raison, elles ont été nommées respectivement pascaline et e-pascaline.
La machine matérielle (Maschietto 2013) a été utilisée dans des classes d'école élémentaire et du début de l'enseignement secondaire pour travailler: l'approche récursive aux nombres naturels, l'écriture en notation positionnelle décimale, les opérations arithmétiques et quelques propriétés des nombres naturels. L'introduction de la pascaline dans les classes permet aussi de traiter la

figure de Blaise Pascal and l'histoire des machines à calculer. Par exemple, des sélections de la lettre de présentation de la machine écrite par Pascal ont être proposées à la lecture collective des élèves.
À partir de l'objet matérielle, nous avons réalisé sa contrepartie numérique dans le cadre du Projet français Mallette de l'IFé-ENS de Lyon (http://educmath.ens-lyon.fr/Educmath/recherche/equipes-associees/mallette/mallette-lyon/mallette). Avec la e-pascaline, nous avons conçu des cahiers informatiques dans l'environnement Cabri Elem (Maschietto & Soury-Lavergne, online first). Dans notre perspective, la pascaline et la e-pascaline sont étudiées en termes of duo d'artefacts, nous permettant d'une part de questionner les relations entre les deux types d'artefacts du point de vue de l'apprentissage des mathématiques, d'autre part de répondre à des demandes institutionnels de ressources pour l'enseignement des mathématiques.
Les données des premières expérimentations avec le duo d'artefacts seront inclus dans le poster. Des exemplaires de la pascaline accompagneront le poster.

Références

Bartolini Bussi M. G., Mariotti, M. A. (2008) Semiotic mediation in the mathematics classroom: Artifacts and signs after a Vygotskian perspective. In English L. (Ed.), *Handbook of International research in mathematics education* (2nd ed., pp. 746-783). NY: Routledge.
Maschietto, M. (2013). Systems of Instruments for Place Value and Arithmetical Operations: an Exploratory Study with the Pascaline. *Education, 3*(4), 221-230.
Maschietto, M. & Soury-Lavergne, S. (online first). Designing a duo of material and digital artifacts: the pascaline and Cabri Elem e-books in primary school mathematics. *ZDM The International Journal on Mathematics Education.*

Room A214

Leticia del Rocío Pardo-Mota and Alejandro Rosas-Mendoza (Mexico): ***Math for Special Education.***

In this poster we address a brief chronology of schools and colleges in Mexico that included mathematics courses aimed at the student population with disabilities.

Towards 1809, 1821 and 1830 were opened some private educational programs for deaf education. Eduardo Adolfo Huett Merlo on February 14, 1867 founded the Municipal School of Deaf in Mexico City and classes began in March 1867 with 12 students, but at the beginning only studied grammar and writing. On November 28, 1867, President Benito Juarez transformed it in the National School of Deaf. It had two areas, the first one is an elementary school for the deaf (they learn arithmetic) and a normal school for teachers who teach deaf.
On March 24, 1870 Ignacio Trigueros y Antigua achieved the creation of the National School for the Blind. Between December 1st, 1890 and March 3rd, 1891, the National Congress for Public Education concluded that it is necessary to increase the number of special schools that were aimed at education of the blind, deaf and young offenders. This point became more relevant after the Law of Basic Education on August 15th, 1908.
In 1915 was founded in the city of Guanajuato the first school to serve children with mental deficiency, subsequently it diversified its services to children and youth with different disabilities.
In January 1925 the government founded the Department of Psychology and School Hygiene in order to investigate and learn the mental development of Mexican children who had school delay (learning problems). This institution starts the application of tests to measure intelligence and

determine who can learn and who cannot. It created a classification for "abnormal children" with six divisions: children with language disorders, children "hard of hearing", visually impaired children, locomotor disabled children, children with epilepsy and children with tuberculosis.
Towards 1940 officials began with the idea that schools for "physically or mentally abnormal children" should provide in short cycles, a curricula including general knowledge, programs, teaching methods and particular organization.
The poster will include pictures and related information from those periods of time.

Room A104

Zhu Liu (China): *Genetic approach to teaching derivative*

Calculus is the main mathematical subject taught in both senior high school and university. However, the teaching of the concept of calculus is universally difficult. A historical and epistemological analysis of calculus is a way to reveal some possible sources of students' difficulties as well as an inspiration in the design of activities for students. Otto Toeplitz first summarized and elucidated calculus of the history of mathematics as an organic evolution of ideas beginning with the discoveries of Greek scholars and developing through the centuries in his book< The Calculus: A Genetic Approach>. The genetic approach to teaching and learning is that a subject is studied only after one has been motivated enough to do so, and learned only at the right time in one's mental development.
The problem of the tangent line is one of the most important problems which lead to the birth of calculus. Through an questionnaire survey conducted to 332 students, we concluded that there are historical parallelism between the students' understanding and that of the ancient Greek mathematicians. On the base of historical and epistemological analysis of the concepts of derivative, we design a teaching instruction by integrating history of the birth of calculus, such as problems of light reflection, curve movement. Based on the reconstructed history, The Cyclotomic Rule by Liuhui is introduced to construct a bridge connecting the static and dynamic concept of the tangent, enabling students to pass from the finity to infinity naturally and successfully. It is revealed through interview and a questionnaire survey that the genetic approach to teaching derivative in conducible to better understanding of the concepts of derivative.

Laurence Kirby: *Title and abstract follow shortly*