Investigating the development of teacher knowledge of models and modelling in science

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1.Introduction

The present study was situated in the context of a one-year post-graduate teacher education program, qualifying participants for the teaching of chemistry at pre-university level (cf. Grades 10-12 of secondary education). Before entering this program, the participants had obtained a Master's degree in chemistry. During the entire program, the preservice teachers worked at practice schools (teaching about five to ten lessons per week). They also took part in institutional meetings and workshops (two afternoons per week, on average), and reported and reflected on their teaching experiences and discussed their findings with each other.

2. Method

In order to monitor the development of SMK and PCK, a multi-method approach (Baxter & Lederman, 1999) was chosen. Data were collected at specific moments that were closely associated with the design of an experimental course module on models and modelling (Van Driel & De Jong, 2001). The data collected consisted of (a) the written answers to a questionnaire and to specific assignments, included in the module, and the audio tape recordings of workshop discussions about these answers, (b) the audio tape recordings of the lessons about a self-chosen topic focusing on models and modelling, made by the preservice teachers themselves, (c) the reflective lesson reports written by the preservice teachers, and the audio tape recordings of workshop discussions about these reports, (d) the written answers to the first questionnaire, which was administered again at the end of the course module.

The data were analysed from an interpretative phenomenological perspective (Smith, 1995), focusing on the identification of regularities or patterns in the (written or oral) statements made by the participants, without the use of an a priori established system of categories or codes. Instead, we developed categories on the basis of the data, through an iterative process during which the data were constantly compared with each other, as well as with theoretical notions (cf. Denzin, 1994).

3. Analysis

The growth in the preservice teachers' SMK of models and modelling was identified using a multi-step procedure. First, the answers to the questionnaire at the beginning of the module and the transcription of the related workshop discussion were analysed by the first and the second authors individually. Second, the answers to the same questionnaire, filled in for the second time at the end of the module, were also analysed by the authors individually. By comparing and discussing our individual analyses (investigator triangulation, Janesick, 1994), several categories emerged during the analysis process to characterize the preservice teachers' SMK. Next, these categories were used to identify individual growth in SMK by comparing the responses given by individual preservice teachers at the beginning and at the end of the module.

The growth in the preservice teachers' PCK of models and modelling was identified in a similar way. First, the responses to specific course assignments and the transcriptions of the related workshop discussion were analysed by the authors individually. Second, the reflective lesson reports and the transcriptions of the related workshop discussion were also analysed by the authors individually. Next, by triangulation of the results, a set of categories was established to characterize the preservice teachers' PCK. Finally, by comparing the responses of individual preservice teachers at the beginning and at the end of the module, individual growth was assigned to these categories. During this phase, the audio recordings of the lessons taught by the preservice teachers were used as additional data, which mainly served to improve understanding of the contexts in which they had written their reflective reports.

4. Results and conclusions

During the presentation, we will focus on the strengths and limitations of the instruments we used, and the analysis procedure we applied, in terms of their potential to investigate the development of teachers' subject matter knowledge and pedagogical content knowledge of models and modelling in science.

5. Bibliography

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