Science in early childhood education: the perception of Spanish teachers during initial training

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Abstract

Science teaching is present in the curriculum at all levels of education. However, little research has been done into what content is taught, how it is taught and what pupils actually learn at the pre-primary stage. In this paper, we will study student teachers' perception about what science teaching is being carried out in Second Cycle of Childhood Education classrooms (3-4-5 years). Using their experiences from teaching practice, a number of pre-school education degree students have completed a questionnaire through which to understand better the educational reality under study. The results reveal the limited attention given to certain content areas and the absence of key activities through which to learn science at these ages. Lastly, attention is given to needs in teacher training, both initial and in practice

Keywords: Early childhood education, science teaching, initial teacher training

Introduction

Many studies have supported the teaching of science in Early Childhood Education (ECE), from 3 to 5 years. From the field of psychology, Piaget's theories provided a large number of contributions, amongst which are those by Kamii and Devries (1983) or those of IMIPAE (Moreno, 1986), which study the experimental behaviour of children at these ages. It is a fact that science is present in curricula at all levels of education. The objective of science at ECE is not to form a solid foundation for the future acquisition of scientific knowledge. Doing scholarly science, even post-compulsory education, is justified because it responds to needs that citizens have – whether they want to be scientists or not – to learn about themselves, for personal development, to understand the world around them, to generate healthy habits with respect to the conservation of the environment, and to make decisions in the face of social problems, among other aspects (French, 2004; Ginsburg & Golbeck, 2004; Eshach, 2006; Worth, 2010).

Teacher training has been a priority in educational research in Spain. Although it was for a long time focused on what secondary school teachers have to know and know how to make, in recent years there have been some investigations about teacher training in the early school stages: ECE and primary school (6-12 years) (Palmer, 2006; Pérez, 2008; Pro & Rodríguez, 2011; Siry, Ziegler & Max, 2012; Riviero *et al,* 2013; Martinez-Chico *et al,* 2014; Cantó, Pro & Solbes, 2017; McNerney & Hall, 2017).

In our opinion, there are many factors that must be taken into account when we study science teacher training in ECE: on one hand, it is important to understand the image that future teachers have of science and its importance in ECE. From our perspective, their interests and attitudes towards science should be kept in mind (Osborne, Simon & Collins, 2003; Pell & Jarvis, 2003; Cantó & Solbes, 2014). On the other hand, if we understand that the ECE is a stage with its own identity, then the nature and characteristics of science that are taught in ECE must be different from those at other educational levels. Therefore, the purpose of the training of professionals must reflect early years

methods (boys and girls, 0-6 years) and consequently should be different from secondary science (Osborne & Simon, 1996; Oliveira, 2010; Arias, Alvarez & Alvarez, 2013).

It is also important to note that, in Spain, the academic background of the majority of students of the Degree in Early Childhood Education is one where the scientific component is not adequate. These deficiencies have been pointed out as the main reason for the little confidence that ECE teachers feel in their capabilities for teaching and including science activities (Greenfield *et al,* 2009). This situation should be changed through initial training. This is an argument used to justify why teachers' degrees aim to increase the level of scientific literacy of future teachers (Sanmartí, 2002; Garcia Barros, 2008).

However, it cannot be ignored that the curricular content of ECE in Spain is organised around three areas (Knowledge of yourself and personal autonomy; Knowledge of the environment; and Languages: Communication and representation) and all are included as scientific content (MEC, 2007). Therefore, it is necessary that future teachers, and teachers of ECE particularly, possess correct scientific knowledge in real life and in the classroom.

Many contributions about the Spanish context have been made with respect to the children of ECE age: resources that can be used in an ECE classroom, methodologies that can be applied, etc. However, despite these contributions, there is a significant deficit of research in Spain on the training of teachers of this educational stage: about their knowledge, about their beliefs and conceptions, about their classroom management, about their professional experiences (García Barros, 2008; Benarroch, 2012). This paper is part of wider research into science education in early childhood education in Spain, which starts by posing the question: what kind of science education is desirable and appropriate for these ages (Hadzigeorgiou, 2002; French, 2004; Eshach & Fried, 2005; Cantó, Pro & Solbes, 2017)?

For this reason, the main objective of this paper is to present the perception of future teachers of science teaching that is to be carried out in the Second Cycle of Early Childhood Education (SCECE) classrooms (3-4-5 years). In our case, as teacher trainers, we need to know how our students perceive the reality of SCECE classrooms in their first approaches to professional practice. Therefore, our research question is about our students' perception of science education in SCECE.

Methodology

Our research was implemented over three academic years (2011-2014) at the University of Valencia (Ontinyent Campus) with three groups of third-year Pre-school Education degree students. Using their experience of teaching practice for two months in a public school in the Valencia province, 120 students completed a questionnaire designed to obtain a better understanding of the educational reality of what is happening in schools:
(36 observations in a class of 3 year-old children, 40 observations in a class of 4 year-olds and 44 observations in a class of 5 year-olds).

Context

The Degree in Early Childhood Education of the University of Valencia is made up of 240 ECTS credits: 103.5 for basic training subjects; 73.5 for compulsory subjects; 12 for electives; 45 for external internships and 6 for work at the end of the degree. It is taught face-to-face and normally takes 4 years to complete.

In relation to the formation of scientific content, the curriculum includes two compulsory subjects: 'Natural sciences for teachers' (CNpM), worth 9 credits, and 'Teaching of the natural sciences in early childhood education' (DCN), worth 6 credits. CNpM is a common subject in the 2nd grade for pre-school and primary education, the purpose of which is that students complete their basic training in the content of scientific disciplines to improve their training as educators. At the time of collecting the information, the participants had already done this study unit: the average score was high – 7.5 (2011-12), 8.4 (2012-13) and 7.8 (2013-14), which reflects a certain success in this. DCN is specific to the Degree in Early Childhood Education and is aimed at studying the content that, in science, is covered in SCECE.

As for teaching practice, according to the curriculum it is *'an activity of a formative nature ...*

supervised by a tutor from the school and by an academic tutor of the University of Valencia. Its main objective is to allow students to apply and complement the knowledge acquired in their academic training while practising, at the same time, the acquisition of teaching competences, preparing them for developing competence in professional activities, to facilitate their employment and promote their entrepreneurial capacity'. It is distributed in three periods: 'School practice of early childhood education I' (7.5 credits, two weeks during 1st grade), 'Early childhood school practice II' (16.5 credits, 8 weeks in 3rd grade) and 'Infantile school education practice III' (21 credits, 15 weeks in 4th grade). The purpose of the second period (at the end of which the information was collected), according to the curriculum guide, is *'to introduce the students to systematic, grounded and critical reflection about the school reality, which allows them to consider the school as: (a) an organizational structure that is part of the school administration, (b) a space for citizen participation in an educational, social and cultural project, and (c) the framework in which processes of teaching and learning are designed, developed and evaluated'*. In addition, it is said that: *'...It is intended that students will progressively assume responsibility for the planning and execution of teaching experiences, and active participation in some of the activities of the school'*. For all these reasons, we consider that participants had enough knowledge and experience to answer the questionnaire with enough credibility and with more than sufficient time to make the observations (8 weeks).

Questionnaire

We wanted to know what was the perception of future teachers about teaching of science in SCECE after carrying out their teaching practices. For this, we designed a questionnaire with 100 questions in order to analyse the following aspects at this educational stage:

- General treatment observed regarding science;
- Content of science work included in the Spanish curriculum;
- General and specific methodology used;
- Technical and manipulative activities carried out; and
- Specific activities related to scientific methodology.

To facilitate its implementation, students only needed to indicate whether they had observed by means of three possible answers: Yes, No and NS (do not know). Before the students answered the questionnaire anonymously, they could ask about the questions and any doubts that arose regarding their interpretation were resolved. The questionnaire took a 90-minute session to complete and took place immediately after the end of 'Early childhood school practice II'.

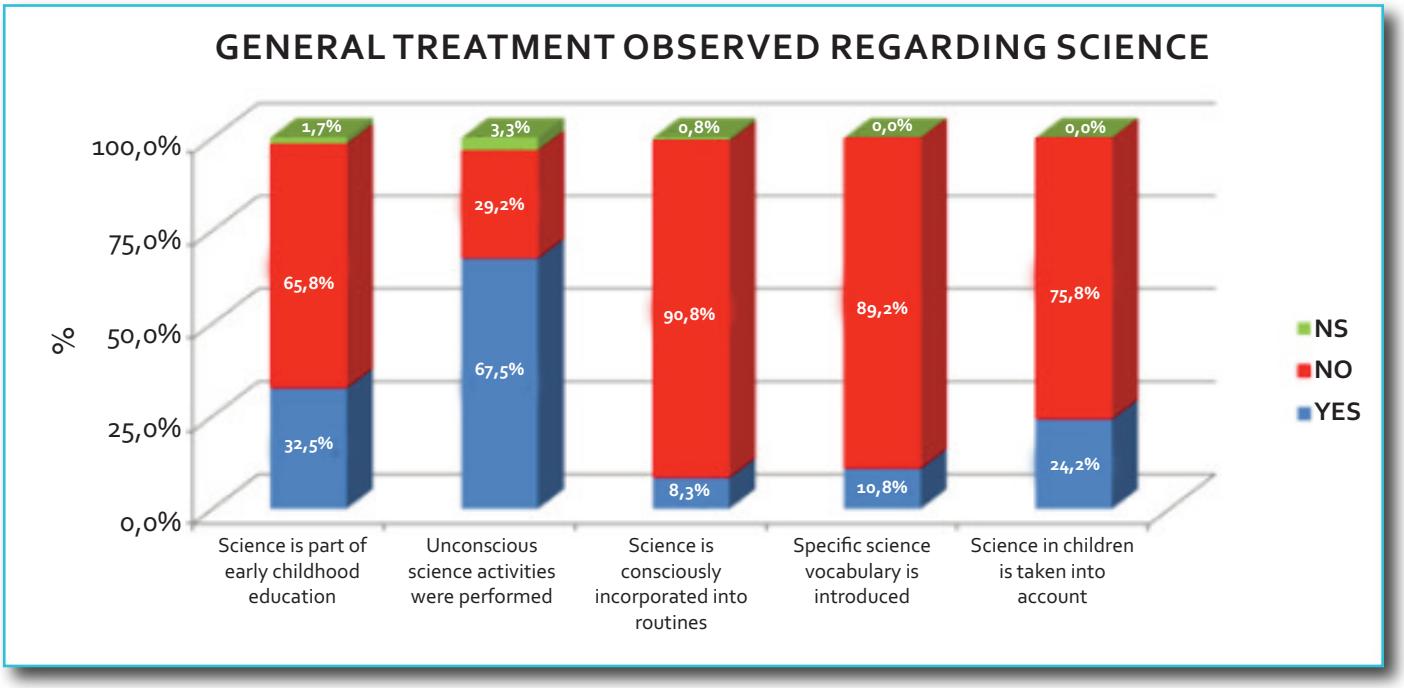
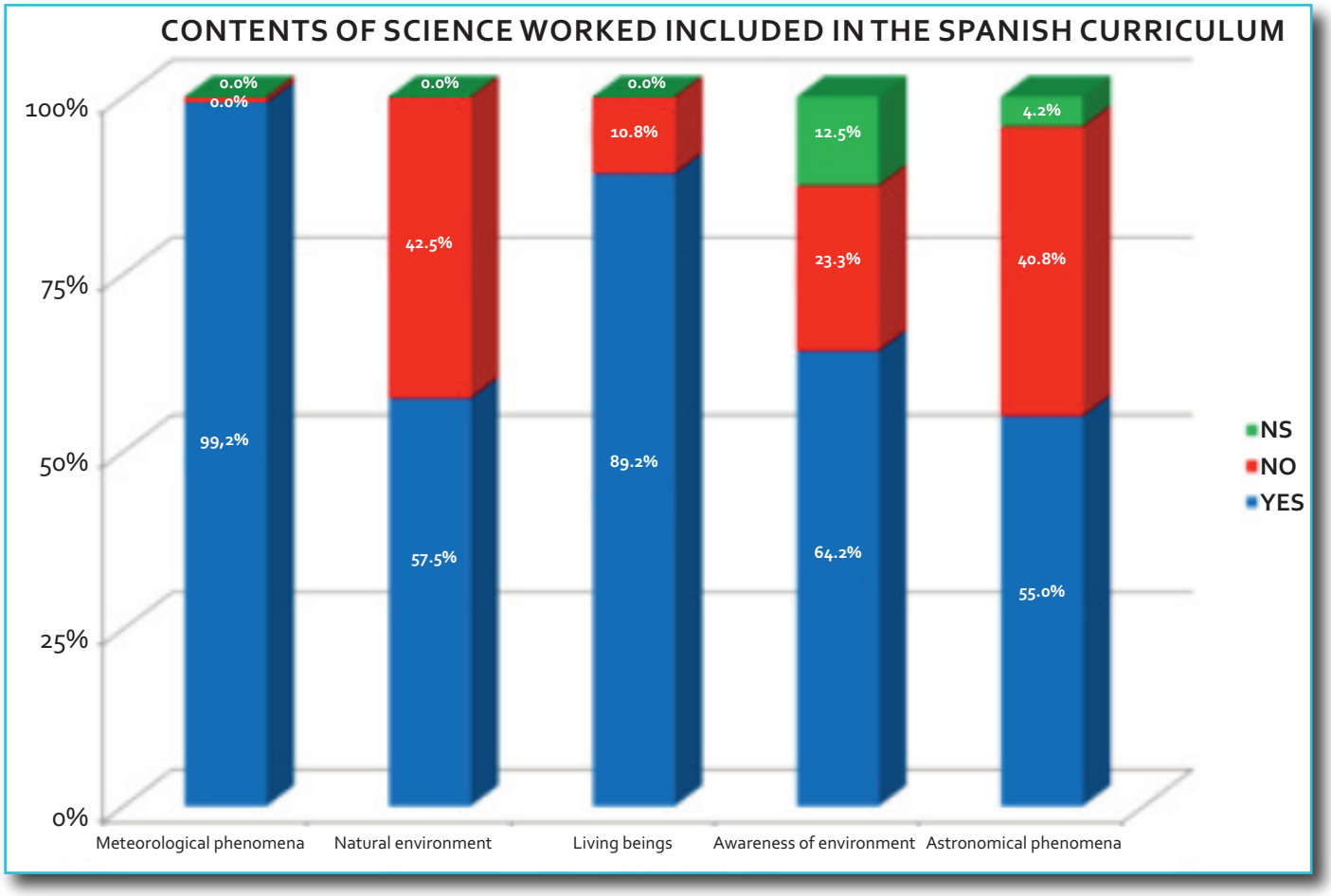


Figure 1: Results about the role given to science.

Figure 2: Different content of science covered in the Spanish curriculum.



Results

The results reveal (from the official Spanish curriculum reviewed in this paper) that there is limited importance attached to some content areas and that there is an absence of key activities through which to learn science at these ages. In Figure 1 we show the results for the general treatment observed regarding science.

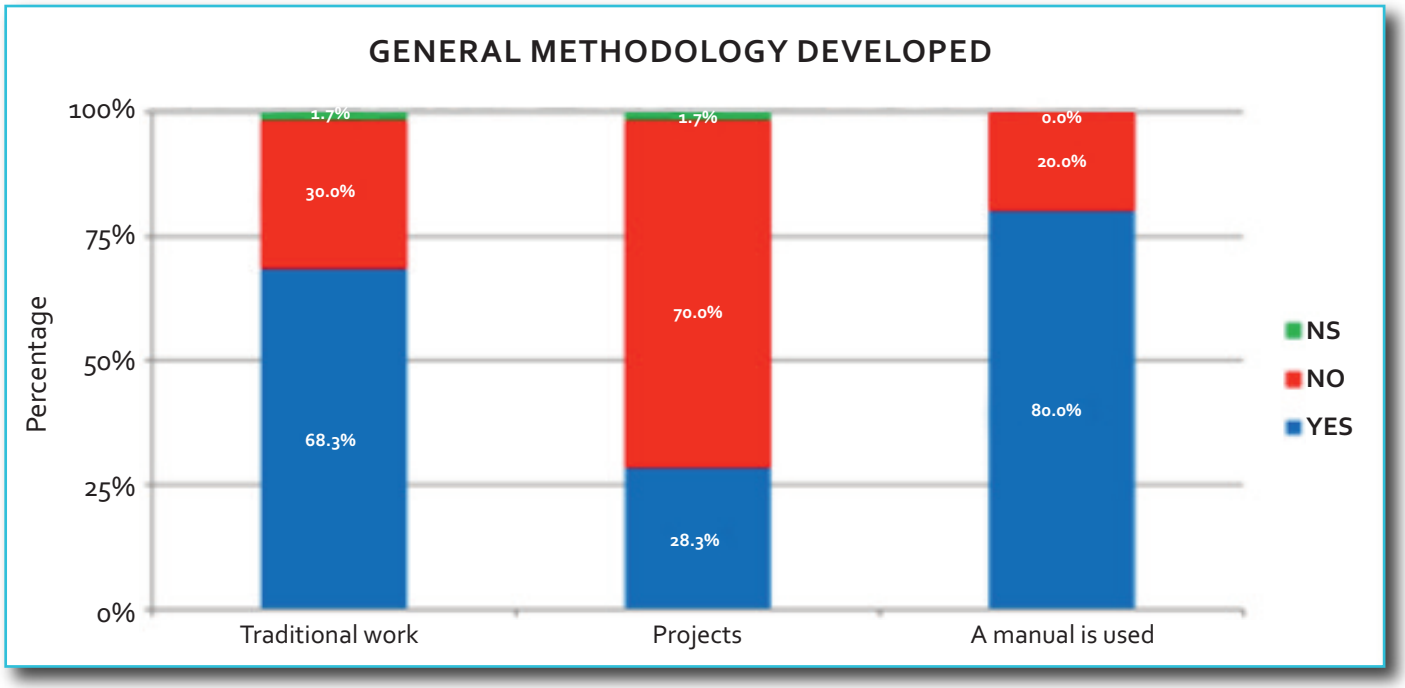
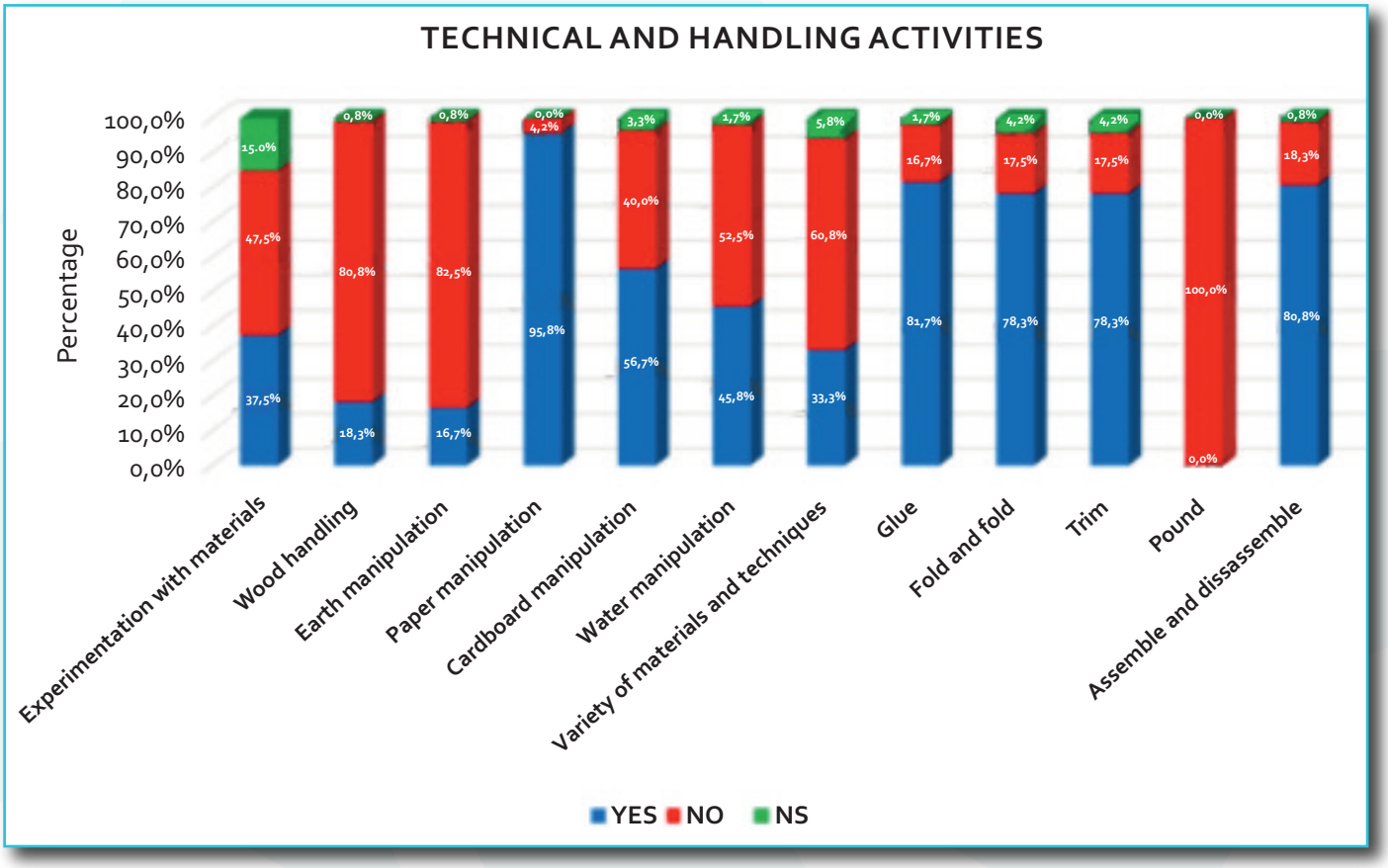


Figure 3: Results in the general methodology developed in the classrooms observed.

Figure 4: Results relating to technical and handling activities developed in the classrooms.



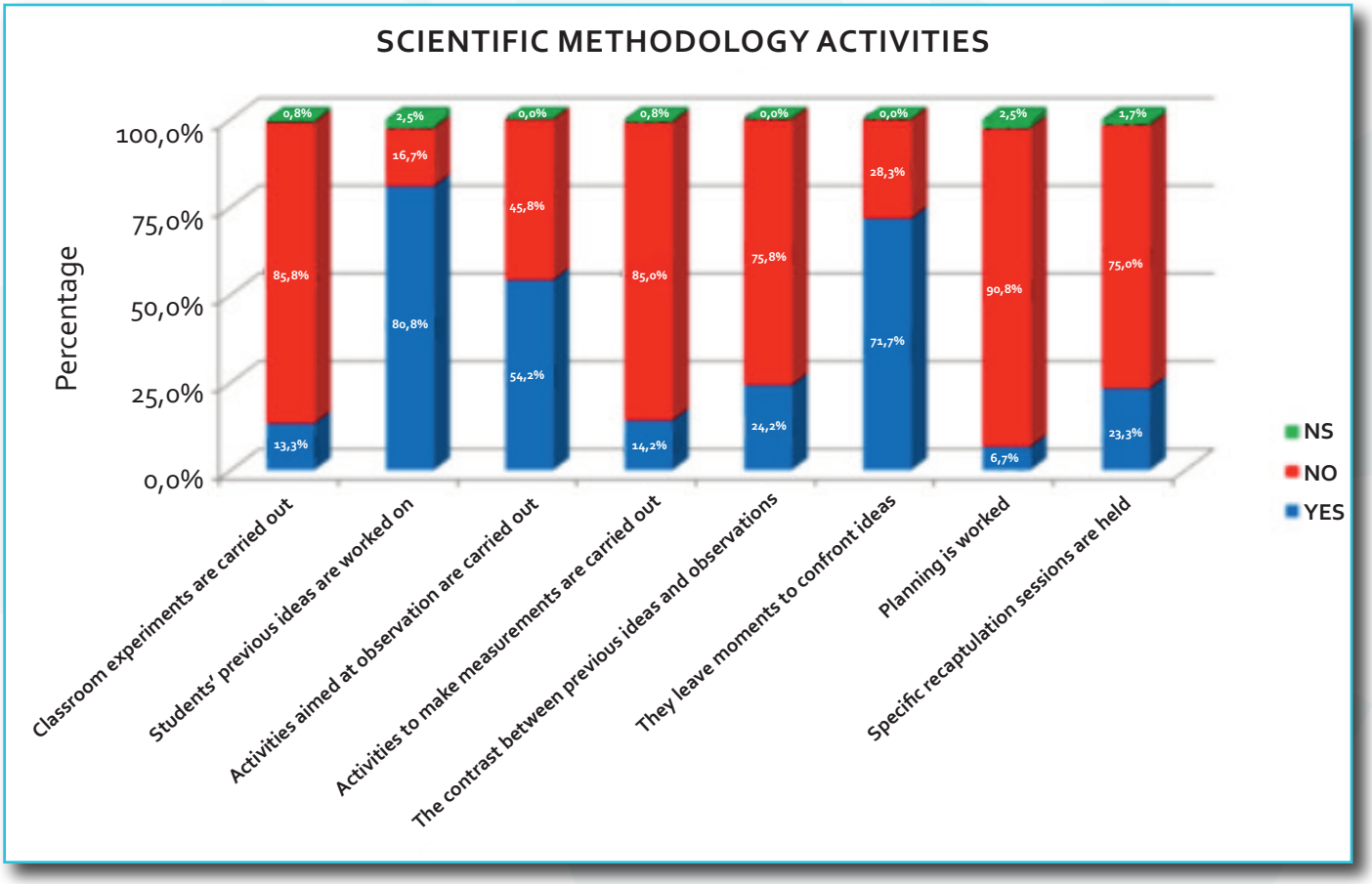


Figure 5: Results relating to scientific methodology activities observed.

It seems that the science does not have an 'intentional presence' in the classrooms; that is, they work but without an explicit purpose, which is both surprising and worrying. We emphasise this as all the answers go in that direction, with percentages higher than 65%.

With respect to the science curricular content that is included in the classroom, four areas were identified: Natural environment; Living beings; Environmental awareness; and Astronomical phenomena. Figure 2 shows the results obtained with respect to the presence of these areas as observed by our students during the practice. Regarding the general methodology used in class, three distinctive approaches were identified: a traditional methodology based on the use of worksheets; the use of general projects that encompass different aspects; and the main use of a manual or textbook. The results, with respect to these aspects, are shown in Figure 3.

As to the technical and manipulative activities related to materials observed by our students, the results are shown in Figure 4.

Finally, in Figure 5, we present the results regarding the activities for scientific methodology.

Conclusion

The answers obtained from our students allow us to have a 'picture' of the situation regarding science in SCECE classrooms in Spain. Thus, we have been able to see that:

- Science does not have the desired presence in many cases. However, it must be acknowledged that our students may have had difficulty in detecting scientific content when it is not presented in the form of didactic units, or with the disciplinary format (not holistically);

- Scientific content has a heterogeneous presence. There is no clear profile of omissions: cyclical nature of certain phenomena or of living beings, activities with plants and animals, not visible realities, simultaneity, measures of lengths and masses;

- As for the general methodology, desirable activities were observed being carried out (work in groups, use of ICT, etc.) but, in parallel, overall there were more traditional ones (using textbooks, etc.);

- Regarding the methodology used to teach science, teachers miss the typical activities of scientific learning: experiences, experiments, games, specific corners of this subject etc.; and

- In terms of activities, there are many technical activities, but less presence of scientific methodology and argumentation; the reasons for this could be attributed to the complexity of the skills required by approaches not used, as well as to the lack of training of the teacher who has to use them.

In conclusion, if this perception reflects the reality in Spanish schools, we should next consider why this is happening, what we can do in the initial training to tackle the situation, and how we can change it.

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