ON MATHEMATICAL IMAGINATION OF PRE-SCHOOL AGED CHILDREN

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Abstract

The kindergarteners do not systematically teach mathematics – they rather shape mathematical imagination, or more precisely the ability of children to view the world through obtained knowledge, experience and interrelations and to apply laws of thinking.

1 Introduction

The elements of mathematics appear in practical life and pre-school aged children get them know intuitively. For example they gradually learn to denote the positions of the parts of their bodies in relation to themselves, but also to other objects or objects in relations to themselves, then they count how many brothers or sisters they have or how old they are and show the number on the fingers of their hands etc. Someone might argue that this is not mathemetics. Well, but these are the very beginnings of mathematics children come across.

2 Some psychological aspects of mathematical imagination

The elemental forms of perception start to develop very soon. For pre-school and junior school aged children there is characteristic detailed perception and rich feeling. Immediate connection of percept with tasks is characteristic and an indispensable condition for the development of the child's receptivity.

In a kindergarten teachers concentrate to the development of the basics of cognitive processes, it means receptivity, perception, thinking, imagination based on speech, attention and memory. Together with the development of knowledge children develop intelectual skills and the beginnings of intelectual habits. Children watch carefully what attracts their attention and very often remember their experience. The development of learning and knowledge goes through the whole life of a child. Children are influenced not only by a kindergarten, but mainly by a family and many other, very often random factors.

It is highly probable that the first eye impressions are flat, two-dimensioned, and the child gets to the three-dimensioned perception through the complicated experience of touch, kinesthetic and ear, while eye experience is dominating.

V. Příhoda [3] states that the shape is probably more important for the child than the colour. The research has proved that 3 years old children sort out objects according the shape rather than colour, while children aged from 3 to 6 are influenced more by colour. For example children look at various geometric shapes in various colours. If we show them a white triangle and ask them to choose an identical one from an amount of other shapes, we find out that children in the mentioned age group more often choose the shape of the same colour, it means, they choose i.e. a white square. At the beginning children distinguish only basic colours (red, white, black). Very soon the ability to distinguish the size of the objects develops. Children at the age from 3 to 4 years can choose also the biggest and the smallest object. As late as at the age of 5 the child can point to the objects of a middle size. The space orientation (distinguishing distance, direction, size, shape, colour and noise) is nearly perfect at the end of the third year.

Forming of the perception of space quality of the objects demonstrates itself mainly as the integration of the sight and touch. In the early childhood the perception developes from the notion in the gradual stratifying of more and more complicated psychical formations. In the time when the function of imagimation and thinking starts to take place, perception can be modificated through their influence. On the other hand the early childhood appears as a period mainly of the perception i.e. „piling" of the elementary experience and also as the period when the abstract thinking is not applied yet.

With precising and with the coordination of the child's movements and improving of the eye and movement apparatus there enlarges also the space and time frame for the use of perception operations. With the help of didactic material (both artificial and natural) children get acquainted with the properties and there are partly formed conditions for forming perception operations aimed to investigating of these properties. Children get senzoric notions from the world around. They get acquainted with the sourranding objects, their properties and simple relations while manipulating with them. While playing their spontaneous and didactic games, children are led to practical distinguishing of objects according to the properties (size, colour, shape) which are perceived by receptors and are led to the elementary „understanding" to space relations between watched and perceived objects.

While playing, children gradually start to catch next, even more complicated relations and contexts, they start to apply imagination and objective thinking. We introduce the activity of „putting in“ and „taking out“ of smaller objects from a bigger vessel, pushing of various objects to holes of various shapes, we let children watch the objects from various sides, (in this way we make early exercises to practise the first understanding of the position, distance and the space). We try to develop the abilities of children to express simply the reality with the help of some building material (cubes) and build according to an elementary intention. In cooperation with the adults we try to lead children to concrete understanding of denoting of the relations in the space (upstairs,downstairs, in the middle, at the side). In real everyday situations we teach children to understand often used designation of positions, location in the space. We lead children to react to various instructions to change the place, position (of objects, people). We lead them to recognize well known objects in the picture (and also in simple relations). We try to develop the elements of purposefulness in games (especially in constructive and imitative ones).

3 Mathematical imaginations and notions of pre-school aged children

The instruction of pre-school children in the area of the development of mathematical imaginatiincludes these parts:

- orientation in the space, relations among objects in the space and in the plane,
- forming of groups of objects (sets), relations among sets, operations with them,
- relations among the groups of objects,
- sorting, arranging, adding,
- gradual getting acquainted with numbers.

Children learn gradually to understand space relations through which we denote the position of their bodies (parts of the bodies) in the space, the position of the things in the space and posibilities of the situation change. That is why it is necessary for them to conceive correctly and then use correctly the prepositions: *on, in, above, below, before, behind, next to, between, among, in front of, facing, upstairs, downstairs, high, low, far, near, inside, outside, ahead, at the back, in the middle, on the right, on the left.* With the help of these words children learn to describe and decide: About their position in the space, about the

situation of objects in relation to their own person, about the mutual situation of two objects. Then they are going to describe and decide about the situation in the plane (the basis of the related system will be a certain object, this time drawn). In the real situations of everyday life we teach children to understand often used designations of positions, location in the space. We lead children to react to certain situations, to change the place, the position (of things, persons). They are lead to recognize well known objects in a picture (also in simple relations). We try to develop the elements of purposefulness in a game (especially in a constructive and imitative one).

All geometric knowledge is mediated to children through games and various manipulative activities with the aim to master the necessary apparatus to express space relations in the real life. Gradual getting acquainted with geometric shapes is supported by comparing the shape of objects, sorting of objects according to some shape, looking up of some shapes among various shapes etc. Shapes properties are acquired by children especially in activities with objects, their touching, modeling, moulding and shaping, drawing, cutting and sticking on. We get children acquainted with geometrical notions in a natural and intuitive way. In pre-school age their performance is not professional and precise yet. But it will express the real level of their imagination and the grade of the abstraction at gradual forming of geometrical shapes.

Pre-school children gradually get acquainted with the names of numbers (they reckon, say the numbers in a line) and with their quantity meaning (they denote the number of objects), with the filing of numbers according the size (they know a row of numbers from the smallest to the biggest) and partly with reading and writing of numbers (some can read and write some ciphers). Children perceive numbers 1, 2, 3 as a frequent reality, current in everyday life and learn them directly as real facts. The groups of one, two or three elements are easily overlooked by children, they can say the names of the single elements correctly, they can match an exact number of objects to a number in the speech. Numbers one, two, three occur very often in counting rhymes, nursery rhymes and songs. In a kindergarten children learn to enumerate according to their experience. Children should also be able to count objects in the given set, respectively to form a set of objects of a given number of elements (up to six, eventualy in the first ten).

The notion of a number, it means the abstraction of a number of an elements group is not possible to create in a different way than by generalizing of a big number of concrete cases and situations. As we have already written, a pre-scho-

ol child perceives and understands numbers 1, 2, 3. It gets to others gradually in such a way that together with suitable instruction and explanation adds one element to a group of elements of the number, which was practised lately. In this process we use objects well known or familiar to children (3 apples and 1 apple are 4 apples). After explaining and practising an appropriate number of examples with real objects, we pass to object counting in pictures, to plane pictures and only after that to schemes (dots).

What should a teacher notice while checking the quality of numerical imaginations?

- To what number the children can count – how much they know the number line.
- What is the highest number of objects they can count.
- To what number expressed verbally (a number) or by a graphic term (by a cipher) they can show the correct number of objects.
- If they can solve some very elementary numerical tasks. Adding (or taking off) one element.
- How many identical elements (things, cases) they can guess and express at once.

Children can obtain the ideas of the object size (dimentions – length, height, width) based on their own experience in simple measuring (i.e. stepping), guessing or mutual comparing dimensions. They set the destination of their journey, the intercourse and way, they solve puzzles in the space and the plane, they realize solutions of the situations with the opened and closed lines (topological propedeutics). Children acquire notions of elementary geometrical shapes in the space and the plane, they distinguish them (or sort them out) on the basis of visual and tactile perceived difference (a circle, a square, round and square objects). Motoric skills are developed through the forming of the space models and patterns of real situations, with the use of brick boxes or a meccano and games with elements of creativity, fantasy. Fantasy developes also at graphic reproductions of the concrete reality – drawing, completing pictures or drawings etc. Propedeutics of relations and of depicting (sorting out, filing out, adding and arranging) can be seen at manipulative activities with real objects. Gradually, with the help of real activities with objects they get the notion of a natural number and numerical operations. A very important place is occupied by some

set of "mathematical competence" of the child at the entrance to the 1st grade of the elementary school.

Mathematic abilities and skills of children can be developed in the best way while playing. A game belongs to natural and the most favourite activities of children. It is necessary to have ready a great amount of didactic toys (games) and while using them, it is necessary to keep to the above mentioned rules.

4 Conclusion

On the basis of the development of mathematical imagination of pre-school children it is possible to improve the quality of the school readiness – a precondition of successful mathematics teaching at elementary schools.

After 1989 there have been various changes in education, many kindergartens have been closed. Not all pre-school children attend kindergartens, it is not compulsory to insert regularly into child's work the activities which would systematically develop the intelectual and mathematical notions and imaginations together.

Current practise of kindergartens goes in the way of the development and acquiring competences. While educating children the development of their abilities, skills attitudes and values as well as enlarging of their learning is supported. Special stress is on the activities in the frame of which children solve, discover, make experiments. These activities can be intelectual or practical ones, more formative or informative, they bring to children, develop or fix the knowledge which is a natural part of pre-school child's competence. The activities should bring to children such knowledge, which is purposeful and understandable, which helps them to understand better the world around and to understand its running, knowledge practical and useful for everyday life, for further studies and learning and so the knowlege which corresponds to the frame of the educational and life needs of pre-school children and which they should master. [2]

On the basis of the contents of pre-school education aimed for the age group of 3 to 6 (7) years it is necessary to adjust the instruction of pre-school pedagogues. Educational contents represent a compact, whole unit which can be stratified to the following areas: a child and its body, a child and its psychology, a child and the other person (partner), a child and a society, a child and the world. The didactic style of children upbringing in kindergartens should be based on the education choice and active participation of the child. A pe-

dagogue should be a guide of the child on its way through learning,wake up its active interest and the willingness to look around, to listen and to discover, not the one who sets tasks and checks the fulfilment of them. A pedagogue is set a task – his main task should be to suggest suitable activities, prepare the enviroment and offer to the child the opportunities how to get to know, think over, see and understand itself as well as to everything around in the more and more effective way. [4]

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