

## **Pedagogical/didactic introduction**

Everyone knows how important experiments are for scientific and technical instruction in schools. There are good reasons, though, why too few experiments are generally conducted.

### **More experiments by lowering the hurdle**

Sometimes the school lacks labs or appropriate classrooms or the necessary equipment, and there is almost never enough time. Setting up and dismantling complex experiments usually involves far too much time and effort. In our performance-oriented school systems, this time is more often spent practicing for the next test or examination. Experimento | 10+ therefore focuses on the concept of easy-to-perform hands-on experiments. The experiment is no longer a nice but time-consuming event but rather an integral part of the learning time.

### **Arousing students' interest through current, true-to-life topics**

Experimento | 10+ makes sure that the experiments always establish a practical connection to industry and business and, to the extent possible, to the students' daily lives. Current problems facing humanity such as shortages in drinking water and the transition to renewable energies are addressed in the form of experiments. Tips and ideas for the teacher are always included in the teacher section of the experimentation instructions.

### **Ideal for interdisciplinary projects**

Current, socially relevant topics such as "Drinking water shortage," "Conversion to renewable energies," and "Depletion of natural resources" are already addressed in many curricula and teaching plans. It is, however, difficult to assign these topics to traditional subjects, as they often involve a mix of physics, chemistry, biology, and geography. Experimento | 10+ includes a wide range of experiments that can be used very effectively as part of interdisciplinary projects or project days.

### **A didactically flexible concept**

Should the experiment teach the student a law of nature, or should it merely confirm his or her existing knowledge of the law? Traditional didactic discussions were focused on inductive or deductive methods. Modern approaches focus on learning by exploring, discovering, and focusing on competency. Given the variety of didactic methods available, Experimento | 10+ deliberately give teachers a free hand. The experiments and the associated instructions are designed such that no specific didactic model is required.

### **Experiments as an introduction to teaching topics**

The experiments in Experimento | 10+ are not intended to cover a complete teaching topic. Rather, they are an excellent way to make experimenting fun for students, arouse their curiosity with a "Eureka!" effect, and get them motivated for the teaching topic at hand. The experiments are designed so that they can usually be conducted especially quickly and easily.

## **Experiments to confirm material already learned**

In most cases, 20 minutes of an experiment will not be enough for the students to infer a law of nature on their own, considering it took brilliant scientists years or decades to do the same. It will, however, always be possible to verify in the experiment that the material has been learned and hopefully understood. As experienced teachers know, the successful application of knowledge is the best intrinsic motivation for learning. For this reason, Experimento | 10+ includes an entire range of experiments that require some prior knowledge.

## **Support for autonomous, competency-based learning**

Although Experimento | 10+ does not support just one specific didactic concept, it was intentionally designed to ensure compatibility with the current concept of competency-based education. When conducted properly, the experiments fulfill the learning objectives for knowledge gained and action competence practically on their own. They teach students to develop, recognize, and answer questions on their own. Their action competence is developed by independently conducting and documenting the test. Students also learn to examine their suppositions and hypotheses by planning tests on their own. Their competence in researching and comparing relevant comparative data is strengthened by independently evaluating measurements and observations.

## **Suitable for different age groups**

Experimento | 10+ was designed to ensure that most of the experiments can be conducted both in younger and older age groups in secondary schools. For younger students, it often suffices to examine the observed qualitative results of the experiments. After all, students can increase their knowledge by learning that, for example, electricity can be obtained by combining various metals with salt solutions, that a solar cell converts light into electricity, or that stomach acid plays an important role in digestion. With older students, these topics can then be elucidated in greater detail with explanation of the physical, electrochemical, or biochemical principles behind the experiments.

## **Instructions help you prepare, monitor, and follow up on the experiments**

The instructions are divided into teacher and student sections. The student section primarily contains practical instructions, tips on observations and evaluations, and questions for review and further study. The teacher section starts with a brief summary of how each experiment can be used best, followed by instructions on curriculum planning. A list and illustration of the equipment and materials required for the experiment help with preparation. A brief explanation of the scientific background also serves as preparation for the content. This provides the teacher with a good reminder of the prior knowledge that the students should already possess. In addition, there is a brief description of the degree to which the experiment relates to the subject matter of the lesson. A chapter referencing the Siemens Stiftung Media Portal helps the teacher find further materials to explain and build upon the material.

## **It doesn't work without a teacher!**

Although the teacher's role in instruction has changed much in recent years, from a focus on the teacher to a focus on the students, nothing works without a teacher. The Experimento | 10+ concept helps make the scientific context more understandable for both the self-directed students and the teacher explaining the material. The teachers and education specialists who participated in the development of Experimento | 10+ are certain that a committed teacher will choose the most effective teaching methods for the situation based on the syllabus and time constraints and will apply them effectively.