

## Main Difficulties in Teaching Chemistry in Secondary Schools

### TEACHERS' CASE STUDY

#### Teacher's Case Study No. 5

Subjects: Chemistry, Biology  
School: Gymnasium Nordenham  
Place: Lower Saxony, Germany

#### Description of the Case Study

1. What do you think are the reasons for major difficulties in learning chemistry at school?

*The approach via everyday life experience is pretty complex. Everyday life phenomena are not always simple chemistry or beginner's chemistry, but they are complicated and chemical formula explaining things are often ambiguous. It is thus not easy to teach chemistry in context (as desirable as it is). Modern chemistry teaching is not learning by heart any more, this has improved. Today's students have a higher chance to learn about the context and coherence. Today the focus is on the relationship and interdependence between chemical properties and structure. The idea is to get this understanding in order to transfer the knowledge to understand other cases. But then again, this is not a simple task.*

2. What major difficulties do you have in teaching chemistry?

*This new focus in teaching chemistry is not necessarily more difficult for teachers, it is definitely more interesting for both students and teachers. At the Realschule the focus is still more on the learning of knowledge and facts. A challenge is the ever more complex world of our students, everything seems to go fast (or has to go fast). Taking your time and observing carefully seems to be out of fashion. But this is what you need in chemistry, patience, careful observation and precise description of events. On top of that, students have less and less practical skills. Years ago they played maybe with a chemistry or construction set, now they start at the Kindergarden with the computer. Therefore, practical work in chemistry teaching has its limits. Especially if you have only two units per week and classes of 30 pupils.*

3. What kind of courses - if any - on didactics of chemistry did you attend?  
*We had some chemistry-oriented didactics, not much, but the lecturer was a teacher from school, so these lectures were indeed not only aimed at school, but we did indeed do practical trainings in this field. Professional knowledge in chemistry is important, no doubt about this, but if you want to become a teacher, that's not all. How do you put your knowledge into school practice, how do you transfer your knowledge and make it interesting for pupils, that's what you need to know as well.*
  
4. Why do many young people quit learning chemistry and, in general, scientific studies after upper secondary school?  
*There are several reasons. Generally, chemistry is regarded as a difficult subject at school that requires extensive and hard learning (which is not totally wrong). Especially if you miss the basics, it becomes very hard to catch up with the topics that are building up later. Then, the importance of chemistry for every day life is not properly communicated. In the media, newspapers, you usually hear or read about negative aspects or effects of chemistry. You never hear that chemistry can positively affect life and the environment. At the same time, chemistry has become less important in industry. Even at BASF there is no chemist any more on the board of directors. The situation is slightly different for laboratory assistants here in the industrial area or even at the university. But these jobs are usually taken by students from the Realschule, not from secondary school. Being a chemist requires a broad spectrum of skills, practical and theoretical skills, informatics, and communicative skills. Chemistry is a very cross-linked subject, requiring a lot of networking. Therefore, job requirements are pretty high, especially in research. And as the number of job offers in chemistry is not constant – sometimes very low, sometimes very high – chemistry is not the most attractive job perspective (and this on top of the negative image of chemistry).*
  
5. How could young people be helped take up scientific studies after upper secondary school?  
*At university maybe with special introductory courses. Right now there is too much theory at the start, so only “hardcore” students stay.*
  
6. Which initiatives has your country undertaken in this direction?  
*The university of Oldenburg still does a lot of didactic and methods training in their studies. So ideas from the model study “Einphasige Lehrerausbildung” are still alive and working. And they still support intensive contacts between lecturers at university and teachers at school. This is not only very useful for both sides – teachers and lecturers, but is also pretty unique in Germany. So in Oldenburg there is a professor for didactics in chemistry and here school internships are prepared and tutored. In this*

*context, the work group “Didaktik der Chemie” consists of university lecturers and teachers from school. This work group supports students who want to become teachers in chemistry and is very useful and helpful indeed.*

*The Chemical Industry Association does quite a lot, also for schools. And then several universities take part in activities to foster chemistry, for example the University Oldenburg with the day of chemistry.*

7. Have you ever taken part into a research project concerning scientific learning?  
*Yes, as a member of the work group “Didaktik der Chemie”.*
8. Could you mention any recent research you have heard of, that might be useful to our project?  
*Maybe not specifically research, but the way the work group “Didaktik der Chemie” works, is definitely interesting for other universities, even on a European level.*
9. Could you suggest any other areas of research that might be useful to our project?  
*No*