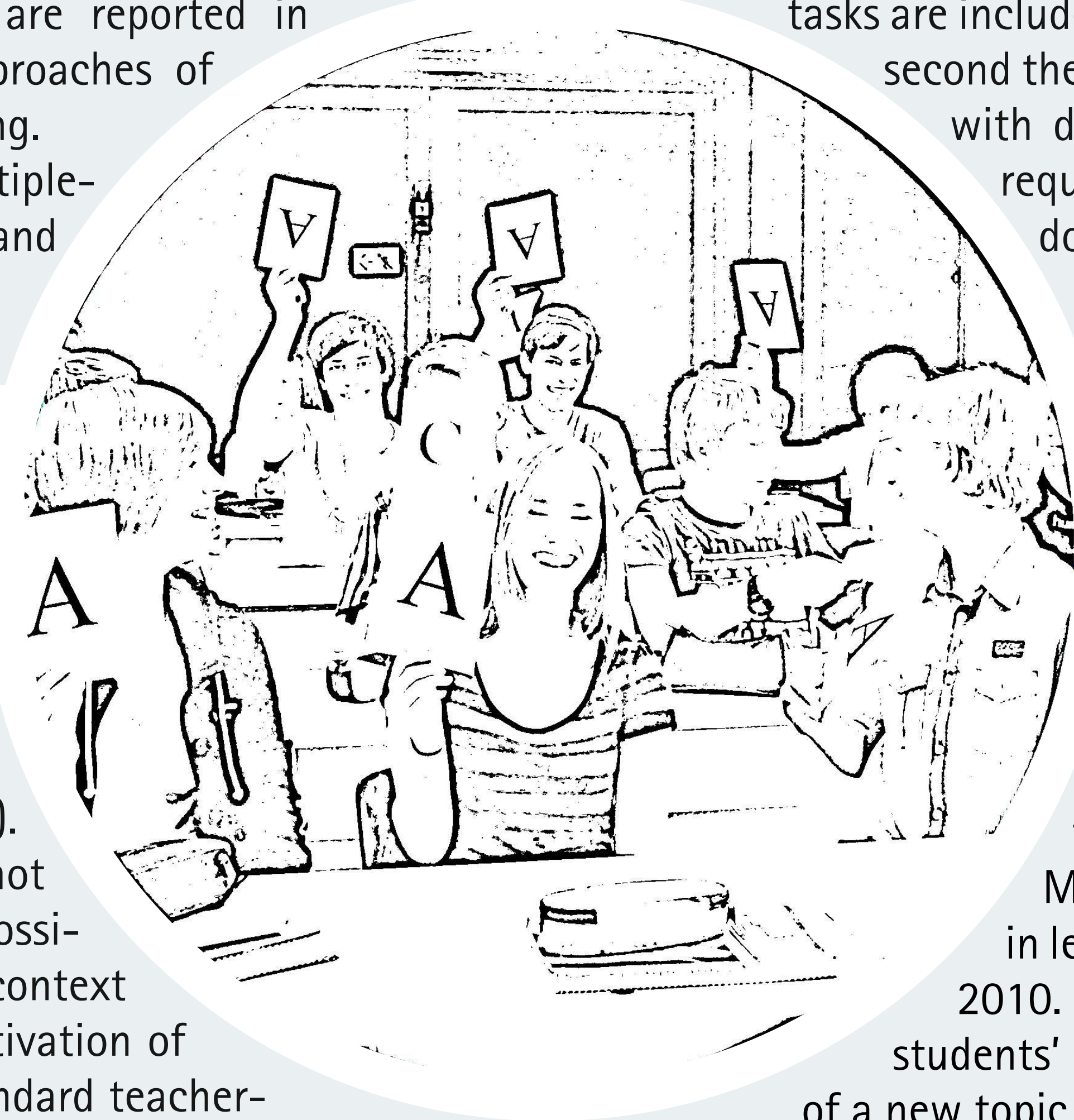


Overview

Multiple-choice tasks are well-known in science education. They are often used in test situations though several negative aspects are reported in literature. Furthermore, there are some other approaches of using this kind of tasks in physics learning and teaching. This empirical study focusses on implementing multiple-choice tasks for enhancing feedback in school and university physics classes. In the school context, the

learner's attitude towards the subject physics is measured. In the first part those tasks are included in educating medical students at MH Hannover, in the second the evaluation takes place in lower secondary class. Dealing with different numbers of students at university and school requires different scripts. Therefore two empirical studies are done independently.

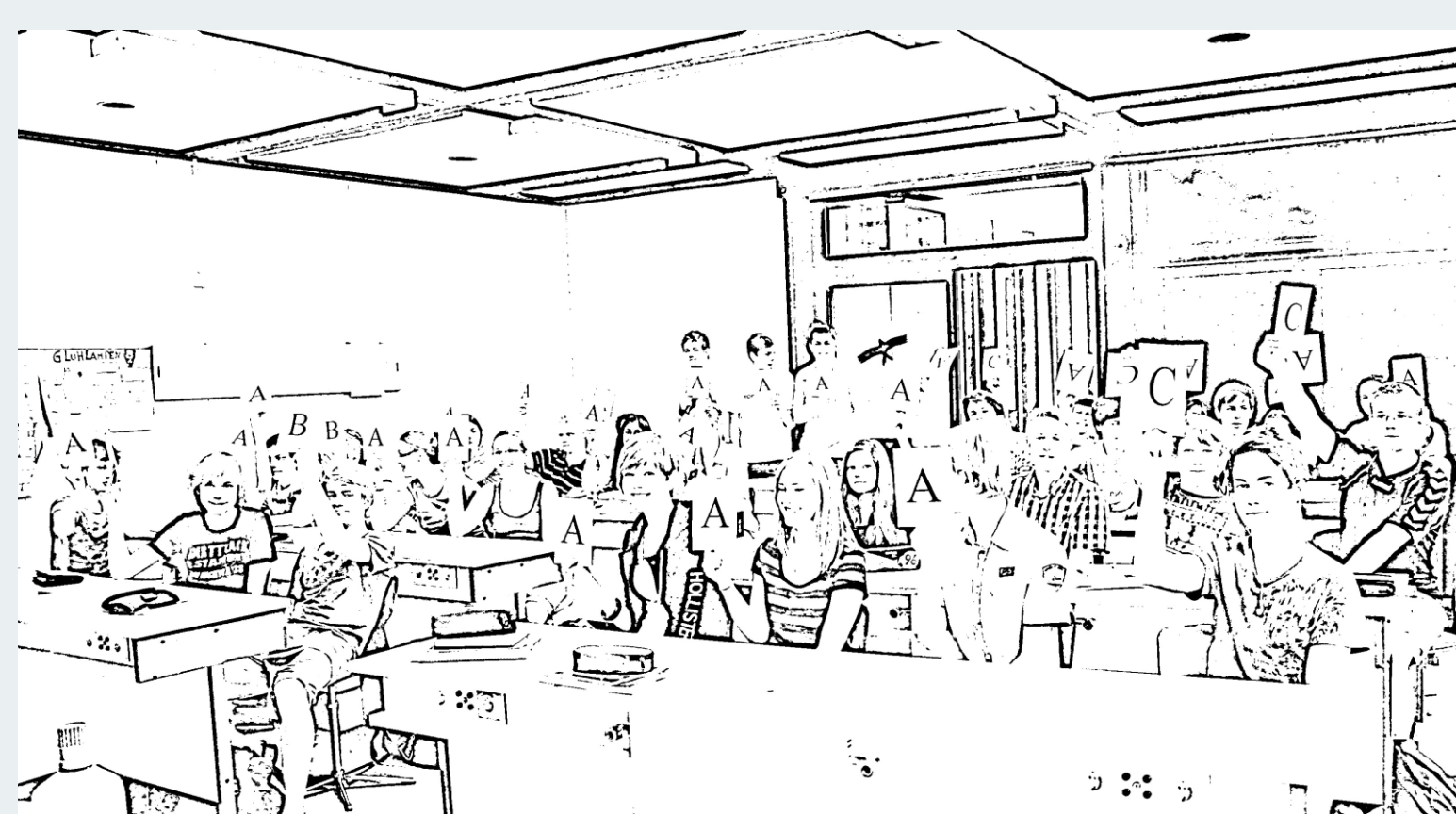


Theoretical background

The potential value of multiple-choice tasks for learning and teaching physics is often described (Treagust 1986), considerable negative aspects mentioned (Butler et al. 2008) and their use is evaluated mainly at college/university level (Mazur 1996). In contrast to that empirical studies in school have not been realized largely. Mie (2002) summarized the possibilities of using multiple-choice tasks in the school context and emphasizes instant feedback and increased activation of pupils as major positive criteria. Compared to a standard teacher-student-conversation at school or university more people are involved and consequently feedback and interaction might lead to a better learning.

Implementing multiple-choice tasks in university physics course (Study 1)

While traditional lectures often show a lack of communication between lecturer and student formative assessment has been developed to improve the learning outcome of medical students. At Hannover Medical School multiple-choice tasks have first been used in lectures of optics and seen as suitable by the lecturer since 2010. Feedback is given with flashcards to gain insight into students' misconceptions and learning outcome. At the beginning of a new topic students' preconceptions/misconceptions are evaluated, so the lecturer can respond to them.



Using flashcards in secondary school's physics class for feedback purpose.



Using flashcards in university physics lecture for feedback purpose.

Implementing multiple-choice tasks in secondary school's physics courses (Study 2)

This part of the study focusses on secondary school's physics course, eight classes ($n > 200$) participating. With "resistors/Ohm's law" and "Hooke's law/addition of forces" two major topics in 8th class were chosen to evaluate implementing multiple-choice tasks into lessons.



A more precise aim is given by the following research questions:

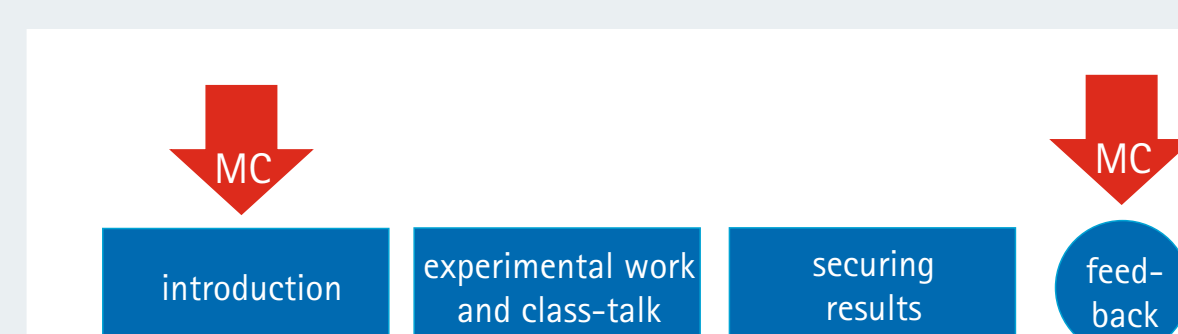
- In physics classes multiple-choice tasks can be utilized advantageously in different scripts of teaching.
- The use of multiple-choice tasks improves pupils' learning of physics content.
- Multiple-choice tasks can improve the pupils' attitude towards physics by giving feedback, improving orientation and transparency.

Focussing on feedback, two different scripts of teaching have been taken for the implementation, exemplarily shown by the following graphs.



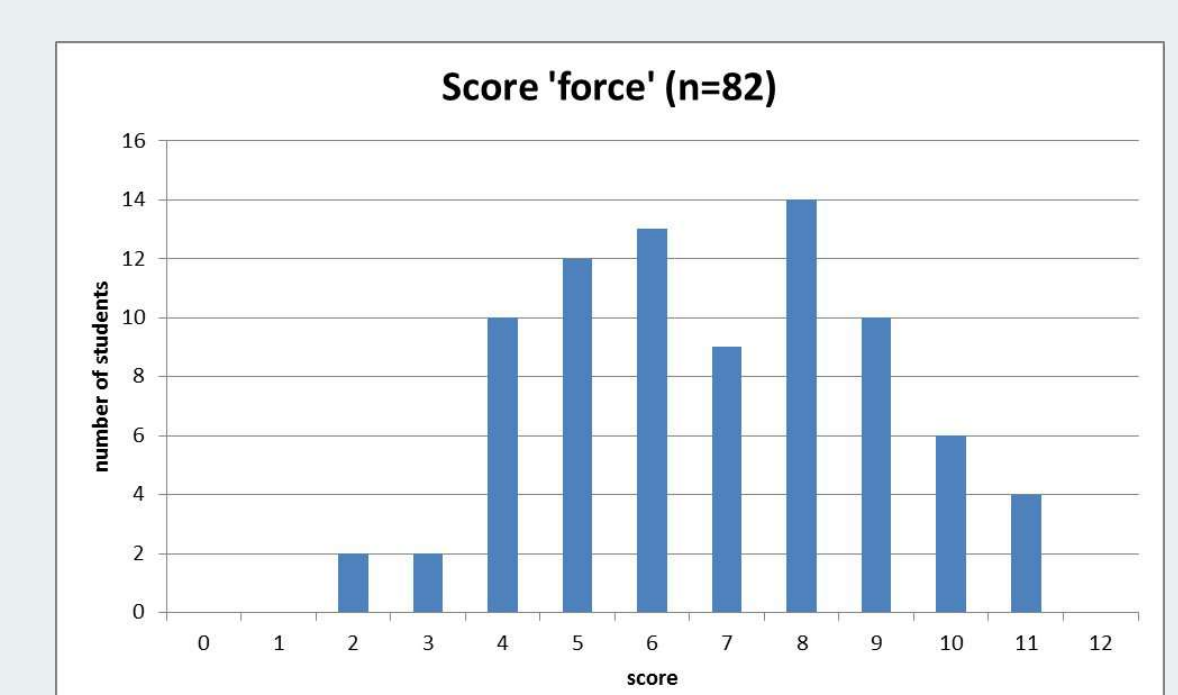
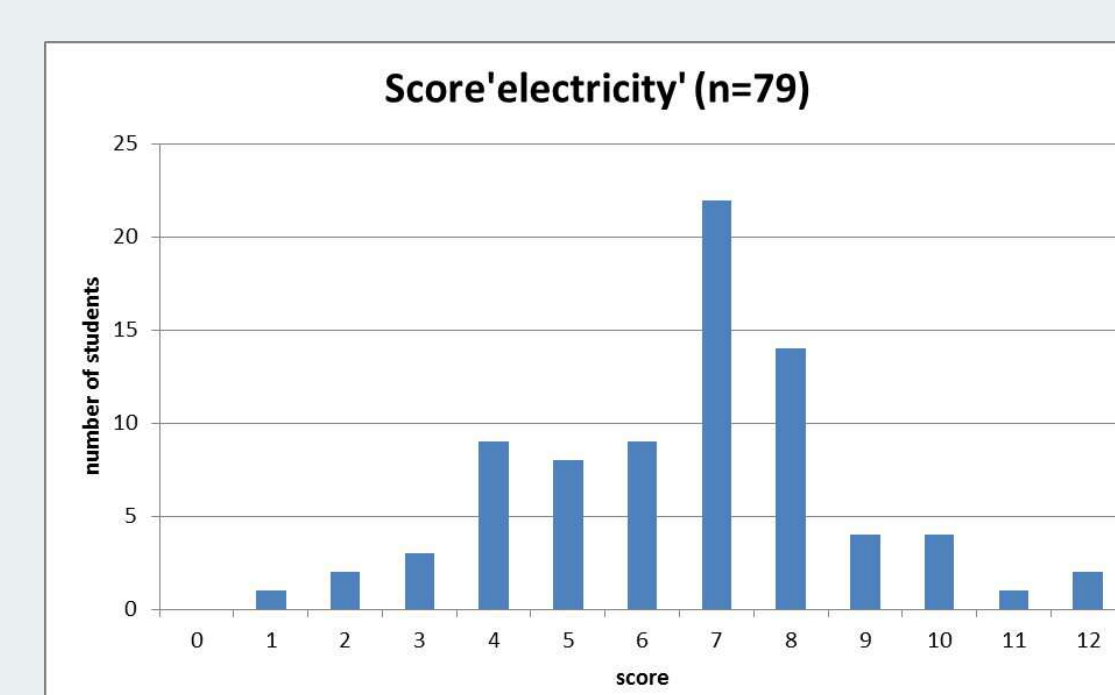
Multiple-choice tasks are only used at the end of a lesson/topic for feedback purpose.

Multiple-choice tasks are used at the beginning introducing the content of the lesson. At the end the results are discussed and further multiple-choice tasks are used for feedback.



For evaluating content-knowledge and attitudes towards the taught subject specific surveys have been developed. Piloting has shown, that standard tests (Engelhardt et al. 2004, Hestenes et al. 1992) are not adequate in 8th grade. Therefore subject-related tests have been developed.

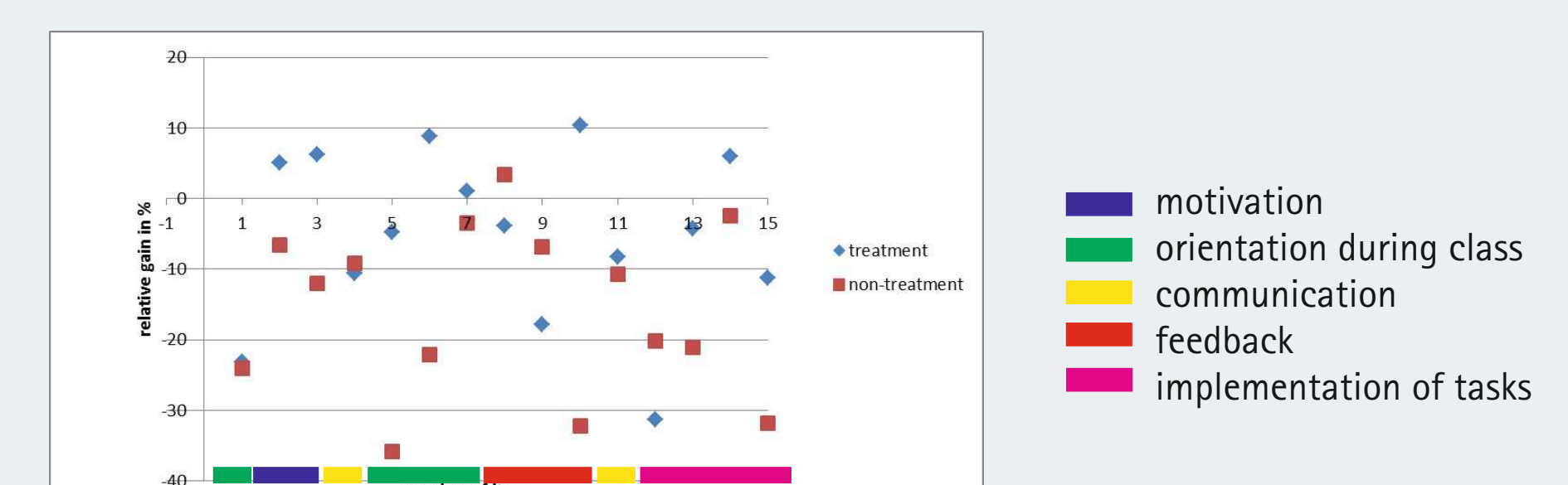
The evaluation of pretests shows that they can be assumed to be normally distributed at a level of significance within 0.02 or larger (KS-Test).



Preliminary findings

Before implementing multiple-choice tasks in physics courses the pupils' content-knowledge and subject-related motivation, use of tasks, orientation and feedback during class have been evaluated.

Overall, the pupils express a lack of feedback: They regularly assess their learning progress, but teacher's feedback is often missing. Tasks are used in class quite frequently, but although the pupils characterize tasks as useful, they do not like them. The following graph shows the relative gain between pretest and midtest. A positive gain is equivalent to a positive development, e. g. more feedback during class.



Exemplarily an item concerning feedback shows, that using multiple-choice tasks in class might have a positive effect on teaching physics.

