

# TEACHING CONCEPTS IN CONTEXTS: DESIGNING A CHEMISTRY TEACHER COURSE IN A CURRICULUM INNOVATION

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## ABSTRACT

This paper focuses on the professional development of school chemistry teachers in the context of curriculum reform in The Netherlands. An important aim of this reform is the implementation of teaching chemistry concepts in contexts, which requires substantial changes in current teaching practice. The aim of our research was to develop an empirically validated course design and design principles for courses, on teaching concepts in contexts. A developmental research approach was used with several cycles of an in-depth case study. We describe the design and evaluation results of the first and second cycles. The conclusions are formulated as design principles for a third cycle of this type of teacher in-service course.

## 1. INTRODUCTION

It is widely acknowledged that teachers play a key role in curriculum innovations by interpreting new curriculum documents and enacting them in practice. It has also been accepted that the implementation of curricula should be accompanied by appropriate teacher professional development which takes into account teachers' knowledge, beliefs, and intentions. There is a growing research interest in this type of professional development (Marx et al., 1998; Van Driel et al., 2001). While many studies focus on deriving general design principles and strategies from specific professional development projects (cf. Loucks-Horsley et al., 1998), the present inquiry focuses on the design of a in-service science teacher course and the intended and realized outcomes of the course.

This research was conducted in the context of an innovation of the secondary school chemistry curriculum in the Netherlands, for which a governmental committee has proposed the implementation of teaching concepts in contexts. This teaching approach is also found elsewhere, for example, the Salters' project (Campbell et al., 1994)) in the UK and 'Chemie im Kontext' in Germany (Nentwig et al., 2002). Instead of simply offering teachers new 'teacher-proof' curriculum materials, the Dutch committee proposes, inspired by the German project, to involve teachers in the innovation by calling upon their willingness and ability to (re)design

curriculum materials. For Dutch chemistry teachers, using contexts to teach concepts requires substantial changes in their practice, and to make such an approach successful, they must be able to recognise the fruitfulness of the innovation with respect to their current practice. They need to acquire knowledge about the innovation for underpinning their intention to change. So far, with respect to chemistry teachers, research in this area is scarce. Consequently, our study deals with this early stage of chemistry teacher professional development.

## 2. BACKGROUND

Teachers do not tend to risk changing their own practice which is rooted in the beliefs and practical knowledge they have accumulated during their years of teaching. To enable them to broaden their perspectives and see the fruitfulness of teaching concepts in contexts, teachers should become actively involved in the process. It is essential that they acquire a sense of ownership of a new curriculum. This requires in-service teacher courses which include multiple elements like the use and adoption of teaching materials, opportunities to try new curriculum ideas, reflection by exchanging practical experiences with peers, and a safe and supportive course environment (Van Driel et al., 2001). We explain these elements below (Stolk et al., 2001).

(a) The use of *innovative teaching materials* is essential to make the general curriculum innovation goals more accessible for teachers. It also creates a crucial opportunity for teachers to learn from these materials because they are addressed at the level of their practical knowledge.

(b) *Reflection*. Because of the tacit character of teachers' beliefs and knowledge, it is very important that teachers are stimulated to exchange experiences and reflect on them. According to Korthagen (2001), reflection promotes teachers' awareness of their own behaviour, creates alternative methods of action, and extends their practical knowledge.

(c) In *teacher networks*, participants learn more effectively than they do individually; such networks also reduce experienced teachers' reluctance to change. External conditions, like available time and clarity of learning goals, and internal conditions like teachers' personal expectations, contribute to creating a collaborative, open-minded environment (Adams, 2000).

### *Teaching chemistry concepts in contexts*

In traditional chemistry education usually refers to an example of a practical application of chemical concepts already studied. Along with the curriculum demand, such concept-led applications become a kind of justification for learning chemical concepts. A traditional approach as this will not enhance students' motivation to learn chemistry topics (cf. Van Berkel, De Vos, Verdonk & Pilot, 2000). In this research project, the curriculum materials developed include a context-