Implementing formative assessment methods in inquiry-based science education in Switzerland

Regula Grob, Monika Holmeier & Peter Labudde
Formative assessment in inquiry-based education

(based on Harlen, 2013)

Student activity 1
Data about student learning

Student activity 2
Data collection about student learning

Next learning steps

Decision on activity

Decision on next steps of learning

Interpretation of the data

Judgement of the student achievement based on criteria

Report on standard achieved

Summative assessment
Formative assessment methods

- Written feedback provided by the teacher:
  this involves the formative use of rubrics (e.g. Smit & Birri, 2014) as well as open comments by the teacher (e.g. Black & Harrison, 2004)

- Peer-assessment (e.g. Leahy et al., 2005; Sluijsmans, 2002)
  the underlying idea is that students give feedback on their peers' work
Topic of this presentation

• Little research on formative assessment practices in Science education in Switzerland

• Strengthening of the role of formative assessment in the new curriculum

→ Potential of formative assessment to enhance students’ inquiry learning

→ Challenges that occur during implementation of specific assessment methods
Research design

• 10 primary science teachers;
  10 upper secondary biology / chemistry / physics teachers

• Implementation of formative assessment methods in inquiry – based education in two rounds

• Written forms on planning of units; written forms on evaluation of units; oral interviews; group discussions

• Open coding, qualitative content analysis (Mayring, 2008)
Content

Introduction and theory

Research design

Results

- Two examples from implementation
- Usability of formative assessment in inquiry-based learning
- Challenges with formative assessment

Discussion and conclusion
Peer-assessment at primary school

- Unit implemented by two teachers
- Students explore the concept of buoyancy with different objects
- Steps of the inquiry predefined
- Peer-assessment on the different steps of the inquiry, scaffolded by questions, with smileys (teacher 1) / with short sentences (teacher 2)
  - quality of hypotheses (“guess”)
  - quality of description of observation
  - quality of conclusion
  - …
Peer-assessment at primary school: written evaluation form

**Question:** Was the peer-assessment worthwhile?

**Teacher 1:** Yes, definitely. The students improved on observing each other, on reasoning and on providing feedback to others. It was also valuable for me because I could hand that responsibility over to the students. That gave me some room for other stuff.

**Teacher 2:** Partly. The reasons for the smileys *[assessment was not provided with words but with smileys because the students are young and writing is hard for them]* were missing. That was quick but not very sturdy. But I was released from the duty of assessing. The students learned to assess based on criteria rather than on sympathy. And the students really enjoyed doing this, despite saying it was a hard task!
Students explore the addition of forces

Unit is interrupted by a student exchange programme of 3 weeks

During that time, the teacher provides written comments on
  - the strategy of investigation
  - the understandability of the written explanations
  - the strength of the arguments

After the exchange programme, the students get the chance to consider the feedback for the rest of the unit
Usability of peer-assessment to foster inquiry-based student learning

<table>
<thead>
<tr>
<th></th>
<th>Primary school teachers’ statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usable criteria</td>
<td>- Criteria must be clearly observable; abstract criteria are not usable</td>
</tr>
<tr>
<td>(in the context of IBE)</td>
<td>- Criteria must be concrete; broad constructs like competences are not usable for students</td>
</tr>
<tr>
<td>Facilitation of learning</td>
<td>- Planning of the next steps in learning facilitated by language that is naturally used by students</td>
</tr>
<tr>
<td>(«how the students learn»)</td>
<td>- Perspective changes, this broadens the horizon</td>
</tr>
<tr>
<td></td>
<td>- Praise during student-centered activities motivates to proceed</td>
</tr>
<tr>
<td></td>
<td>- Feedback comes immediately</td>
</tr>
<tr>
<td>Learning gains from peer-assessment («what the students learn»)</td>
<td>- Collaboration in groups</td>
</tr>
<tr>
<td></td>
<td>- Communication abilities</td>
</tr>
<tr>
<td></td>
<td>- Ability to reflect upon own actions</td>
</tr>
</tbody>
</table>
### Challenges of peer-assessment

<table>
<thead>
<tr>
<th></th>
<th>Primary school teachers’ statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Providing feedback</td>
<td>- Students may have problems with rules of communication; with the vocabulary and the tone of their feedback</td>
</tr>
<tr>
<td></td>
<td>- Students’ feedback may be little concrete; it may be hard to draw conclusions on the future learning from them</td>
</tr>
<tr>
<td></td>
<td>- Students are not always objective but confuse sympathy and assessment criteria</td>
</tr>
<tr>
<td></td>
<td>- Not all students are equally critical, not all students take the task serious</td>
</tr>
<tr>
<td></td>
<td>- Writing feedback is very time-consuming</td>
</tr>
<tr>
<td>Processing feedback</td>
<td>- --</td>
</tr>
<tr>
<td>Role of the teacher</td>
<td>- Teacher cannot control everything, does not know all the details</td>
</tr>
</tbody>
</table>
Conclusions

• Critique of research design:
  – sample not representative for Swiss science teachers
  – almost exclusively perspective of the teachers considered
  – triangulation with student questionnaires, school visits and teaching materials

• The teachers from both school levels generally agree that both assessment methods are usable in inquiry units. Their expectations on the learning gains of the students differ.

• The challenges related to the two assessment methods are seen similarly by the teachers from both school levels: with peer-assessment, nobody can be sure that the feedback is valid. Comments provided by the teacher are time-consuming and only worth the effort if the feedback is taken into account in the next steps of learning.
To what extent is formative assessment a normal part of the teaching in your country?

Compared to the presented changes and challenges of formative assessment in Switzerland: How is the situation in your country?

ASSIST-ME: Assess Inquiry in Science, Technology and Mathematics Education
www.assistme.ku.dk

regula.grob@fhnw.ch