

4.4 Case study 4 (CS4 Germany)

Concept focus	Introduction to the concept of speed
Activities implemented	Activity A
Inquiry skills	Planning investigations
Scientific reasoning and literacy	Scientific reasoning (identification of variables)
Assessment methods	Classroom dialogue Teacher observation Student devised materials (investigation report)
Student group	Grade: 7 th grade (lower second level physics class) Age: 12-13 years Group composition: mixed ability and gender (30 students) in a Gymnasium (highest educational level in Germany) Prior experience with inquiry: Some experience

In this implementation of the Speed SAILS inquiry and assessment unit, the teacher adopted an *open inquiry* approach for introducing the topic “how to describe motion.” The teacher observed the students process, and did not get involved unless specific assistance was needed. Skill in *planning investigations* was assessed through observation and classroom dialogue, where the teacher posed questions during the inquiry process. The students submitted reports after the lesson, and the teacher provided written feedback on these.

(i) How was the learning sequence adapted?

The **Speed** SAILS unit was implemented in a single 120 minute lesson. An experienced teacher used some tasks from the speed activities in her regular teaching in the 7th grade. This teacher was part of cohort 1 in the SAILS teacher education programme and also took part in analysis of the **Speed** SAILS unit in a SAILS workshop.

The unit implementation was used as an introductory activity for the topic “How to describe motion” and was carried out in a two hour session. The following questions were used:

- How long does it take you to walk 5 metres, walking slowly, then walking quickly?
- How far can you walk in 5 seconds, walking slowly, walking quickly?
- How can time and distance measurements be related to one another?
- What can you work out from the measurements?

At the beginning of the lesson the teacher showed a video of the comic Asterix. The students described different types of movement (linear, curvilinear and oscillations). The teacher asked how a physicist describes movement in general and waited for suggestions of the students. Without discussing the answers in detail, she wrote the speed activity questions shown above as a work order on the whiteboard. The order was given without further information. The students had to plan their investigation. The materials (measure tape and a stopwatch) were provided on the teacher’s desk. They worked in groups of 3-4 students. The teacher did not restrict the organisation of the groups (self-selected groups). The students chose their groups as they liked, and they were mostly mixed gender groups. The activities were carried out in the classroom and outside the school building.

(ii) Which skills were to be assessed?

When students were carrying out their investigation the teacher observed the students process and tried to give specific assistance. However the execution of the experiment (*planning investigations*) did not pose a problem to the students. Differences in quality between the students’ approaches were mainly observed in the accuracy of the measurement of time and length. As the students

showed no major problems in collecting data, the teacher did not interrupt the students' practical work. The summary of selected student groups showed that they had no difficulties in planning and execution of the measurement.

After finishing the data collection the teacher asked for a description of the experimental process, as evidence of *scientific reasoning*. The presentation of their results showed that most of the students were able to mention the two physical quantities as variables concerning faster or slower walking. The teacher reported that some students described a relation by saying that a person walks fast, if she needs less time by constant length of the path or that a person walks slow, if she walks less distance in a constant time. However, very few students were able to specify velocity in a mathematical way and to name velocity by the quotient of length and time.

At the end of the lesson the students were requested to write records of their investigation. The teacher collected these student artefacts and provided written feedback. The teacher reported that most students were able to document their investigation by drawing a sketch, describing their accomplishments and writing down their observations and measurements in a table. The teacher did not influence the students' work at that point. Improved records showed a separation of the inquiry issue, the accomplishments and the observations. Some of the students finished with a sentence containing their conclusions. The best reports had a very clear structure. They defined the question and described the accomplishment as an approach to find answers to the question. At the end different velocities of the group members were given as a result.

(iii) Criteria for judging assessment data

The teacher's assessment was focussed on the skill of *planning investigations* (including carrying out an investigation). The skills were assessed by teacher observation and questioning while students reported their accomplishments. The teacher suggests that a focus on other inquiry skills may be possible, but in the lesson she did not have the capacity to assess other skills.

The teacher recognised difficulties after the lesson by evaluating the students' written records. During the lesson she did not assess experimental data, instead students' documentation skills were analysed by evaluation of the students' records. The teacher's description showed that she was able to assess the variance in students' skills through in-class observation, even though this observation was not planned by the teacher in a systematic way. In the interview she showed interest in using rubrics as a formative assessment tool during the students' process.

(iv) Evidence collected

Teacher opinion

The teacher was impressed by the motivation and interest that the students showed in carrying out the investigation. The teacher reported that the class is very interested in science but beyond that she observed a special motivation in the way the students worked out their tasks. Data collection did not pose a problem for the students but a larger number of students were not able to generalise the results of their measurements.

The teacher felt she would like to use a rubric system, for example those used in the Woodlice SAILS unit, but in preparation of this lesson she had no time to adapt the rubrics for use with the Speed unit.

(v) Use of assessment data

Evaluation of student written reports showed a qualitative distinction in the students' skills to document their investigation. For future documentation of an investigation process the teacher

considers inclusion of peer-assessment as an additional part of the lesson. A rubric system that is adjusted for self- or peer-assessment might be a good tool, in her opinion.