

## **‘How to Make your Students feel Chemistry with Chemistry?’ A Few Words about Motivating Young People to learn Scientific Subjects more Efficiently**

**Magdalena Gałaj**

Wyższa Szkoła Informatyki i Umiejętności

Łódź, Poland

[magdalena\\_galaj@wsinf.edu.pl](mailto:magdalena_galaj@wsinf.edu.pl)

### **Abstract**

*Contemporary schooling in Poland faces many obstacles with regards to teaching scientific subjects. Despite undergoing a few educational reforms Polish students are still quite reluctant to study subjects like Chemistry and Physics and object to learning anything more than the required minimum. The majority of young people find science difficult, boring and useless – young people clearly call chemistry, biology and physics their least favourite subjects, and they do not have any motivation to explore them further. Within this, teachers struggle in the classroom trying to work both in compatibility with the core curriculum requirements, which after the reforms contains a reduced number of chemistry lessons in all the educational stages, and with the agreement with their own consciousness. Schools are poorly financed and chemistry or physics laboratories badly equipped. Many of teachers are forced to change their teaching and adapt it to the existing situation i.e. poor infrastructure, students’ little expectations and changes in the curriculum. Motivating students is not an easy task but undoubtedly worth trying as there is not a better feeling for the teacher as seeing a young person fully content and satisfied, involved in a scientific task. Teacher’s role today focuses not only on teaching but also on opening students eyes to the world around them, on making them sensitive to critical scientific issues. He or she should be aware of a few tricks how to make science more digestible and student-friendly to a young, curious mind.*

### **Introduction**

With the rapid development of our civilisation and the constant ageing of society there has been a great demand for new medicines, surgeries or alternative, economical sources of energy. Without any doubts contemporary world is in a desperate need for well-educated and creative scientists, thanks to whom the world of science could develop further, that is why, the sooner the governments, Polish government including, start to promote initiatives of raising society’s awareness of science-oriented disciplines, the better. It has been proved that first fascinations with science can be created and developed already in the early childhood e.g. Albert Einstein was inspired by a magnet which he saw as a child. This leads us to inspiring children; to such a powerful influencing of young kid’s imagination, and making them interested to so such extent, that they are motivated enough, at the later stages of their education, to come back to their childhood passions. They are willing to learn chemistry or physics as they associate them with something they experienced in the early age.

### **1. How to share with young people our passion to learn scientific subjects?**

Many educators in Poland struggle hard trying to find a logical answer to this simple question. Without any doubt it is the school and the student’s own home which should be motivating teenagers to learn any subject, and scientific subjects in particular. There is nothing more precious than supportive, encouraging parents and eager, passionate teachers who are able to inspire and awaken even the most critical and reluctant minds to discover passion and pleasure in learning in general, and learning

science in particular. According to Monika Pawluś, an educator and an advocate chemistry teacher from a lower-secondary school in Łódź – it is the teacher himself or herself who is responsible for building up and developing students' eagerness to learn the world and about the world around them. Interesting facts supported by examples from real life make pupils think and analyse. It is the teacher who is responsible for familiarising teenagers with the beauty of scientific subjects. It is him or her who should share his or her passion with young people and undoubtedly, only then pupils' reaction to such a teacher's attitude is more than positive one. Teenagers appreciate teacher's efforts to prepare and conduct an interesting, interactive lesson and they cooperate learning effectively and efficiently.

Dr Stefania Elbanowska-Ciemuchowska from the Chair of Didactics of the University of Warsaw pinpoints her University's initiative to help teachers from secondary and lower secondary schools to motivate their students to learn. She concentrates on a little gap between the science and scientific world and the real, everyday life. Presenting knowledge in a tangible, non-abstract context and showing its feasible applications in practice are the key targets of the successful chemistry or physics lesson. That is why, hands-on activities, experimenting, practical labs and logical tasks are more than appreciated by young people due to the arousal of their imagination and use of creativity.

### 1.1. Teacher's work on developing student's creativity

According to the educational reform and its main objectives teachers should help their pupils to gradually pass from a specific to formal way of thinking – young people should be encouraged to creative, independent thinking, analysing, deducting, assuming, evaluating and assessing. All the tasks teachers face their students with should be compatible with their intellectual potential – tasks adapted for the students' capabilities are a synonym of success and do not demotivate teenagers unnecessarily. At the same time, science-oriented students with special abilities should be fully involved in the class and teachers must not allow them to get bored. Their special talent should be promoted and facilitated in all kinds of additional initiatives such as contests, competitions and knowledge quizzes. It is them who are involved in academic and institutional cooperation with universities or technical universities, as well as chemical companies and plants. Talents are revealed and developed with special and careful care to let the most apt students blossom. This leads us to development of individual treatment of each pupil and with his or her special skills in mind, driving, steering or gearing their science oriented-education even at the earliest stages of scientific education. This could be realised with the help of applying various tasks which need to employ logical thinking skills and analysis skills e.g. posing questions, making assumptions and giving logical justifications to solutions. Students ability to think creatively, working on hypothetical cases, linking potential relationships between various issues could be confirmed by experimenting and observation. Teaching students creative thinking means the tasks become more digestible to them. Simple, real-life examples such as stating differences between kinds of petrol, ingredients of cosmetics or cooking procedures – whether to put salt to cold or hot water, whether to pour raw meat with cold or hot water first or why we cover icy roads with salt in winter – all this facilitates students interaction with a teacher and engages creative, independent thinking.

### 1.2. Teacher's work on developing student's motivation

Nothing is more interesting to us if we are fascinated with it. What is meant by that is fascination and interest in something work as triggers to get actively engaged in any task. Think of a story for kids read in the early childhood – a mother reading it, modulates her voice, she becomes an actress and all this to have a greater impact of the story on her child. A good teacher of chemistry or physics should become an actor on the stage influencing students' emotions, too. Chemical experiments with tricks, unexpected, interesting solutions always stay in memory despite students' age, abilities or attitude. What is more, a teacher should be able to tell students the story of a famous scientist and his career as a chemist, the same way a mother reads a bedtime story to a kid. Boring facts and figures from the scientist's life and work are easily forgotten, whereas something original and funny could inspire students or at least arouse some interest in the covered topic or chemical issue. It all depends on the teacher's will and devotion to make the lesson interesting and understandable. Good preparation, research and planning of an interactive, engaging, preferably technology-based lesson is more than required.

A good, motivating teacher's role in the classroom is also the one of a lesson's director. He/she should be ready to offer and allow experiments and observations performed in the classroom, by students, too. It is not the teacher who should actively involve, but the students. Theory is needed but cannot fully substitute practice – hands-on activities and 'classroom action' help students to understand laws of science and nature better, faster and more efficiently. It is true for all students, even those who have not reached the level of independent, abstract thinking.

Without any doubt, an eager, motivating teacher should cooperate with various specialised scientific institutions, organisations, universities, polytechnics, chemical plants and business initiatives in order to support his or her classroom teaching in a more practical context. Trips to chemical plants, visits to production lines of chemical factories, lectures and classes with experts and scientists would undoubtedly facilitate traditional teaching and learning process. All this could reveal the secrets of science and link the most difficult and problematic fields with easy to understand, everyday applications, digestible enough for a young, curious mind. Polish students love participating in lessons organised by Orlen or Organika companies for example. These companies are very much involved in developing students' passions and supporting teachers' initiatives in the classroom. Experiments online, lessons on demand in particular schools, visits to factories all this promotes understanding chemistry as a more friendly subject. Academic institutions such as University of Adam Mickiewicz in Poznan, University of Marie Curie Skłodowska in Lublin, University of Lodz, University of Warsaw as well as Technical Universities organise contests, lectures, 'chemistry nights', chemistry shows and experiments even for the youngest kids.

When motivation in the classroom is concerned one must not forget about a motivating, interesting course book. With its layout, structure and visual, interactive content it could make learning a more enjoyable process. And here a question arises what makes a coursebook a good one. Undoubtedly, it should be inspiring enough to allure students to think creatively and independently and should be able to, at least attempt to, teach them scientific thinking i.e. planning, performing and analysing experiments. Of course it should be well illustrated, 3D models of elements and processes and photos explaining various experiments step by step are certainly supporting the visualisation process. It would definitely need interesting facts and stories from chemistry, sometimes even widening requirements of the core curriculum. Real examples, tables and diagrams substitute lists of difficult facts and figures. All this to develop students interests and passion with the subject. Contemporary chemistry coursebook should be interactive in content, too. Electronic materials, both for students (e-book) and teachers, would make the coursebook more interesting and easy to use. For students they would allow further practice and revision and for teachers they would be a useful source of extra material to be used in the classroom, during progress tests or just to consolidate students knowledge before exams. From the teacher's perspective a good coursebook should also be flexible, accompanied with an interactive syllabus compliant with the core curriculum requirements, which could be easily updated, altered and adapted to the students' special needs. An accompanying e-book or e-activity book would facilitate students' systematic learning and help them visualise chemical concepts further. E-materials are also various sets of diagnostic and evaluative tools which would make teachers work much easier and pleasurable.

## 2. Work on teacher training

To educate someone to become a valuable teacher of chemistry or physics is a long process. Potential teachers must not only be well prepared theoretically but also trained how to pass their knowledge to students in a clear, easy to understand way. A lot depends on the teachers themselves, their personality, attitude, sense of humour and enthusiasm. Being enthusiastic about their subject, teachers share their eagerness, zest and passion for nature and science with their students. Only then students are able to see and appreciate both ordinary and extraordinary achievements of mankind and science can be an interesting and alluring subject for them. To achieve this teachers should be supported from above levels. Their education should be more practical and methodology courses are specially tailored to meet this demand. Both students of chemistry, and then graduates, teachers and educators should have a wider and easier access to various forms of trainings, workshops and conferences in order to keep them updated with latest trends in chemistry and the methodology of a 21 century, modern classroom. Initiatives, like teacher manuals and magazines dedicated to developing their skills and comply with novelties of the science world are more than appreciated and welcome. Polish teachers, students of chemistry and scientists have a chance to contribute to



development of a magazine 'Chemia w szkole'. Apart from practical teaching tips and methodology-oriented context, the magazine contains information about chemistry events, reports from conferences, overview of novelties and trends in contemporary teaching, as well as interesting lesson plans to be implemented in the classroom. International projects like Chemistry is All Around Network add more ideas to chemistry teaching. Didactical resources and materials available online, free of charge are very much appreciated by both students and teachers. Teachers use them as a point of reference or core material for lesson preparation. Ready-to-use tools facilitate teachers work and allow students to practise on their own both in school labs and at home.

### 3. Parents' role in creating and shaping children's interest in science and nature

As it was mentioned earlier, from the early childhood parents should encourage their offspring to explore nature. Simple experiments with water and colour can be performed at every household even with nursery or pre-school children. Floating objects at bath time, mixing ingredients when preparing a meal or watching lightening and thunders during the storm are some of the experiments or observations even an inexperienced chemist-parent can interest his or her children with. At later stages of mental and intellectual development children should be encouraged and supported to participate in various kinds of scientific initiatives addressed at whole families e.g. science and nature picnics, trips, scientific festivals and of course last, but not least, chemistry knowledge quizzes, competitions and contests organized by universities or technical universities in various places in Poland. Family events are more than enjoyable; appreciation of parents can be seen and passion for science can be shared. All this might have a really powerful effect on the young, creative minds and it might not only make students choose science subjects to study and explore further because they are useful and needed in everyday life, but also because they are fascinating and spellbinding.

### Conclusions

Polish educational system has been reformed. Teaching and learning have become more practical, developing creativity of a student's young mind and allowing teachers, at the same time to implement new technologies in their classroom. Educational films, activities available online, meetings with external experts both in factories, universities or other businesses force teenagers' imagination to rapid action and teach them chemistry in a more interesting way; not as a subject full of boring facts, figures, numbers and special characters but as a useful knowledge of the world they gain for lifetime.

### References

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