DOCUMENT RESUME

ED 474 041 SE 066 772

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TITLE	Two Dilemmas in Communicating Mathematics in Adult Basic Courses: "How To Support Pre-Knowledge of Adult Learners" and "How To Support Democratic Classroom Decisions."
PUB DATE	2000-00-00
NOTE	6p.; In: Proceedings of the International Conference on Adults Learning Mathematics (ALM-7) (7th, July 6-8, 2000, Medford, MA). For full proceedings, see SE 066 771.
AVAILABLE FROM	Peppercorn Books, P.O. Box 693, Snow Camp, NC 27349.
PUB TYPE	Guides - Classroom - Teacher (052) -- Reports - Research (143)
EDRS PRICE	EDRS Price MF01/PC01 Plus Postage.
DESCRIPTORS	*Classroom Environment; Adult Education; *Adult Programs; Cognitive Processes; *Learning Processes; Mathematics Instruction; Student Attitudes

ABSTRACT

This study explores how adults' perspectives, intentions, blockages, resistance, and fascinations are reconstructed during a mathematics course in adult basic education. These aspects are discussed as important building blocks for developing theory in adult educational research. Adult mathematics education was compared in different institutional settings--adult basic education, adult vocational training, and informal general education. Results showed two dilemmas faced by educational planners and teachers in adult basic mathematics: (1) how to meet the adult learner's already established conceptions and procedures; and (2) how to support democratic classroom decisions. (KHR)

Two Dilemmas in Communicating Mathematics in Adult Basic Courses: "How to Meet Pre-Knowledge of Adult Learners" and "How to Support Democratic Classroom Decisions"

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Conversation Between Researcher and Practitioner

It just seemed so obvious. As the theme of ALM-7 was announced as "A Conversation Between Researchers and Practitioners," it came naturally for us to prepare a joint presentation: Lena Lindenskov as a researcher in mathematics education and Eigil Peter Hansen as an adult teacher in mathematics. Our common aim of the presentation at ALM-7 was to present and discuss experiences from a one-year mathematics course in adult basic education, conducted by Eigil and observed by Lena. This course was given in a suburb of Copenhagen, the capital of Denmark.

We acknowledge the need to develop, explore, and document different ways of connecting theory and practice in adult mathematics education—different ways of cooperation between research and teaching. Our cooperation in this project is one way among several possible ways, and we might choose another way in future cooperative projects. Our cooperation this time can be characterized by the following components:

- The teacher has absolute power over mathematical content and pedagogical methods, and the researcher has no influence.
- The students have the right to a veto on participating in research conversations and interviews. In the first lesson the teacher asked the class if they would allow research visits, and each student was, at any time, free to break off research conversations and interviews.
- The researcher has absolute power over research questions, methods, and analyses.

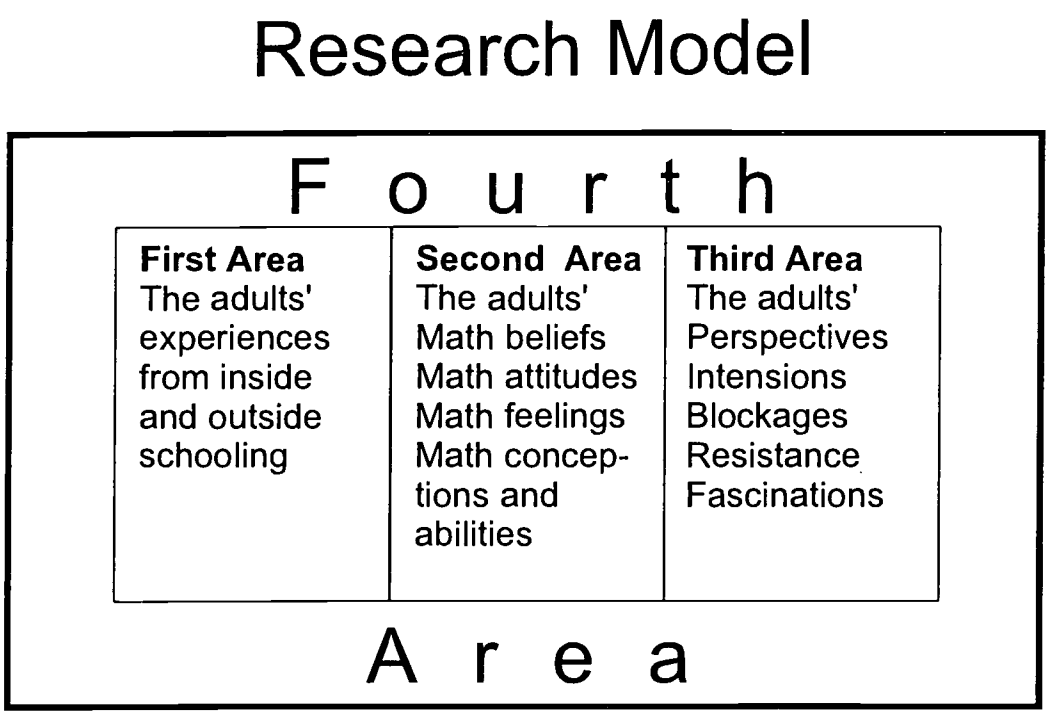
The purpose of our cooperation is research and production of theoretical knowledge. Teaching practices and learning practices play two roles. Understanding for improving teaching practices and learning practices is an *ultimate goal*, as for all theorizing in adult mathematics educational research. But teaching practices and learning practices are also *means*: instead of setting up any experimental design, ongoing teaching practices and learning practices in natural settings provide grounds for theoretical analyses.

Lena started the presentation with her relatively optimistic view on research-teaching cooperation, strongly supported by personal experiences of taking different roles as a teacher and a researcher. Lena sticks to the obligation of ensuring research being not-teaching. In research you can observe and interview individual students and groups, immerse yourself in the extensive literature in mathematics education, and visit and observe the diversity of math-containing practices in different educational institutions and different settings outside education. These are activities which are not included in normal teacher practices, and that's why it is important that researchers make the most of it.

Research Questions

The project we presented at ALM-7 provides knowledge of different agents' understanding of everyday mathematics inside and outside education. The project explores how adults' perspectives, intentions, blockages, resistance, and fascinations are being reconstructed during a mathematics course in adult basic education. The project compares adult mathematics education in different institutional settings: adult basic education; adult vocational training; and informal, general education (the last is called day-folk-high schools).

In the model below, which consists of four areas, the core questions are how the fourth area influences the third area. The fourth area contains elements that are specific to the profile of the particular educational institution. It includes elements such as the profile of the teachers, curriculum, tasks, materials, fitting up of the classroom, and the establishing of relations between the ongoing teaching-learning practice and other practices.



The specific research questions were:

1. How do elements in the fourth area facilitate the adults' intentions (of what and how to learn and use methods and wisdom in mathematics) in being expressed, lived, and developed?
2. How do elements in the fourth area facilitate the adults' blockages and resistance in being expressed and interpreted by others as blockages and resistance?
3. How do elements in the fourth area facilitate the adults' fascination in being expressed, lived, and developed?

The idea for Lena's observing and documenting Eigil's teaching and the adults' learning was to explore, to learn, to be surprised and let new doubts arise. Lena has learned a lot. She has started thinking of teaching as being confronted with dilemmas without best solutions, and thinking of dilemmas as core issues to reflect upon. Concepts of dilemmas might become important building blocks for theory development.

The Climate for Learning in the Class

Starting the class it was important for Eigil to support a good climate for learning. The class spent time on mattering: beliefs people have, whether right or wrong, that matter to someone else, that are the object of someone else's attention, and that others care about and appreciate. Eigil sees four dimensions of mattering:

- Attention
  The feeling that another person notices you or is interested in you.
- Importance
  Others seem to care about what you want, think, and do.

- Dependence
  You feel that you are a contributing member and others are counting on your participation.
- Ego-extension
  You believe that others are interested in your successes and disappointments and actively follow your progress.

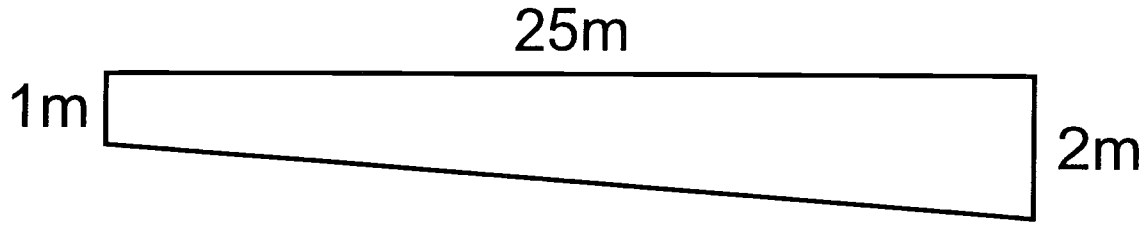
The First Dilemma
We define a dilemma as a right-right choice situation. In the presentation we talked about two dilemmas which we consider as general in teaching adult basic mathematics.

The first dilemma, faced by educational planners and teachers in adult mathematics, is how to meet the adult learners' already established conceptions and procedures:

> How are learners' established conceptions and procedures actually met by the teaching materials and how do teachers meet them in classroom conversations? And how could/should they be met?

It is often said that best practice is helping the adults become aware if they have methods to calculate, approach, and solve problems. It is important to give the adults time to remember and discuss their methods. It is important to arrange learning situations where the adults can build upon their methods. But observing and interviewing the adults in Eigil's class challenged these ideas and showed the relevance of introducing light and shadow into these ideas.

Among the adults in Eigil's class we saw three groups. The first group did not have any methods themselves. They liked to be introduced to and to engage in developing new methods. They might feel lost and spend time for no purpose in classroom work and discussions on learners' methods. One adult articulated it this way: "Oh, but I have nothing in my own head, so of course I want to get methods from the teacher and use those methods." A second group had their own methods and actually did not care about the teacher's or other learners' methods. The second group did not try to make new methods usable. In the presentation we showed examples from working with area and volume where adults stuck to their own old methods.



Different ways to calculate the area:

$1 \times 25 + \frac{1}{2} \times 1 \times 25$

$2 \times 25 - \frac{1}{2} \times 1 \times 25$

$\frac{1}{2} \times 25 \times (1+2)$

A third group had some methods already, but improved them or replaced them during the course. We gave examples in the presentation from calculating percentages, where several different methods existed among the adults. The different methods were discussed in the class.

Examples of different methods of calculating problems with percentages:

150 increases by 15%: 150 + 15% of 150 (150 + 0,15 x 150) or 115% of 150 (1,15 x 150)
150 decreases by 15%: 150 – 15% of 150 (150 – 0,15 x 150) or 85% of 150 (0,85 x 150)

150 increases to 180 - How many percent?
180 – 150 = 30 (30/150) x 100 = 20% or 180/150 = 1,20 (= 120%) = an increase of 20 %

150 falls to 120 - How many percent?
150 – 120 = 30 (30/150) x 100 = 20% or 120/150 = 0,80 (= 80%) = a fall of 20%

As we see the question of how to meet existence and non-existence of pre-knowledge as a dilemma, we cannot describe just one right answer to give planners and teachers. We see many right answers as to how to meet pre-knowledge. Which answers are better than other answers depends on complex elements, e.g., the institution's and the adults' intentions with the course. And it might be highly influenced by individual characteristics.

A year after the course ended, we invited the adult learners to an informal meeting. Only three came. A remark from one of them illuminated the dilemma, when she told that one day at her job she told about the new percentage method from the course. She had been both proud of the method and worried that it was far from everyday use. Then one of the more educated colleagues responded that it was a well-known method that was often used in the company. After that day she always used the new method. For us it is obvious that the social reaction to new methods from education is overwhelmingly influential, e.g., as to whether the adults will remember, appreciate, and use new methods and knowledge or not.

The Second Dilemma
The second dilemma concerns the power of the learners. To give you some idea of the learners' intentions and feelings, let us tell you about Anett. She was born in 1966. In her thirties it became her intention to get an education. Mathematics was her worst subject in school as a child. She told us that still as an adult she can feel shocked when a mathematics teacher approaches her, but expected that as an adult it MUST be possible for her to understand mathematics. She said she finds it highly demanding to express out loud when there is something she does not understand. She knew she herself was responsible for getting it expressed, but still it was felt both difficult and tough. The best moments for her were the warm feeling of understanding. Then she felt like crying out loud: "YES YES YES, I understand." After those moments she went home thinking it was worth the struggle.

According to Danish legal provision, the learners participate in the ongoing planning of the course. In Eigil's class two themes were democratically chosen: *The first was art, the second was food.* Most of the adults imagined "food and mathematics" more relevant to everyday life than "art and mathematics," e.g., Anett. Anett spoke highly in favor of food and mathematics in the democratic decision process, but she did not mention food and mathematics at all at the end of the course. Instead she wrote that working with mathematics in art had been "cool." It was fun and exciting, combined with creativity (cutting and pasting), measuring, calculating, hanging up the pictures, and getting the photos of themselves. At the end of the year the adults as a group considered "art and mathematics" as being mostly relevant. This was confirmed a year later at the meeting. The adults said that mathematics and art had changed their way of looking about their surroundings and had given inspiration for holiday activities with their sons and daughters. So the second dilemma is how to provide the learners with adequate information to base their decisions upon. Again it is not to be expected to find the one and only right answer, but to be able to reflect upon several good answers.

We have given some documentation on how some Danish adults choose between proposals, and we feel the need of two concepts on motivation in order to understand the dilemma:

- We need a concept of what might be called "Motivation A." Motivation A drives you to choose between proposals.
- We also need a concept for what might be called "Motivation B." Motivation B drives you through the ongoing work, the detailed mathematical ideas, the detailed tasks, the detailed calculations, etc.

What kind of material should we then provide the learners with? We doubt that a discussion of the relevance of the theme (art, food) is suitable. That only serves the purpose of involving motivation A, but not motivation B. The examples given show that when a theme such as "mathematics in art" has the potential of expanding the horizon of the learners, but is not directly applicable in everyday life, then motivation A might be low, and motivation B might be high.

Why "Motivation A" might be high for mathematics and food
The students deal with different items such as:

- cooking, recipes, temperatures;
- new and old units of measurements;
- shopping;
- calories, weight, exercise.

Why "Motivation B" might be high for mathematics and art
The students deal with different items such as:

- basic rules and tools for rectangle, circle, and triangle;
- permutation;
- the divine fraction and the golden rectangle;
- area measuring;
- the Pythagorean theorem.

And at the same time they learn and train rules about mathematic models, equations, etc.

SE066771

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