

[Panel Session]

Aiming at Education for All in Brazil: quantitative and qualitative perspectives

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The main purpose of this short talk is to contribute to the discussion of the theme Promotion of Education for All, especially from the viewpoint of Teacher Education.

It has been remarkable in last decades the phenomenon of globalization of the world making much more visible the contrasts as well as the issues of common interest in education problems especially in Mathematics Education. Mathematics is one fundamental part of school curriculum in all countries so the contemporary world of fast communication invites to develop international collaborations beyond the frontiers of geographic, cultural, economic, language levels in order to broaden the knowledge about this research area as well as to amplify the efficient teaching and learning methodologies.

I first introduce the characteristics of Brazil, because in order to understand the world educational issues going beyond the knowledge about small local and familiar environments, one must look at the quantitative and qualitative scale of other countries that would lead to finding the common grounds of educational issues.

In this talk, I will display how the influence of Lesson Study principles in Problem Solving Lessons and Singapore Mathematics bar model are contributing to a Brazilian Project of Professional Development for Lower Secondary Mathematics school- teachers. This project helps teachers to overcome the difficulty of paradigm change in teaching style, deepening the understanding about the role of teacher in the dynamics of participative learning and the improvement of quality assessment. Other initiative is Master Program especially designed for in-service teachers.

Brazil is a continental size country in South America (8.5 million km²), being a colony of Portugal starting 1500, so its young history is quite different from of old countries like Japan. The massive immigration in 19th and 20th centuries from Europe and Japan after the end of slavery system contributed to extensive diversity of Brazilian population from North to South, economic as well as ethnic and culturally. Brazil has a rich environment as different as Amazonian tropical region to arid Northeastern region and Industrial and agriculturally developed Southern region in which the Metropolitan area of São Paulo is larger than Tokyo.

The growth of population in Brazil is a big challenge for any government, for in 30 years it has doubled, from 93 million in the decade of 70's to 190 million in 2000. Currently it is around 200 million. Since the development and the prosperity of a country depend strongly on the education level of its population, it is a duty of every governmental administration to rule a policy to offer Quality Education for All.

The establishment of Educational Regulations to make the Fundamental Schooling (1 to 9 grades, 6 to 14 years old) mandatory 25 years ago was the start of the struggle to achieve the goal of young generation with literacy in language and mathematics. Before 80's the school education was a privilege of few.

In the recent education census of 2011, one sees that about 92% of children of ages 6 to 14 years old was enrolled in the school system, still having more than 5 million out of the classrooms. It sounds that quantitatively the picture is not that bad. However, the school dropping and functional analphabetism is huge educational problem reflected in the poor result in international comparative examinations, for example in PISA-OECD (57th out of 64 countries).

In this challenging scenario, as mathematician and mathematics educator, focused in the improvement of Teacher Education, I am convinced that the key factor that will contribute to demanded transformation of education is a constant monitoring of the modernization of Teacher Education Curricula, simultaneously to reinforcing the many professional development courses for teachers towards research type activities “in and for” **practices**.

In Brazil, we see increasing need for qualified teachers aligned to the quantitative dimension as consequence of inclusive policy of providing Education for All. Besides the number factor, the teacher education system presents a gap between the profile of teachers working in 1st to 5th grades of elementary cycle of Basic Education and of working in 6th to 9th grades and upper secondary level (10th to 12th grades). The mathematics and methodological knowledge gap between the levels is one of the reasons that the quality of Brazilian students’ knowledge has not improved in decades, though the quality of higher research in basic sciences has achieved international level, being a young Brazilian researcher the first awardee of Fields Medal in South America.

In this difficult scenario, my research projects aim to take the advantage of the knowledge exchanged between CRICED-U. Tsukuba to integrate the best strategies of teaching and learning mathematics to diminish the gaps, especially between levels, focusing in developing hands-on workshops with materials followed by conceptual mathematics that would explain the evolution process of learning.

My current projects concern a Master level graduate course for mathematics teachers, and a professional development courses for lower secondary school teachers, with theoretical framework of Pedagogical Content Knowledge, Lesson Study principles, Problem Solving Lesson Design through inquiry and discovery to enhance the content knowledge and capacity to teach through error analysis. The research trend follows the PBPD (practice based professional development) as distinguished in ICMI Study 15, and we make progress in production of PLT (professional learning task). The PLT of the project PROF-OBMEP uses a series of teaching material developed for in-service teachers to learn how to teach, to change the paradigm of the classroom dynamics, to understand the pedagogical meaning of problem solving steps, to amplify the meanings of assessment of students’ learning through qualitative analysis of errors.

In this talk, I will illustrate with pictures taken from field experiences of the projects based on Lesson Study principles in Brazilian environment since 2004, as well as from the Graduate Master Program in Teaching Mathematics of UFSCar. I acknowledge the many collaborators, students and schools that have taken the proposal of the projects to the classroom-practices.

I have the privilege of collaborating with CRICED- U. Tsukuba for profitable exchange of experiences and knowledge that goes beyond the frontiers of countries and culture towards a meaningful research in Mathematics Education. Many thanks are due to professor Masami Isoda for generous partnership in this collaboration.

Aiming at Education for All in Brazil: challenges from quantitative and qualitative perspectives

Panel Discussion Japan Education Forum
February 5, 2015

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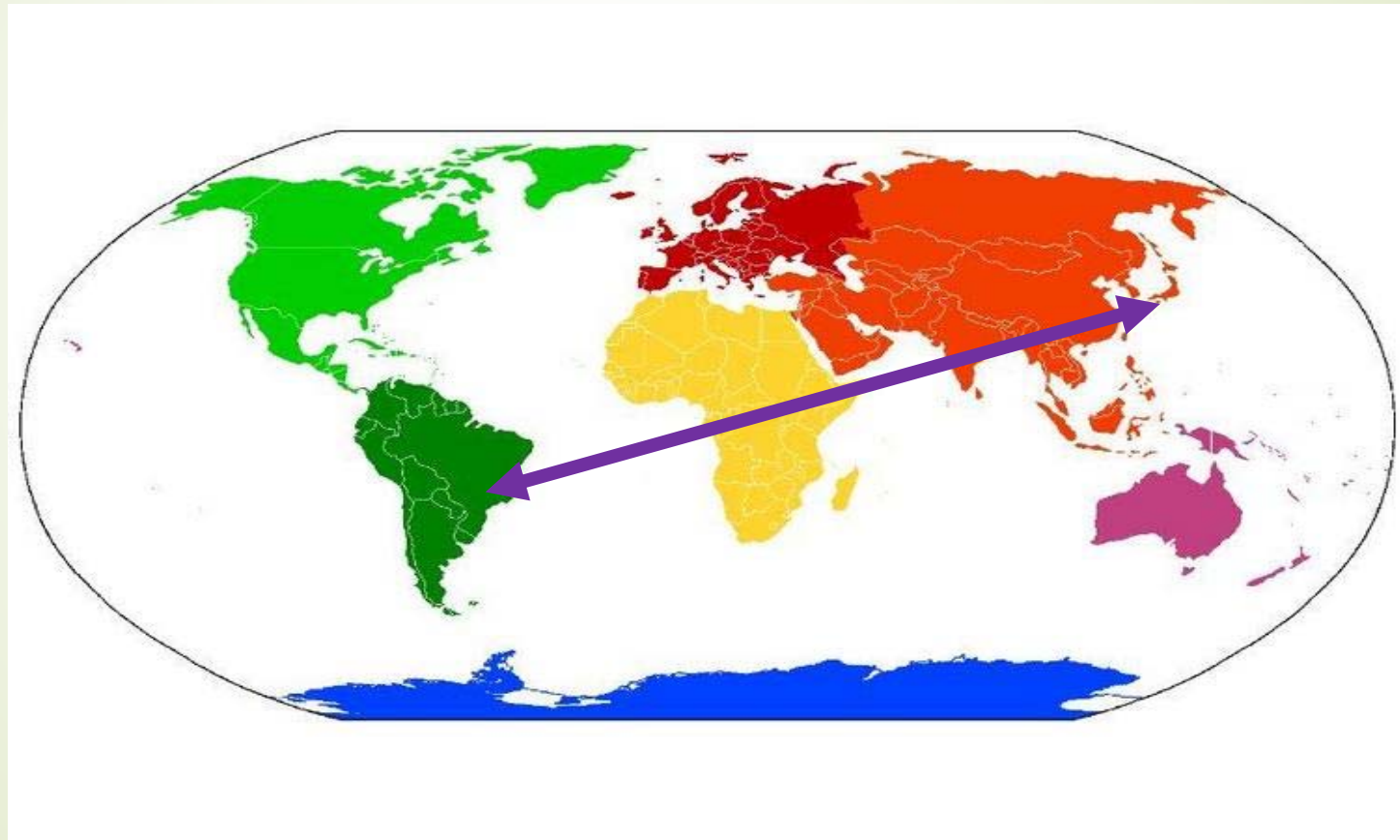




Summary

- ❖ Brief introduction to my motivation to some initiatives in Professional Development Courses for Teachers: challenges of a developing country and reflection about the role of teacher educators to attend the demands of teacher education of 21st century;
- ❖ Characteristics of Brazil and its challenges:
 - ❖ the figures of recent educational census of Brazil → quantitative discourse
 - ❖ the educational gap of basic school system → structural difficulty
 - ❖ The educational gap of teacher education → INTERNATIONAL COLLABORATION, RESEARCH TOWARDS EFFICIENT PROFESSIONAL DEVELOPMENT OF TEACHERS (LESSON STUDY, LESSONS CENTERED IN PROBLEM SOLVING, LESSONS BASED ON INQUIRY AND DISCOVERY)
- ❖ What can be the collaboration between Japan and a developing country like Brazil

Brazil and the World: Collaboration beyond the frontiers



Fifth largest country in the world: ~8515000 km²

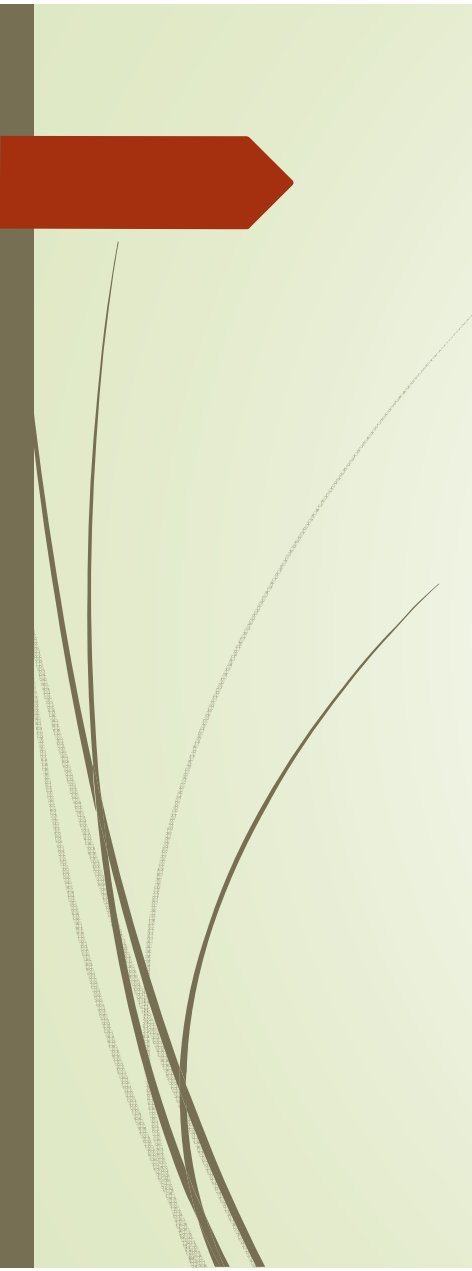
Large social- economic differences between North and South



Challenges of fast increasing population, migration and urbanization

	1970	1980	2010	2014
Population	93139000	121150500	190755799	202768500

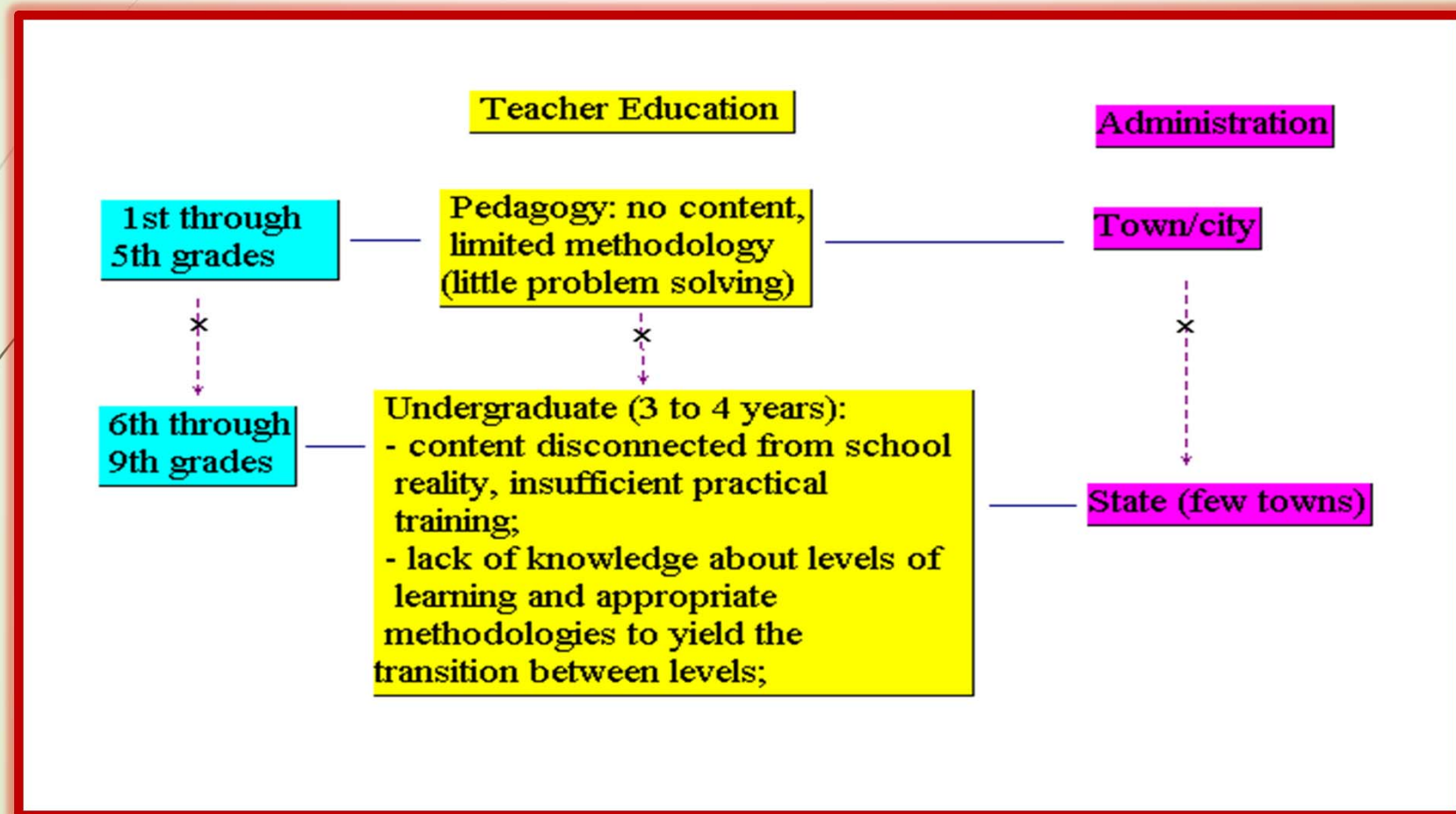
- In 30 years the population DOUBLED (!)
- The city of São Paulo has currently population about 12 million, its great metropolitan area has population about 18 million (9% of the total population of the country)
- Migration phenomenon from countryside towards big cities: impoverishment of villages and small towns implying worsening basic education as a whole.
- Rapid urbanization of bigger towns and cities does not support quality education, enough school facilities, qualified teachers for ALL.



Quantitative perspectives of Brazilian Education: recent education census

- ▶ 2011 education census indicates 92% (~30.5 million) of children from 6 to 14 years old (Elementary I 1-5th grades, Elementary II 6 to 9th grades) is enrolled in school system. **HOWEVER**, the students' achievement of the competencies in each school level content knowledge is still below the goals (National Plan of Education) and expectation of the educators.
- ▶ Brazil presents a dichotomic scenario of displaying fast growing international level of scientific knowledge (research publications, Internationally recognized Universities and Research Institutes, Results in Math & Sciences Competitions, **THE 1st FIELDS MEDALIST (2014) in Latin America**, Extensive Funding Program to support the graduate and undergraduate studies in Institutions abroad, etc) **YET** struggling with poor PISA (OECD) results, 57th among 64 participating countries.


Challenge of Basic Education in Brazil: a structural gap in Elementary Schooling and Teacher Education System






How to ensure Quality Education for All? (Qualitative Perspective)

- Goals of National Global Plan for Education in Brazil (2013):
 - ❖ guarantee the enrollment in Basic Education Course (9 grades) for **all** children (6 to 14 years old) and secure the achievement of the knowledge adequate to each grade. Goals to be accomplished until 2016 and 2024 respectively.
- **Educate teachers prepared to new era of communication world:**
 - ❖ Modernization of curriculum: content, pedagogy and ICT competencies
 - ❖ Integration of Mathematics and Mathematics Education to bridge gaps of formation
- **Help in-service teachers in their professional development:**
 - ❖ Paradigm shift in their classroom practices (**Lesson Study principles**),
 - ❖ Reinforcement of content knowledge through **Investigative Problem Solving**
 - ❖ Pedagogical content knowledge for teaching, learning, assessment.



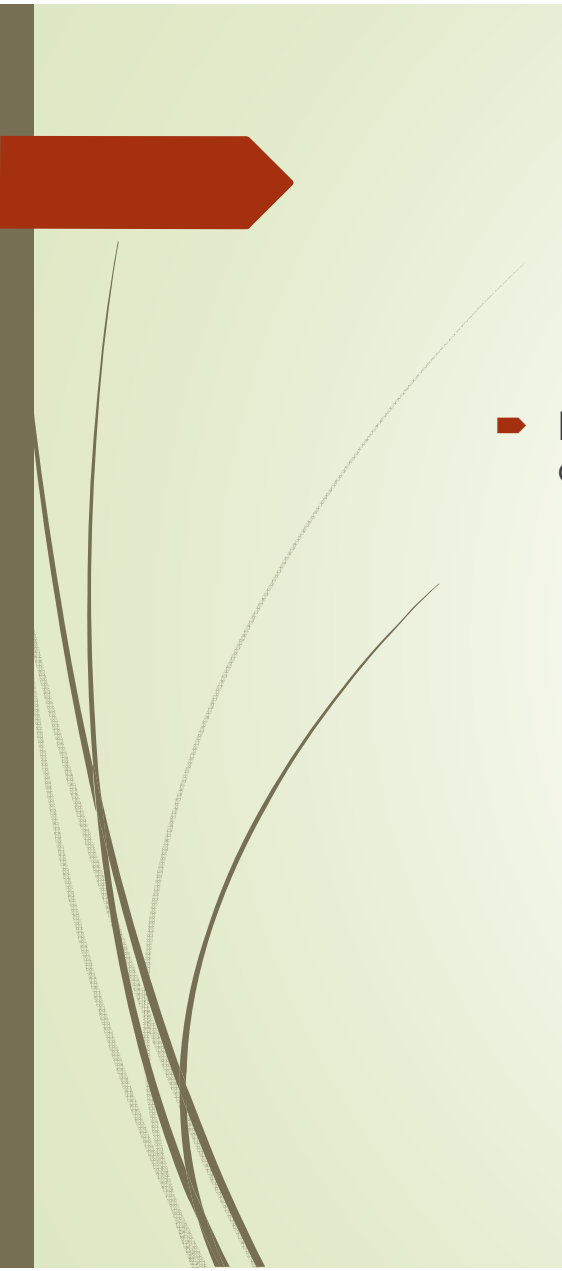
International trend in Mathematics Education Research on
The Professional Development for School Teachers (ICMI Study 15):
Practice Based Professional Development - PBPD

- ▶ The increasing perception of Math Educators about the research field of “*teaching and learning Mathematics*” requiring focus on the “*practice in and for classroom activities*”
- ▶ Some initiatives in Brazil aligned to this research field, in which I am working:
 - ▶ PPGECE (Master Program for In service teachers) at UFSCar;
 - ▶ PROF-OBMEP (Special course for in service teachers aiming at a *connection* among topics of mathematics and *the teachers' knowledge*, and a *paradigm shift* in the attitude of teachers and students in a problem solving lesson → *original research on the development of didactical material with the use of innovative and challenging problems (Baldin & Silva, 2012~to date)*
 - ❖ Inspiration and influences from *Lesson Study - Japan, Singapore approach to elementary mathematics concepts and pictorial model for problem solving.*



The role of teacher educators: now and the future

- ▶ Reflection on curriculum of traditional teacher education courses for prospective teachers:
 - ▶ more focused content from the discipline Mathematics making connection with classroom practices, Pedagogy and Mathematics education theories interpreted in professional context;
 - ▶ integration of ICT in teaching techniques
 - ▶ Modelling and Application of Mathematics
 - ▶ Problem Solving as the main methodology to learn how to teach meaningful mathematics lessons that engage students in their own learning, and to apply it as pedagogical aid to better assess students' mistakes and difficulties.
 - ▶ Modernization of classroom dynamics: paradigm shift from teacher centered expository lessons to participative learning environment(Lesson Study principles)
 - ▶ Diversification of topics of contemporary mathematics for the enrichment of cultural knowledge of school-teachers(confer The Klein Project for 21st century- ICMI-IMU Project)



The role of teacher educators: now and the future

- ▶ Reflection on the updated demand for continuous professional development courses to support the in-service teachers:
 - ▶ Workshops of training procedures or only theoretical seminars are not enough: teachers need to be continuously educated through PLT (Professional Learning Task – ICMI Study 15);
 - ▶ Development of specific didactical material for teachers to learn new approaches and modern mathematical ideas to enhance personalized and contextualized lesson planning.
 - ▶ Help teachers to reinterpret their knowledge of mathematics content of school curriculum with the language, the advantages and the limitations of Technology
 - ▶ Help teachers to follow the accomplishments of Mathematics Education research bridging them into classroom practices suited to new generation of students with their specific needs of modern time.
 - ▶ And many more considerations arise! Let us discuss and learn !

Some places in which the Brazilian projects (UFSCar) have been worked out



From classroom practices (PPGECE): problem solving, lesson study principles, bar model from Singapore Mathematics, (Campinas, SP)

Dados

1ª etapa 2ª etapa 3ª etapa 4ª etapa

Equação

$$15 + x + x + 15 + 15 + x + x + 15 = 124$$

$$4x + 60 = 124$$

$$4x = 124 - 60$$

$$4x = 64$$

$$x = \frac{64}{4}$$

$$x = 16$$

Resposta

1ª etapa: 15 Km	+ 15 Km
2ª etapa: 16 Km	+ 16 Km
3ª etapa: 16 + 15 = 31 Km	+ 31 Km
4ª etapa: 15 + 16 + 16 + 15 = 62 Km	+ 62 Km
	124 Km

Resposta: Na primeira etapa ele percorreu 15 Km, na segunda etapa ele percorreu 16 Km, na terceira etapa ele percorreu 31 Km e na quarta etapa ele percorreu 62 Km.

Produtos da Escola A

ARROZ 3,5 kg	ERVILHA 2,1 kg
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Produtos da Escola B

MILHO 1,6 kg	LATAS DE PALMITO
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$3,5 + 2,1 = 5,6$?
 $5,6 = 1,6 + 4$?
 $5,6 = 1,6 + 4$
 $5,6 = 5,6$

$\frac{3,5}{1,6} = \frac{31}{16}$
 $\frac{2,1}{1,6} = \frac{21}{16}$
 $4 + 0,5 = \frac{40}{8} + \frac{4}{8} = \frac{44}{8}$

A Regina comparou 8 latas de palmito. Para falta o valor da massa dos latos de palmito para fazer uma igualdade. Então sabendo que falta 4,0 Kg para ter uma igualdade de massa dos produtos das duas escolas, e sabendo que cada lata pesa 0,5 kg, basta dividir o Kg de todos os latos pelo Kg de cada lata, para obter a quantidade de latos de palmito que foi comprada.



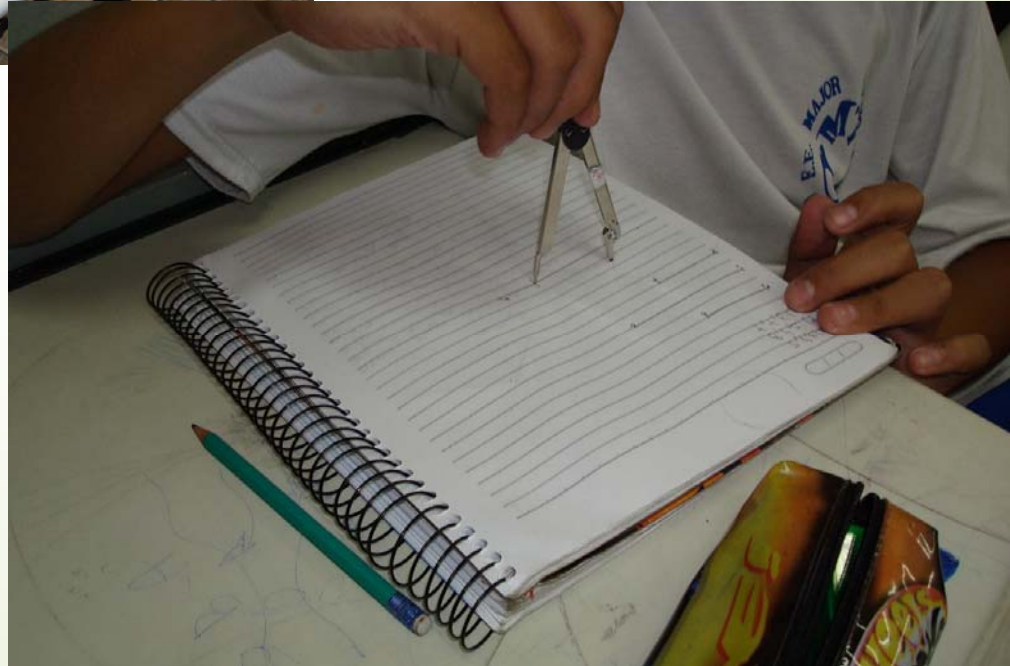
HAPPY to include a student! Franca, SP

Problem Solving lesson with participative learning, manipulating concrete models to explain discovery of the properties by students themselves(6th grade), Franca, SP





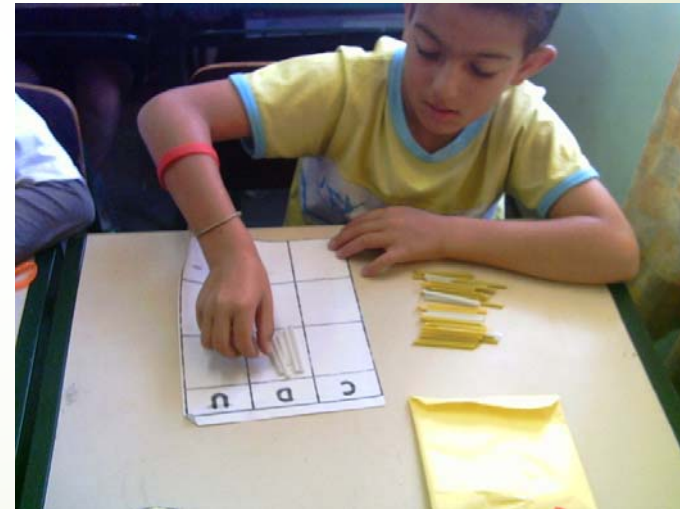
Using tools to learn geometric constructions, 6th grade, Osasco, SP



Production of models in solid geometry lessons, 6th grade (supportive use of DGS), Osasco, SP



Elementary School (3rd grade), Atibaia, SP



Field experience of new approach to Arithmetic (Atibaia,SP)



The use of GC in Lesson Study for 10th grade, Pinheirinho, RJ: Modeling Functions in Problem Solving



A sequence of Lesson Study for 8th grade classrooms, a School Project with GC

(Ribeirão Preto, SP):

1- Preparing session: study and discussion with teachers



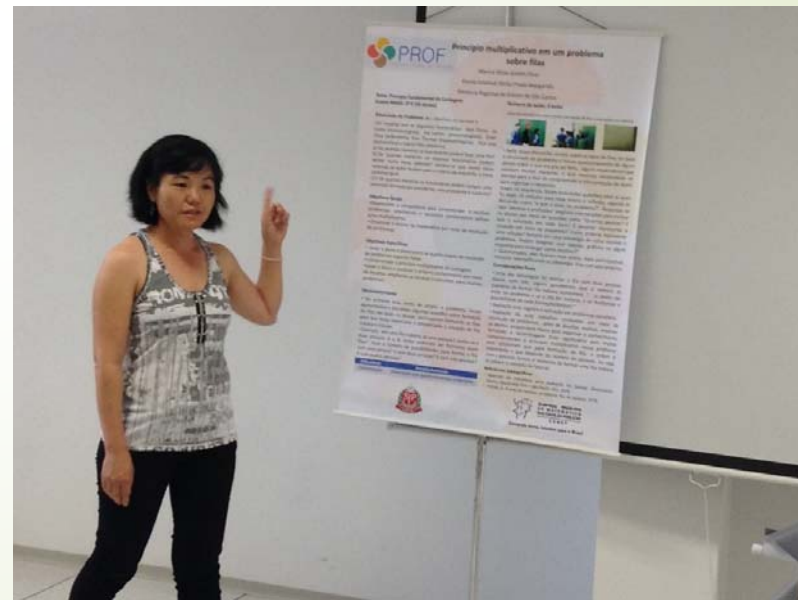
2-Training session and pilot experimentation with assistant-students



3- Classroom activity (Ribeirão Preto)




Poster Presentation of results of the project **PROF-OBMEP**: Group discussion, Exchange of experiences, New ideas, Growing confidence (2013 and currently). Trying to pursue the model of true Lesson Study!





Conclusion

- ▶ However far being apart, countries with different historical, social and cultural backgrounds can collaborate to learn from each other for good experiences to overcome the complex problems of mathematics education of teachers.
- ▶ The mission of teacher educators and researchers of teaching mathematics should be focused in providing opportunity to everybody to achieve mathematics literacy through problem solving.
- ▶ Lesson Study as grounding methodology to stimulate teachers to become better teachers is a major outcome of a joint research effort between CRICED-U. Tsukuba- Japan and UFSCar- Brazil.



Thank you very much for your
attention!