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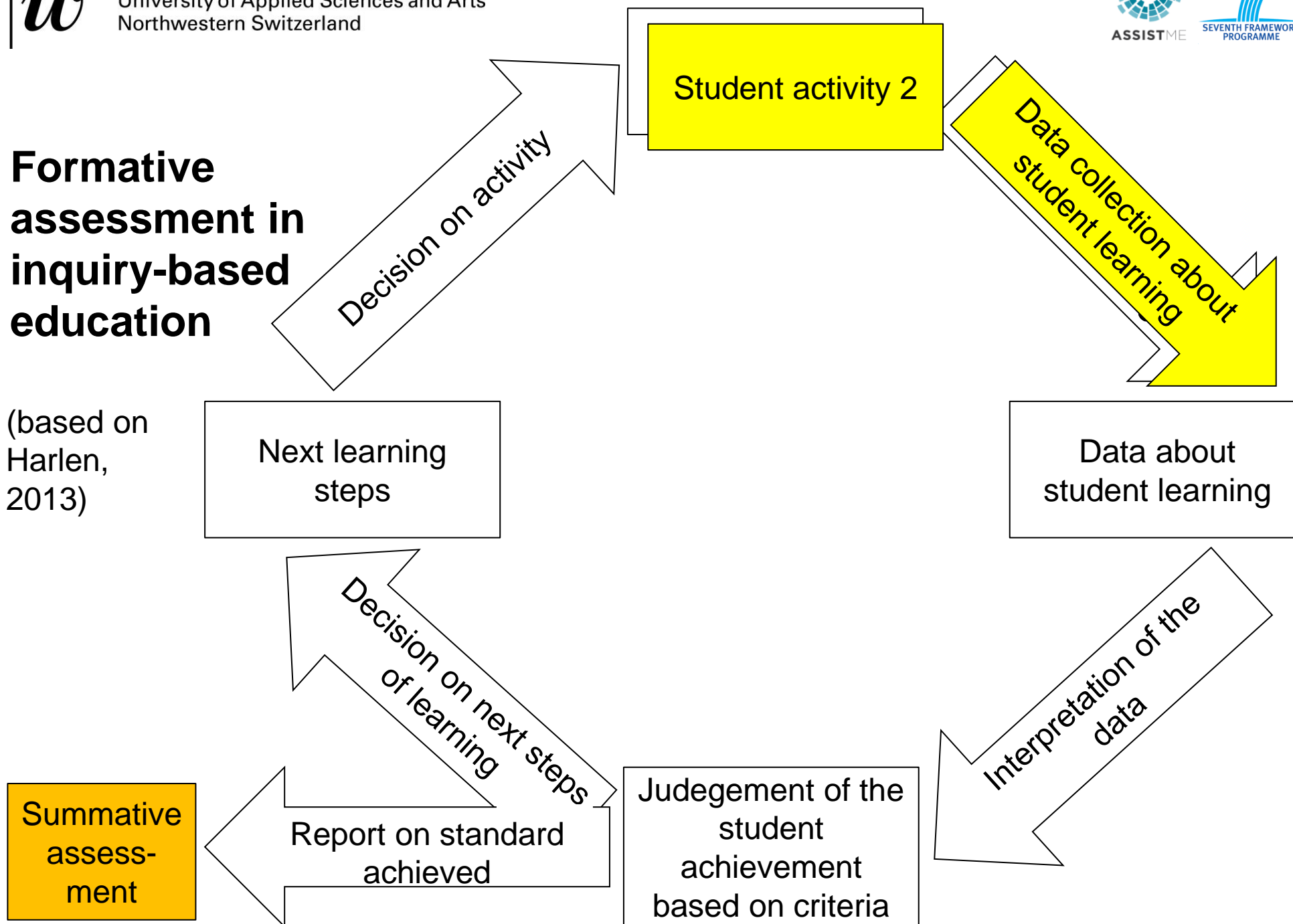
Implementing formative assessment methods in inquiry-based science education in Switzerland

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Formative assessment in inquiry-based education

(based on Harlen, 2013)

Student activity 2

Data collection about student learning

Decision on activity

Next learning steps

Data about student learning

Decision on next steps of learning

Interpretation of the data

Summative assess-ment

Report on standard achieved

Judegement of the student achievement based on criteria

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

- Strenghtening 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, qualtitative 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

  - …

Schwimmer-Nichtschwimmer

1. Wählt einen Gegenstand aus und beschreibt ihn.
Beispiel: „1 Fränkler": Rund, flach, glänzend, schwer, silbern, klein, glatt

2. Überlegt euch, ob der Gegenstand schwimmt oder nicht schwimmt. Eure Vermutung muss begründet sein.
Beispiel: Der „1 Fränkler" schwimmt, weil er glänzt.

3. Probiert es aus und sagt was ihr beobachtet.
Beispiel: Der 1 Fränkler ist gleich gesunken und am Boden liegen geblieben.

4. Stimmt eure Vermutung?
Wenn ja, geht zu Punkt 6.   Wenn nein, fahrt mit Punkt 5. weiter.

Peer-assessment at primary school: written evaluation form

Question: Was the peer-assessment worthwile?

Teacher 1: Yes, definitely. The students improved on observing each other, on reasonning 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 critieria rather than on sympathy. And the students really enjoyed doing this, despite saying it was a hard task!

Written comments provided by the teacher at upper secondary school

- Students explore the addition of forces

- Unit is interrrupted by a student exchange programme of 3weeks

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

- After the exchange programme, the students get the chance to consider the feedback for the rest of the unit

$\vec{F}_1$

$\vec{F}_2$

$\vec{F}_3$
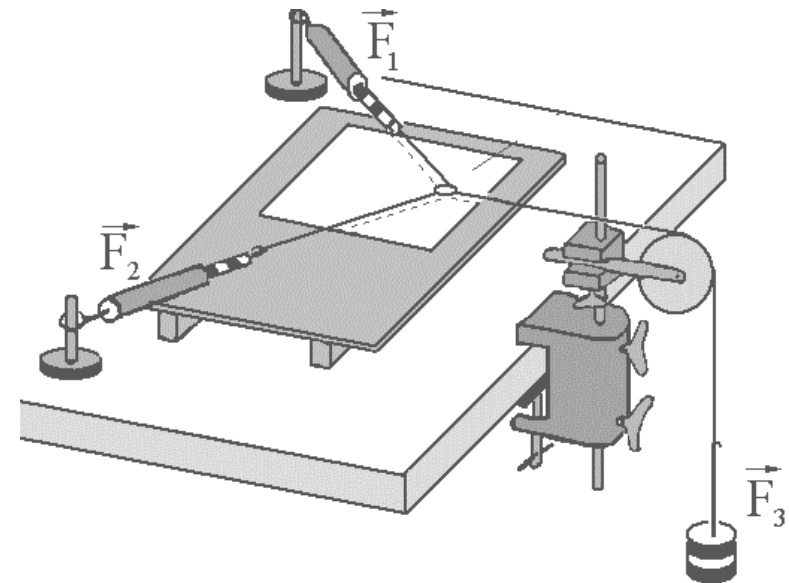
Usability of peer-assessment to foster inquiry-based student learning

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

Challenges of peer-assessment

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

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?

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