Introduction of the Concept of Length and Perimeter in Primary School

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Abstract: This paper investigates the acquisition of the concept of conservation of length and perimeter. Conservation in mathematical terms is the invariance of property under some geometrical transformations e.g. rotation, translation, reflection.

The study describes an experiment, which focuses on the issue whether measuring the length and the perimeter of the various objects with both old Hungarian units, and standard units might provide a contribution to the development of the concept of perimeter.

In this mathematics class the children work in a different way: together, either in groups relying on the contributions of others, or on their own.

The study describes a teaching experiment, in which measuring perimeter with old Hungarian measurements of length plays an important role.

Introduction:

Teaching measurement is one of the most important parts of mathematical education in primary school. As experience has proven students have serious problems with measurement in every age group. The reason for this can be that in the first class pupils have to learn concepts and connections which most of them are not able to understand due to the characteristics of the age group. The other reason can be that children generally gain few experience in measurement and their experience acquired in real life is not used at school. Discovering the connection between the terms of everyday life and that of science is essential in education. (Vigotsky: Thought and Language)

In Hungarian mathematical education according to the curriculum the measurements of length, mass and time and their units are introduced from the first grade to third. So we assume the children have acquired these quantities and level of relationships and abstraction that enables them to change the units of measurement in given number sets. This is inconsistent with theory of Piaget and also everyday experience.

In our opinion it is probably not a good idea that the different kind of measurements follow one after the other in the textbooks and most of the teachers follow this order. So all units of measurement and the connection among them are taught at the same time, which will inevitably be confusing for the children.

In this paper we focus on how children gain experience in measuring length and perimeter and how they can combine it with their knowledge in real life. We suppose that collecting a large amount of experience in measurement can help the pupils to grasp the concept of perimeter and area in mathematical education.

The content and method of the study

The research has been carried out in the first and second grade of a school in a housing estate (Bocskai István Primary School in Debrecen, in Hungary). The children are of average ability, the school is poorly equipped and the teaching methods lag behind the requirements of our age. These aspects are very important in the choice of the school so that we could come to the right conclusions with respect to mathematical education.

It was in the spring of 2004 that our research began. At first we used the measurement units of Hungarian tales for the introduction of the measurements of length. It was carried out in 12 lessons. In the first four lessons the concepts of arm, fathom and span were presented which followed by standard units of length. At the beginning the children worked together, and then they worked in groups and later on their own. The introduction of each unit was followed by measuring in groups. Each group was given different measurement tasks and they had to measure with two or three kind of units. The data they gained had to be organised in a given

table. The group leaders gave account of the measuring in groups; and they compared the estimation of pupils with the measured numbers and the numbers of the different units with each other. Pupils found relationships on the basis of the measured data and then they drew the conclusion for the units and index number and estimation and measuring.

The lessons were videotaped.

At the end of this work the children wrote a test paper and the researchers checked the knowledge of pupils in this theme, the delay test was written a month later..

The research was continued in the autumn of 2004 with the same children. Now we focused on the preparation of the concept of perimeter. The researcher taught 14 lessons in the afternoon activity. During the first three classes the children measured the length, width and, heights of large objects (e.g. the fence of the school) using different units (fathom, meter, arm and span).Children worked in groups in the course of measuring then they organised their estimations and the numbers in the given tables.

In the following task; children had to determine the length of the opened and closed figures by line segments on the square grids by counting. At the beginning the children mixed up the right and left while drawing the line segments. Later the children planned such lines and the others drew these according to the instruction of the author. At the very beginning 80 percent of the pupils didn't give the right length, they gave the number of the inside tangent square or the outside. A few of them changed directions during the count. These tasks developed beyond the determination of the length of line in counting and in orientation in plane.

The children used thread and rulers too to measure unopened lines. In the course of measuring with thread the children observed every line could be rectified that is perimeter meant length. Measuring with ruler helps to define the concept of perimeter, since the figure by line segments have to be added up.

The pupils' level of the knowledge was continually checked by means of test paper which was used in course of planning the further work.

For the preparation of the concept of the rectangle and square children worked in the school yard. The groups had to form different rectangles or squares by means of string of different lengths. (4 m, 6 m, 8 m) Since there were one-to-one child in all vertices of these polygons so children could form subsequent polygon.

Video recording were made form these profession.

In spring of 2005 the children wrote a delay test since we wondered how much children could recall from what they have learned. After analysing the solutions of the tests we made interviews with children. First we made interviews with groups, then with pairs. In the course of the group interviews the children were rather shy, who were not very active in the lessons. The interviews carried out in pairs were more successful because they revealed more from the children's way of thinking. We have taken into consideration several aspects when we selected the pairs. We put an efficient pupil with a less efficient one in pair, and these pairs generally worked well together. However, there was an efficient pupil, who was not willing to work together with a less efficient one. We have also noticed that friends worked together well, and they listened to each other very much. The pairs of efficient pupils with the same level of knowledge didn't help each other very much, they were rather competitive; the pairs of less efficient pupils made progress rather slowly, but they helped each other. The interviews were taped.

The protocols of the lessons contain the researcher's and the teacher's observations and experience.

Results

Since during these activities children started from scratch, they did not have to face the fact of being stereotyped in the learning process. Thus even some of the pupils could have come into the limelight, who were not able to do so earlier. It was particularly demonstrated in the drawing open and closed figures by line segments and measurements in groups.
The children were able to estimate much better than earlier, which is demonstrated by one of the measurements in groups. (See table below).

The length of the fence at the street (Munkácsi Street)	estimation	measuring
Fathom	28-32	53 and half
Meter	50-60	103
Arm	70-100	136
step	115-120	163

The majority of children could identify the length of the segments which is also demonstrated by the results of one of the test papers in which the length of an open and two closed figures by line segments had to be identified, and one of them was a rectangle.
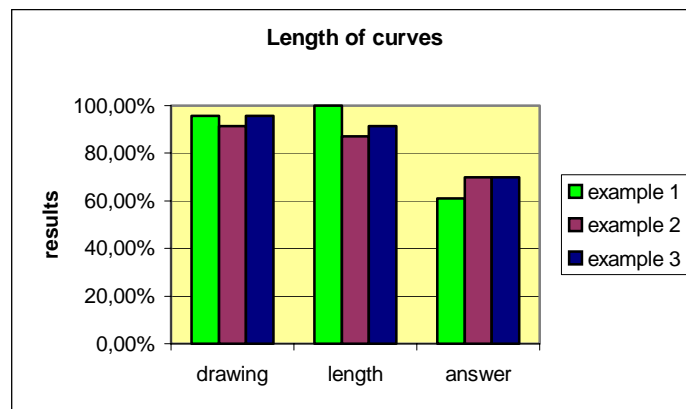
Almost all of them were able to use the ruler properly, which can be due to the fact that in the pair interviews the more experienced pupil helped his or her partner to eliminate the mistakes.
Their vocabulary has also increased and more and more pupils were able to express themselves and to come up with their opinion.
They do not mix up the measurement units of length with other units they have learned before, but they may have problems with other types of measurement units.
Identical lengths are recognised by half of the class in case of parallel shift.

Conclusion

The majority of children even in the second grade have difficulties in changing measurements of simple units which is why we think that the teaching of this topic could be delayed for at least one year.
More time should be allotted to teaching measurement, the materials to be covered according to the curriculum is too much. Therefore the time is not enough for measurements and the

structure of course books is not really suitable to gain the necessary amount of experience in measurement.

In our opinion children should do much more measurements, and also everyday experience should be an essential part of education. If this does not happen, teaching measurement units and the relations of them will be nothing but learning by rote, lacking any practical experience. Thus children may mix up not only the relationships between the identical types of measurement units, but the various types of measurements well.

The afternoon activities are absolutely suitable for carrying out measurements while the children are outdoors as if they just walking or playing games in the playground. We could also make use of these afternoon activities, thus geometry and teaching measurement could be a more integral part of the curriculum.

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