Pilot implementation of SAILS
POLAND

WOODLICE UNIT – APPLICATION AND ASSESSMENT AT THE LOWER SECONDARY SCHOOL LEVEL.

Level of education/type of school: **lower secondary**
Students' age: **13 y.o.** Size of the group: **117**
Teacher's experience in IBSE: **rarely uses IBS**
Pupils' experience in IBSE: **first implementation**

Assessed skills:
a) planning of experiment
b) carrying out experiment
c) analysis of data and presentation of results
d) drawing conclusions

dr Beata Sobocińska

Assessment criteria and information on how the skills were assessed:

Skill a) - planning the experiment
During the first lesson, dealing with characteristics of woodlouse biology, To evaluate the planning abilities, I used as a tool, a rubric (see below) with descriptive assessment of three levels of students' skills, to which the respective number of points were ascribed, finally transformed (as percentages) to a resultant mark.

Tool: Rubric

Assessed skill	2 points level	4 points level	6 points level
1) Asking questions	Student can put a series of questions, but he/she does not discern between those possible and impossible to be answered by means of an investigation	Student can, with a help of others, re-formulate questions, so as they are possible to be answered by means of an investigation	Student can, without external help, re-formulate questions (own or others'), so as they are possible to be answered by means of an investigation
1) Formulating hypotheses	Student can formulate hypotheses that are impossible to be proved by means of a school experiment	Student can formulate hypotheses that after teacher's or colleagues' revision may be proved by means of a school experiment	Student can him/herself formulate hypotheses that may be proved by means of a school experiment
1) Design of a scientific experiment	Student can design an experiment, but without precise description of its course and not considering its repeatability	Student can design a precise experiment (or a series of them) with a help of the teacher's advice or directing questions	Student can him/herself design a precise experiment (or a series of them) choosing the conditions and identifying variables correctly and considering its repeatability

Maximal no. of points to be earned in the area: 18
Mark levels: 0-5 (unsatisf.),6-9 (med.), 10-13 (satisf.),14-16 (good), 17-18(v. good)

Skill b) - carrying out the experiment
Tool: Assessment based on teacher's observation
•**Equipment and materials preparation (rubric)**

2 points level	4 points level	6 points level
Student can collect all materials necessary to conduct a basic experiment, without change of factors/variables	Student can collect all materials necessary to conduct a series of experiments, but with a help of the teacher	Student can him/herself collect all materials necessary to conduct a series of experiments, grouping them respectively to enable measurements under changing controlled parameters

•**Investigation execution:**
a) data collection
- compliance with the safety rules and correct organization of the working environment (1point)
- experiment's repeatability (1 point)

b) documentation
- project of a data collection mode (e.g. table)
(max. 2 points: 1 pt – correct construction of the table with description, 1 pt – correct filling in the table)

Maximal no. of points to be earned in the area: 10
Mark levels: 0-3 (unsatisf.), 4-5 (med.), 6-7 (satisf.), 8-9 (good), 10 (v. good)

Skill c) - analysis of data and presentation of results
Tool: Three-level rubric

2 points level	4 points level	6 points level
Student can interpret data correctly (categorizing the measured variables as lesser – greater) but cannot create a proper graph based on them	Student can present the data on a graph, but the graph lacks or has poorly developed elements as axes titles, scale, legend etc.	Student can present the data on appropriate graph(s) having all necessary elements as axes titles, scale, legend etc. prepared correctly
Student can point out basic / selected sources of biased / incorrect results of the experiment	Student can enumerate all main factors that might be sources of biased/incorrect results of the experiment	Student can analyse all main factors that might be sources of biased/incorrect results of the experiment and indicate ways to avoid them in the future
Student can propose elements of a method serving to improve the experiment	Student can propose improvement of the course of the entire experiment step by step	Student can compare results of other groups, discuss data interpretation and propose methods to improve both own and the other groups' experiments

Maximal no. of points to be earned in the area: 18
Mark levels: 0-5 (unsatisf.),6-9 (med.), 10-13 (satisf.),14-16 (good), 17-18(v. good)

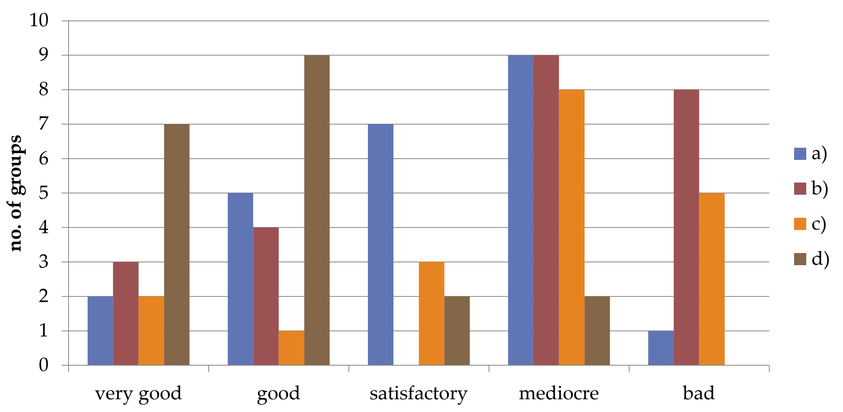
Skill d) - drawing conclusions
Tool: Open question:
•**Formulating conclusion** (0-2 points: 1 pt – merits of the conclusion OK, 2 pts – merits and language (formulation) of the conclusion OK)
What conclusion can you draw based on the investigation carried out?
…….
Tool: Test questions:
I. Find all the correctly formulated conclusions that could be drawn based on the investigation **(T for true, F for false)** (0-5 points)
1. Basic food of the woodlouse are decaying rests of plants and animals. **T/F**
2. Woodlice feed on fresh plants. **T/F**
3. Woodlice are sometimes cannibalising on the animals of their own species, especially on their rests. **T/F**
4. Woodlice are active during the daytime. **T/F**
5. Woodlice serve as a prey to many animals, a.o. lizards. **T/F**

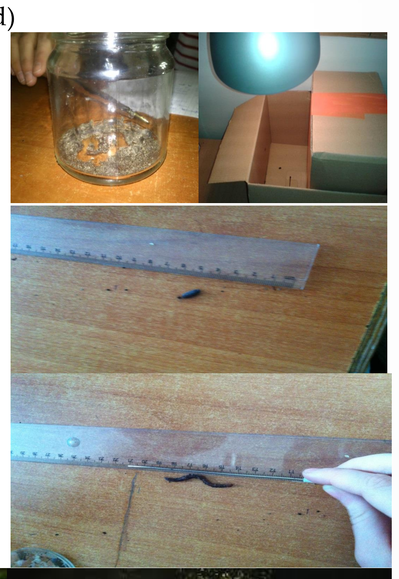
II. Indicate right conclusion(s) from the investigation.
Underline the proper answer *with its true part* and choose its right premise**.** (0-4 points)

1. Woodlice avoid sunny/moist places	because	a. it may lead to their death by drying out
2. Woodlice live only in the dry/moistenvironment		b. their chitine armour is impermeable to (not penetrable by) water

Maximal no. of points to be earned in the area: 11
Mark levels: 0-3 (unsatisf.), 4-5 (med.), 6-7 (satisf.), 8-9 (good), 10 -11(v. good)

Results





Modifications of the original scenario:

Students planned, carried out and analysed results of the experiments entirely on their own. Teacher did not suggest them variables to be considered in the investigation, giving them possibility to act actively and use their imagination. In their attempts to devise experiments, besides the basic parameters of the woodlice biology (food preferences, humidity, light intensity), students showed their interest also in: avoidance of danger, way and speed of movement and other abilities (as swimming, ability to move on various surfaces of different inclination) of the animal. Students displayed their creativity to acquire study animals (including attempts to buy woodlice at pet shops and by the Internet), using other subjects (as crickets, earworms, beetles, millipedes, meal beetle larvae and earthworms) in case of problems with obtaining real woodlice.

Conclusions:

1. Evaluation with IBSE methodology is difficult both to a teacher and students. It requires adjustment and adaptation to every new situation, individualisation seems necessary (see 2).
2. Evaluating all students in the group using the same scheme may be unfair for the individual pupils.
3. Majority of students are fascinated by discovering the world using scientific method.
4. IBSE methodology is extremely time-consuming and in the reality of the Polish school system (necessity of going through an extensive curriculum within reduced number of hours, considerable number of students – often more than 30 – per class, lack of the necessary equipment) its implementation in entirety seems impossible. Only elements of the IBSE methods may be put in practice, but it nevertheless should have a positive impact on the education results. Up to the present time, majority of students had no experience with the scientific method during their school career.
5. In case of a few students, symptoms of zoophoby could be observed (that may be a side-effect of the civilizational development), that also must be taken into consideration when realizing units involving real living creatures. Nevertheless, even such pupils found these activities attractive and interesting, trying to involve as actively as possible.

SAILS Strategies for Assessment of Inquiry Learning in Science

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 289085