

# CURRICULUM REFORM BASED ON THE DEVELOPMENT OF SCIENTIFIC COMPETENCES: CONTROVERSIES IN TEACHERS' OPINIONS

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*Abstract. This paper examines certain controversies among a group of secondary education science teachers with regard to the teacher's role and his/her professional environment, their views being gathered following a training programme aimed at introducing a key competences approach into the Spanish science curriculum. During the programme they were required to design, implement, and assess their own teaching unit for developing students' scientific competences by means of context-based learning. At the end of the programme a representative group of teachers were selected to take part in a focus group in which they discussed the training received and its transferability to the classroom. Their statements were then analysed and categorised in order to identify factors associated with their professional environment (at the level of both school and the wider education system) and the implications they had for classroom practice. The present study focuses on those aspects which generated controversy among the teachers, specifically as regards whether they were seen as facilitating or as an obstacle to the teaching of science via a competence-based approach. The issues of controversy related to the following topics: the approach to teaching, the content to be taught, the views of and coordination with colleagues, the utility of contexts and the need for reflection on one's own practice. The paper concludes by considering potential reasons for these issues of controversy and the implications they have for a competence-based approach to teaching.*

*Keywords:* Curriculum reform; Scientific competences; Controversies in teachers' opinions.

## INTRODUCTION

The current education system in Spain (MEC, 2013) follows the recommendation of the European Parliament and Council regarding the role of key competences in lifelong learning (EU, 2006), this being seen as a way of promoting active learning and scientific and technological literacy among citizens. However, designing common approaches to science education based on the development of competences, and especially scientific competences, poses a number of challenges related to the conception of the teaching/learning process, the organisation and culture of schools, working practices and the development of teaching materials, among others. In relation to these challenges, a wide range of professional factors influence the extent to which the required changes may be taken on board by teachers (Ryder, 2015); these include personal teacher factors, as well as factors that are internal to schools or linked to the wider education system. In order to meet these challenges, teachers need to be adequately trained.

The present study forms part of a broader piece of research (Authors, 2016) that sought to identify the main aspects which teachers believed either facilitated or acted as an obstacle to the development of scientific competences through context-based learning (Fensham, 2009), and also to consider the implications of this for science education. The specific aim here was to identify the aspects of the required educational reform which teachers regarded as a posing a challenge to their professional identity (Ryder & Banner, 2013). The study was carried out following a wide-ranging training programme (Authors, 2015) in which teachers had to develop a classroom-based teaching unit for a problem of everyday interest. This approach enabled us to consider the following questions: a) What elements of the teacher's professional environment generate controversy in terms of their impact on the use of a context-based approach to the development of scientific competences? and b) What might be the reasons for these points of controversy?

## METHOD

The sample comprised four teachers who participated in the aforementioned training programme, and who were selected so as to provide a diversity of backgrounds (i.e. in terms of how long they had been teaching, their previous experience in the design of teaching materials, and any prior involvement in educational

research or innovation initiatives). Their views were gathered in the context of a focus group (Callaghan, 2005), a widely used technique in educational research. Transcriptions of the focus group discussions were then subjected to qualitative analysis, with the researchers organising and categorising significant fragments of text (units of meaning) in order to identify issues of controversy with regard to the aspects which teachers saw as either facilitating or as obstacles to the teaching of science via a competence-based approach. In order to ensure the validity of this analytic strategy, each member of the research team analysed independently a representative percentage of the units of meaning, chosen at random. The level of agreement in categorisation among the three researchers was above 85%.

## RESULTS

Table 1 shows the results obtained, indicating for each idea and the topic to which it corresponds the teacher who initiated the discussion, whether the idea was seen as facilitating (F) or as an obstacle (O) to a competence-based approach, the number of teachers in favour and against, and the number who expressed mixed views. In addition, each idea is linked to one of the categories established by Ryder (2015) to classify the factors that influence teachers' responses to externally-driven science curriculum reforms.

Table 1. Classification of controversies among teachers emerging during the focus group

IDEA; TOPIC	Category according to Ryder	Facilitating / Obstacle	Teacher			
			Initiated by	In favour	Against	Mixed
I1. Through their daily practice, teachers acquire a clearer idea of what the competence-based approach entails, and this enables them to decide whether or not a given text book is a useful tool; Approach to teaching	PERSONAL Pedagogical skills	F	T1		T3, T4	T2
I2. If the aim is to develop students' scientific competences, then as far as possible one should avoid compartmentalising content by areas; Compartmentalising content	INTERNAL Science department working practices	O	T3	T1		
I3...but colleagues from other subjects don't like interference from other areas; View of colleagues	PERSONAL Perceived audiences for his/her work	O	T3	T4	T1	
I5. Coordinated working is good but it's difficult to achieve without the presence of new teachers who can set an example of sorts for older staff, who tend to put up obstacles to ideas like this; Coordination with colleagues	INTERNAL School and departmental leadership style	F	T3		T4	
I4. It would be helpful to know about specific examples of competence-based activities and contexts that have been used by other teachers with more experience of this approach; Awareness of context-based activities	INTERNAL Availability of teaching resources	F	T3	T2	T4	
I6. Working with an everyday context from students' lives isn't such a novel idea, and its importance is relative; there may be other more integrative methods; Utility of context	PERSONAL Subject knowledge	O	T4		T1, T2,	T3
I7. It's useful to have a good theoretical grounding for these strategies and to reflect on them from this perspective; Personal reflection	PERSONAL Pedagogical skills	F	T4		T2	

The data in Table 1 reveal seven issues of controversy, two of which (I1 and I6) involved all four teachers. One of these (I1) concerned teachers' ideas and beliefs about the concept of scientific competence in the curriculum and how it could be understood in relation to science education. The teacher who raised this issue (T1) regarded it as a facilitating element, two teachers (T3 and T4) saw it as an obstacle and the fourth (T2) had mixed views. A similar pattern of controversy can be observed in relation to I6. Controversy involving three of the four teachers emerged in relation to two other issues: how colleagues viewed their work and the relationship with them (I3), and the availability of teaching resources to support a competence-based approach (I4).

## CONCLUSIONS AND IMPLICATIONS

The results of this study show that the use of context-based learning to develop students' scientific competences is an issue that raises a number of controversies among teachers, and that these controversies relate to both the personal and school (internal) level (Ryder, 2015). One potential reason for these points of controversy concerns a lack of opportunities within the ordinary working day for an exchange of ideas among colleagues, that is, a setting in which teachers could reflect on and analyse their own classroom practice. It should also be borne in mind that in order to change their beliefs teachers need time to assimilate new ideas, especially when the proposed approach requires them to reorganise their pedagogical knowledge and to establish clear criteria for incorporating these new ideas into the curriculum and the process of student assessment. Our results highlight the importance of helping teachers to develop their pedagogical content knowledge (Abell, 2008) so as to avoid the fragmentation of important knowledge areas, a problem illustrated by the controversies we observed in relation to different aspects of teachers' professional environment.

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