The project AKA-CONICYT 09 (2010-2013)

On the development of mathematical understanding and performance when dealing with open-ended problems

Salomé Martínez

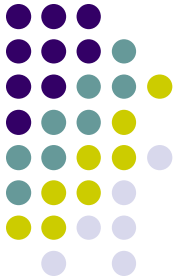
CONICYT, March 24 2015

PURPOSE

To develop a model for improving the level of understanding and performance of pupils and teachers when using open-ended problems in elementary school mathematics, with the active participation of teachers, and experimentation in real classrooms in Chile and Finland.

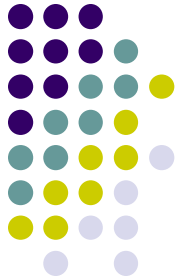
PI: Leonor Varas (CIAE-CMM)-Erkki Pehkonen (U. of Helsinki)

CHILEAN RESEARCHERS INVOLVED



- Salomé Martínez
- Alejandro López
- Patricio Felmer
- Cristián Reyes
- Paulina Araya
- Alex Fuentealba
- Valentina Giaconi
- María Victoria Martínez

FINNISH RESEARCHERS INVOLVED



- Liisa Näveri
- Maija Ahtee
- Markku Hannula
- Anu Laine
- Laura Tuohilampi
- Laia Saló i Nevado

Longitudinal study

- 3rd grade students were followed through 4th and 5th grade.
- 10 classes in Finland and 14 classes participating in Chile: 10 classes in 5 public schools of the municipality of Quinta Normal, 2 classes in 2 different charter schools of the Primary Instruction Society Network (Sociedad de Instrucción Primaria, SIP), 2 classes in other two charter schools.
- In both countries a control group of classes with similar characteristics were considered.

Implementation

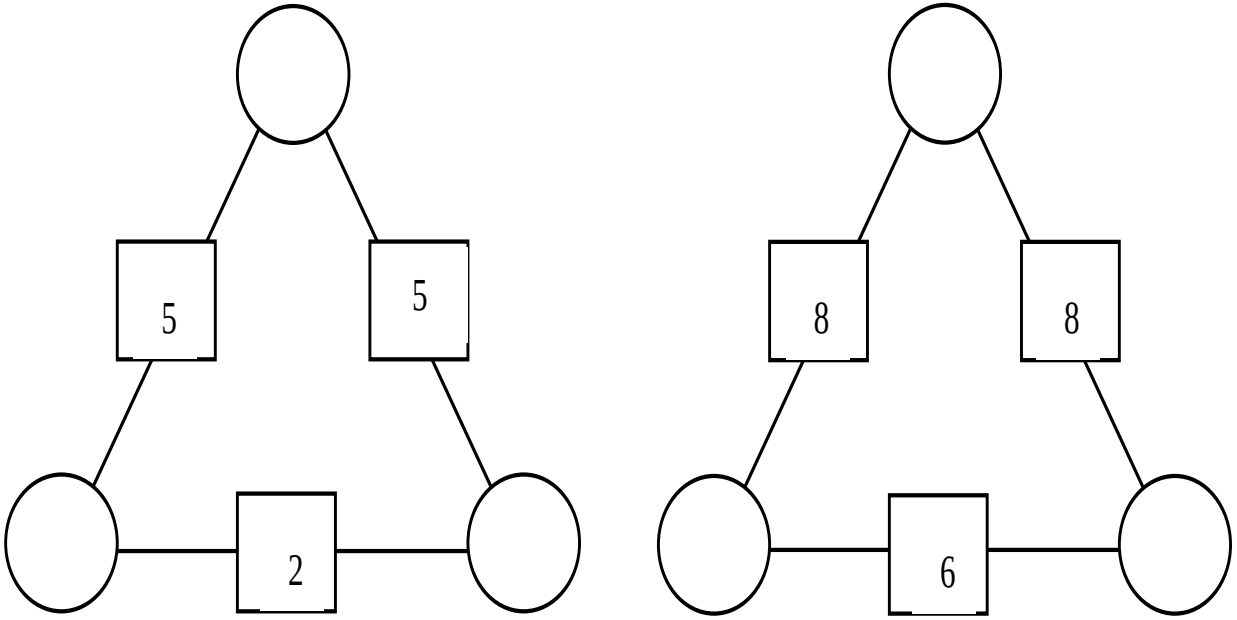
- Once a month (7 times in the school year) the mathematic lessons were devoted to work in an open-ended problem that was the same for all experimental classes in Chile and in Finland. These lessons were videotaped and the pupil's works were collected.

- The open-ended problems were constructed and discussed by both research groups in Chile and Finland. The open-ended problem solving lessons were prepared by the group of teachers and the research team in a monthly meeting. In these meetings the same group analyzed the previous implemented task

All the participating teachers and the leading researchers had the opportunity to visit the schools in the partner country, abroad.

Example of mathematical task

Below there are two arithmagons, you should find the missing numbers in the corners.



Arithmagons can be solved in many ways. How did you solve it? Did you find a method for solving any arithmagons, when the numbers on the sides are given and two of those are the same?

We studied

- the advancement of pupils in terms of:
  - mathematical performance
  - understanding
  - self-confidence
  - attitudes towards mathematic
- The teachers' change in terms of
  - Expectations
  - Pedagogical content knowledge
  - Selfconfidence
  - Ability to "listen" to the pupils ideas,

as a product of the implementation of open-ended problem solving in the classroom.

Data collection

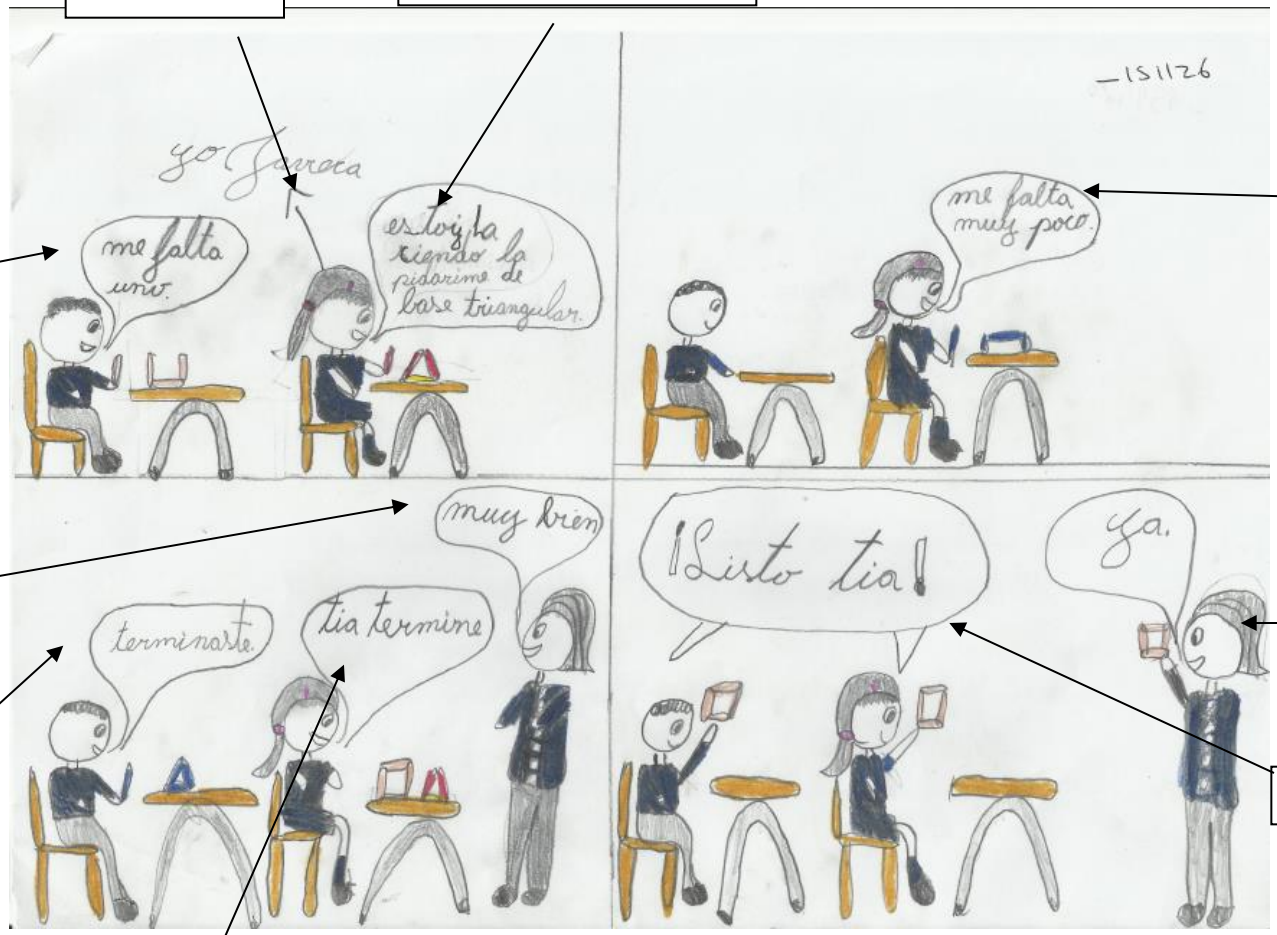
The instrument used to collect and register data had been designed jointly by both research groups in order to facilitate the comparative studies.

- pupils and teachers questionnaires,
- students mathematical knowledges and skills test,
- teachers' interviews,
- pupils' drawings of their mathematic class,

which were applied at the beginning and at the end of the project, to the participating classes and to similar classes in the control group, in Chile and in Finland.

Me, Javiera

I'm making the triangular-based pyramid



I' m about to finish

One more to go

Very good

All set

You' re done

We' re done, miss!

Miss, I' m done

DISEMINATION

- **Congress Presentations:** 14 papers were presented to 10 different international congresses; 9 of them are co-authored by Chilean and Finnish researchers.
- **Book:** Resolución de Problemas de Final Abierto en Clases de Matemática; la experiencia de los profesores participantes en el proyecto bilateral Chile-Finlandia “Desarrollo de competencias matemáticas a través de la resolución de problemas de final abierto” AKA 09.
- **Congress Organization:** Workshop in Mathematics Problem Solving, December 2013, Santiago, Chile, with the participation of 25 speakers of 15 different countries

Journal papers

- Tuohilampi, L., Hannula, M., Varas, L., Giaconi, V., Laine, A., Näveri, L., Salo i Nevado, L; (2014) Challenging the western approach to cultural comparisons: young pupils' affective structure regarding mathematics in Finland and Chile, International Journal of Science and Mathematics Education, DOI : 10.1007/s10763-014-9562-9

- Tuohilampi, L., Laine, A., Hannula, M., Varas, L., (2015) A comparative study of Finland and Chile: The culture-dependent significance of the individual and inter-individual level of mathematics-related affect, International Journal of Science and Mathematics Education, accepted.

- Giaconi, V., Varas, M.L., Tuohilampi, L., Hannula, M., Affective factors and beliefs about mathematics of young Chilean children: understanding cultural characteristics, submitted to the Editorial Committee (Jeremy Kilpatrik, Erkki Pehknonen, Patricio Felmer) of the book: Mathematics Problem Solving, Springer Verlag.

- Pehkonen, E., Ahtee, M., Varas, L., Martinez, S.; Mathematics lesson as seen in third-graders' drawing; Educational Studies in Mathematics (ISI) submitted.

Workshop in Mathematics Problem Solving

December 10-13, 2013

Universidad de Chile
Blanco Encalada 2120, Santiago - Chile

Plenary Speakers
Jinfa Cai (U. of Delaware, USA)
Markku Hannula (U. of Helsinki, Finland)
Jeremy Kilpatrick (U. of Georgia, USA)
John Mason (U. of Oxford, UK)

Organizing Committee
Patricio Felmer (CMM-U. Chile)
Markku Hannula (U. of Helsinki, Finland)
Erkki Pehkonen (U. of Helsinki, Finland)
Leonor Varas (CMM-U. Chile)

Speakers
Andras Ambrus (U. of Budapest, Hungary)
José Carrillo (U. de Huelva, Spain)
Victor Cifarelli (U. of North Carolina, USA)
Wim van Dooren (U. of Leuven, Belgium)
Patricio Felmer (U. de Chile, Chile)
Torsten Fritzlar (U. of Halle-Wittenberg, Germany)
Markus Hähkiöniemi (U. of Jyväskylä, Finland)
Masami Isoda (U. of Tsukuba, Japan)
Oh Nam Kwon (Seoul National U., Korea)
Roza Leikin (U. of Haifa, Israel)
Henry Leppäaho (U. of Jyväskylä, Finland)
Yew Hoong Leong (Technological U. of Nanyang, Singapore)
Susan Leung (National Sun Yat-sen U., Taiwan)
Peter Liljedahl (Simon Fraser U., Canada)
Salomé Martínez (U. de Chile, Chile)
Erkki Pehkonen (U. of Helsinki, Finland)
Manuel Santos (Cinvestav, Mexico)
Edward Silver (U. of Michigan, USA)
Leonor Varas (U. de Chile, Chile)
Yan Ping Xin (Purdue U., USA)
Bernd Zimmermann (U. of Jena, Germany)

Chile-Finland research Project (AKA-CONICYT09) On the development of pupils' and teachers' mathematical understanding and performance when dealing with open-ended problems

As part of the program there will be a presentation of the findings of the project, as well as experiences of in-service teachers by main researchers and participating elementary teachers, respectively.

http://wmps2013.cmm.uchile.cl

For more info: gladys@dim.uchile.cl

ciae Centro de Investigación Avanzada en Educación Universidad de Chile

CMM Center for Mathematical Modeling

ACADEMY OF FINLAND

CONICYT

Seminario
Resolución de Problemas en clases de Matemática
+ Talleres de Profesores para Profesores

Viernes 13 de Diciembre de 2013

Escuela de Ingeniería y Ciencias - Universidad de Chile
Beauchef 850, Santiago

Programa

09:00 - 09:45	Presentación del proyecto bilateral Chile-Finlandia. M. Leonor Varas
09:45 - 11:45	Talleres de profesores para profesores: "Clases de Matemáticas en torno a la Resolución de Problemas de Final Abierto"
11:45 - 13:00	Conferencia de Markku Hannula
15:00 - 17:45	Presentación de investigaciones realizadas en el proyecto
17:45 - 18:30	Ceremonia de cierre

Inscripciones y mayores detalles en:

http://eventos.cmm.uchile.cl/chile-finlandia2013/

Para mayor información: gladys@dim.uchile.cl

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ACADEMY OF FINLAND

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The teachers book

Este es un libro de profesores para profesores. En él se recoge la experiencia del proyecto bilateral Chile – Finlandia "Desarrollo de competencias matemáticas a través de la resolución de problemas de final abierto" AKA 09, que introdujo esta actividad en catorce aulas chilenas y 10 aulas finlandesas de tercero básico. Estos profesores y sus cursos, a lo largo de tres años, una vez al mes dedicaron la clase de matemática a trabajar en la resolución de uno de estos problemas. Su reflexión, su aprendizaje y sus resultados son estimulantes y sin duda inspirarán a otros profesores. La experiencia acumulada y su análisis colectivo sistemático, les permiten entregar consejos prácticos de gran utilidad para un profesor que quiera utilizar en sus clases los problemas que aquí se presentan y discuten.

CMM Center for Mathematical Modeling

ACADEMY OF FINLAND

Otec/Ate Purranque

RESOLUCIÓN DE PROBLEMAS DE FINAL ABIERTO EN CLASES DE MATEMÁTICA

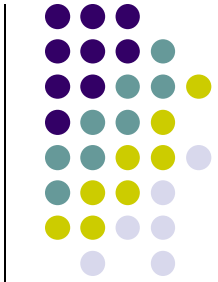
CENTRO DE INVESTIGACIÓN AVANZADA EN EDUCACIÓN
UNIVERSIDAD DE CHILE

RESOLUCIÓN DE PROBLEMAS DE FINAL ABIERTO

EN CLASES DE MATEMÁTICA

La experiencia de los profesores participantes en el proyecto bilateral Chile – Finlandia "Desarrollo de competencias matemáticas a través de la resolución de problemas de final abierto" AKA 09

Impacts



- **Postdoctoral project** about “teacher change in his own perspective", leaded by María Victoria Martinez, that obtained financial support from Conicyt.

- The observed development of the participating teachers contributed also to the design of a new project **(FONDEF IT13I10005** “Herramientas para fortalecer la formación de profesores de educación básica basadas en experiencias de enseñanza de la matemática en el aula”), currently in execution, leaded by Salomé Martínez and Leonor Varas.

- The Project inspired a **research line** in an important new project for Centers of Excellence, **Project FB 0003** from the Associative Research Program of CONICYT, which will study different models of in-service teacher preparation

Impacts

- Some of the teachers participating in this AKA project, continue giving talks and delivering courses for colleagues in Santiago and Arica, sponsored by the municipality of Quinta Normal and a private educational support company (Pumanque).

- Some instruments validated in this project, like pupils drawings, are being used in the classroom practice study and mathematic instruction analysis included in the Anillo project SOC 1104, leaded by Cristian Bellei, that studies schools with trajectories of improvement. This synergy is important because teacher samples in each study are small and aggregating the sample helps to understand the relative distance of the value of one indicator on two teachers.

Teacher Change

- 11 teachers from Quinta Normal were awarded as “excelent teacher” in the last National Teacher Assessment process. 4 of them participated in this project.
- Participating Teachers recognize that they
  - ✓ Can learn from their students
  - ✓ Have change their perceptions about their self efficacy, mathematic and math education
  - ✓ Learn to give time… to think, to talk, to make mistake
  - ✓ Have higher expectations on pupils’ capacity

Concluding Remarks

- The bilateral collaboration was essential to the success of this project.
- The project produced
  - new knowledge in Chile and in Finland
  - Opened new research questions
  - Inspired new initiatives and ways to help teachers and pupils development

THANK YOU