

4.4 Case study 4 (CS4 Slovakia)

Concept focus	Investigating the living conditions of woodlice
Inquiry skills	Planning investigations Developing hypotheses Working collaboratively (discussion in groups)
Scientific reasoning and literacy	Not assessed
Assessment methods	Classroom dialogue Teacher observation Presentations
Student group	Grade: lower second level Age: 12-14 years Group composition: co-ed, mixed gender groups, 20 students Prior experience with inquiry: Some prior experience in IBSE

Skills assessed were *planning investigations*, *developing hypotheses* and *working collaboratively*, which were assessed based on teacher observation during class discussions. The teacher assessed the way students engaged in discussion and argumentation and used a four-level rubric to distinguish performance levels. The teacher provided feedback on what the students did well and explained where improvements could be made. The teacher also found that students welcomed feedback from their classmates and used this to improve their investigations.

(i) How was the learning sequence adapted?

Before implementation of this unit students looked for images of woodlice on the internet and then found woodlice in nature. In this way, students should notice the environment in which they live. Groups of four students were asked to bring at least 10 of these creatures to the biology lesson when the unit was to be implemented. The lesson began with conversations about whether they found or did not find woodlice, and where they were found (Figure 1). Students discussed their expectations regarding woodlice on the basis of a picture that they had found out on the internet. They imagined woodlice to be like big and ugly animals. When they found them, they were pleasantly surprised by the fact that they are small and likeable. Furthermore students talked about the process of collecting the woodlice – how they collected and stored the woodlice. Some groups collected them in the sunshine and all groups found that woodlice survived without problems in boxes of damp earth for a few days. Other groups collected them just after rain and put them in boxes where there was only a little dry clay and almost half of the collected woodlice perished. A spontaneous discussion was held as to why this happened. The students were able to suggest other assumptions about the behaviour of woodlice, which could be verified by experiment.



Figure 1: Students working and discussing in groups

(ii) Which skills were to be assessed?

In this case study, a four-level rubric was used to assess *working collaboratively*, *developing hypotheses* and *planning investigations* (Table 1).

(iii) Criteria for judging assessment data

Students' inquiry skills were assessed during group discussions. The teacher posed some initial questions, such as "Have you found information about woodlice?" or "In what kind of environment do they live?" and "Where did you find woodlice?" before leading a whole-class discussion. The teacher assessed the way students engaged in discussion and argumentation, when talking about what information about woodlice they found on the internet, where and how they were looking these animals in nature, into what they collected them and whether they took care about them until they brought them to school. The teacher did not intervene in the discussion very much. He observed how students argued for their actions, how they hypothesised that woodlice prefer a moist environment and how this idea was formulated (for example "Woodlice do not like drought," "Woodlice like water," "If they can get on wet or dry paper, they will go on wet," "It is necessary to give them wet soil, where they survive," etc.). Students expressed the assumption that the cause of death of the captured woodlice was lack of moisture, and therefore they prefer moist environment from the environment dry. The students could develop the hypothesis that woodlice prefer moist environments with very little intervention by the teacher.

Table 1: Rubric for assessment of inquiry skills in CS4 Slovakia

Assessed skill	Emerging	Developing	Consolidating	Extending
1. Peer discussion and forming coherent arguments	The student describes the course of their own search (information or animals).	The student argues for the search approach and achieves a result (brought woodlice, found out the facts about them).	The student argues logically for the search approach, achieves the result, listens to the experiences of others and responds to them.	The student argues logically for the search approach, achieves the result, responds to the experiences of others, and following discussions, concludes and formulates a hypothesis
2. Formulating hypotheses and conclusions of investigation	A prediction is made	A testable prediction is made linked to the question	A testable prediction to the question is made that suggests a clear outcome	A testable prediction to the question is made that suggests a clear outcome based on scientific reasoning
3. Planning investigations	The student has a plan to verify the hypothesis.	The student has a plan to verify the hypothesis, consults with others and is willing to compromise.	The student has a plan to verify the hypothesis, consults with the others and is inclined towards a solution that allows them to obtain an accurate result.	The student has a plan to verify the hypothesis, consults with others, and is inclined towards a solution based on scientific thinking.

It was difficult to find students who performed at the "extending" level (Table 1). However, the teacher was able to give feedback on what the student did well and explain where improvements

could be made to progress to the next performance level. The teacher also found that students welcomed feedback from their classmates and used this to improve their investigations.

(iv) Evidence collected

Teacher opinion

In the Slovak language the word for “woodlice” is very unusual: “žičiavka.” For students who had not heard this word before, it evoked ideas such as prickly (sting), lighting (turned on), hot (burning) earthworm (from Czech language “žížala”), rather than the image of a woodlouse. Students were interested in this word and willingly explored the meaning behind it. As woodlice usually hide, and have a drab colour, most students had never previously noticed them. Initially after searching on the internet for “woodlice” students were afraid of their size and appearance, but when they carried out experiments with them most students handled them very willingly.

Observer notes

The unknown, but very Slovak sounding term, for woodlice, stimulated students’ interest in this investigation: “žičiavka.” The inquiry began by investigating the meaning of this interesting word. After finding that it is an animal that lives near people, students were motivated to find woodlice in nature.

Sample student artefacts

Developing hypotheses

During the whole class discussion, students suggested that they investigate the hypothesis related to moisture as part of the living conditions of woodlice. For example one student reasoned that:

“I think that some woodlice perished in the box, because I collected them after rain and when I put them into almost dry box without water they suddenly died from thirst.”

Planning investigations

Another student group planned their investigation during the group discussion, by considering what would be a measurable response to moisture, compared to what might be simply coincidence:

Initial suggestion: ***We pour them some water to the Petri dish, whether they will go to drink.***
 Response, with experimental plan: ***They are very small, and they could drown, let's rather put a filter paper into a bowl and moisten half. Let's put them on the dry half, whether they will climb over on wet side.***
 Further development: ***But what if they will not want to move so much, let's give them exactly in the middle between the dry and moist paper so that they can choose alone where they will go.***
 Response, recognising a potential error or difficulty: ***Good, but it is enough put there just only one woodlouse, what if it isn't thirsty?”***
 Response, with experimental plan: ***So let's put 10 woodlice there.***
 Query: ***Why 10? It is not enough six?***
 Response, with reasoned explanation for experimental plan: ***If they look for moist, all will climb over. But when they are few for example two, so it can be a coincidence***
 Final experimental plan: ***Yes, let's give them more into a bowl, than we will count how many climbed and how many remained after 10 minutes. If it goes into wet more than half, we were right.***

The students then carried out the planned investigation, the result of which is shown in Figure 2.

Formulating conclusions

The teacher also observed student discussions after the experiments were completed. Students discussed how to interpret their results, and decided how to present their conclusions (Figure 3). For example, students discussed the outcome of their investigation:

"Woodlice like damp places."

"One of the ten of woodlice remained dry, but nine were on the half wet."

"One of woodlice was on the dry side so it was a loser and 9 winners were on the wet half of the paper."

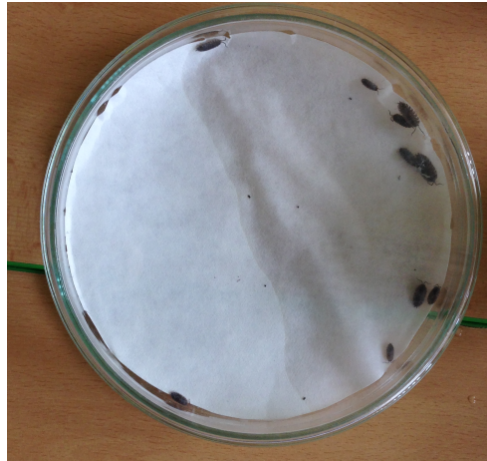


Figure 2: Student's experiment to test preference for wet conditions



Figure 3: Verification of other assumptions about woodlice behaviour (dark and light) – presentation of results