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SCHOLA LUDUS: THINK, DO AND SHOW. Pupils' exhibitions of simple physical demonstrations and pedagogical research

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About the project

It is real art of teaching to accept children's ideas, to create a space for their individual thinking and work. Considering that the outer approach is closely joint with inner contents, the SCHOLA LUDUS THINK, DO AND SHOW project was built up to support this kind of art [1].

THINK, DO AND SHOW is a project for home and school in the frame of which we invite teachers and parents to encourage children to prepare simple experiments and science toys. We have prepared a small booklet addressed first to adults including proposals how to build and how to play with them. In the text we tried to emphasise both, the scientific and the technological aspects, the creation of suitable questions and the search of satisfying answers [2]. There was preserved a high degree of choice of the tasks' realisation to support children's creativity. Children were asked to present and discuss their results in classrooms. Teachers were recommended to use the children's exhibits as school aids. Both, children and teachers were encouraged to organise interactive exhibitions at the end of the school year which should be open also to the public.

Videotapes

The children's exhibitions are recorded on videotapes. To encourage further teachers' and children's activities records on videotapes are offered also those schools which up to now did not participate in the project . At the same time the videotapes represent a valuable material of pedagogical research. Valuable is the fact that children are in a different position than usually at school. They work on voluntary base, they are encouraged to show their results and to pass their knowledge on to others, they want to do it.

We present records from four schools, two in Bratislava, one in a small town and one in a small village with children from the fifth to the eighth grades[1] (10 - 14 years old). In the first two schools children prepared demonstrations evidently by themselves chosen from literature, in further two schools the demonstrations were prepared under the guidance of teachers. In spite of the fact that all children and teachers were fans of physics the results document that there is significantly suppressed the natural curiosity and invention. There is a lack of play and pleasure.

Lack, lack, lack

Together there were performed 102 different demonstrations but only in very few cases the demonstrations fulfil the requirements of experiments though just this approach is important for developing discussions, to open and solve problems.

- No one changed explicitly parameters of the demonstration.
- No one was pointing out consciously the technical differences of the particular solutions.

[1] In the fifth grade there is no physics as a school subject.

- Only in 13 cases the same phenomenon was demonstrated in several (at least two) ways to the end that to compare different characteristics of different materials or to show the evidence of the followed characteristics.
- Only in 15 cases we can accept the accompanying explanation as relevant (except 18 descriptions of the youngest children).
- Only in 7 cases there appeared children's natural preconceptions (water lens: Water makes things bigger; liquid in a swinging vessel: If the motion of the vessel is slow enough, the level has time to become horizontal, if the motion is quick ; two plastic bottles hanging close to each other: If we blow between them they get near because the air flows round the bottles, etc.).
- Only in two cases there were made comparisons with practice (Vortex in washing machine, hydraulic press).
- We did not find any scientific toy.

In most cases the comments were wrong with only false seeking for reasons. The children were satisfied by the insufficient continuity of the successive phenomena. Real relations between observations, reasons and consequences remained to the children hidden. There didn't appear any ideas related to the concept of process. What we evaluate as very bad is that we could recognise only very weak criticism and feedback. The children didn't satisfactorily control either their own procedure of work (for example, they were satisfied with the large size of the vessel though they evidently had not enough force to blow enough air inside in order to demonstrate the function of a pressure fountain), or the logics of their answers (communicating vessels: At the bottom there is the same pressure from both sides and this is the cause that the levels of a liquid become the same).

The influence of school

In all cases there was felt the role of the teacher, his / her individual approach and methods. There was a significant difference between the children's explanations addressed to children and to teachers. The right comments appeared practically only with the youngest children, those who only described the observed phenomena without physical terms (Carthesianus goes down because its bubble is diminishing). The older pupils attempted to give explanations but they were uncertain turning often for help to their teachers.

The results hint to non-adequacy of schools' aims and of the school's scale of priorities in evaluation of teachers' and children's work:

- A large group of wrong answers were real foolishness (the bottle must be sealed, in other case the pressure would run away), evidently influenced by school education. Children combine words giving no senses. They tried to use „right scientific terms" without their understanding. The records prove that children don't understand most of basic physical concepts (for example centre of gravity, field of gravitation, pressure, beam of light). The introduction of these terms in school is not balanced with respect to the pupils' experience. The definitions of physical terms have no meaning for them doing physics too far from reality. They lost the thread. As consequence we can find in life people having a mess from physics (and science) and others „being indifferent of science" at all.

- The children are evidently used to get ready results. Their natural attempt to give own explanations is strongly suppressed. In discussion they are not used to speak

about the way of the preparation of their exhibit. They don't appreciate their experience gained during the building of the demonstrations.

Light in darkness

We appreciate greatly the small group of answers which represent a mixture of preconceptions and terms taught in schools. Practically all these mixtures were fallacy (a candle standing in water covered by a bottle: By combustion there is created pressure and consequently, in the bottle instead of oxygen there is getting water), but yet the healthy core of preconceptions is still clear. If we remove the sapient part of the sentence (the pressure) we can get a reasonable point of view. This shows one of the potential way of improvement.

Exactness

Physics need exactness. But what kind of exactness we should teach first? The pupils need at first to understand the role of the particular objects in their mutual relations. Nature has its inner rules. They must learn to understand the unambiguous meaning of these relations. There can be used many ways of explanations but there cannot be changed the subjects and objects and the links among particular, phenomena and their characteristics. Thus, not the pure definitions of terms but the exactness of relations is a necessity. Step by step building of concepts by playing and own experience.

Conclusion

To develop creativity one must know, what he/she is doing and why. The described results are unfortunately typical for our schools. We consider the described insufficiencies as serious reasons of people's negative attitude to physics. To change the situation, the given analysis should be taken into account by curricula makers. Studying the presented videorecords can enable teachers to revise their own teaching procedures. They can confront the children's knowledge on different examples from several schools. At the same time, the records provide the teachers and children from further schools with actual proposals for experiments and demonstrations. They can profit also from successful solutions.

These are things which a booklet alone cannot provide sufficiently. In combination with videorecords we hope to encourage new exhibitions at further schools. In the frame of our analysis we have emphasized mainly the negative moments. Of course, there were plenty of positives and the children and teachers involved in the project in the first year want to go on in the future. We promise to visit them and prepare new videotapes ...

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References

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