

Collaborative diagnosis of scientific and pedagogical conceptions

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Instructional models for pre-service teachers usually are split between content courses and pedagogical courses. The learners are expected to develop the pedagogical content knowledge (PCK) on their own during their practical experience in teaching; assuming that the integration required for teaching is simple and happens in the course of experience. In fact, this integration does not occur easily, and often does not happen at all.

This dissertation is concerned with the design and study of a geometrical optics course trying to bridge this gap. The course employed an innovative meta-cognitive instructional strategy, **Collaborative Diagnosis of Conceptions (CDC)**, accompanied by a component of continuous and explicit discussions about the pedagogical characteristics of the strategy.

The CDC strategy is aimed at developing the pre-service students' deep understanding of content and at the same time develop their PCK about ways to interact in the future with their students using a similar instructional strategy. In particular, it is designed to enhance one of the important skills of teaching: the ability to follow closely the students' conceptual understanding and to respond accordingly with appropriate instruction. They carry out individually some activity, examine the answers collaboratively with peers, compare and contrast the answers and attempt to come up with a consensual answer. Later in the course they try to identify conceptions that underlie various answers (their own and hypothetical students' answers) and are asked to come up with suggested activities to advance students' understanding.

The CDC strategy was tried out and studied with a total of 123 pre-service elementary science teachers in several geometrical optics courses. The results show that the teachers advanced significantly in their understanding of the optical concepts. However, only after we added the meta-cognitive component requiring the pre-service teachers to discuss and explicate, continuously, the pedagogical characteristics of the strategy, they also advanced significantly in their understanding of the pedagogical merit of this strategy. These findings demonstrate the potential benefits of integrating the acquisition of content and pedagogical content knowledge by pre-service teachers.