PARENTS AND STUDENTS INTERACTION IN MATHEMATICS : DESIGNING HOME MATHEMATICAL ACTIVITIES

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ABSTRACT

In this paper we tried to investigate some facets of parents and students interaction concerning mathematics at home. We studied the difficulties that some parents experienced as they tried to communicate with their children in different kinds of home–mathematical activities. The results showed that the parent-child communication proceeded more smoothly when the home mathematical activities did not look like the activities in the school textbooks. Moreover, the parents seemed to need experiences about the different ways of solving a mathematical problem.

THEORETICAL BACKGROUND

Many researches have shown that students' home experiences influence their beliefs about mathematics as well as their mathematical activity in the classroom (Anderson, 1997; Leder, 1992; Young Loveridge, 1989; Wang, 2004). This fact means that if parents' involvement is crucial to the mathematics education of their children, then parents can not be founded at the margins of mathematics education (Peressini, 1998). We should mention that, in our country, parents declare that they spend a lot of time in doing mathematics with their children at home (82,4%) and they declare that they spend more time on mathematics in comparison with other school subjects (57,5%) (Kafoussi & Ntziahristos, 2003).

In the previous CIEAEM conference we presented research results concerning parents and teachers interaction about students' mathematics learning in school (Kafoussi, 2005). Our research results had revealed three basic problems regarding the communication between the teacher and the parents, when the teacher tries to follow a new approach for the learning and teaching of mathematics (cf. NCTM, 2000). The first problem was related to the traditional beliefs that the parents had expressed about the teaching and learning of mathematics. The second problem concerned the negative feelings that the parents had experienced as they tried to follow the teacher's instructions in doing mathematics with their children at home. The third problem was connected with the difficulty of the parents to accept the autonomy of their child's thinking in mathematics, when they were engaging with mathematical activities at home.

According to our opinion, all the above results speak for a reappraisal of the relationship between school and family regarding students' mathematics education, so that parents' beliefs and practices to be in accordance with the aims of mathematical education nowadays. More specifically, the parents have to encourage their children to communicate their thinking in mathematics and to acquire faith in their ability in doing mathematics. However, in our opinion, such a change concerning the management of parents-students interaction is dialectically connected with the quality of the given homework.

The purpose of this paper is an initial effort to investigate facets of parents and students interaction concerning mathematics at home. The basic research question was the following: What difficulties do the parents experience as they try to interact with their children at home in mathematics, when they are engaged in different kinds of home–mathematical activities? A first effort to answer this question could give us the opportunity to discuss about the appropriateness of the different kinds of home mathematical activities.

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METHOD

Four parents with their children participated in this research. The students attended the sixth grade of elementary school (12 years old). The research took place in 2005-2006. The parents accepted voluntarily to participate at the program. Moreover, these parents had expressed to the teacher of the class their agreement to the new approach about the teaching and learning of school mathematics. The teacher of the class had tried to follow an approach compatible to the constructivist and interactionist theories of mathematical learning (Cobb & Bauersfeld, 1995).

We gave to the parents different kinds of mathematical activities that they could realize with their children at home. These activities were given to them in October, in December and in March. Moreover, in October, we discussed with them about their role when they would be engaged in mathematical activities with their children at home. The activities given to them were based on proposals from different researchers (cf. Borasi, 1987; Kloosterman, 1998; SMP, 1987) and they could be classified in the following categories:

a) *Games*. **For example: Make a row of four numbers: The child choose two numbers from a small square and he/she finds their product. Then, he/she puts a monochrome counter in a big square covering the number that corresponds to this product. The parent does the same by using a counter of a different color. The winner is the one who will cover 4 successive numbers horizontally, vertically or diagonally.**

132	77	20	70	108	50
44	110	40	48	32	55
66	48	60	42	99	24
35	72	56	36	120	96
40	45	80	60	72	30
88	28	63	84	54	90

10	5	9
4	11	7
6	8	12

b) *Activities connected with everyday experiences*. For example: The parent gives to the child a catalogue with school office materials and their prices from a newspaper in order to make a list of materials that he/she needs for his/her office and the corresponding budget.

c) *Unusual mathematical problems*. **We used the term "unusual" in order to distinguish them from the typical school textbook problems. For example: Mr. Pythagoras made up a code. In his code each figure stood for one of the numbers 1,2,4 or 5. He wrote the following number sentences. Guess his code.**

d) *Students' mathematical errors*. **We gave to the parents usual mathematical errors that the students make in school mathematics. For example: The teacher asked their students to find which number is**

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missing in the following operation: 1287 - … = 576. George answered : "1863". The parent had to discuss with the child what he/she would say to George in order to help him to understand his error.

The dialogues among the parents and their children when they were engaged in mathematical activities at home were tape-recorded. Moreover, we realized two meetings with the parents, after having finished a group of activities. In these meetings, we discussed with them their impressions from their engagement in these activities as well as concrete moments of their interaction with their children. These discussions were tape-recorded, too. So, our data was based on the transcripts of these dialogues (parent-child, parent-researcher).

RESULTS

The results of this research showed the following:

a. The parent-child cooperation proceeded very smoothly when the home mathematical activities concerned games. Both of them enjoyed these activities. The parents left the child alone to think and decide about his/her actions and sometimes they discussed about them. For example in the game described in our method (Make a row of four numbers) some parents asked their child why he/she chose some concrete numbers in order to find their product.

b. We were impressed when we found out that all the parents did not show an interest in the mathematical activities that they were connected with everyday experiences. They were engaged in these activities towards the end of their cooperation with their children and two of them left the child completely alone to give an answer to these activities. The comment of a parent about this fact was: "This activity was completely indifferent to me. It looked like an exercise in the school textbook."

c. The parents experienced anxiety with the unusual problems, because they estimated that they were difficult and their children could not find a solution. When their child solved the problem, they were impressed (e.g. "I was very impressed with this problem. It was a nice surprise for me, because I thought that it was very difficult for her."). However, when their child could not find a solution with facility, they experienced a lot of difficulties in order to help him/her. These difficulties were connected with the absence of flexibility that they experienced as they tried to think different pathways to solve these problems. The following transcripts are representative of this situation.

The problem that the parents had to discuss with their children was the following*: In a farm, there are chicks and rabbits. All together are 18 and they have 58 legs. How many chicks and how many rabbits are there?*

Episode 1

Parent 1: This problem is very difficult for you, do you know equations ?

Child   : Yes, I know!

Parent 1 : What do you know?

Child   : We know about x.

Parent 1 : Oh, yes, I remembered.

Child   : But here we don't need it. We will make a division.

Parent 1 : What will you divide?

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Child : I will divide 58 with 4.

Parent 1 : What will you find?

Child : …

Parent 1 : You can't find something from this. Take a paper and a pencil. *(He tried to explain the problem to her daughter as a system of equations using algebraic or arbitrary symbols, but as he failed, he was nervous and he proposed to her to give up).* I used a way that I remembered from the school but it is confused.

Episode 2

Parent 2 : How many legs does a rabbit have and how many legs does a chick have?

Child : A rabbit has 4 legs and a chick has 2 legs.

Parent 2 : Ok. All together have 58 legs. How can we find how many chicks and rabbits are there? What do you think?

Child : I will divide with 4 in order to find how many legs have the rabbits…

Parent 2 : But you know that all they have 58 legs.

Child : Yes, but we can find for the rabbits separately…I will multiply 18 with 2.

Parent 2 : This is an idea. Ok.

Child : I can do it with my mind…36.

Parent 2: So, if all the animals were chicks, they would have 36 legs. But we have 58 legs, because we have rabbits also. What does this difference mean?

Child : The rabbits.

Parent 2 : So, the other legs are from the rabbits. However, the rabbits have 2 more legs. So, what can we do now?

Child : I will multiply with 2 again… no with 4…

Parent 2 : (She repeats her thinking again) Think! We have 58 legs. If the animals had 2 legs we would have 36 legs. So the difference from 36 to 58 has to do with the rabbits that they have 2 more legs.

Child : I will divide 58 with 4.

Parent 2 : But, what would you find? …How many more legs do we have?

Child : Ah! I will subtract 36 from 58.

Parent 2 : Ok.

Child : 22

Parent 2 : So, what does this mean now?

Child : ….

Parent 2 : Can we find something from this now?

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Child   :….

(They stop to discuss about this problem)

d. The parents gave a lot of guidance when they had to discuss the mathematical errors with their children. In that case they expressed the opinion that their child had to be able to correct the errors, as these problems were connected more directly to their school mathematical knowledge. So, they were upset when their children did not find the correct solution quickly. Moreover, they tried to guide their children in order to find a solution that they thought it was the easier according to their opinion. The following episodes are representative.

In the first episode that is presented the parent and the child had to discuss the following error concerning fractions:

Maria made the following operations with fractions:

½-1/3= 1/6

1/3-1/4=1/12

1/6-1/7=1/42

Then she said: "When you subtract fractions, you can multiply the denominators and to put the number 1 as the numerator". Do you agree with Maria?

Episode 1

Parent : Do you see something common in these fractions?

Child : Yes, all the numerators are the number 1.

Parent : Do you see something else?

Child : The difference of denominators is 2 units.

Parent : Is it 2?

Child : No.

Parent : How many units do they differ?

Child : What do you mean? 2 times 3 is 6, 3 times 4 is 12, 6 times 7 is 42.

Parent : How many units do the denominators differ?

Child : 1.

Parent : Ok. If the difference of the denominators was 2 units, what would be happen? For example, you can try to make the subtraction 1/3-1/5.

Child : 1/3-1/5= 5/15-3/15=2/15.

Parent : So, this is not correct.

In the second episode the parent and the child had to discuss the following error:

The teacher asked Katerina to answer the following problem: "Which is the number with 25 units, 16 hundreds and 13 tens?" Katerina answered: "251.613". What would you say to Katerina?

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Episode 2

Parent : What would you say to Katerina?

Child : I would say that this is wrong because the units are at the end and not at the beginning and the units hide 20 tens.

Parent : If you said these things about units and tens , Katerina probably could not understand her error. Think which is the right answer and then think what you would say to Katerina. If you say confused things she will not understand. Katerina is a child like you and she made an error. Try again.

 Child : Katerina, this is wrong because the units are at the end.

Parent : Which is the right answer?

Child : I will begin from the units, 25 units are 5 units and 2 tens. Then I will go to tens, I will add 2 and I will say 13 plus 2, 15, but they hide one hundred and I will write 5. Then, I will go to hundreds and we have 16 hundreds : 1655.

Parent : If you wanted to check it, what would you do? Be careful! I would think the following! I will do everything in units in order to be sure: 16 hundreds, how many units are they?

Child : 106…160. I don't know! (*She gets upset.*)

Parent : OK. The 16 hundreds are 1600 units (16x100). The 25 units are 25 units. The 13 tens are 130 units. We add them and we find the number *(he makes the addition).*

Child : 1755.

Parent : Why did you make an error?

Child   : I forgot to put the one hundred.

Parent : Which is the easier way? Your or mine? Your way is more quick, but I think that my way is the easier in order to help Katerina. Could you explain again your way?

Child   : I would say that 25 units are 5 units and 2 tens…(*she repeats her thinking*).

Parent : Do you think that Katerina would understand?

Child   : Yes!

Parent : If I was Katerina, I would be confused….It is more difficult to think with the mind…but when I write the numbers, I am more sure...*(he repeats his solution).* Do you think that your way is easier?

Child   : Yes!

CONCLUSIONS

In general, the results showed that the communication among the parents and their children was better, when the mathematical activities were not similar to the activities in the school textbooks. At this case, they discussed with their children without anxiety and they did not give them guidance. When the activities concerned topics which the parents evaluated that their children should know, the parents got more upset and this fact pushed them to give to their children more directions.

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Moreover, the parents seemed to experience difficulties in order to help their children in the problems given to them. They did not have the flexibility to think different ways of solving a mathematical problem. The organization of workshops at school, where the parents could discuss the management of some representative mathematical activities of this kind could maybe help towards this goal.

As these results came from a small sample of parents, we propose that more research in this area is necessary in order to understand better the mathematical experiences that students bring in school as well as to promote a better cooperation between family and school concerning mathematics education.

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