

Introducing novice student teachers to the complex dynamics between teachers and his work in primary science

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The Issue

Teaching in schools is a complex activity that novice student teachers meet when they enter practice situations for the first time in teacher training programmes. A new world opens up when they meet pupils in schools. The interactions are shaped by the teaching/learning activities they encounter, the knowledge, practices, ideas and artifacts. One of the challenges facing novice teacher students in the beginning of teacher training is to build a knowledge base that balance a theoretical introduction to pedagogical content knowledge with the experiences of the complex realities teachers has to deal with in actual teaching/learning situations with pupils. An effective strategy for student teachers to learn pedagogical concepts might be to use a holistic approach where student teachers from day one experience the complex realities of teaching and are put in situations where they can articulate and reflect on pedagogical and didactical concepts in collaboration with peers and scaffolded by teacher educators. I have an interest in studying how introducing novice student teachers to the complex realities of teaching practice impact on the student teachers learning and positive and negative emotions about teaching.

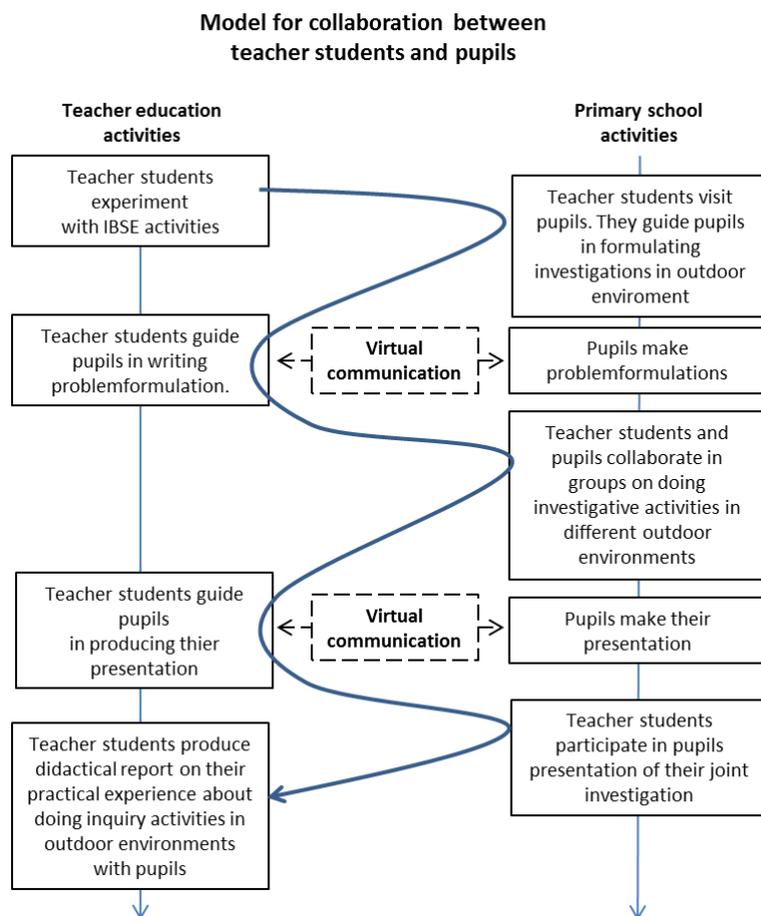
Research context

This study investigates ways to prepare teacher educators to include, think about and work with practice situations in the context of the new Danish teacher education reform (LU13) that aims (amongst other aims) at introducing and including practical classroom work from the beginning and more frequently in the teacher training. These practice experiences are intended to support student teachers reflecting on the realities of the teacher profession.

We describe here an

intervention where 28 novice pre-service primary science teacher students were involved. They started their first semester of teacher education to conduct inquiry based science teaching (IBST) with a primary school class. The module is characterized by an iterative process of student teacher moving between training at the teacher college followed by working with pupils in outdoor environment, then returning back to the teacher college for further training while continuing

supporting the pupils via email, Skype, sms and Facetime. Data was collected both by teacher students, teacher educators and pupils over the period of 3 months. Student teachers collected and produced multimodal snapshots of what happened as part of the teaching activities and produced video diaries of this process. The researchers collected information, including observations and field notes including photos. In this workshop I would like to focus on the case of one group of student teachers, Kirsten, Poul and Rune (pseudonyms) who also produced a website as an outcome of their reflective work.



The materials that were collected chronologically display the student teachers developing thinking, their plans, joys, and frustrations about IBST. Their work with the pupils produced reality snapshots of classroom practice and aimed at helping them to think about inquiry instruction with their future pupils and about pedagogical and didactical concepts that they reflected on theoretically in their final report. For example: *motivation, teacher guidance, pupils enactment in investigative activities, pro-active and re-active roles in inquiry activities*. The information from the student teacher's reflections and the various observational data suggest a strong linkage between a place based, content and context focused 'scientific' investigation that defined the nature of the focus of the guidance that the student teachers provided for pupils. The student teachers also wrote about pupils' lack of motivation to engage in the inquiry activities and resistance to take on a more pro-active role in the inquiry activities. The materials also produced evidence of the nature of guidance the teacher educators needed to provide to scaffold building competencies of the teacher students developing pedagogical content knowledge (PCK) situated in their experience of teaching inquiry. It meant that the student teachers had to deepen their content knowledge in how to conduct science investigations, learn selected conceptual science ideas and widen their ideas on how to assist, prompt, and focus pupils' inquiries. For example:

The pupils came through the steps of inquiry and ended up with an investigation that they presented to the class. They went through the process by constructive collaboration guided by us. Using an explorative approach we collaboratively found out that we wanted to investigate water quality in a small pond based on their interest for animal life. It was a victory to present the investigation to their peers.

On the issue of motivation Kirsten, Poul and Rune wrote in their final report:

The entire experience was a very good learning experience for us. A challenge that we struggled with was the pupils motivation. Our pupil-group was interested in studying the biodiversity in a small pond next to the school and then compare the biodiversity with another waterpond. When they found out that the teacher had assigned us and the pupil-group to another lake further away their motivation diminished.

Our findings suggest in Kirsten, Poul and Rune's case that their reflections on IBSE were very much shaped by their situated experiences. The teacher students had to learn what it means to provide guidance that is neither too minimal nor too restrictive so that pupils would not become lost or frustrated (Kirschner, Sweller & Clark, 2006) while keeping open endedness as joint key feature of the investigations. The nature of conducting investigations in the outside environment meant that despite a defined focus for the inquiry both teacher students and pupils had to discover together what could be found out adding a dimension of authentic shared interest. The horizontal and vertical acquisition of teacher competencies on how to teach inquiry learning in a concrete outdoor setting and focused scientific investigations helped to teach also what it means to be a reflective practitioner. This finding applied to both the student teachers as well as the teacher educators. The outcomes here went beyond reporting about teachers becoming aware of new information and skills and implementing or adapting these for classroom practice to also expand by gaining insight into teacher students' learning processes and their reactions to the professional development they received as part of their training. What will be of interest in the future is how sustainable this approach to teacher education is and whether teacher competencies in inquiry will successfully translate into teaching practice beyond preservice training.

Underpinnings

The concept of professional dilemmas provides a valuable framework for understanding the complex dynamics between the teacher and his work (Fransson & Grannäs, 2013). Teacher dilemmas can be characterized as tensions that might arise when values, beliefs and teacher identity, and the following actions might come into conflict with the educational context etc. Teachers cope with these dilemmas by positioning herself within these tensions in a way that she feels comfortable with the situation (Ruys, Van Keer, & Aelterman, 2014). Windschitl (2002) suggest four different frames of references to describe dilemmas that teachers faces in the implementation of constructivist teaching strategies: a) conceptual dilemmas that are rooted in teachers' attempts to understand the theoretical underpinnings of and reconciling their current beliefs with them, b) pedagogical dilemmas that arise from pedagogical decisions and choices in teaching practice, c) cultural dilemmas that emerge between teachers and pupils/context when changing pedagogical practice, and d) political dilemmas that are related to the confrontation and negotiation with various stakeholders in the school community. The study presented can be seen

as a model for introducing novice student teachers to the world of professional dilemmas that teachers face.

Equipping becoming science teachers with the competencies to include inquiry into their repertoire of pedagogical approaches has been of interest to research, yet it is still surprising how little opportunities teacher students have to practice and learn how to achieve this (Windschitl, 2003). In fact, hoping that teacher students will simply pick up this idea when they are starting to teach is unreasonable, also because inquiry in science requires a highly sophisticated level of teacher knowledge of science content and related processes as well as using suitable pedagogical approaches in responding. Generally speaking, inquiry based science education departs from the idea of students passively absorbing information, to engage in interactive activities. Inquiry covers a wide spectrum of higher-level thinking and activities including forming and testing a hypothesis, learning how to solve problems, model predicted outcomes, and learn how to communicate and also critically assess and review information and feedback (Windschitl, 2003). The idea that in inquiry the teacher becomes a 'guide on the side' can easily lead to misinterpretations of 'guidance', when it is assumed that the learner is only presented with initial information to then find out and construct an argument for him or herself (Kirschner, Sweller, & Clark, 2006). While in inquiry teachers need to be able take risks in practice situations and carefully weave and connect the conceptual, procedural, technological and societal learning outcomes together with learner needs, interests, knowledge and abilities (Abd-El-Khalick et al., 2004).

In view of increasing inquiry based science teaching (IBST) implementation in Denmark it is important to gain insight into the challenges novice student teachers are confronted with when implementing (IBST) in their initial teaching practice. The aim of the study presented here is to examine novice pre-service primary science student teachers' experiences with IBST that was introduced at the beginning of their four year teacher training programme. In this article we aim to identify the challenges the student teachers were confronted with during these initial experiences and how they reflected when facing these challenges.

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