

## ASSESSMENT OF SCHOLA LUDUS PROGRAM “SCIENCE BY PLAYING” AT SECONDARY SCHOOLS

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### INTRODUCTION

For many lower secondary pupils physics is just pointed out as the least preferred science subject. If you ask why their most common answers are “because it is stodgy, difficult and problematic to learn”, “we don’t understand formulas”, “we have to solve tasks only by inserting numbers”... and “Why to learn physics? What kind of profit can I gain for my future?”

But physics don’t have to be stodgy and scaring. The SCHOLA LUDUS Centre for Support of Science Education and Non-formal Lifelong Science Education at the Faculty of Mathematics, Physics and Informatics Comenius University in Bratislava is focused for long time on attractive ways of teaching science subjects, mostly physics.

### PROJECT SCIENCE BY PLAYING

In years 2006 – 2008 the SCHOLA LUDUS Centre realized a complex educational, science-popularization program for lower secondary schools named “Science by playing”. The main goal of the program was to support long-term interest in science career among young people. The goal was filed through describing basic methods of scientific work to 12-15 years old pupils and through showing the science and specially one of science branch – physics – as a domain worth of their interest for everyday live and further learning.

Members of the SCHOLA LUDUS Project group realized wholly 5 mobile science-popularized modules. 47 lower secondary schools were involved in 3-5 day long programs in Nitra, Trnava and Trenčín region. Modules were prepared with emphasis on school physics’ themes and on attractive domain of modern science and technology. SCHOLA LUDUS strategies and tools for complex creative learning and teaching were used in development of particular modules.

1. Educational module „Kvap(k)aliny“ (the name combined words “Liquid” and “Drop”) focused on physical properties of liquids;
2. Educational module „Potápkaliny“ (the name combined words “Diver” and “Liquid”) focused on investigation of liquid properties linked with buoyancy (Archimedes’ law) and hydrostatic pressure (Pascal’s law) with emphasize on untraditional applications in current science and technological research;
3. Educational module „How to draw it“ focused on deeper understanding of motion, (uniform, non-uniform), time, velocity, change and development concepts as well as on supporting visual thinking;
4. Educational module „What is this center point about?“ focused on the physical concept “center of mass”;

5. Educational module „Silence“ focused on acoustics – investigation of sound and its’ properties with emphasize on untraditional and interesting application in current science and technology.

Each module consists of four educational parts:

1. Scientific theatre – shows with aim to engage pupils and motivate them for further learning the theme;
2. Interactive exhibition of simple physical demonstrations – each demonstration stimulate pupils to make their own hypothesis and to realize their own simple experiments;
3. Creative-discovery workshop focused on development of pupils’ thinking and knowledge;
4. Educational game focused implicitly on verification and confirmation of new knowledge.

Totally 5648 pupils and 149 teachers involved in modules. Each school involved in program get a educational multimedia material include science theatre scenario, multimedia presentation used in program, methodic-didactical sheets for teachers and worksheets for pupils as well as photo- and video gallery from the modules realization.

### CONCEPTUAL CHANGES

Summary conceptual changes are apparent from fulfilled activity sheets during CDW. For example, tasks from the CDW on droplets to gain preconceptions: “Draw and describe a water droplet. Consider your droplet in motion... Where similar droplets occur?” – Pupils drew circles, tears and many tears. (Example of solution is shown on Fig. 1)

And at the end of CDW: “Try to sketch water droplet development by dripping from a faucet. Title the phases by short physical characteristics for each phase.” (Example of solution is shown in Fig.2) Pupils shifted their understanding from static droplets towards dynamic processes of fluids.



Fig. 1 Development of a droplet– preconception

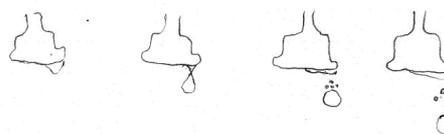


Fig. 2 Development of a droplet – changed conception

### QUESTINNAIRES

A set of questionnaires was a component part of each realized module. Questionnaire A – we asked pupils before the realization of the module to fill introductory questionnaire focused on pupils' assertiveness to physics and scientific recognition, on pupils' conceptions about science and career in science and on pupils' interest to addict them to science in future. Questionnaire B – followed up the short-term effect of the educational module upon above mentioned factors. Pupils filled these questionnaires immediately after module realization. Questionnaire C – followed up the long-term effect of the educational module (approx. 3 months after realization). Questionnaire D – devoted to teachers, focused on identification the importance of the module to them and for their future pedagogical praxis. Questionnaires were prepared with simple statistical routine.

Program influenced pupils' look on physics and science in general. It drew attention to phenomena that pupils don't recognize before. Pupils want to look for more information about physics and about discovering in science and technology. They want to discover and investigate in future. Program changed also pupils' attitude to learning. They become aware of their right on their own conception about physical phenomena, of the right to change the conception and of the possibility and capability to ask questions and look for answers.

Particular educational parts were rated by pupils in numbers 1 - 5 (as in school). Exhibitions attained the best rating; they were followed by creative-discovery workshops, science theatres/shows and educational games. Particular parts attained "marks" 1,3 – 1,5. Most pupils expressed interest to take part in similar programs in future; they jump at such programs as component of school education.

On the basis of questionnaires we can allege that all parts of modules influenced pupils in positive way. One of positive assignments is active involving of pupils with less initial motivation (girls and slow pupils). Part of problematic subject matter becomes understandable and evident.

Most teachers adopt the program very positive as well. Some of them were inspired by program; some of them use particular parts in their lessons some will use obtained educational multimedia material in designing future lessons. Teachers observed positive change in pupils' behavior after modules realization. First of all pupils are more active - they ask more questions, discuss, involve imagination in etc..

One of the most valued teacher's statements is: The program influenced my view on teaching towards deeper and more effective learning/investigation of the real world, towards looking for connections, meaning of live, towards reverence of thinking and creativity. Gratifying is that even other subject (not physics) teachers rate the program focused on physics positively. As an illustration we can quote teacher of Hungarian language and literature and Slovak language and literature: „Program convinced me about necessity of concrete teaching. I will use it even on my lessons.

It is required that teachers will free of ossified ways

of teaching and will be not afraid of bringing more creativity and invention to teaching process. Teachers have to give pupils more space to express their conceptions and confront these one another.

## CONCLUSIONS

Results of realization and evaluation of the project SCHOLA LUDUS „Science by playing“ are:

- Educational modules SCHOLA LUDUS as a educational form are effective means to show pupils that physics/science is interesting – educational modules free pupils from viewing physics obscure, modules show them physics charm and its attractiveness for future career.
- Educational modules SCHOLA LUDUS support learning, creativity, expression of pupils own opinions.
- Using educational modules with SCHOLA LUDUS strategies, forms and tools is universal – these tools allow preparing educational modules regarding any subject and any theme.
- Educational modules may be designed both - monothematic and interdisciplinary. This intensifies pupils' delight from learning.
- Educational modules SCHOLA LUDUS are means to change the way of teaching in harmony with school reform towards teaching attractive to pupils.

Success of the project SCIENCE BY PLAYING showed that educational modules are means to make physics more attractive to pupils and teachers. SCHOLA LUDUS department will continue to develop and realize educational modules also in the future. Should the physics be interesting and not frightening to pupils, it is necessary to introduce innovative educational approaches into everyday teaching praxis.

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