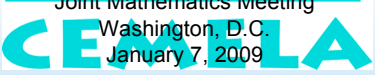


**Mathematics From Work and Home:
Lessons Learned**


José María Menéndez
(jmenendez@math.arizona.edu)

The University of Arizona

Joint Mathematics Meeting
Washington, D.C.
January 7, 2009




Funded by the National Science Foundation,
Grant No. ESI-0424983



Framework


- Sociocultural perspective: dynamical structures, co-constructed knowledge, ZPD (Vygotsky, 1978)
- Funds of knowledge (mathematics knowledge from the household and work)
(González et al., 2001)
- Adult education: self-directing (Knowles, 1968)
- Work with parents (Civil, 1999, 2001, 2002, 2004)
- Cognitive-affective lens:
 - Affective domain: emotions, attitudes, and beliefs & Local and global affect (Gómez-Chacon, 2000)
 - Mathematical 'performance' and subject's 'positioning' from one's peculiar history (Evans, 2000)



Background

Research on adults learning mathematics considers

- Difference in approach and setting
- Variations of motivation - purpose
- Meaning of numeracy (numerical literacy) in the UK - quantitative literacy in the US (Safford-Ramus, 2008)
- Place of nonformal education for adults
 - In the context of lifelong education (Schlöglmann, 2007)
 - In the spectrum from formal to informal education (Coben, 2006): semi formal, non-formal,... (Ettling, 1993; Kalantzis, n.d.)



Our understanding

- *Nonformal education is the type of education that is*
 - *systematic,*
 - *not for accreditation or promotion,*
 - *adapted to the unique situation of the participants,*
 - *of voluntary attendance, and*
 - *relatively flexible structure.*



Systematic

- “Tertulias Matemáticas” (mathematics workshops for parents)
 - Frequency and time: Seven-session modules, 1.5 hr once a week
 - Content: Reform-based curriculum from school (6th to 8th grades) and fractions (per parents’ request)




Voluntary attendance and flexible structure

- Content
 - Self-contained
 - Mathematics focus: Introduction, individual or small group hands-on tasks, group discussion
 - Discussion focus: perceptions on teaching/learning mathematics, experiences with school system, experiences as learners
- Modifications (due to ownership?):
 - Time (from mornings to evenings)
 - Participants (include children)
 - Choice of content (from curricular to fractions)




Non for accreditation

- Participants
 - Latino parents and children (middle school) and their friends
 - Parents formal education level: 2nd grade to college (median 10th grade)
- Link to school
 - Parents recruited by a school staff member
 - No money exchange
 - Parents receive a “diploma” with no official value




Adapted to unique situation...

- School setting
 - Middle school (grades 6 to 8)
 - Borderland city in the U.S. Southwest
 - 94% Latino
 - 87% low SES
 - 25% English language learners
- Parents' situation
 - Mostly recent immigrants
 - Limited English proficiency

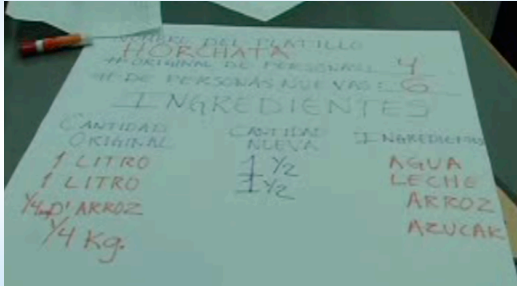


Recipes and proportions

- Topic: Proportional reasoning
- Task: come up with a recipe, list the amount of ingredients for a specific number of servings; adapt the amounts to a different number of servings



Recipe and proportions



Recipes and proportions

- Funds of knowledge: problem rooted in their daily life
- Solution via dialogue
- Different schooling and attitude
- Conversion to grams (prior knowledge) yet the problem is posed in fractional terms: "It is going to be half of a fourth for two more people."

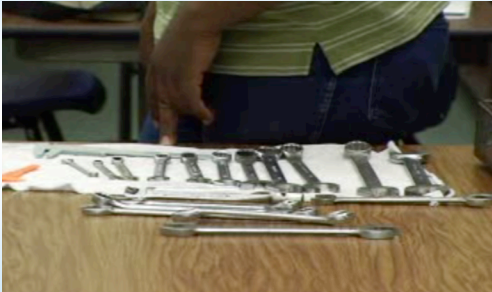


Wrenches and fractions

- Task: Is $\frac{3}{4}$ greater than, equal, or smaller than $\frac{6}{8}$?
- Isidoro's solution: He used rectangle of the same length, divided one in fourths and the other one in eighths, shaded equivalent lengths.
- Marcos' objection: That is not the case with wrenches (there is no $\frac{6}{8}$ " wrench).



Wrenches and fractions



Wrenches and fractions

- Funds of knowledge: consider work and life experience to make sense of the problem
- Parents are experts: engagement and ownership
- Fractions as measure
- Flexibility in use of representations



The fear to the board

- Parents had shown apprehension to explain their solutions in front of everyone on the whiteboard
- They connect this fear with prior schooling experiences



The fear to the board

- **Norberto:** *They were, teachers certainly were strict. Or maybe because, back then, that is how the teacher's system was. You would be asked to come up to the board and... many times, you would forget something, so, you would also get the (imitates teacher hitting student with a stick), the punishment, or a pinch.*
- **Facilitator:** *Physical punishment?*
- **Norberto:** *Physical. So, I think [as a result] one grows somehow afraid of being in front (of people). You start getting distrustful, eh, how do you say it?... psychologically, you start getting afraid of the public. That was, in elementary, right? It just happened. . . .*
- **Norberto:** *Many times I knew, but I had fear, and one gets a mental block. And then that's it: You move neither forward nor backward, so that.*



The fear to the board

- **Facilitator's intention**
 - Showcase different strategies
 - Recognize the participants' contributions
 - Provide opportunities of leadership
 - Position participants as intellectual resources
- **Result**
 - Apprehension and anxiety



Conclusions

- Adults respond to contextualized and concrete problems
- They use everyday experiences to make sense of mathematical ideas and to solve mathematical problems
- Prior experiences mediate their learning (engagement & expansion)
- Small group work/conversation are key for reflection and appropriation
- Flexibility (pace, content, context) -> participation and ownership
- Emotions play an important role in adult education
- Self-contained -> flexibility in attendance ; sense of belonging