



## Reflection-Stimulating Tasks to Promote a Theory Related Planning of Teaching in Science Education

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### Abstract

*Teacher training students believe, that their quality of teaching and expertise increase quite natural when they obtain more practical experience during their studies [1; 2]. However, the effectiveness of learning through school practical experience has not yet been sufficiently documented [3; 4]. Instead of the unreflected accumulation of experiences, the critical examination of theory and practice in an authentic work area should be in the foreground in order to develop the basic attitude of a “reflective practitioner” [5]. For promoting reflection skills of student teachers in the field of biology education a reflection-stimulating pool of tasks has been developed and tested. Tasks are processed in an accompanying seminar in preparation for school practice phases. The tasks especially outline coping with different dimensions of heterogeneity in school, under consideration of consequences in planning biology lessons. The students choose a didactic focus in their subsequent practical training, for example, language-sensitive teaching or differentiation. In addition, they receive “prompts” to assist in their theory-based analysis and reflection of their own teaching. The prime objective of those tasks and prompts are to train reflection skills, focusing on subject-related didactical aspects, and an increase of student teachers’ awareness of creating an adequate learning environment with regard to the needs of the pupils. The results from a survey (n=55) show a high acceptance for dealing with the tasks and an increase in their biology didactical theoretical understanding. The content analysis (n=15) of the reflection reports, however, showed that didactic theories were only used occasionally to analyze their teaching. To conclude, there are indications for a positive relationship between the use of prompts and the quality of written reflections. It can be assumed, that the reflection-stimulating tasks, in combination with prompts, can promote the reflection skills of the student teachers leading to a critical self-examination.*

**Keywords:** *teacher training, professional development, reflective practitioner, reflection skills*

### 1. Introduction

Practical phases are an important element within the studies of teacher training students since school is their professional field. From the students’ point of view, collecting experiences are quite valuable for becoming a teacher. Though, solely learning from experiences misses the scientific approach of relating didactical theories to analyze their own experiences [6]. The aim of practical training is not to promote an “acting as a teacher” but fostering a critical and reflective attitude to evaluate their experiences, taking the context and setting into consideration from a multi-perspective view [7]. However, reflection as a major skill has to be trained in order to ensure that the practical training meets the demands of developing professional competencies.

### 2. Theoretical Background

Reflection can be defined as the ability to systematically analyze didactical situations and actions retrospectively by taking distance from the actual events, according to Schön as “reflection-on-action” [5]. There have been attempts of measuring reflection skills and characterizing different levels from a describing type of writing to a critical reflection [8]. According to Levin & Meyer-Siever experiences in didactical or pedagogical situations can be reflected by relating them to a theoretical background [9]. Furthermore, reflection skills include evaluating alternative possibilities for action, considering different perspectives and referring to individual professional development (Figure 1). The paradigm of nowadays teacher education is, that not the experienced teacher is the ideal but the reflective one by implying a flexible way to transform didactical knowledge in practical situations [10].

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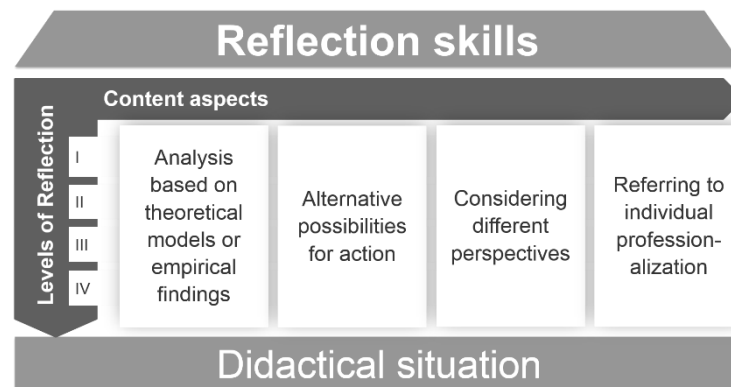


Figure 1: Model of reflection combining levels of reflection and four content aspects [based on 8; 9].

### 3. Design of tasks & prompts

To acquire reflection skills in a subject-related practical training, profound pedagogical content knowledge (PCK) is necessary, which is proven to correlate with the learner's outcome [11]. A purposeful preparation on practical training is the priority objective to give the students an opportunity to apply PCK on short practical units with limited scope, for example working out teaching material or analyzing case studies. Based on the theory of moderate constructivism, students should meet the demands of heterogeneous learners and support their best outcome. Therefore, the tasks have been developed for the accompanied seminar focussing on dimensions of heterogeneity in schools.

#### 3.1 Example of a task

The concept of the task will be explained in the following by means of the example "Dealing with pupils' conceptions". All tasks comprise of four consistent parts which can vary in its methodical or medial approach.

##### I. Self-assessment of the biology-didactical-knowledge to a certain topic

In the first phase, the students are confronted with the topic. In this example they are invited to make contributions in plenary about plausible conceptions pupils might have about immunobiology. They are also considering obstacles for learning the scientific accepted conceptions.

##### II. Theoretical Input with recommended references

After that, students are reading a self-written survey article about current research and findings to this topic including examples for diagnostic tools or competence models. The theoretical foundation of dealing with conceptions was established by Kattmann [12] and implies, that individual conceptions about a subject-related topic should be the starting point of planning a lesson because they initiate a lasting and reasonable learning process.

##### III. Applying theoretical knowledge

Working on case studies offers a great potential to foster PCK. With the authentic context and under a multi-perspective view, the students are gathering flexible and practice-oriented knowledge. In this task, they are watching a case study video vignette in which a pupil from the 5<sup>th</sup> grade is verbalizing his conceptions about the "immune system", "immune defence" and "vaccination". The students analyze the transcript from this vignette, working out metaphors, concepts and anthropomorphisms. Finally, they are figuring out alternative ways to initialize a conceptual change which are again discussed in plenary.

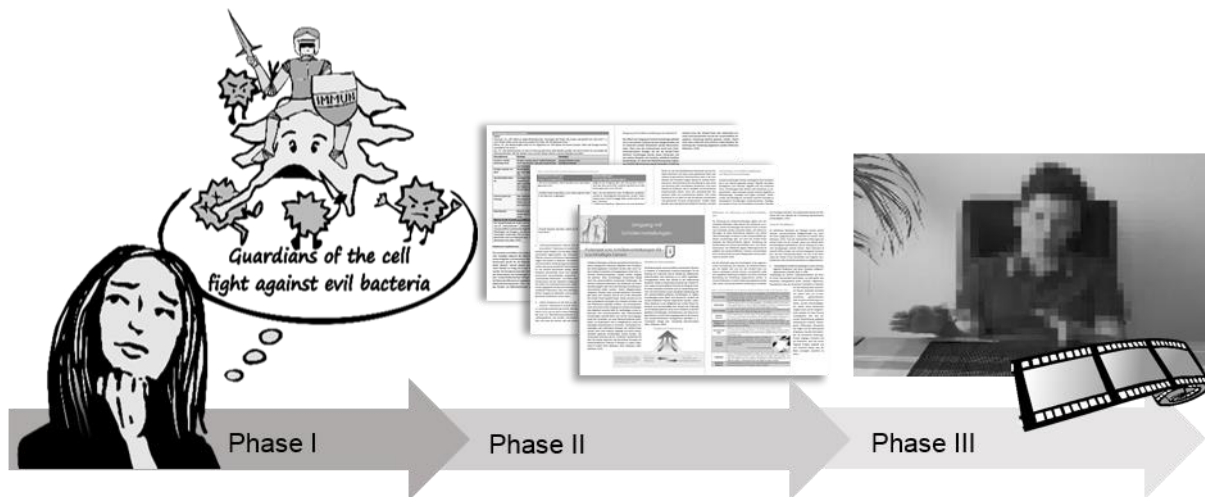


Figure 2: Illustrated phases I to III of the task “Dealing with pupils’ conceptions” which are completed within the seminar.

#### IV. Choosing a didactic focus in their subsequent practical training

The first three steps are finished within seminar time. The fourth step is realized during the practical training. For planning and performing their own lesson, they have to choose a didactic focus which will be consolidated by reflecting on their teaching. As a support, they can align to prompts, which are specified for each didactical focus.

### 3.2 Prompts

The prompts give the students an idea of the main subject matter of the didactic focus by splitting up and clustering the aspects into the four content aspects of the model of reflection.

Table 1: Extract from the prompt according to the didactical focus “Dealing with pupils’ conceptions”.

<b>Analysis based on theoretical models or empirical findings</b>
Please expound in regard to theoretical models or empirical findings:
<ul style="list-style-type: none"> <li>• Which diagnostic tool would you apply in order to determine existing conceptions?</li> <li>• Which conceptions are already described empirically in this topic?</li> <li>• How would you plan your biology lesson in order to these findings?</li> </ul>
<b>Alternative possibilities for action</b>
Please assess theory-related in which extent you succeeded to diagnose conceptions and to initialize a conceptual change to scientific valid conceptions. Are there any alternative possibilities?
<b>Considering different perspectives</b>
Please describe, analyze and reflect a phase of your biology lesson in regard to:
<ul style="list-style-type: none"> <li>• the knowledge of the pupils.</li> <li>• the pupils’ reaction to different conceptions (misconceptions or scientifically valid conceptions).</li> <li>• your feedback to the conceptions of the pupils.</li> <li>• the revision of the existing conceptions after your teaching unit.</li> <li>• the diagnostic tool you applied in your lesson (concept-cartoons, drawings, etc.).</li> </ul>
<b>Referring to professional development</b>
Please reflect on your learning outcome with regard to your professional development while working with this task:
<ul style="list-style-type: none"> <li>• How important is it for you to deal with conceptions for planning and performing biology lessons?</li> <li>• Which challenges did you face for planning and performing learning arrangements?</li> <li>• Which personal abilities are still to develop? How can you improve further lessons?</li> </ul>



#### 4. Objectives and Research Questions of the Pilot Study

The aim of the concept is to promote teacher training students in transforming PCK systematically on planning and performing biology lessons. Furthermore, the focus is fostering the ability to reflect on the experiences in school from the subject-related point of view and based on biology-didactical-theories regarding heterogeneous learners. So the main questions are a) whether the tasks are being accepted by the students b) which content aspects are examined in their reflections and on which qualitative level and c) if the students are sensitized for different dimensions of heterogeneity in schools.

#### 5. Design of Research

The tasks were piloted in the weekly seminar in the Department of Biology Education in the winter term 16/17 (n=55). A task-specific survey was used for evaluating the acceptance of the tasks. The majority of the students were in their 5. Bachelor semester. Besides, a selection of written reflections were criteria-based analyzed with regard to the model of reflection (n=15). The written reflections were submitted on March 2017 as a chapter in the students' internship report. The practical training requires four lessons performing and four lessons observation of biology classes.

#### 6. Findings & Discussion

The results from the survey show a positive rating for the tasks, ranging on average of minimum  $M=3,8$  to maximum  $M=4,2$  using a Likert-Scale from 1=absolute negative to 5=absolute positive (6 items;  $\alpha=0,603 - 0,892$ ). In addition, reading the survey article in the second phase of a task is also rated positive  $M=4,17-4,39$  (5 items;  $\alpha=0,683 - 0,846$ ). These results are satisfactory and show, that the concept of the task can maintain with minor improvements.

The content-analysis of the written reflections show on the one hand that the students mainly consider alternative possibilities for action and they are able to reflect their performance with regard to different perspectives, also taking into consideration their own professional growth. On the other hand, in only four reports they are referring to didactical theories. The quality of the statements differ from the describing type of writing to justified ones, but rarely on an analytical or even a critical level. Some of the written reflections reveal the use of prompts. They adopt the structure of the prompts for their texts which results in a higher level of reflection and they also refer to didactical theories, taking more aspects in a differentiated way into consideration. This means there are indications that prompts can foster a transformation of knowledge to analyze and reflect practical experiences. Furthermore, the group of learners in class are mainly reflected upon their performance (in 10 reports out of 15), their linguistic competency (4/15), their previous knowledge (2/15) and at least in one report upon gender-specific interactions. From this result it can be assumed, that the different dimensions of heterogeneity in schools might not be transparent enough.

#### 7. Conclusion and Prospects

The pilot study shows, that the main objective has not fully been achieved. From solely analyzing the written reflections it is not possible to draw valid conclusions about the impact of working with the tasks on the students' PCK and their ability to reflect. In addition, it is still doubtful if this concept promotes a stance as a "reflective practitioner" because in contrast offering prompts might imply an understanding of reflection as a technical tool [13]. So, for further research, stimulated recall interviews will be conducted to gather more information about the relationship of how the students perceive the tasks for planning and analyzing their biology lessons. In addition, the written reflections are undergoing a methodological revision with a modification of the coding guideline to define cogent quality levels. The tasks have been prepared for the winter term 17/18, further data collection will be conducted in 2018.

#### References

- [1] Weyland, U. & Wittmann, E. "Expertise. Praxissemester im Rahmen der Lehrerbildung. 1. Phase an hessischen Hochschulen", DIPF, Berlin, 2010, 1-41.
- [2] Bosse, D. & Seel, A. "Mythos Praxis. Editorial.", Journal für Lehrerinnen- und Lehrerbildung, 11 (3), 2011, 5-7.
- [3] Hascher, T. "Veränderungen im Praktikum – Veränderungen durch das Praktikum. Eine empirische Untersuchung zur Wirkung von schulpraktischen Studien in der Lehrerbildung", in: Allemann-Ghionda, C. & Terhart, E (Ed.) "Kompetenzen und Kompetenzentwicklung von Lehrerinnen und Lehrern", Weinheim, Beltz, 2006, 130-148.



- [4] Weyland, U. "Schulische Praxisphasen im Studium. Professionalisierende oder deprofessionalisierende Wirkung?", *bwp@Berufs- und Wirtschaftspädagogik – online*, 2014, 1-24.
- [5] Schön, D. A. "The reflective practitioner. How professionals think in action.", New York, Basic books, 1983.
- [6] Hascher, T. "Die Erfahrungsfalle", *Journal für Lehrerinnen- und Lehrerbildung*, 5 (1), 2005, 39-35.
- [7] Hascher, T., Cocard, Y. & Moser, P. "Forget about theory – practice is all? Student teachers' learning in practicum", *Teachers and Teaching*, 10 (6), 2004, 623-637.
- [8] Hatton, N. & Smith, D. "Reflection in Teacher Education: Towards Definition and Implementation", *Teaching & Teacher Education*, 11 (1), 1995, 33-49.
- [9] Levin, A. & Meyer-Siever, K. (in prep.) "P:ier - Entwicklung der Reflexionsfähigkeit im Rahmen eines fächerübergreifenden e-Portfolios", *Resonanz*, Universität Bremen, 2018.
- [10] Herzog, W. & von Felten, R. "Erfahrung und Reflexion. Zur Professionalisierung der Praktikumsausbildung von Lehrerinnen und Lehrern.", *Beiträge zur Lehrerinnen- und Lehrerbildung*, 19 (1), 2001, 17-28.
- [11] Baumert, J., Kunter, M., Blum, W., Brunner, M., Voss, T., Jordan, A., Klusmann, U., Krauss, S., Neubrand, M. & Tsai, Y. "Teacher's Mathematical Knowledge, Cognitive Activation in the Classroom and Student Progress", *American Educational Research Journal*, 47 (1), 2010, 133-180.
- [12] Kattmann, U. "Schüler besser verstehen. Alltagsvorstellungen im Biologieunterricht", Hallbergmoos, Aulis, 2015.
- [13] Häcker, T. "Grundlagen und Implikationen der Forderung nach Förderung von Reflexivität in der Lehrerinnen- und Lehrerbildung", in: C. Berndt, T. Häcker & T. Leonhard (Ed.) "Reflexive Lehrerbildung revisited. Traditionen, Zugänge, Perspektiven", Bad Heilbrunn/Obb, Julius Klinkhardt, 2017, 21-45.