

4.5 Case study 5 (CS5 Germany)

Concept focus	Context of crash tests
Inquiry skills	Developing hypotheses Planning investigations (carrying out investigations) Working collaboratively
Scientific reasoning and literacy	Not assessed
Assessment methods	Classroom dialogue Peer-assessment Student devised materials (reports)
Student group	Grade: 10 th grade (upper second level, physics class) Age: 16 years Group composition: all male, mixed ability Prior experience with inquiry: No prior experience

In this case study, the teacher adapted the unit to investigation collisions of small cars on inclined planes, as this was a good fit with curriculum and suitable for the laboratory setting. Skills assessed were *developing hypotheses* and *planning investigations*, as well as implementing investigations. Assessment was solely formative; feedback was provided during the lesson and the teacher evaluated written work after the implementation.

(i) How was the learning sequence adapted?

The **Collision of an egg** SAILS unit was modified for implementation in this case study. The teacher took the central idea of the crash of a body (collisions) but skipped the context egg and also did not choose the vertical fall of a body. Instead, he planned the unit around the context of crash tests, and the students had to work on several stations mostly with inclined planes and small cars. Reasons for this adaption were (1) seen as a better fit to the curriculum, (2) the possibility to arrange a series of (safe and tidy) experimental settings and (3) prior experiences of the teacher with these kind of investigations.

(ii) Which skills were to be assessed?

The main elements of inquiry that this activity addressed were *developing hypotheses* (finding ideas), *planning investigations* and carrying out experiments. It was important to find out the origin of the ideas (group member, teacher, members of other groups) and the kind of the investigations.

(iii) Criteria for judging assessment data

The teachers made observations of the students and wrote an extensive “coaching protocol,” in which he wrote down all the ideas of the students, advice he gave groups or advice/comments a group got from other groups. This coaching protocol contains all hints that were exchanged between groups and between teacher and a group (in chronological order). The students had to write protocols for documentation of their experiments and findings. The teacher did not use written feedback methods yet, but will use the results of analysis of the protocols in the next teaching unit.

(iv) Evidence collected

Teacher opinion

The teacher was responsible for this group of students since only a short period of time. He therefore took this opportunity of the unit to check if the students are able to work on scientific investigations on their own or if he had to reduce the openness of tasks in this physics class. The students had to work in groups of three or four students. Gender issues did not occur because all students were male.

In general, the teacher was satisfied with the cooperative working in the class. Of course, not all students were equally able and some students took specific roles. However, as a result, independent working on scientific investigations seems not to be a problem in this class.

The teacher reports that this 3-hour unit was too short to discuss and explain all the physics concepts in details. On the other hand, he says that he will be able to take this unit and the results as a starting point and basis of the next mechanics topic in a few weeks. He was very satisfied by the inquiry activities of the students. They especially came up with sound experimental set-up (after one to three attempts) and made good measurements.

Sample student artefacts

The teacher collected a lot of information during these lessons; in particular he assessed the different experimental set-ups for investigation of the crash of a body, i.e. the collision of a body with some kind of obstacle and/or testing of a crumble zone.

Students prepared protocols, which contained different kinds of data according to the different tasks. This varied depending on the carefulness of the students in their collecting of data. In addition, students make a lot of effort to sketch their experimental set-ups.

(v) Use of assessment data

The student groups got feedback from the teacher and other groups in a formative way; they used the feedback mostly, in some cases they did not. The protocols of the students show that the students were able to work on the tasks with only little guidance. A summative assessment was not planned at this stage of the class.

(vi) Advice for teachers implementing the unit

Although the unit runs well, the teacher gave some advice for new teachers who want to do this unit with his adaptations:

- Do not underestimate the difficulties in the experimental set-ups
- It could be wise to give a bit more guidance in the phase planning of the experiments especially if it is a bigger group
- Spent a bit more time on implementation, especially for more theoretical issues.