- National Standards of Education

normative function:

Description of comparable competences and abilities all learners should achieve at the end of lower secondary education *(„output-steering“)*

Experiments in Science Education
in Germany

education standards → competences to acquire

↓ ↓

classroom practice culture
culture of experimental practice

example of competences:
gaining of perception / understanding

Use experimental and other methods as well as scientific models

…

Learner's basic ability –
to achieve at the end of lower secondary education:

- realize, which questions in a complex situation or problem is to be solved by chemistry (biology, physics)
- use appropriate methods of investigation

experimental method

- constitutive for science
- means for perception and understanding

background theory of learning:

each learner actively constructs his knowledge and understanding of the world ⟶ learning by doing

How must experimental classroom practice be designed?

Consequences for experimental classroom practice in science education

Learners **themselves**

- put the questions to investigate
- modify the question in order to answer it by an experiment
- design the experiment
- carry out the experiment
- observe and judge critically their observations
- make up their conclusions about the question at the starting point
- judge critically the suitability of their experiment
- …

classroom practice = research work

Consequences for experimental classroom practice in science education

classroom practice = research work

experimental work is constitutive in each lesson:

Integrate experiments in each lesson –

don‘t disunite theory and experiment!

Consequences for experimental classroom practice in science education

Teachers - responsible for

the extent to which their pupils achieve the required competences –

- initiate questions and problems of sufficient complexity
- accept their pupil‘s (wrong?) ideas and conceptions
- supports their experimental work (design, preparation, execution, evaluation, …)
- allows wrong ways
- are highliy flexible
- …

No recipes!

Consequences for experimental classroom practice in science education

Less is more: less grinding

but more building up real competences, including scientific knowledge

less teaching

but more learning

time, time, time …

patience, patience, patience **…**

Example: