The interaction between reflection and practice in the professional development of a secondary education science teacher

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Abstract: The work that we describe here is a case study of a secondary education science teacher about how action-oriented reflection and action itself interact, and their influence on professional development. In our theoretical outline, we stress the concepts of reflection which sustain the theoretical-practical dialectic, and of complexity which is seen to be a progression hypothesis of central importance, and in which we distinguish three dimensions: technique, practice, and criticism. The results showed the teacher to be in transition from a technical to a practical dimension, with both her reflection and her classroom practice in the process of becoming more complex, and with the two being closely integrated. It was also found that she had a hard core of obstacles impeding her professional development.

1. Background

Research with science teachers has found that the process of teacher change is continuous but gradual (Mellado et al., 2006). Teachers do not usually make drastic changes. Instead, they progressively put the ideas that seem to them to be important and at the same time attainable into practice (Gunstone et al., 1993). For experienced teachers, professional development is an internal process of "growth" and "gradual development" based on what they already think and do (Day, 1999; Mulholland & Wallave, 2005), on the real problems of science teaching and learning, on their everyday concerns, and on the context in which they work (Jiménez & Wamba, 2003).

2. Aims and Framework

From a constructivist perspective, experienced science teachers have conceptions and teaching models that have been consolidated by their own professional experience which are very stable and resistant to change (McRobbie & Tobin, 1995). Teachers do not easily change their conceptions, and even less so their educational practices, because there exist conditioning elements that reinforce traditional models, and are obstacles to changing them (Verjovsky & Waldegg, 2005).

We stress the role that reflection plays in our theoretical framework, sustaining teachers' theoretical-practical dialectic. We consider that complexity in reflection has to be related to complexity in classroom practice. We establish the Complexity Hypothesis with three dimensions, both for reflection and for classroom practice: technique, practice, and critique. In our hypothesis, each dimension becomes more complex, from the purely instrumental interests to social awareness and the emancipating role of education.

The action-research programs have proved effective in promoting the professional development of science teachers (Baird et al., 1991), thanks to the cooperative action that it involves, and to the team work by means of which the teachers guide, correct, and assess their own problems, and take decisions in order to improve, analyze, or question their educational practice (Imbernón, 2002).

We summarize in the form of questions the problems that we set ourselves: a) Is it possible to base professional development on the integration and complexity of reflection and classroom practice? b) Is there a degree of convergence between reflection and classroom practice? How do they both evolve through time? c) In which dimension of the Complexity Hypothesis is Marina situated, both for reflection and classroom practice?

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3. Methods and Samples

Our work forms part of an action-research program carried out in a state secondary-education school in a town of 20 000 inhabitants in Spain. In the present article we will centre on the case of a teacher we will refer to as Marina, a Geology graduate, with eight years teaching experience. To put into operation the process followed with the teachers, we applied the Kemmis and McTaggart (1988) action-research model, whereby successive methodological cycles of planning, behaviour, observation, and reflection are established. The work was carried out during two school years, 2001-2002 and 2002-2003, with students of the 3rd year of Secondary Obligatory Education (14-15 year-olds).

The reflection data collection instruments were the teacher's diaries and memos, transcriptions of the work group meetings, questionnaires, and interviews. For the classroom practice, the ethnographic notes and extracts from the videotapes of the class sessions, and other documentary sources. For data analysis we considered 17 analysis structures that were tested previously (Vázquez et al., 2007) organized in a System of 74 Categories (Annex I), and in harmony with the complexity hypothesis, we distinguished three dimensions —technique, practice, and critique— for each analysis structure that characterize each frame (Figure 1). The information was processed using the AQUAD computer program (Huber et al. 2001).

4. Results

By way of synthesis, we have represented in Figure 1 the integration between classroom reflection and practice. All the structures to Marina's reflection and classroom practice are distributed along the horizontal axis.

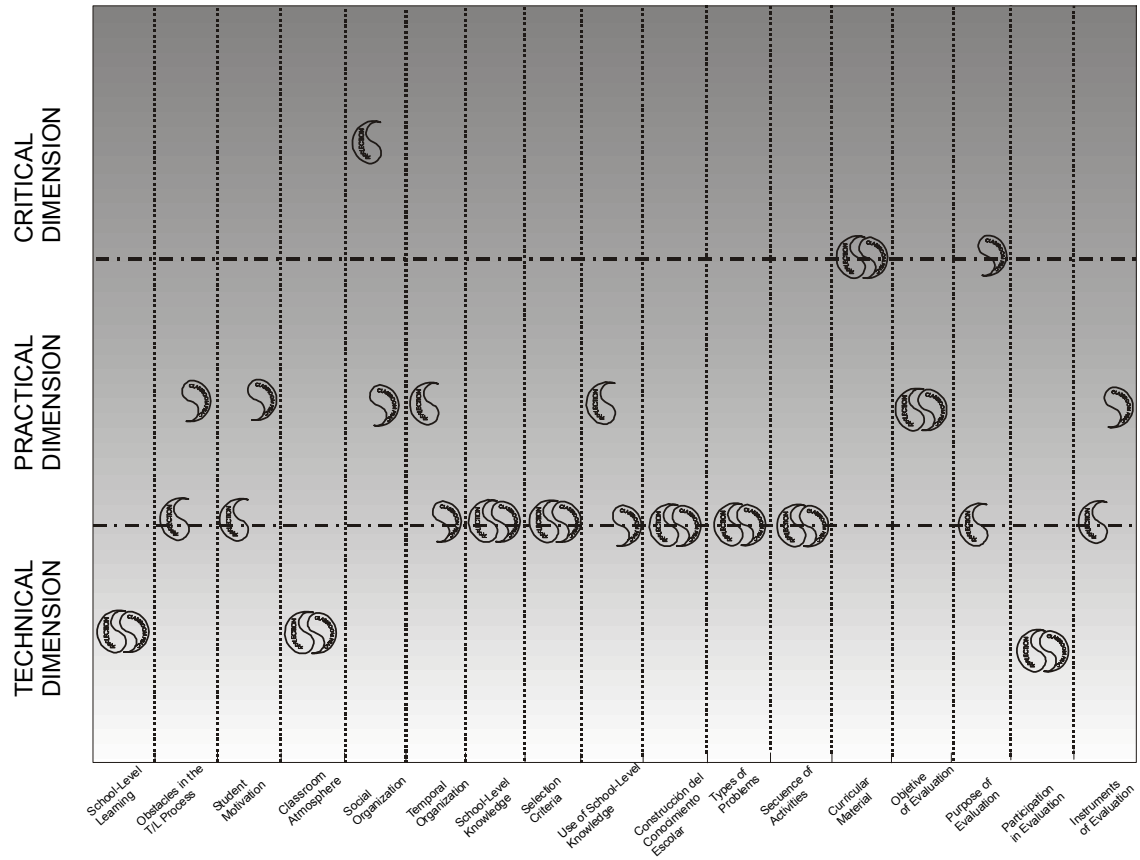

Figure 1. Marina's reflection-practice integration.

The three zones corresponding to the critical, practical, and technical dimensions are located on the vertical axis, and between them there are two intermediate zones, represented by dash-dotted lines, which symbolize the transition towards the practical or critical dimensions. In the centres of each dimension are the zones of the dimensions themselves. These forms of representation express the degree of complexity obtained in each structure analyzed.

At the same time, the possible integration or non-integration is represented by the corresponding symbol of Figure 2. The symbols express the degree of integration between reflection and classroom practice, so that the symbol on the left would indicate total integration between the two aspects, and that on the right incomplete or no integration. In the latter case, there may be various degrees of integration symbolized by the greater or lesser distance between the two figures.

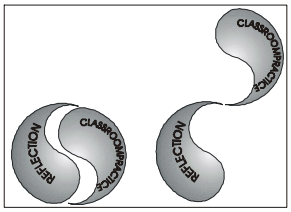

Figure 2. *Degree of integration.*

5. Conclusions e implications

a) In the complexity hypothesis, we would highlight the multiple influences that impact on the teaching-learning process and the conditions under which it develops. The establishment of levels of increasing complexity has allowed us to orient and make explicit the degree of development of Marina.

b) The analysis of the integration confirmed that there existed a degree of full integration between reflection and classroom practice in Marina in 10 of the 17 areas studied. In other areas, however, there was a degree of partial integration or even an evident lack of integration between reflection and practice.

c) This holistic vision of the evolution of Marina shows how the teacher is in transition from the technical towards the practical dimension. After two years of collaborative work, it is clear that Marina's pedagogical model has not undergone a total change, but rather a gradual evolution with some aspects having evolved more than others. In Marina's case, it will be necessary to continue paying special attention to three aspects that remain in the technical dimension: school-level learning, the classroom atmosphere, and evaluation.

6. Bibliography

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THE INTERACTION BETWEEN REFLECTION AND PRACTICE IN THE PROFESSIONAL DEVELOPMENT OF A SECONDARY EDUCATION SCIENCE TEACHER

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Aims and Framework

From a constructivist perspective, experienced science teachers have conceptions and teaching models that have been consolidated by their own professional experience which are very stable and resistant to change (McRobbie & Tobin, 1995). Teachers do not easily change their conceptions, and even less so their educational practices, because there exist conditioning elements that reinforce traditional models, and they are obstacles to changing them (Verjovsky & Waldegg, 2005).

We stress the role that reflection plays in our theoretical framework, sustaining teachers' theoretical-practical dialectic. We consider that complexity in reflection has to be related to complexity in classroom practice. We establish the Complexity Hypothesis with three dimensions, both for reflection and for classroom practice: technique, practice, and critique. In our hypothesis, each dimension becomes more complex, from the purely instrumental interests to social awareness and the emancipating role of education.

Our work forms part of an action-research program carried out with five teachers in a state secondary-education school in a town of 20 000 inhabitants in Spain. In the present article we will focus on the case of a teacher we will refer to as Marina, a Geology graduate, with eight years teaching experience.

We summarize in the form of questions the problems that we set ourselves: a) Is it possible to base professional development on the integration and complexity of reflection and classroom practice? b) Is there a degree of convergence between reflection and classroom practice? How do they both evolve through time? c) In which dimension of the Complexity Hypothesis is Marina situated, both for reflection and classroom practice?

Methods

To put into operation the process followed with the teachers, we applied the Kemmis and McTaggart (1988) action-research model, whereby successive methodological cycles of planning, behaviour, observation, and reflection are established. The work was carried out for two school years, 2001-2002 and 2002-2003, with 3rd year of Secondary Obligatory Education students (14-15 year-olds).

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Results

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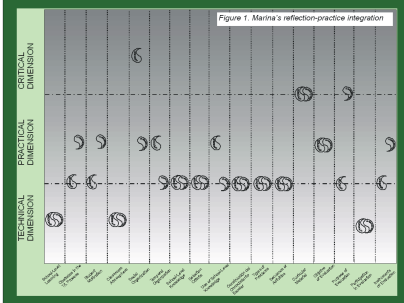

Figure 1. Marina's reflection-practice integration

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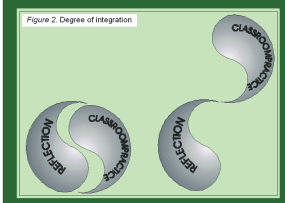

Figure 2. Degree of integration

At the same time, the possible integration or non-integration is represented by the corresponding symbol of Figure 2. The symbols express the degree of integration between reflection and classroom practice, so that, the symbol on the left would indicate total integration between the two aspects, and that on the right would indicate incomplete or no integration. In the latter case, there may be various degrees of integration symbolized by the greater or lesser distance between the two figures.

There exists a degree of total integration in the following study areas (Figure 1): school-level learning, classroom atmosphere, school-level knowledge, criteria for the selection of information sources, construction of school-level knowledge, type of problem, activity sequence, teacher and student curricular materials, objective of evaluation, and participation in evaluation.

Conclusions and implications

a) In the complexity hypothesis, we would highlight the multiple influences that impact on the teaching-learning process and the conditions under which it develops. The establishment of increasing levels complexity has allowed to us to focus and make explicit the degree development in Marina.

b) The analysis of the integration confirmed that there existed a degree of full integration between Marina's reflection and classroom practice in 10 of the 17 areas studied. However, in the rest of other areas, there was a degree of partial integration or, even an evident lack of integration between reflection and practice.

c) This holistic vision in Marina's evolution shows to us how the teacher is in transition from the technical towards the practical dimension. After two years of collaborative work, it is now clear that Marina's pedagogical model has not undergone a total change, but rather a gradual evolution with some aspects having evolved more than others. In Marina's case, it will be necessary to continue paying special attention to three aspects that remain in the technical dimension: school-level learning, the classroom atmosphere, and evaluation.

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