

ANALYSIS OF THE CURRICULAR EMPHASIS PREFERENCES OF PRESERVICE SCIENCE TEACHERS IN CHILE AND SPAIN

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In context-based science education, the concept of curricular emphasis exhibits a particular interest to teachers, as it helps to identify what they consider science education to be. Therefore, in this work, we present a quantitative study on the curricular emphasis preferences from two educational context, Chile and Spain. Using a Likert-type questionnaire as a research instrument, we comparatively analyze the choices of 40 pre-service science teachers from Physics and Chemistry, identifying similarities and differences between both countries. The results show a clear preference for the emphasis on Science, Technology and Society, even though the contrasts of the two educational systems and the profile of the pre-service teachers.

Keywords: context-based learning, initial teacher education (pre-service), inquiry-based teaching

INTRODUCTION

A common trend that has been registered in recent years in science education consists of adopting a context-based approach (Pilot & Bulte, 2006), to promote students' interest in science, providing coherence and necessary cohesion to the contents addressed in the curricula.

In this sense, its combination with the practice of inquiry, in which students adopt a positive attitude towards science, participating actively linked to the educational transposition of scientific research and more independent in the learning process. Therefore, it is associated with a change in the perspective of teaching, applying the context as a starting point for the development of scientific ideas, and not the other way around, as is usual in more traditional methodologies (Bennett et al., 2007; Lupión-Cobos et al., 2017).

However, this conceptual change requires the inclusion of new teaching strategies and approaches related to the development of both personal and professional skills, which allow students to acquire an adequate understanding of the Science, Technology and Society relationships (STS), which applies to everyday situations and contributes to their personal development and active integration in society, as scientifically and technologically literate citizens (Boerwinkel et al., 2017; European Commission, 2014).

In this educational framework, teachers not only require a solid knowledge of the content, but they also need to be involved in the design and practice of the teaching process, which is associated with numerous responsibilities (Slavit et al., 2016). From their guiding role, they are expected to help their students develop critical thinking, problem-solving, and decision-making or use ICT tools, thus enhancing responsible citizenship skills.

Thus, teachers' sense-making processes are involved in a social setting of teachers' understanding and perceptions of new aspects related to teaching innovative curricula compared to teaching conventional curricula (Spillane et al., 2002).

METHODOLOGY

Participants in this study were 40 pre-service science teachers (PSST) from the Chilean Physics Pedagogy Degree (25) and the Spanish Master's degree in Secondary Teacher Education (15). For data collection, we used the questionnaire developed by de Putter-Smits (2012), which consists of an extension of van Driel et al. (2005). The five-points Likert-type questionnaire (1: totally disagree; 2: disagree; 3: neither agree nor disagree; 4: agree, and 5: completely agree), was translated into Spanish from its English version, has a total of 54 questions (38 about science education in general, and another 16 specific to Physics and Chemistry), and includes three curricular emphasis: fundamental science (FS), science, technology and society (STS) and knowledge development in science (KDS). While FC considers that theoretical notions and scientific knowledge should be taught first, since they provide a basis for understanding the natural world and are necessary for students' future education, STS implies the relevant role of communication and decision-making in matters involving scientific issues. Finally, KDS, related to the nature of science, connects with the idea that students should learn how scientific knowledge develops in socio-cultural contexts, understanding science as a constant development system.

Table 1 classifies according to the three curricular emphases, the 38 items on science teaching in general and table 2 classifies according to the three curricular emphases, the 16 items specific to Physics and Chemistry.

Table 1. Classification of the 38 items about science education in general.

	Fundamental Science (FS, n=12)	Science, Technology and Society (STS, n=8)	Knowledge Development in Science (KDS, n=9)
Items	1, 6, 7, 13, 18, 21, 23, 29, 30, 32, 35, 37.	3, 5, 9, 15, 17, 20, 22, 25, 26, 28, 31, 34, 38.	4, 8, 11, 12, 14, 16, 19, 24, 27, 33, 36.

Table 2. Classification of the 16 items specifics for Physics and Chemistry.

	Fundamental Science (FS, n=5)	Science, Technology and Society (STS, n=0)	Knowledge Development in Science (KDS, n=3)
Items for Physics	40, 42, 43, 44, 46.	-----	39, 41, 45
Items for Chemistry	40, 42, 43, 44, 46.	-----	39, 41, 45

For both countries, we collected the data prior to implementing an inquiry and context-based teaching proposal, located at an equivalent learning moment (6th semester in Chile and 2nd quarter in Spain). Given that within the 54 initial questions de Putter-Smits (2012) identifies the items with the highest correlation, we calculated the frequency distribution, mean scores and standard deviation for the set of items associated with the different emphasis.

RESULTS

We present the main findings concerning each of the curricular emphasis and educational contexts. Regarding STS items (I1-I12) results, we observe a similarity in the preferences (figure 1). The value means for the Spanish PSST in this emphasis is 4.04, which is lower than the Chilean PSST (4.34), expressing a marked predilection for the use of Science-Technology and Society contexts for the last ones. Thus the Spanish students scored considerably lower in items I2, I10 and I11, related to the importance given to the discussion of current social topics in the science subject, to whether the exit qualifications should be based on an analysis of social situations where science plays an important part, or to the preference on the use of societal context to show what the importance of science is, respectively.

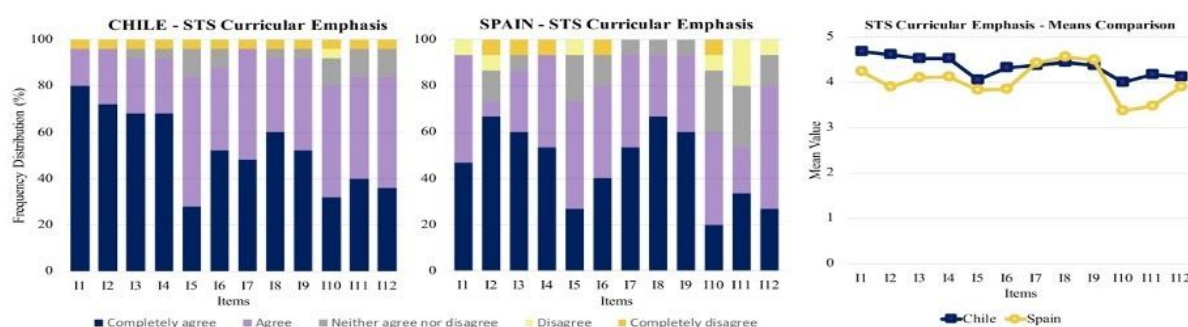


Figure 1. Frequency distribution (Chile and Spain) and means comparison for the STS curricular emphasis.

About the KDS curricular emphasis items (I13-I19/I20) (figure 2), although the total means value still differs a little (4.25 for Chile and 3.89 for Spain), the profile depicted by both Chilean and Spanish PSST is even closer. There are just two considerable differences concerning I13 (about the important task of science education to acquire insight into the socio-historic development of scientific knowledge) and I19 (about the relevance of treating the historical background of radioactivity). Hence, for both items, Spanish PSST scored lower than Chilean. Here we would also like to remark that the absence of Chilean data for I20 is due to the specificity of this item for Chemistry PSST, and therefore, only Spanish students scored it.

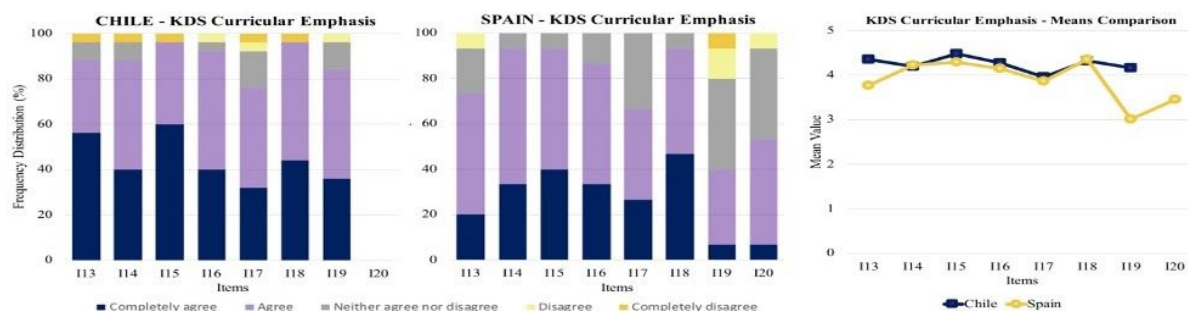


Figure 2. Frequency distribution (Chile and Spain) and means comparison for the KDS curricular emphasis.

Finally, although the results on the FS curricular emphasis items (I21-I28/I29) (figure 3) are practically identical for both countries, and so are the total mean values (2.85 for Chile and 2.87 for Spain). We want to highlight the scores on I24, related to whether students should acquire basic scientific skills before working on applications. For FS emphasis, this item obtained the

highest scores both in Chile and Spain, even though all the others did not score greater than 3.5. As it happens before, the absence of Chilean data for I28 is due to the specificity of this item for Chemistry PSST, and therefore, only Spanish students scored it.

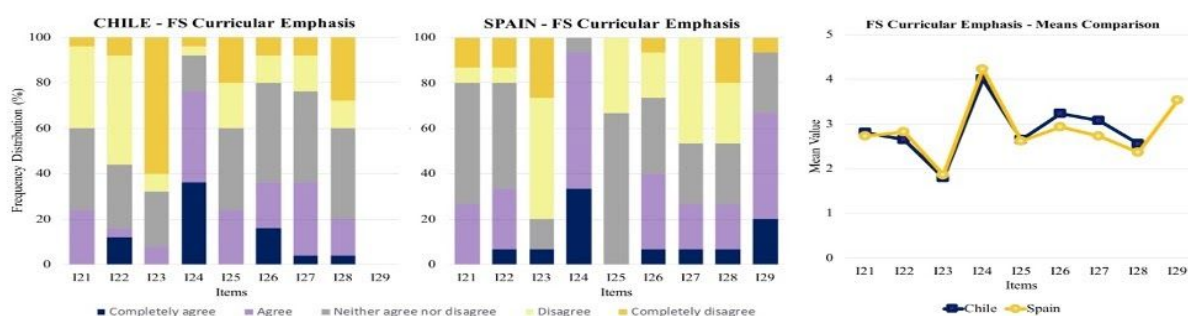


Figure 3. Frequency distribution (Chile and Spain) and means comparison for the FS curricular emphasis.

CONCLUSIONS

Since international studies usually highlight the disparities between educational systems, even more considering the differences when approaching inquiry and context-based science education, we gratefully have established a small-scale comparison about Chilean and Spanish PSST's curricular emphasis preferences. For both, we observe an apparent positive inclination towards the use of STS and KDS emphasis, a trend that, according to van Driel et al. (2005), would represent an approach to more active teaching strategies. This tendency is more marked for Chilean PSST, mainly due to the curricular structure and duration of the Physics Pedagogy degree and the Chemistry Pedagogy degree, as well as to the differences in the scientific background with respect to the Spanish ones. Although these finding may not be generalisable and apply to a small number of participants, the satisfying results obtained encourage us to continue promoting this type of didactic approaches, highlighting the relevance of teaching in context and providing tools for its proper implementation within the two countries.

ACKNOWLEDGMENTS

This study is part of the project PID2019-105765GA-I00 “Citizens with critical thinking: a challenge for teachers in science education”, funded by the Spanish National R&D Plan, through its 2019 research call. Dr García-Ruiz thanks the “Plan Propio” of the University of Málaga for the postdoctoral grant received. Project funded by the General Directorate of Research of the Universidad de Playa Ancha. Regular competition 2019, key CNE 10-2021

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