

Activando la Resolución
de Problemas en las Aulas

Mathematics Problem Solving and Professional Development under the Covid-19 Pandemic



Universidad
de Chile

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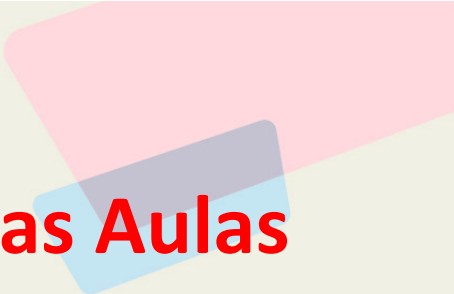


ARPA Experience under Covid-19

Patricio Felmer
Universidad de Chile

Santiago, December 10th, 2020





ARPA

Activando la Resolución de Problemas en las Aulas


Activating Problem Solving in Classrooms

ARPA Initiative has the purpose of:

Offering teachers the opportunity to solve problems

Encouraging (preparing) them to propose problems to their students

As a consequence, students solve problems and improve their mathematics learning



Some guiding ideas

- Problem solving is central to mathematics, but this centrality has not reached schools yet
- For problem solving to reach schools, teachers have to be problem solvers
- Problem solving may be the basis of a professional development program aiming to change teacher practices for improving students learning

What is a problem?

A problem is a mathematical activity for which the person facing it does not know a procedure that leads to the solution, the person is interested in solving it, it is a challenge and the person feels he/she can solve it. A problem may be in mathematics context or a real life context

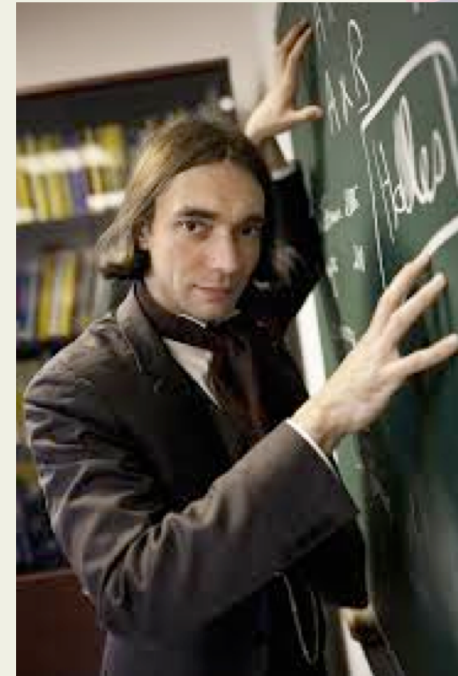
What happens when you solve a problem?

- He or she does not know if will succeed or not
 - The challenge produces some anxiety
 - Anxiety, if not too strong, motivates the work
 - Once the problem is solved the person gets happy
 - Happiness is proportional to the level of anxiety
 - Emotions in problem solving are crucial
-
- The sequence of emotions -*Challenge-anxiety-happiness*- is very important to get motivated in mathematics achievements.

*This happens to students,
to teachers and
also to mathematicians*

Cédric Villani
2010 Fields Medal

<http://www.arpamat.cl/2016/12/cedric-villani-un-matematico-que-resuelve-problemas/>






Our Professional Development Program



Strategies based on Problem Solving



- **RPAction** (3-4 hours) teachers solve problems and reflect about it.
 - **Summer Workshops**, a 25 hour workshop during a week in summer or winter.
 - **RPClassroom**, a year long workshop, whose main goal is to introduce problem solving in classrooms, aiming to produce actual changes in classrooms.
- 



RPClassroom

the main PD strategy

A brief description of RPClassroom

Session 1 March	Session 2 March	Session 3 April	Session 4 May	Session 5 June	Session 6 August	Session 7 September	Session 8 October	Session 9 November
PS	PS	ARPA	Activation	Consolidation	Discussion	Problem Construction	Keep Improving	Closing Session

- Between two sessions, teachers do an *arpa*, a problem solving activity in classroom, with their students
- In every session (3:15) teachers discuss the result of their earlier *arpa* and plan the following *arpa*
- The workshop is based in *Doing* and *Reflecting*






***arpa* model for classroom**



arpa *problem solving activity in classroom*

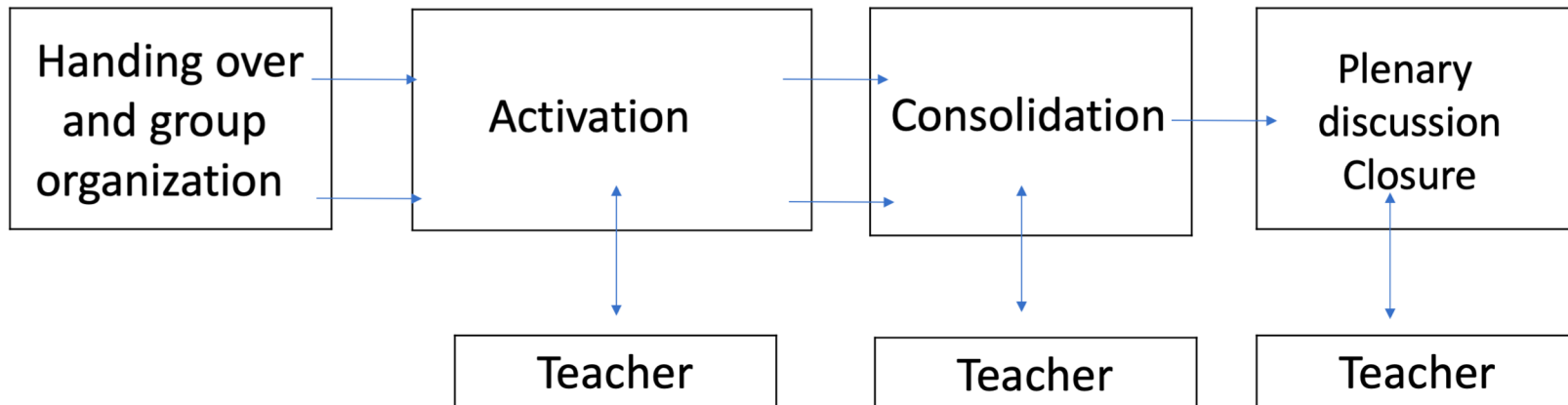
- It is the basic school activity that we propose to teachers
 - 45-90 minutes
 - One problem, with simplifications and extensions
 - Students work in random groups (3 or 4)
- 

PROBLEM SOLVING ACTIVITY IN CLASSROOM

arpa

a good problem

development of abilities



arpa: problem solving activity in classroom

- Teacher answers with questions
- Student groups work independently
- Teacher never gives the solution
- Problem is solved when each group member knows how to solve it
- Students explain the solution to teacher



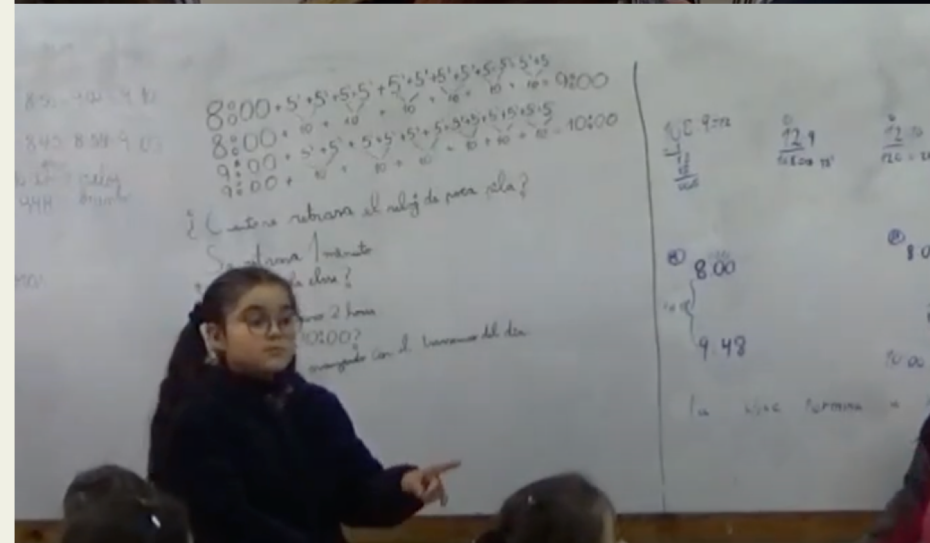
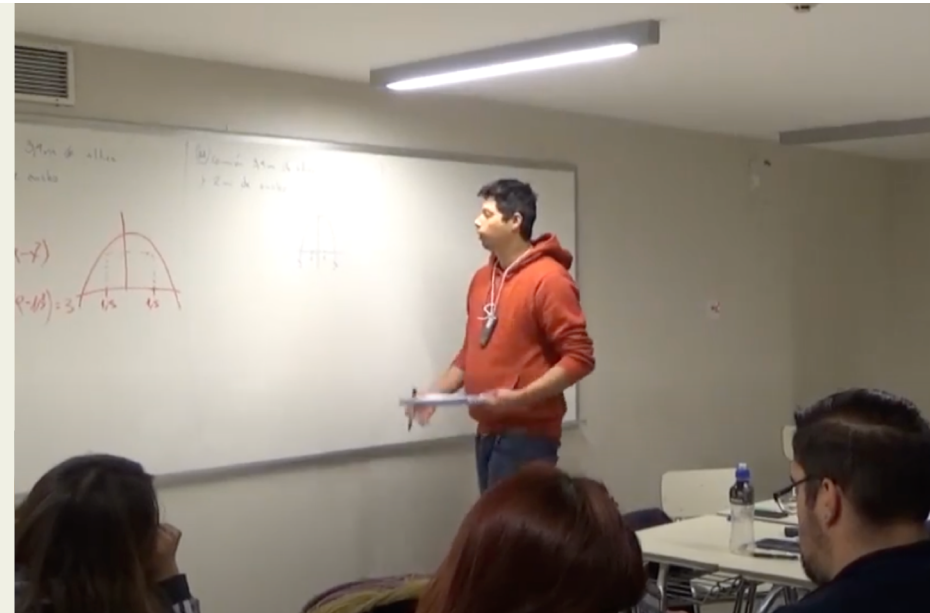
arpa: problem solving activity in classroom


- If a group has difficulties with the problem then teacher gives them a simplified version of the problem
- If a group solves the problem then teacher gives them an upgrade



arpa: problem solving activity in classroom


- Students come to blackboard to explain their solution
- Discussion among students is promoted
- Sequence of students going to blackboard is chosen by teacher





March 16, 2020

After a weekend of rumors, on Monday 16th authority announced the closure of schools, universities and other public institutions because of the pandemic






We had contracts with schools
and other institutions and all of
them were cancelled...




First approach to Pandemia: just wait until coming back

April

Days after March 16, we sent a message to team members letting them know that we would use these confinement days to strengthen the team, preparing material for teachers and improving our diffusion strategy



After about a month... we
realized that the situation was
much worse...



Desolation

All our workshops were face to face and so were interaction between teachers and students

We realized that what we used to offer was no longer useful to teachers, students or principals.

We could not wait until pandemia is over...we felt like experiencing the day after an earthquake



May




May-June

The Revenant

We started a series of meeting with teachers to learn what were their needs...

We needed to know what was going on in schools, with students and teachers






May-June

Meetings with teachers

The difficulties they had were mostly associated with connectivity of students

Some teachers reported that they have contacted only 30% of their students

Teachers were frustrated for not being able to have contact with their students, no feedback, no affect, ...






May-June

Meetings with teachers

Many teachers send *Study Guides* with activities, and they received little feedback.

Only few students were able to connect through zoom.

Invariably, teachers were very grateful of the meetings with us, because they needed to talk to other teachers about their experiences, out of school duties.



RP-Action Workshops are back

We started our first on-line experiences with our RPAAction workshops for elementary and secondary teachers

The team started to get experience in managing these workshops through zoom

Creating groups, visiting groups, asking questions to teachers while they solve problems

May-June

We are back to solve problems and reflect together

Volvemos a resolver problemas y a reflexionar juntos

Taller dirigido a: Docentes que hacen clases en Educación Básica (primer y segundo ciclo)

Fecha: Martes 19 de mayo 2020

Hora: 15:00 horas

Cupos limitados: 80 participantes; taller gratuito, previa inscripción

Formularios de Inscripción:

Matemática: bit.ly/arpa_matematica_virtual

Escritura: bit.ly/arpa_escritura_virtual

Ciencias Naturales: bit.ly/arpa_cnaturales_virtual

Ciencias Sociales: bit.ly/arpa_csociales_virtual

Una vez registrado, le enviaremos un correo con las instrucciones de acceso a los talleres.

Consultas: arpa@ciae.uchile.cl



RP-Action Workshops

The hardest part is managing plenary discussions...

you are not able to use body language, gestures are not so useful and the delay in answering.... produces anxiety

Are they hearing me? Did they understand my question? Are they willing to answer?

May-June



Taller RP Acción Virtual
Volvemos a resolver problemas y a reflexionar juntos

2^{da} versión

Taller dirigido a: Docentes que hacen clases en Educación Básica (primer y segundo ciclo)

Fecha: Jueves 28 de mayo 2020
Horario: 15:00 a 17:00 horas
Cupos limitados; taller gratuito, previa inscripción

Formularios de Inscripción:
Matemática: bit.ly/arpa_matematica_virtual_basica_v2
Escritura: bit.ly/arpa_escritura_virtual_basica_v2
Ciencias Naturales: bit.ly/arpa_cnaturales_virtual_basica_v2
Ciencias Sociales: bit.ly/arpa_csociales_virtual_basica_v2

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aRPa | Activando la Resolución de Problemas en las Aulas

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***Arpa-d* model for classroom at distance**



July

Arpa-d model

With the information and experience obtained during these months
We created a model for problem solving activities at distance
It should be useful in various levels of connectivity
For teachers with different digital experiences
Eventhough Zoom was great, it was not the main available tool



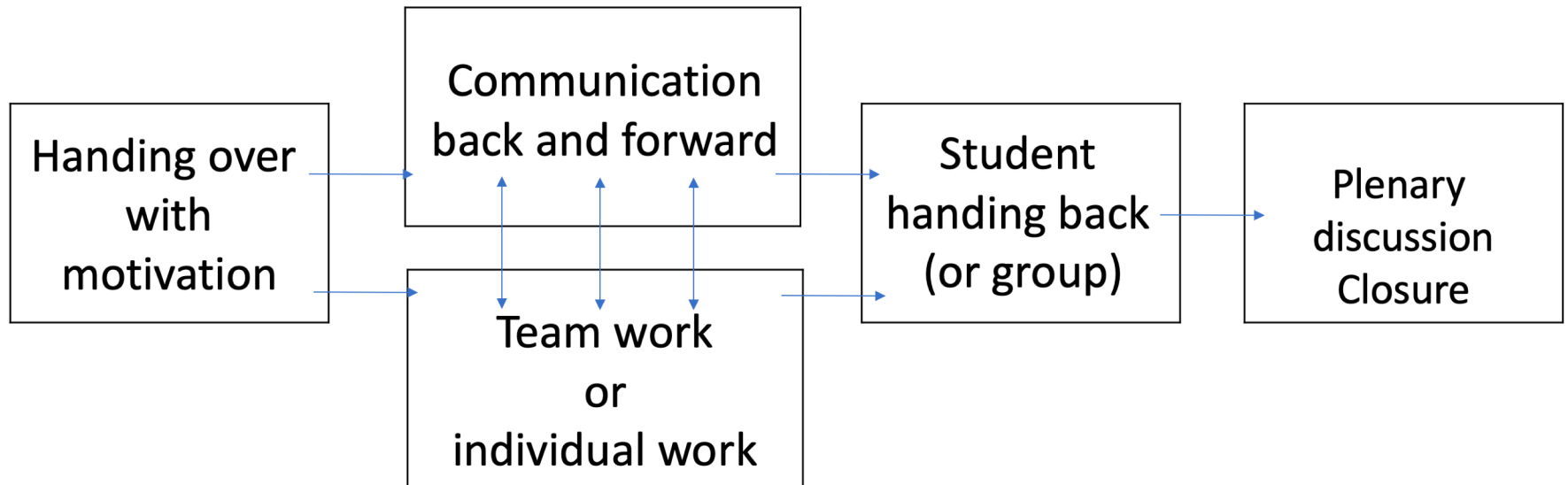
July

PROBLEM SOLVING ACTIVITY IN CLASSROOM-DISTANCE

arpa-d

a good problem

development of abilities



First two workshop for distance pedagogical practices

5 weeks (19 chronological hours) 8 synchronous meetings

Week 1: What is arpa? synchronous problem solving

Week 2: modeling students-teacher with teachers-monitor asynchronous *arpa-d* with low connectivity


Week 3: Planning their own *arpa-d* with their students

Week 4: Implementing their *arpa-d* with their students

Week 5: Reflecting on their experience and the experience of their students with *arpa-d* and closing the workshop

August

Cursos ARPA a distancia:
Prácticas pedagógicas a distancia para promover el desarrollo de habilidades y actitudes por medio de la Resolución de Problemas*



*10% descuento egresados U. de Chile
*15% descuento en 2 o más participantes de una misma institución educativa

Dirigido a:
Docentes de Educación Básica y Media que enseñen en las áreas de Matemática, Lenguaje y Comunicación, Ciencias Naturales y Ciencias Sociales.


Inscripción y programa:
ingenieria.uchile.cl/cursos/165257

Valor:
CLP\$170.000 / USD \$216

Inicio:
Semana del 10 de agosto 2020

Duración:
25 horas en 5 semanas

Contacto:
arpa@ciae.uchile.cl / pherrera@dim.uchile.cl



Logos:
arpa: Actuando la Resolución de Problemas en las Áreas
fcm: Facultad de Ciencias Físicas y Matemáticas
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August-
October

First two workshops for distance pedagogical practices

We run the workshop two times with 24 and 9 teachers, respectively.

The participants came from different regions of the country

Some teachers worked in rural areas

Some had good connectivity and others almost no connectivity



Week 1: synchronous problem solving with teachers via zoom

"I highlight the importance of sharing strategies and different missions so all of us get together a common result. The distance makes it more difficult, but this can be a plus for the development of mathematical language, to be able to make you explain. This is especially important in working with young children to have a common vocabulary and expand the mathematical vocabulary"

Week 2: asynchronous arpa-d with low connectivity modeling students-teacher with teachers-monitor

From monitor's report:

“Using social networks, a strength was that there is a large variety of possibilities to present the material (audio, photo, email, etc.) and weakness would be the consumption of data. However, they think it is more comfortable”

“They believe that there was not much collaborative work because everyone solved the problem before talking to the group”

“Using phone calls is not that comfortable or easy. One of the strengths, it gives the possibility for everyone to solve it before to have something with which to contribute to the group”

Week 3: Planning arpa-d with their students

Modeling arpa-d was reported by some teachers to have been crucial to understand what to do with students

Teachers worked collaboratively in groups through zoom

Monitor has a lot of works helping teachers in planning the problem with students

Many different situations, connectivity, aside of the school level!

Week 4: A lot of candies



**In one rural school,
children's answers were
given through videos**



In a urban area with low connectivity, children's answers were sent through whatsapp

Francisca y Ricardo recibieron una bolsa de caramelos. Los compartieron de una manera uniforme entre ambos y les sobraron caramelos. Justo cuando había terminado de compartirlos, llegaron sus amigos Verónica, Anna y Paul. Ellos también querían caramelos, por lo que los niños nuevamente los compartieron uniformemente entre todos. Esta vez les sobraron dos caramelos. ¿Cuántos caramelos creen tú que trajo la bolsa?

Francisca X Ricardo

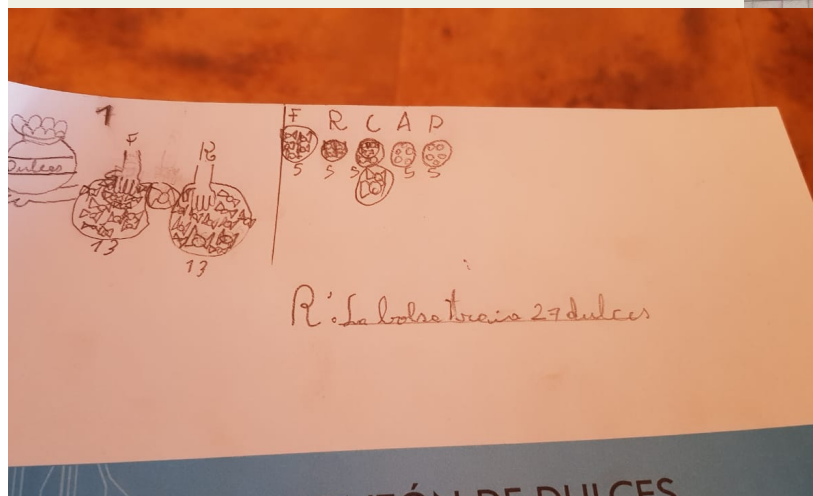
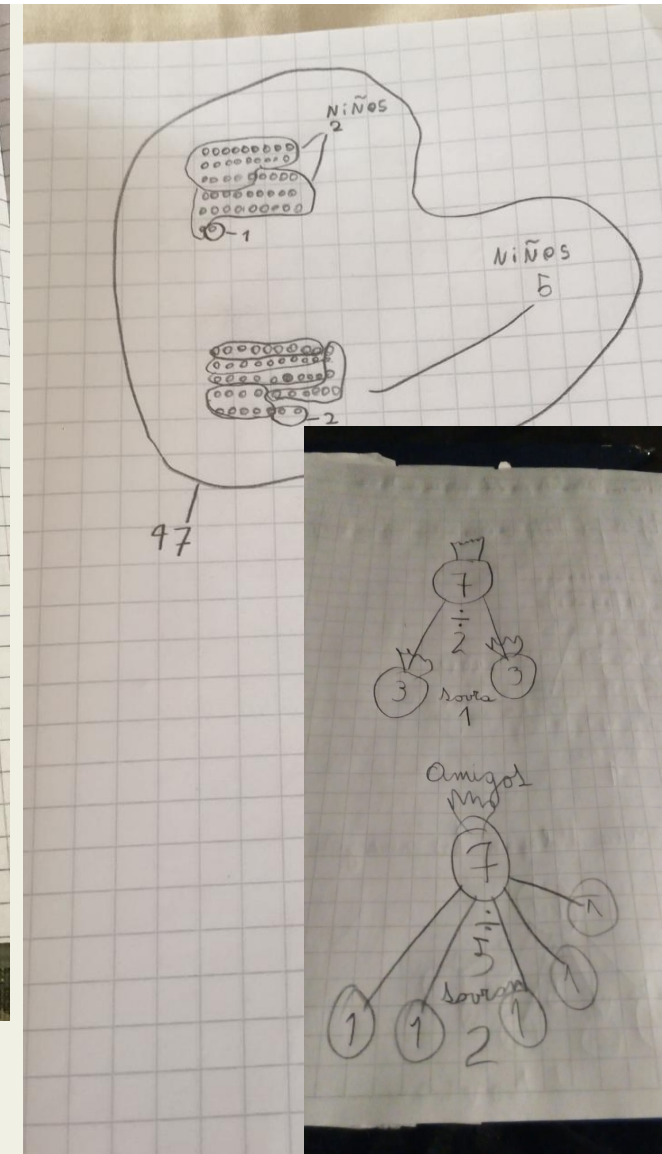
8 = 16

Sobra 4

Verónica Anna

3 + 3 +

15 sobran 2



R: La bolsa tenía 27 dulces

R: La bolsa tenía 7 dulces

Plenary discussion through a presentation

Teacher prepares a presentation to be sent to all students giving them the results of the other students, showing and comparing different strategies and somehow closing the cycle of the problem...

Ahh, and an opportunity for an extra challenge!

Un montón de caramelos

Francisca y Ricardo recibieron una bolsa de caramelos.

Los compartieron de manera uniforme entre ambos y les sobró un caramelo.

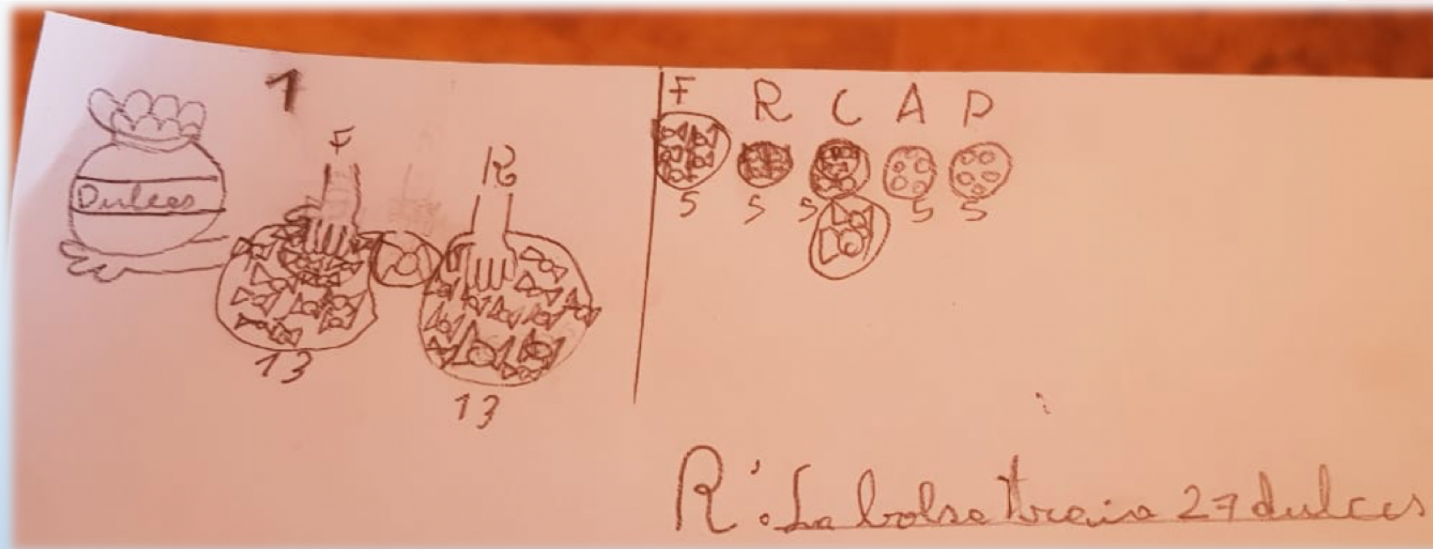
Justo cuando habían terminado de compartirlos, llegaron sus amigos Cristián, Ana y Paul.

Ellos también querían caramelos, por lo que los niños nuevamente los compartieron uniformemente entre todos. Esta vez les sobraron dos caramelos.

¿Cuántos caramelos crees tú
que traía la bolsa?



Representación por conjunto



$$13 + 13 = 26 + 1 = 27$$

Para cada uno

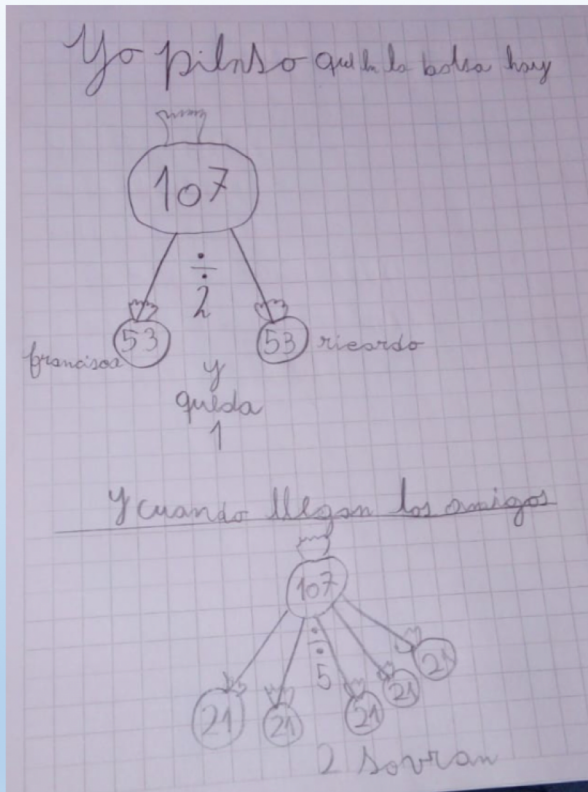
Lo que sobra

$$5+5+5+5+5 = 25 + 2 = 27$$

Para cada uno

Lo que sobra

Por división y adición



$$107 : 2 = 53$$

Para cada uno de los dos amigos

1

Lo que sobra

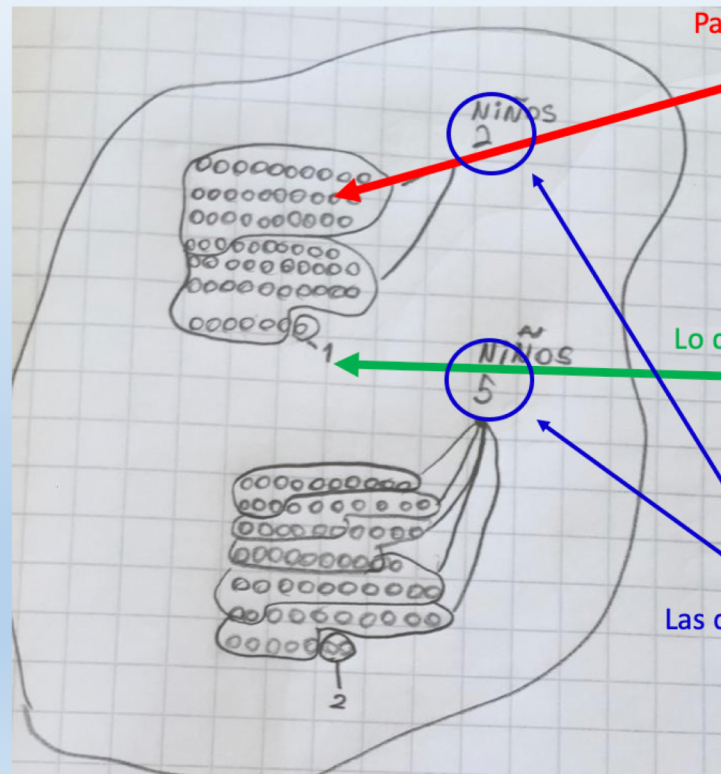
$$107 : 5 = 21$$

Para cada uno de los cinco amigos

2

Lo que sobra

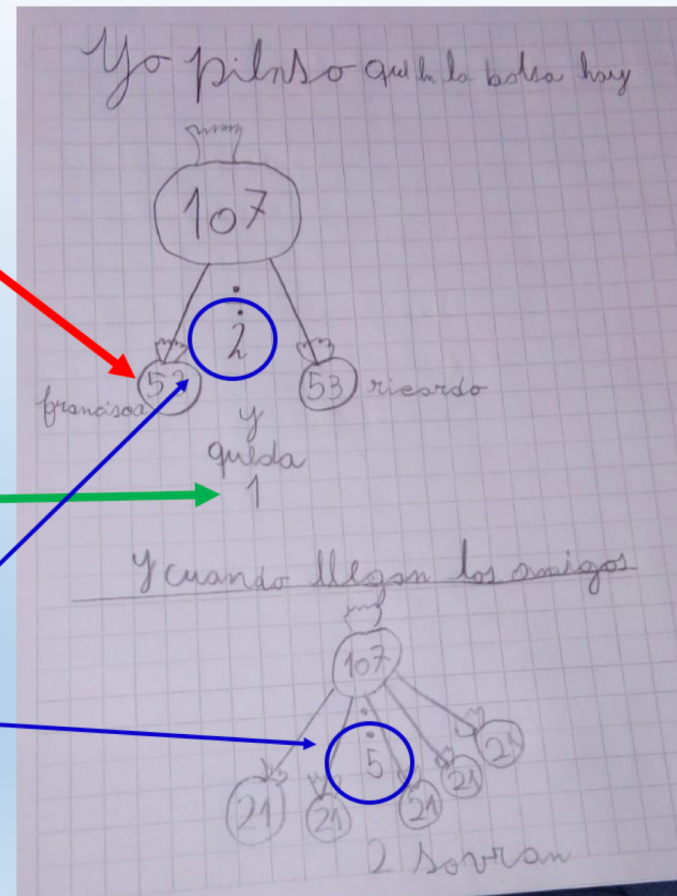
Conexión de estrategias



Para cada niño

Lo que sobra

Las dos situaciones



Las soluciones

La bolsa de caramelos tenía ...

107 dulces

7 dulces

27 dulces

87 dulces

¿podrán haber otras respuestas
correctas?

Week 5: What teachers value about the workshop?

“I found it very good, I am an old teacher and I was used to use exercises and routine problems, so solving non-routine problems was quite enriching, and now I have a large battery of problems to use”


“I was also used to exercises and routine problems, the truth is that at the university ... they did exercises and routine problems for us and one just replicates it at school”

Week 5: What teachers value about the workshop



“I am from Coyhaique, this is part B of the pandemic, which allows you to interact with colleagues from another region, I think this type of instances are very good....”

“...there have been very few instances where I am a teacher and they treat me as a student, it is the best way to model teachers, if you don't live it, you won't learn it”



Week 5: What teachers value about the workshop

“One of my students said: *teacher, I found the exercise very difficult, but I really liked it, we should do it again.* I was very happy to stop being afraid, the important thing is not to arrive at the answer, but rather to think and argue the procedures”

“The challenge now for teaching at distance is to teach parents to play a supportive role in solving problems, rather than just telling them not to give the answer. They have to teach their children to think...”



What is coming for 2021...?



To finish this talk...

“I love your way, you know how to reach children and I learned to ask my students questions with confidence, How would you do it? It helped me to question my teaching practice and see it from another point of view ”

Many thanks to Paula González





... thanks to ARPA team

AND
THANK YOU FOR YOUR ATTENTION!

www.arpauchile.cl
pfelmer@dim.uchile.cl



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