Technology supporting formative assessment -
A digital tool for formative self-assessment

Aim

Technology enhanced self-assessments often look like this:

```
Question
32. Which of the following is the co-ordinates of the point A given in the graph below?

Answer
A. (3,2)
B. (1,2)
C. (2,1)
D. (2,2)

Well Done!
```

“Self” refers mostly to the organization of the assessment

Evaluation is based on two categories: right or wrong

Technology takes on the role of the assessor

(www.wuolite.com)
Aim

BUT:

- active involvement of students is a key aspect of formative assessment
- investigating their (mis-)conceptions helps students to:
  - gain sensitivity for their strengths and weaknesses
  - use metacognitive strategies
  - adopt responsibility for their own learning process

Aim: Develop a digital tool that allows students to become assessors themselves!

(Black & Wiliam 2009, Wiliam & Thompson 2007, Heritage 2007)

What to expect?

- Context: EU-Project FaSMEd
- Theoretical Background & Research
- Digital Self-Assessment Tool
Context

FaSMEd = Raising Achievement through Formative Assessment in Science and Mathematics Education

- Introduction and investigation of technology enhanced formative assessment practices
- Design-based research
- 2014 - 2016
- 9 partners in 8 countries: FR, IE, IT, NL, NO, UK, ZA, DE

Final Toolkit will be available 12/16: www.fasmed.eu

Theoretical Background

Formative Assessment (FA)

“Assessment can be considered formative only if it results in action by the teacher and students to enhance student learning.”

(Bell & Cowie 2001, p.539)
Theoretical Background

Conceptualizing formative assessment

William & Thompson 2007 conceptualize FA in 5 key strategies:

<table>
<thead>
<tr>
<th>Where the learner is going</th>
<th>Where the learner is right now</th>
<th>How to get there</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher</td>
<td>1 Clarifying learning intentions and criteria for success</td>
<td>2 Engineering effective classroom discussions and other learning tasks that elicit evidence of student understanding</td>
</tr>
<tr>
<td>Peer</td>
<td>Understanding and sharing learning intentions and criteria for success</td>
<td>4 Activating students as instructional resources for one another</td>
</tr>
<tr>
<td>Learner</td>
<td>Understanding learning intentions and criteria for success</td>
<td>5 Activating students as the owners of their own learning</td>
</tr>
</tbody>
</table>

(Black & William 2009, William & Thompson 2007)

---

Theoretical Background

Conceptualizing formative assessment - FaSMEd framework

![Diagram showing the FaSMEd framework](http://www.fasmed.eu)
Theoretical Background

The concept of functions

Transformation of representations:

situationa

description

graphical
representation

(Barzel 2009, Dubal 2002)

Mental mathematical representations of functions („Grundvorstellungen“):

mapping

The function maps one value of the independent quantity to exactly one value of the dependent quantity.

static local view

covariation

The function describes the change of two quantities with each other.

dynamic regional view

object

The function as a whole describes a new object.

structural global view


Typical misconceptions:

• Graph as a picture
• Swap axes
• ...


Research

Methodology:

• Design-based research
• Case studies: task based interviews & class trials
  • Pilot: pen-&-paper version: 11 students, grade 8 (2 schools)
  • Pre-run: digital version: 18 students, grade 10
  • Cases (Dec 15): 2 students + classes, grade 10 (2 schools)
  • Cases (May 16): 2 university students (2nd semester)

Hypothesis: A digital tool with a hyperlink structure based on typical misconceptions can support students’ formative self-assessment.
Tool Design

Open assessment task „Test“

Can I sketch a graph based on a given situation?

Test

For the following situation, sketch a graph to show how the speed changes as a function of the time.

Niklas gets on his bike and starts a ride from his home. He rides along the street with constant speed before it curves up a hill. On top of the hill, he pauses for a while.

view solution
reset

Hamburg, 29th July 2016  Hana Ruchrwicz  11

Tool Design

Check  ✓

There are many right answers to the test task
What is important is ...
Sample solution ✓ Your solution ✓

Set y-axis...  

submit  reset

Hamburg, 29th July 2016  Hana Ruchrwicz  12
Tool Design

Structure

Digital self-assessment tool

Structure
Digital self-assessment tool

(1) Sketch a graph that shows how many liters of water are in the tub at a certain time after opening the drain.

First select button 1 above and then sketch your graph.

Task types

1. Graphing
2. Matching
3. Selecting
4. Open answer

(2) Type in your description of the three sections here.
First Results of Case Studies

We can reconstruct processes of FA as students are able to:

- identify mistakes based on the check (S1)
- identify correct aspects of their work (S2)
- decide to take further steps in their learning
- reflect upon their work
- formulate self-feedback

**S1**

**Check:** „I realized that the time is the independent variable recorded on the x-axis and that the speed is the dependent variable recorded on the y-axis.“

„The speed and time were wrong, because there [x-axis] needs to be the time and there [y-axis] the speed. I did not realize this.“

**S2**

**Reads the info concerning the same check-point.**

„Oh, that is correct as well, because I did it the same way.“

First Results of Case Studies

We can reconstruct processes of FA as students are able to:

- identify mistakes based on the check
- identify correct aspects of their work
- decide to take further steps in their learning
- reflect upon their work
- formulate self-feedback

These FA processes can be characterized:

**Self-assessment is difficult for students:**
- expect feedback from tool or teacher ➔ need for instruction & training
- don’t identify all of their mistakes ➔ need for enhancement of tool
- don’t overcome all of their mistakes ➔ need for deeper analysis of learning processes
Discussion

questions?

comments?

Thank you for your attention!

hana.ruchniewicz@uni-due.de

Hamburg, 29th July 2016

Hana Ruchniewicz

References

www.fasmed.eu