The **ScienceMath**-project: **Boyle's law and Concept of Variable**
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Further Information

Experiences

This teaching material was tested with the refraction, thermal expansion and buouancy experiment in three different classes.
Students discover the functional relationship between both variables. While finding the formula they mostly discover the relationship, when they are looking at measuring values which are twice as big resp. half as big. If hints are given e.g. to apply elementary arithmetic operations at the pairs of measurands, almost everybody found a relationship without major problems. Once they found a relationship, discovering properties of variables were no problem. Almost everybody realized that the relationship changes due to changes in the environment of the experiment on an interpretive level. Stronger students even came up with a formula which is true for any environment.
Students chose words, letters or units as their variable names.

Students should be familiar how to handle measuring errors. It is sufficient if a short introduction before starting the experiment is given. While finding the formula, students should be reminded to consider measuring errors. Since the product of both measurands is about 10, variations around the real product might be comparatively high. Quite a few students had trouble accepting that the product was supposed to be constant.

At task 4, when finding a formula, teacher should give hints to apply elementary arithmetic operations on the pairs of measurands. Particularly weaker students will benefit by that.

The worksheet artificially considers variables only. It could be expanded by a task to graph the measurands, so that it may serve as an introduction to the concept of function as well.

Further investigations done by problem-oriented interviews have shown that the different aspects of the concept of variable can be touched on a descriptive and abstract level. Introduction to the concept of variable by Boyle's law allows differentiation within a class. Besides the concept of variable, aspects of the concept of function, equivalent equations and modelling competencies can implicitly be touched.

The Experiments should be rather used to introduce the concept of variable than to show an application of it. When doing the interviews some students had preknowledge of the concept of variable and some hadn't. A lot of students who got to know the concept in class thought that a formula should be "something with x". Students who didn't cover variables in class, approached to the problem more naturally without thinking about this "ominous" x.

Literature

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