

Abstract

This study is part of a bi-national program that was more comprehensive and collaborative regarding teachers' continuous professional development (CPD), a program that was conducted between King's College, London, and the Weizmann Institute of Science, Israel. An evidence-based model for continuous professional development (CPD model) of chemistry teachers was developed and implemented. The CPD model consists of five components, each of which is known in the literature as a supportive source by itself. The CPD components are as follows: (1) a teacher's guide; (2) a summer induction course; (3) a workshop; (4) an evidence-based portfolio; (5) and videotaped observations in the classroom. In this study, all these components were combined together for the first time. The research focused on chemistry teachers who implemented, for the first time, an inquiry-type approach in the classroom-laboratory.

The main goal of the study was to investigate the professional development, over time, of chemistry teachers who were novice to the inquiry approach, and who were involved in the CPD program, and to investigate the relative contribution of the five components to the teachers' development.

This study focused on the following questions:

- How do the teachers perceive the contribution of the support, structured in the CPD model, to their professional development?
- What changes in one teacher's practice, regarding her teaching skills, took place, over time, while she practiced the inquiry approach in the classroom-laboratory, with respect to pedagogical-content knowledge (PCK)?
- What are the similarities and differences between Yarden and the other teachers regarding their professional development changes?

In-depth analysis of eight teachers' behavior in the laboratory and one case study of Yarden were used in order to address the research questions. All teachers were experienced in chemistry teaching, but novice to the inquiry approach. Several qualitative research tools were used in order to assess teachers' change:

- Videotaping of classroom-laboratory observations were done for two years during three open-ended inquiry activities (20 hours per teacher).
- Interviews were held for two years on different occasions (15 interviews per teacher).

- A year-long workshop was held for three years, creating a community of practice.
- Pieces of evidence, based on artifacts that the teachers brought from their classroom-laboratory practice and their students' work, were prepared and used.
- Questionnaires were used a few times for two years (4 questionnaires per teacher).
- Field notes were written immediately after observations or a conversation that was not documented otherwise.

Each research tool is unique and has its specific contribution, yet, together, they created a full and profound triangulated picture.

The data were qualitatively analyzed and also combined with quantitative analysis of the qualitative data. Data triangulation validated and reinforced the findings. A set of categories was especially constructed for this study, based both on the literature and on the emerging categories during the analysis. This set of categories was tailored especially to the inquiry approach teaching style, and to its unique teaching skills. Analyses of the videotaped observations were held using Videograph software. Content analysis was carried out on the qualitative data that were gathered from: The workshop's discourse, interviews, questionnaires and field notes.

The main findings were as follows:

- The process of change was complicated, yet all teachers developed professionally, either in a similar manner or in different ways.
- Three out of the five components of the CPD model were found to be meaningful for the teachers' professional development: the workshop, the evidence-based portfolio, and the videotaped observations.
- It became clear that the "hot" reflective interviews that were held immediately after the observations, which were meant to be used only as a research tool, are an important and meaningful tool for professional development as well.

The interrelationship between the three meaningful components of the CPD model and the "hot" reflective interviews are largely based on the teachers' reflections. It was found that by using different kinds of tools in order to reflect upon their own practice, teachers can undergo profound professional development.

- The most significant change in teachers' practice was found in their pedagogical-content knowledge (PCK). We suggest that this was attributed to teachers' reflection upon their authentic practice, which was done simultaneously with the workshop, preparation of evidence, observations, and interviews.

- The summer induction course provided the teachers with preliminary, but rather important tools needed to practice the inquiry approach. Yet, since it was a short professional development course, it had only a limited contribution, but it was necessary in order to start enacting the inquiry approach.
- The teacher's guide, developed at the Weizmann Institute by members of the Chemistry Group, contained elaborate information referring to only a few inquiry experiments; thus it had only a limited contribution.

The built-in reflection existing in the three most meaningful components of the CPD model, combined with authentic practice, accompanied by the yearly workshop, supported and expedited the process of change the teachers underwent, much more than if they had only taken the summer induction course.

To summarize, all teachers had developed professionally as a result of the CPD model. Therefore, it is recommended that in future the most profound components of this model will be used in long-term professional development processes, both in chemistry as well as in other disciplines.