Developing pre-service biology teachers’ diagnostic and teaching skills with regard to biological models

Sarah Lena Günther, Jennifer Fleige, Annette Upmeier zu Belzen & Dirk Krüger

Background Information

Model competence forms part of the aspect content knowledge which deals with the way in which scientific knowledge develops (Shulman 1986). In biology education, models are often used as a medium to transmit information, visualizing the structure and function of the original. That models could be a tool for scientific inquiry is a prominent view in science but not in the classroom (Grosslight et al. 1991, Trier & Upmeier zu Belzen 2009).

Based on a theoretical framework of model competence (Upmeier zu Belzen & Krüger 2010; Table 1) we successfully developed trainee teachers’ model competence (Fleige et al. 2012) but not their diagnostic or teaching skills. This was evident as their students did not develop model competence consistently.

Aims

This project aims at developing a pre-service biology teacher training program investigating learning cases (Levin 1995) as a tool for instruction in order to foster... pre-service biology teachers’ model competence. ...pre-service biology teachers’ diagnostic and teaching skills for model competence.

Furthermore, the study serves to evaluate the case method as a tool that can be used by instructors to foster the described competences.

Description of the study

Process

The study is being conducted in three major steps (see Figure 1):

(1) Pre-service biology teachers’ model competence is improved by the application of an evaluated program (Fleige et al. 2012).
(2) Pre-service biology teachers analyze learning cases with regard to fostering model competence.
(3) Pre-service biology teachers develop and teach lesson units which foster students’ model competence.

The pre-service biology teacher training program contains elements which foster content knowledge and pedagogical content knowledge. By using learning cases, this study combines theoretical and practical elements.

Learning cases

Learning cases are detailed, contextualized, narrative accounts of teaching and learning (Levin 1995) containing problems and dilemmas of real-world lessons that form the basis for discussion aimed at finding possible alternatives. The learning cases constructed for this study each describe a biology lesson with the focus on fostering students’ model competence (Excerpt; see Figure 2). They deal with problems created according to a catalogue of criteria that are said to help foster model competence (Fleige et al. 2012):

• not enough lessons with focus on model competence
• missing reflection in the lessons
• competence level in students’ answers not correctly identified by the teacher
• too many aspects of model competence taught in one lesson
• lesson focuses on content rather than on scientific inquiry
• content is not easily accessible

Pertinence of the study

The German education system requires students to have an elaborated model competence as part of their scientific literacy (KMK 2005). Teachers, therefore, face the challenge of promoting their students’ model competence. Fleige et al. (2012) revealed that, for this purpose, an elaborated model competence of the teacher is not enough. One can conclude from this that there is a need to improve pre-service biology teachers’ diagnostic and teaching skills.
Literature


