

Report from the FP7 project:

# Assess Inquiry in Science, Technology and Mathematics Education



**ASSIST**ME

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## Assessment Method Description for 'Engineering Design in Technology' Competence Peer-Assessment of Written Data: Lab-Journal

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<b>Dissemination level</b>	PP

# 1. Introduction and summary

This description presents a possibility of applying peer feedback in the context of a dismantling analysis in technology education or technology-related subjects by means of lab journals (written data) in the context of a dismantling analysis.

Based on a close product observation, individual students or groups of students disassemble, analyse and reassemble a technological object. The object used in this example is the engine of a scooter. At different stages of the lesson, the students give feedback to each other and reflect upon the learning and working process.

Subject	<ul style="list-style-type: none"><li>• Assessment method generally adaptable to all technological subjects</li><li>• Paradigmatic example in technology; topic: Dismantling of an internal combustion engine</li></ul>
School level	<ul style="list-style-type: none"><li>• Assessment method generally adaptable to lower and upper secondary level</li><li>• Paradigmatic example in upper secondary school</li></ul>
Assessed competences	<ul style="list-style-type: none"><li>• Evaluating the prototype/ technical object against criteria, reasoning</li><li>• Testing a prototype/technical object by collecting, analysing, interpreting and representing data</li></ul>
Data collection about student learning	<ul style="list-style-type: none"><li>• Written data; lab-journal</li></ul>
Feedback method	<ul style="list-style-type: none"><li>• Peer-assessment</li></ul>
Combination with summative assessment	<ul style="list-style-type: none"><li>• Paradigmatic example and feedback method for formative assessment, but task generally usable for both formative and summative assessment</li></ul>

**Table 1. Main characteristics of assessment method "peer-assessment of written data: lab-journal".**

## 2. Description of Feedback Method with Guidelines

### How to Use it

The feedback method "peer-assessment" describes formative assessment which is conducted by student peers. This chapter will provide a description of the principle along with short summaries of different varieties.

With peer-feedback, it is of central importance that the goal of a task and the criteria of evaluation are clearly understood by the students (Sadler, 1989; Black et al., 2003). Black et al. (2003) suggest supporting this understanding by showing examples.

Peer-feedback allows the teacher to move freely between the students and concentrate on individual problems since she / he does not carry the responsibility of doing all the assessment of the whole class.

Why you  
should do  
this

The process of peer-assessing pieces of work from time to time should help the students to bear in mind the aims of their work and therefore assist them in becoming independent learners (Black et al., 2003).

#### Principle of peer - feedback

Peer-feedback follows the idea of "activating students as instructional resources for one another" (Leahy et al., 2005). Peer-feedback is seen as particularly powerful since *"students may accept criticisms of their work from one another that they would not take seriously if the remarks were offered by a teacher. Peer work is also valuable because the interchange will be in language that students themselves naturally use [...]"* (Black et al., 2004, p. 14). The same authors find evidence that *"when students do not understand an explanation, they are likely to interrupt a fellow student when they would not interrupt a teacher."* (Black et al., 2004, p. 14).

However, Black et al., 2003, also mention that before being able to assess their peers' work, students have to learn how to behave in groups (listening to others, taking turns) and how to communicate their feedback usefully.

#### Varieties of peer - feedback (non-exhaustive list)

##### *Reciprocal peer-feedback*

Reciprocal (or two-way) peer-feedback is the type of feedback which emerges when students get involved with a reciprocal peer-assessment setting. In *reciprocal* peer-assessment, students undertake both the role of the assessor and the assessee by assessing each other's work. The rationale lying behind reciprocal peer-assessment is that all students are given the opportunity to experience both the role of the assessor and the assessee and benefit from both practices. In order to implement reciprocal peer-assessment, pairs of individual students or pairs of students' groups need to be formed. Then the pairs of students and/or groups share their work/ learning outcomes from the learning process. Initially in the peer-assessor role, the students are asked to assess their peers' work and to produce peer feedback. The peer feedback could either

be of quantitative (e.g. grades) and/ or qualitative nature (e.g. oral or written comments which could include suggestions and recommendations for future action).

### *One-way peer-feedback*

One-way peer-feedback is the type of feedback which emerges when students get involved with a one-way peer-assessment setting. In one-way peer-assessment, students undertake either the role of the assessor or the assessee. The different element of one-way peer-assessment from that of reciprocal peer-assessment is that in the first method the students can either only provide peer feedback or merely receive peer feedback. In this case a group of students can act as the assessors and another group of students can act as the assessees. This type of peer-assessment method falls short of the benefits that could emerge when a student experiences both the role of the assessor and the assessee.

### 3. Paradigmatic Example: Technology, Upper Secondary level

Dismantling a technological object is an important procedure in technology education. This paradigmatic lesson plan is concerned with the analysis of a scooter engine and is to be understood as a suggestion. It is also possible to have other household appliances (such as a hair dryer, a bicycle or a CD player) disassembled and analysed by students. The dismantling analysis procedure does not change with the object to be investigated and consists of the following steps:

<i>Typical phases of a dismantling analysis</i>
1. Observing the product and making assumptions concerning its functional connections and the possible ways of disassembling it.
2. Dismantling the product – organising and grouping
3. Defining functional connections – Drawing a functional layout
4. Reassembling
5. Evaluating

In order to ensure a documented dismantling process, it is important to pay attention to the students grouping the disassembled items according to their function or interrelation. Moreover, the individual parts can be placed on a poster, and their component group, as well as the flow of energy and/or material information, can be highlighted by using different colours. If necessary, the teacher can advise and help the students.

A dismantling analysis also lends itself to an incorporation of aspects of inquiry-based learning. Before the actual dismantling begins, the students are encouraged to ask questions about the technological object, formulate hypotheses concerning functional interrelations, and plan the research process in advance, e.g. with the scooter engine.

A so-called lab journal forms part of the assessment. In this written record, students record the main aspects of the lesson (see information box). For this reason, lab journals are exchanged between students.

# Information:

In general, the **Lab Journal** should contain the following:

- Cover sheet
- Table of contents
- Selected approach
- A list of the dismantling steps
- Documentation of the dismantling procedure by means of photos, etc.
- Drawings
- Demonstration of functional connections
- Disposal recommendations for individual parts (depending on the material)
- Student notes about the dismantling process
- ...

The criteria of the peer assessment are connected to the different phases of the dismantling analysis. Feedback can be provided regarding hypotheses about functional connections, proper ways of dismantling, the correct grouping and systematization of individual and interrelated parts, the accuracy and comprehensibility of the drawings, the reassembling, aspects of the evaluation and the conclusions. The peer assessment method can therefore be applied at various stages of the dismantling analysis of the scooter engine. The dismantling analysis offers two basic possibilities. First, students can decide themselves when the peer assessment takes place. The different groups can provide reciprocal feedback, answer questions and evaluate certain (independently selected) aspects of the dismantling analysis. This option is characterized by a high degree of student independence and regulation. For students in need of a more rigid structure, the peer assessment phases can be determined by the teacher, for instance, after the grouping of individual and interconnected parts or when the question of the functional connections of the technological object arises.

## References

- Black, P., Harrison, Ch., Lee, C., Marshall, B., and Wiliam, D. (2003): *Assessment for learning: putting it into practice*. Open University Press, London.
- Black, P., Harrison, Ch., Lee, C., Marshall, B., and Wiliam, D. (2004): *Working inside the black box: assessment for learning in the classroom*. Phi Delta Kappan, Sept. 2004.
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