

# Light pollution – an interesting context for teaching and learning optics

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Physics as a school subject is very unpopular. One reason is that physics instruction is frequently decontextualized and students can hardly see any relevance of understanding physics for their lives. Contrary, science and technology play a crucial and increasingly important role in our lives and in our globalized society. At the same time, edutainment focusing on science topics is booming. Interest studies like the ROSE-study may give one reason for this discrepancy: the choice of contexts does often not meet students' interests. In this research project a context-oriented learning environment on light pollution is developed to stimulate learning processes in optics.

## 1 Introduction and Motivation

Physics is one of the most unpopular school subjects in many countries. This is also true for Austria, where highschool students' performance in Physics is also very modest according to international comparative studies like PISA. A low performance in scientific literacy goes along with a generally low motivation for science, which is even lower for girls than for boys. Physics instruction which is teacher-centered and focuses on decontextualized scientific facts rather than on "application of science knowledge and skills in real-life situations" [1] may be identified as reasons for low motivation and interest.

Research on students' interest in science shows (ROSE, IPN) [2, 3] on the other hand, that students' needs and interests are frequently not in line with topics and contexts chosen for conventional instruction. Conventional physics classes do typically not integrate contexts like social, environmental or health issues which are of high and equal interest for male and female highschool students.

Socioscientific issues – social dilemmas with conceptual ties to science [4] – are seen as an opportunity to meet students' interest and at the same time initiate the development of scientific literacy. "Negotiating socioscientific issues involves understanding the content of an issue, processing information regarding the issue, attending to moral and ethical ramifications of the issue, and adopting a position on the issue." [4]

The topic of light pollution can serve as such a socioscientific issue which addresses students' interest and supports learning processes in optics. Light pollution, which can be defined as the presence of anthropogenic light in the night environment, is a phenomenon of our modern society. In general light has a very positive connotation as it enables modern society to be active even after sunset. Negative side-effects of the massive illumination of our natural surroundings and thus of the reduction of night environments have not entered public perception so far. There is also a lack of research on the phenomenon of light pollution. "Despite the increasing interest among scientists in fields such as ecology, astronomy, health care and land-use planning, light pollution lacks a current quantification of its magnitude on a global scale". [5] Related fields are the side-effects of different illuminants on human health and ecosystems.

## 2 Learning Environment on Light Pollution

The aim of this project is to develop a learning environment on light pollution which supports learning processes in optics and at the same time increases students' interest in physics.

The design process of the learning environment for highschool students was based on the model of educational reconstruction [6]. In a first step students' conceptions on light and light pollution were investigated with the help of semi-structured interviews. In a second step, elementary key-ideas for the learning environment were developed based on the clarification of science content. Finally, these key-ideas were contrasted with students' conceptions identified in the semi-structured interviews.

After this first development phase, the learning environment was tried out in the field setting with year 8 classes. The gain in content knowledge and the development of interest was evaluated with questionnaires. [7]

## 3 First results

In the research project on light pollution a number of students' conceptions on the phenomenon of light pollution and its effect on society and environment could be identified. Based on these findings and learning environment was developed, which proved to be able to increase students' interest. In addition, the results show an increase on conceptual knowledge for some topics of optics.

## References

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