Family Mathematics Education: Building Dialogic Spaces for Adult Learning Mathematics

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Teacher training for a family mathematics education in multicultural contexts, 2007/ARIE/00026 (AGAUR)
How does adults learn?

Merriam (2004) argues that we have no single theory or model of adult learning. What we have instead is what she calls "knowledge base of adult learning", that is "a colorful mosaic of theories, models, sets of principles, and explanations." (Merriam, 2004, page 199).
How does adults learn?

Adults learn...

Making meaningful connections to their previous experiences (Flecha, 2000; Freire, 1977, 1997; Knowles, 1984, Lave & Wenger, 1991; Mezirow, 1997; Rogers, 1969).

*Adults as agents of their own learning process.*

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Active learning methodologies

- Freire (1977; 1997): Read and write the World critically; “el método de la palabra”
- Knowles (1984): Andragogy (learning self-directed)
- Flecha (2000): Dialogic Learning
“Social turn” to explain how adults learn

People from disadvantaged environments are penalised at schools (Abreu & Cline, 1998; Abreu, 2005; Secada, 1992; Gallimore Goldenerg, 1993; Tate, 1997; Civil & Andrade, 2002)

Theoretical concepts from Bourdieu & Bernstein
- Cultural capital
- The distinction - habitus
- Classification / Frames / codes
“Predicated on the assumption that classroom cultural and linguistic patterns should be congruent with cultural and linguistic community patterns, researchers and practitioners sought to bridge what came to be regarded as the discontinuity or mismatch gap” (González, Andrade, Civil, Moll, 2001, p. 116).
Transfer knowledge (Evans) - **Thesis of transferability**

Situated practice (Lave & Wenger, 1991)
Culturally transmitted (Scribner & Cole, 1981; Lave, 1988)
Dialogical practices (Flecha, 2000; Freire, 1997; Aubert, Flecha, Garcia, Flecha, Racionero, 2008; Bakhtin, 1981; Wells, 2001)
Funds of knowledge (Moll et al., 2005)
THEORETICAL BACKGROUND

(1) adults learn in context, and
(2) adults are more likely autonomous and self-directed in their own process of learning.

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What are the contributions from the previous researches and theories?

Social and cultural contexts are relevant variables that have an important impact on how adults learn.

Our proposal

We want to go further: building spaces where adults feel free to participate is a crucial fact to promote this “transfer” of knowledge.
How dialogic spaces impacts on adults’ learning mathematics?
What does it mean “dialogic spaces”?

A dialogic space is a “place” (a classroom, a meeting point, a situation, etc.) created by the persons involved in a particular activity, according to non-power criteria, but dialogical principles.

Dialogical principles include (1) the same opportunity for all participants involved in the activity to make contributions, drawing on their own background, experience, etc.; (2) to reach agreements drawing on validity claims, not to impose statements based on a particular power-position; (3) to recognize everybody’s knowledge, not just the academic knowledge.
METHODOLOGY

Teacher training for a family mathematics education in multicultural contexts, 2007/ARIE/00026 (AGAUR) // Family training for school inclusion, 2008/ARIE/00011 (AGAUR)

MAIN AIM

To improve the quality of the teaching practices carried out in Catalonia, through the intervention on family training.
METHODOLOGY

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Teacher training for a family mathematics education in multicultural contexts, 2007/ARIE/00026 (AGAUR)

SPECIFIC AIMS

(1) to identify the elements and educational strategies in the work with adult people in the field of mathematics education, from a multicultural lens; (2) to create training resources addressed to teachers of mathematics in adult education, in order to promote equity and opportunities for everyone to learn mathematics; and (3) to offer resources for a teacher training of quality, connected to real classroom-situations, in order to promote a inclusive family training in mathematics education.
METHODOLOGY

2 CASE STUDIES
(Stake, 1995)

1 elementary school: CEIP Las flores --> Learning Community

1 middle and high school: IES Las manzanas

4 workshops of mathematics addressed to the families (drawing on CEMELA’s work)
25 families involved
Different nationalities: Catalonia, Morocco, Colombia, Ecuador, Romania, Czech Republic, Armenia
CRITICAL COMMUNICATIVE METHODOLOGY

Universality of language and action
People as transformative social agents
Communicative rationality
Common sense
The disappearance of the premise of an interpretative hierarchy
Equal epistemological level
Dialogic knowledge

DATA COLLECTION

Qualitative techniques: videotape, field notes, discussion groups and in-depth interviews.
**DATA ANALYSIS**

**Children’s perceptions of parent’s involvement**

- **Home-based involvement**
- **School-based involvement**

**FAMILY INVOLVEMENT**

- Encouragement
- Modeling
- Reinforcement
- Instruction

**Family perceptions**

- Hoover-Dempsey

**METHODOLOGY**

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TEACHING AND LEARNING OF MATHEMATICS

Prior experience

Social Process

Dialogic Learning

Interaction

Egalitarian dialogue (or not)

Creation of meaning

METHODOLOGY

Adult Education

Social Representations

Attitudes towards mathematics

Expectations towards mathematics

Family Training

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METHODOLOGY

DATA ANALYSIS

A *posteriori*

Grounded Theory (Glasser & Strauss, 1967)

Categories

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THE WORKSHOPS

Some examples of activities

Elementary school
- The Catalan Giant’s Tale
- The Candy Jar

Secondary school
- Meeting through statistics
- Algebra: equations (systems), algebraic language, etc.
THE WORKSHOPS

The Catalan Giant’s Tale: *El gegant del pi*

How tall is the giant?

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The Catalan Giant’s Tale: *El gegant del pi*

A food measures $1/7$ parts of a person’s height.

$$\phi = \frac{1 + \sqrt{5}}{2} = 1.618034...$$
The Catalan Giant’s Tale: *El gegant del pi*

A food measures $\frac{1}{7}$ parts of a person’s height.

$$\phi = \frac{1 + \sqrt{5}}{2} = 1.618034\ldots$$

The golden ratio

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The Candy Jar

Doing estimations

The jar was full of candies. How many candies are there in the jar?

Working groups (mothers and children) to propose possible answers.

Strategies: grounded on “volume”, or “counting”.
THE WORKSHOPS

The Candy Jar

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THE WORKSHOPS

Meeting through statistics

To introduce basic statistics concepts using personal and everyday elements.

• How many children do you have?
• What is your favorite color?
• How many brothers and sisters do you have?
• Etc.
Algebra

Solving equations (systems)

• From natural language to algebraic one
DISCUSSION

Building a “dialogic space”: the ice-breaking activities (Díez-Palomar & Prat, 2009)

to (a) break the gap between “home-based practices” and the school ones, and (b) create this environment of safety

We did it using the *dialogic learning* principles (Flecha, 2000; Aubert, Flecha, Garcia, Flecha, Racionero, 2008)
What we mean by “dialogic learning principles”?
DISCUSSION

What we mean by “dialogic learning principles”?

Egalitarian dialogue

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What we mean by “dialogic learning principles”?

Egalitarian dialogue

Solidarity
DISCUSSION

What we mean by “dialogic learning principles”?

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Transformation
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Creation of meaning

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DISCUSSION

What we mean by “dialogic learning principles”?

Egalitarian dialogue
Solidarity
Transformation
Creation of meaning
Equality of differences

Díez-Palomar & Molina; ALM 16; London
DISCUSSION

What we mean by “dialogic learning principles”?

Egalitarian dialogue
Solidarity
Transformation
Creation of meaning
Equality of differences
Instrumental learning

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What we mean by “dialogic learning principles”?

Egalitarian dialogue
Solidarity
Transformation
Creation of meaning
Equality of differences
Instrumental learning
Multicultural intelligence
DISCUSSION

What we mean by “dialogic learning principles”?

Egalitarian dialogue
Solidarity
Transformation
Creation of meaning
Equality of differences
Instrumental learning
Multicultural intelligence

Javier (facilitator): So... eh... as I was telling you... The first activity... Can be to introduce ourselves to each other and we can meet each other... is to draw a graph using our own personal data. So, for instance, the first question could be “how many children do you have?” So that way...

Joan: We write down... Do we need to write down our name?
Javier: Yes. If you want, I can write it down for you...
Maria: Ah, ok. So he can start... the “gentlemen”...
Joan: Me? I have no children.
Maria: Three.
Celia: One.
Hadiya: Three.
Kristina: Two, two boys.
Javier (facilitator): And Javi... by the moment zero.
Participants: - laughing- (Source: Fieldwork, CEIP Las Flores. First session; 2007/ARIE/00026; AGAUR, Agència Catalana de Gestió d’Ajuts Universitaris per a la Recerca).

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DISCUSSION

Sharing different ways to solve a situation

The Catalan Giant Tale
The Catalan Giant Tale

Javier (facilitator): It seems that there are more groups solving the problem in this way: that is, they call the height of the giant as “x”. Then they established the relationship: if my length is this, and my foot measures that, then the giant should be... if we know the height of the foot, then “x” would be that. So they used the “rule of three”. (Source: Fieldwork, CEIP Las Flores. First session; 2007/ARIE/00026; AGAUR, Agència Catalana de Gestió d’Ajuts Universitaris per a la Recerca).
Javier (facilitator): Ah... Over there, I think that you also were doing something in relation to statistical average of several feet...
Many people: Yes, yes...
Will: ...This is a way to explain that too...
Maria: You explain!
Will: Well, we took several samples to calculate it more precisely, more exactly... So we did it by statistics. This is statistics sampling. Then you calculate the average. That’s why I was asking you. Because to me... I already knew that, as average. To me the rate does not make any sense.
Javier (facilitator): Aha, aha... ok. This is another way to solve it. (Source: Fieldwork, CEIP Las Flores. First session; 2007/ARIE/00026; AGAUR, Agència Catalana de Gestió d’Ajuts Universitaris per a la Recerca).
Solving “conflicts” about mathematics

Context: We are in a classroom placed in a centre with Middle and High School. First row of chairs was empty. Five mothers were sitting in the second one. In the third, three mothers. Behind them, three more mothers are present in the classroom. We know that there is a man also in the audience: a father. They are working on lineal equations. They are translating sentences from regular language to algebraic language. Tona (the facilitator) is solving a equation on the chalkboard. Some noise is in the room. It seems that some mothers do not understand the strategy that Tona is using to solve the equation.
DISCUSSION

Solving “conflicts” about mathematics
Tona (facilitator): Every equation such as $ax + b = c$ has one unique solution.
Mother 1: But... but...
Tona (facilitator): Yes... (At the same time).
Mother 1: I always did it like this, and I understand it that way... But teachers now they teach children to simplify, to let the “x” like... to have all numbers simplified. Then if I get three “x” here, and two more “x” over there, to make them “disappear” I need to take away these two “x” in this side and I also need to take away the same 2 “x” in this other side...
Tona (facilitator): They [the children] do the same...
Mother 1: Yes, but this is more complicated...
Tona (facilitator): Let me explain you.
DISCUSSION

Solving “conflicts” about mathematics

Mother 1: Because she [the teacher] wants [the homework] like this... and to me is, is...
Tona (facilitator): Let me explain you.
Mother 1: It is more complicated.
Tona (facilitator): Yes, it is more complicated, but the teacher may considerer that this is more clear in terms of concepts.
Mother 1: Yes...
(Some noise can be heard in the background. Tona starts to write down something in the board –see the figure-). Javier (facilitator): Aha, aha... ok. This is another way to solve it.
(Source: Fieldwork, IES Las manzanas. Third session; 2007/ARIE/00026; AGAUR, Agència Catalana de Gestió d’Ajuts Universitaris per a la Recerca).

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DISCUSSION

Solving “conflicts” about mathematics

\[ 2x + 5 = 40 - 3x \]
\[ 2x = 40 - 3x - 5 \]
\[ 2x + 3x = 40 - 5 \]
\[ 5x = 35 \]
\[ x = \frac{35}{5} \]
\[ x = 7 \]

Proof:

\[ 2x + 5 = 40 - 3x \]
\[ 2x + 5 - 5 = 40 - 3x - 5 \]
\[ 2x = 35 - 3x \]
\[ 2x + 3x = 35 - 3x + 3x \]
\[ 5x = 35 \]
\[ x = \frac{35}{5} \]
\[ x = 7 \]
DISCUSSION

Building knowledge towards dialogue and interactions

Context: Parents are working to solve this problem: “If is $\frac{3}{4}$ parts of a ribbon, draw the ribbon corresponding to $\frac{1}{2}$, $\frac{2}{4}$, $\frac{4}{3}$ and $\frac{3}{2}$. You may justify your answer.
DISCUSSION

Building knowledge towards dialogue and interactions

Agustín: To four... three fourths... since they are the same, this bit would be the whole ribbon. That means...
(Some noise in the background)
Pilar: The total... the ribbon would be that...
Alberto: The unit is four fourths. You need to divide the bits, so you get four fourths.
Pilar (at the same time): ... we need for the whole unit...
Agustín: I don’t remember the percentages...
Somebody: The half.
Agustín: ... so if we have five sixths, then... here we can add as much bits as we need, and this would be the parts that correspond.
Javier (facilitator) –He stands up and goes to the board-
Somebody: There are two.
CONCLUSIONS

- Dialogic spaces are spaces where people interact to each other.
- Adult learners share their own ways to solve the different activities, which provides a plethora of different mathematical strategies to consider and discuss among all the participants.
- Adult learners bring home-based examples to solve the activities.
- These home-based examples usually are grounded on “funds of knowledge” referents.
- Dialogue becomes a “tool” to connect school-based knowledge and non-school-based types of knowledge (everyday live experiences).
- Adults come with all these experiences when they feel safe and comfortable in the learning space (classroom, etc.).
REFERENCES


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