

Reflection-stimulating tasks to promote a theory related planning of teaching in science education

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Theoretical Background

The main objective of practical training within teacher training programs is to develop the basic attitude of a “reflective practitioner” [1]. Instead of an unreflected accumulation of experiences during practical training, the students shall rather pursue the scientific approach of a critical examination of individual experiences against a subject-related theoretical background (PCK) in a multi-perspective view [2]. To acquire reflection skills in subject-related practical training, profound pedagogical content knowledge (PCK) is necessary which is proven to correlate with the learner’s outcome [3]. Therefore, a reflection-stimulating pool of tasks with focus on biology didactical theories has been developed and tested in an accompanying seminar prior to the practical training. The tasks especially outline coping with different dimensions of heterogeneity in school, under consideration of consequences in planning biology lessons.

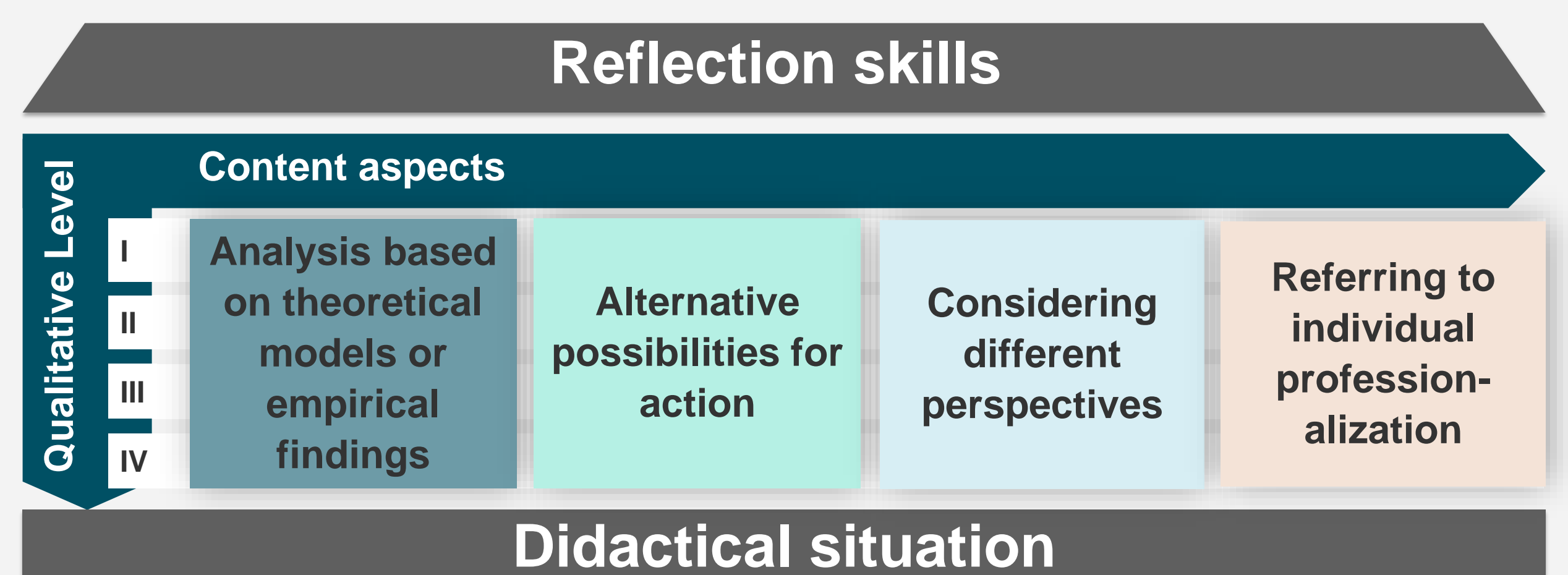


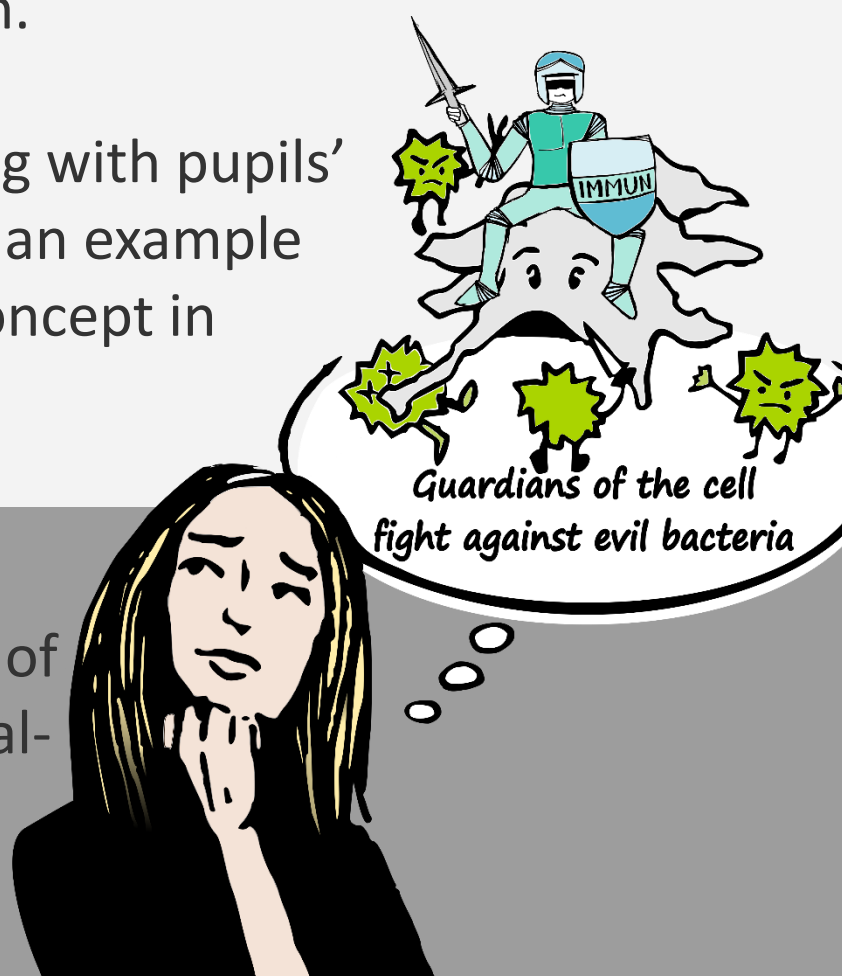
Fig. 1: Interdisciplinary model of reflection with four main content aspects (based on [4, 5]).

Concept of the Tasks

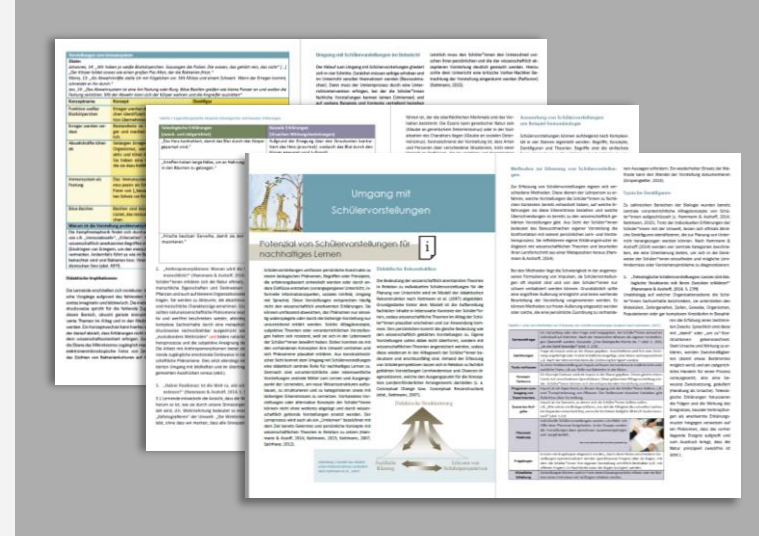
The tasks give the students an opportunity to foster PCK by applying it on short practical units with limited scope. All tasks comprise of four consistent parts which can vary in methodical or medial approach.

The task “Dealing with pupils’ conceptions” as an example illustrates the concept in the following:

Phase I:
Self-assessment of biology-didactical-knowledge to a certain topic



Phase II: Theoretical Input



Phase III: Applying theoretical knowledge



Prompts

Phase IV: The students choose a didactic focus in their subsequent practical training. They receive “prompts” to assist in their theory-based analysis and reflection of their own teaching. The prompts refer to the model of reflection.

Please expound in regard to theoretical models or empirical findings

- which diagnostic tool would you apply in order to determine existing conceptions.
- which conceptions are already described empirically to this topic.
- how you would plan your biology lesson in regard to these findings.

Please describe, analyze and reflect a unit from your biology lesson in regard to

- the knowledge of the pupils.
- the pupils’ reaction to different conceptions.
- your feedback to the conceptions of the pupils.
- the revision of the existing conceptions after your teaching unit.

Please assess theory-related in which extent you succeeded to diagnose conceptions and initialize a conceptual change to scientific valid conceptions. Are there any alternative possibilities?

Please reflect on your learning outcome with regard to your professional development:

- How important is it for you to deal with conceptions for planning and performing biology lessons?
- Which challenges did you experience and identify for planning and performing learning arrangements?
- Which personal abilities are there still to develop? How can you improve further lessons?

Pilot Study

The tasks were piloted in the weekly seminar in the Department of Biology Education in the winter term 16/17 (n=55) with students of the 5th Bachelor and students of the 1st Master semester (n=34). After completing the seminar, the bachelor students started their practical training, which required four lessons performing and four lessons observation of biology classes.

Research question

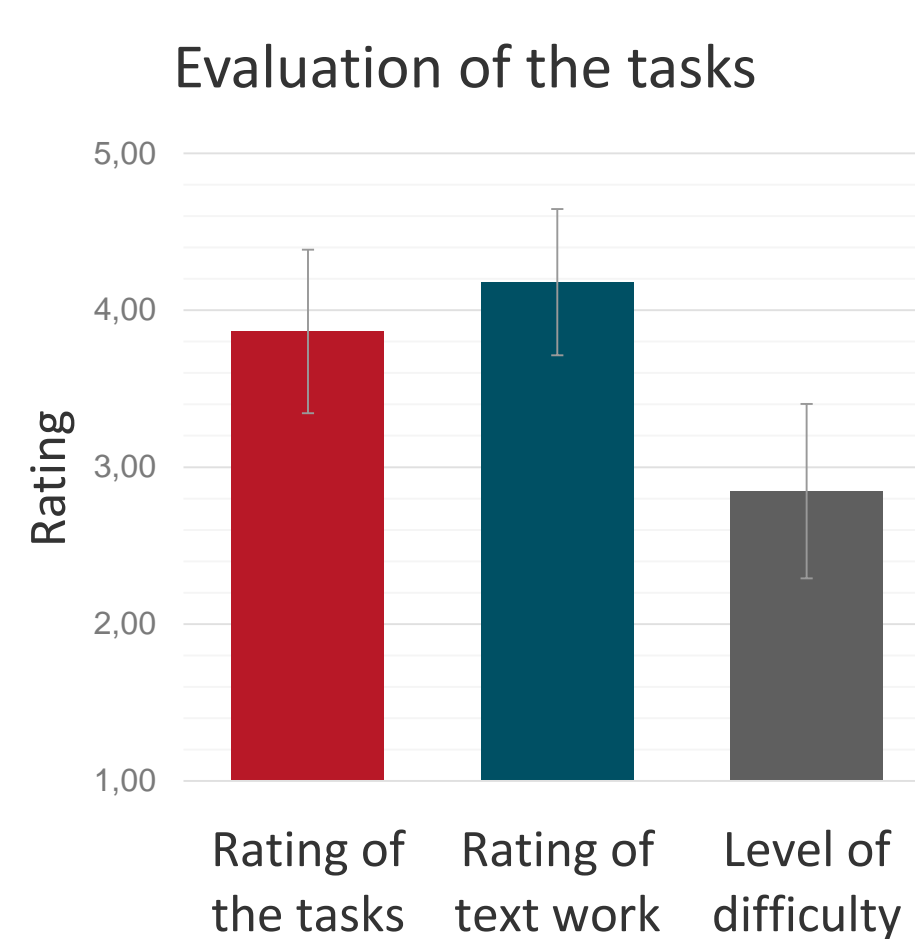
- Are the learning tasks being accepted by the students?
- Which content aspects are examined in their reflections and on which qualitative level?
- Are the students sensitized for different dimensions of heterogeneity in schools?

Design of Research & Evaluation method

- Task-specific evaluation sheet assessing acceptance of the tasks (6 items; $\alpha=0,603 - 0,892$; n=89), working with texts (5 items; $\alpha=0,683 - 0,846$; n=75) and the difficulty of the tasks (n=89). Data evaluation by descriptive statistical analysis with IBM SPSS Statistics 24.
- & c) Criteria-based content analysis of the written reflections (n=15) which were submitted in the internship report with regard to the model of reflection (according to [6, 7])

Findings & Discussion

a)



- Positive ratings on average for the tasks and text work using a Likert-Scale from 1=absolute negative to 5=absolute positive
- Acceptable level of difficulty (scale 1=very easy so 5=very difficult)
- Concept requires only minor improvements

b) The findings of the content analysis are listed below:

- Alternative possibilities, considering perspectives and referring to professionalization are the main content aspects which were reflected
- Qualitative level mainly identified as descriptive and justified writing (level I-II)
- Didactic theories were only used occasionally to analyze their teaching (4/15)
- Indications for a positive relationship between the use of the prompts and the quality of the written reflection
- Transforming PCK on their own experiences is still challenging

c) Dimensions of heterogeneity in schools are reflected upon:

- 10/15 performance
- 4/15 linguistic performance
- 2/15 previous knowledge
- 1/15 gender-specific interactions
- Due to the focus of the tasks on diverse abilities of the learners, the students are insufficiently taken different aspects into consideration for reflecting their planning and performing biology lessons.

Future Prospects

- Revision of the prompts to support all content aspects of the model of reflection, in particular considering PCK for analyzing and reflecting the performance
- Outlining more different dimensions of heterogeneity in biology education not only focusing on the performance of the learners, for example by developing case examples
- Conducting stimulated recall interviews for gathering more information about the impact of the tasks & prompts on their professional development in practical training
- Continuity of reflective praxis through a joint dialogue between the students and lecturers from the subject didactics as well as lecturers from educational sciences

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