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## Prospective early childhood teachers' difficulties in analysing children's ideas about the natural and social environment

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This study deals with detecting the difficulties that prospective teachers encounter in recognising and analysing children's ideas in the domains of social studies and science. It qualitatively analyses the reports written by 94 third-year Early Childhood Education degree students, while they were taking courses on "Teaching the natural environment to age groups of 0 to 6 Years" and "Knowledge of the Social Environment." The results show that the titles prospective teachers use for their proposals titles do not arouse the children's interest, even when they are not being taken literally from the limited Spanish curriculum. Nevertheless, they demonstrate a great capacity for adapting to the children in terms of the language used in the instruments designed to detect the children's ideas. The greatest obstacle they find is in the analysis of the children's ideas, especially in the process of categorising the responses. Further work with prospective teachers is therefore necessary to provide them with experience of direct contact with children, and to accompany them in the detection and analysis of the children's ideas.

**Keywords:** children's ideas; curriculum; early childhood education; educational investigation; learning; prospective early childhood teachers; scientific field; social studies domain; teacher training; teaching

### Introduction

This article is based on the belief that, in their practicum, prospective early childhood teachers (PECTs) should explore the view that children have of their reality (Dayan & Ziv, 2012). The goal of this is to facilitate the children's emotional, physical, and social development by attending to their individual characteristics, based on such theories as that of Vygotsky (1978), who argues that teachers must adapt their teaching proposals to the child's zone of proximal development, or that of Piaget (1976), who stresses the importance of giving children the opportunity to build their own knowledge.

Detecting and analysing children's ideas are undoubtedly essential objectives in the training of prospective teachers at any educational level. Using children's own ideas in teaching aids the teacher's reflection upon his or her own knowledge on the content and the process of teaching and learning. It also facilitates the development of an educational intervention that is well suited to children's learning demand (Johnston, 2005; Larkin, 2012). We thus consider children's ideas or conceptions to be key elements in the learning process, since they constitute the starting point from which knowledge can be built.

For this reason, it is fundamental that teachers structure their work around their children's ideas, developing instruments that allow them to access those ideas and thus diagnose the starting situation. It is also important that teachers know how to analyse their children's ideas, so as to identify the difficulties and weaknesses that may become major obstacles to learning (Sickel, 2017).

In this paper, we focus on how prospective early childhood teachers diagnose and analyse the ideas of children between the ages of three and six. We think it is necessary for teacher educators to know what difficulties PECTs encounter when doing this, and how students value the educational implications of the process. Having this diagnosis allows teachers to adapt their teaching proposals to the student's zone of proximal development, giving students the opportunity to build their own knowledge. This could improve the quality of the learning-teaching process at the initial PECT training.

### Early Childhood Children's Ideas about the Content of Knowledge of the Social and Natural Environment

An educational approach that focuses on detecting and taking into account the children's ideas could be contextualised as part of so-called democratic and participatory early childhood education (Avgitidou, Pnevmatikos & Likomitrou, 2013; Dayan & Ziv, 2012). Here, the children are given a voice, their viewpoints are taken into account, and consensus is reached with them on many everyday educational issues (Horn, 2009).

The accepted constructivist perspective of learning and teaching is based on teachers identifying their children's ideas and conceptions (Kerr, Beggs & Murphy, 2006). These ideas take shape from the children's everyday experiences even before they begin formal education (Allen, 2014; Driver, Guesne & Tiberghien, 1985). Some of these initial ideas will be alternatives to scientifically accepted concepts, while others will be consistent with them. Detecting the children's ideas, in terms of what they think about a certain scientific concept, allows the teacher to adapt their teaching in the best possible way for their children. If children receive appropriate guidance, they can restructure their initial alternative ideas, and thus avoid them becoming entrenched in mental structures which will be more resistant to change later on. Kambouri (2016) differentiates between preconceptions and alternative ideas. The former (from birth to seven years) arise from the child's experiences, with no influence from the teaching of science, since this is sparse or even non-existent. The latter

(from 8 years onwards) are more firmly set, but are also influenced by repeated exposure to scientific teaching. Louisa, Veiga, Costa Pereira, and Maskill (1989) state that class activities that do not take into account the children's ideas increase the resistance to change of the alternative ideas that the children may have.

There is a deficit in research on early childhood science teaching. Despite there being fewer studies on the prior ideas of children in early childhood than on those of children at other educational levels (Kambouri, 2016), those studies still cover a great variety of topics related to the natural and social environment. There have also been reviews of studies on the literature on children's ideas in early childhood that are related to scientific concepts (Kerr et al., 2006).

#### Initial PECT Training and Science Education

Teachers tend to teach in the same way as they themselves were taught, so breaking this cycle requires good initial teacher training (Pringle, 2006). Working with real classroom experiences is essential to guide the student towards understanding and developing appropriate professional knowledge.

PECTs have been studied by several authors (Akerson, Buzzelli & Donnelly, 2010; Öztürk, 2016; Saçkes & Trundle, 2014). The influence of PECT training is crucial, because it is perhaps more stable than it is often assumed to be (Smith, 1997), and the importance of quality education for individuals working with young children is widely accepted in the field of Early Childhood Education (Early & Winton, 2001).

Timur (2012) studied the cognitive structures of PECT on such topics as "force and motion," and found many alternative ideas about them. He concluded with suggestions for the improvement of the initial training of these teachers, such as practical activities in which their ideas would enter into conflict. Kerr et al. (2006) compared prospective teachers' ideas on various scientific concepts with those of children between the ages of 4 and 11. Similarly to previous authors, they also found that, because prospective teachers do not have any training in science, they may have ideas that are similar to those of the children they teach for some concepts, such as "flower" or "animal." These authors recommend that initial training should not only aim to achieve better scientific knowledge of the material that will later be taught, but also to foster greater commitment to the children's ideas in the teachers' professional development, to value those ideas, and incorporate and relate them to the teaching and learning of science.

PECTs have been asked by different authors about various educational themes, such as the promotion of children's active participation and

decision-making, the role of the teacher, the way children learn, the reasons for schooling, the children's needs, child-teacher relationships, etc. (Avgitidou et al., 2013; Lin, Gorrell & Silvern, 2001). However, to the best of our knowledge, there has been no approach to PECTs' analysis of children's prior ideas about scientific topics. We have only found such studies at a different educational level, or in early childhood education, but with in-service teachers.

Kambouri (2016) analysed the data obtained from in-service early childhood teachers in relation to their beliefs and practices in the classroom related to their children's prior ideas. The results showed there to be a deficit in the time dedicated to identifying the children's ideas when the teachers planned their proposals, as well as a need to improve their ongoing training, because many of them had no previous scientific training before their education degree.

Mavuru and Ramnarain (2017) affirm the call for teacher education institutions to review their science teacher education programmes, with a view to incorporating and emphasising knowledge of learners' socio-cultural background as an important domain of teacher knowledge in their preparation. Demirbaş and Ertuğrul (2014) strongly recommended to preschool teachers that they organise activities that will enable them to identify their students' misconceptions (conducting interviews with them and analysing their answers to given questions). In order for them to be able to do so, preschool teachers ought to be provided with in-service training sessions.

In this context, we consider it to be of absolute importance in the initial training of early childhood education teachers for them to learn how to detect and analyse their children's ideas (Botha & Reddy, 2011), so that they "know how to," not just "know," and then are able to include constructivist and inquiry-based methods in their classes. This study was therefore aimed at determining (a) the instruments that the PECTs design, so as to identify what ideas their children hold about the natural and social environment; (b) how they analyse the results they obtain; and (c) the didactic implications and usefulness of the results they get for their educational planning.

#### Method

##### Participants and Context

The participants were 94 third-year Early Childhood Education degree students (Spain). Cruz-Guzmán, García-Carmona and Criado (2017) put forward these students' profiles. Most of them had a low preference for science. More than half had accessed the degree course via a study path that did not include science subjects, but instead through social sciences, a humanities pre-university baccalaureate, or modules of professional training

in education. Many had last studied science between the ages of 14 to 16, and had begun the degree course with an inadequate background in the subject.

They were organised into 21 groups of 4–5 students. They were all taking the two coordinated courses “*Teaching the natural environment to age groups of 0 to 6 Years*” and “*Knowledge of the Social Environment*.” The coordination of two of these subjects is justified on the basis of the confluence of the content that they cover. They both deal with developing professional competencies related to why to teach; the children’s ideas; what to teach; how to teach; and what, how, and when to evaluate. These aspects are developed through topics related to experimental sciences in the first subject, and to social sciences in the second.

This study was made possible by the intervention carried out in class in the section denominated “the children’s ideas.” In it, the prospective teachers acquired the knowledge necessary to design an instrument to be able to detect children’s prior ideas about a theme selected from the early childhood education curriculum. They applied it to a sample of six children of the same age, who were in the second cycle of early childhood education, analysing the ideas of the children they interviewed, and then preparing a report with open questions to be assessed in the two subjects.

#### Data Collection Instrument

As the instrument for the collection of data, the present study uses certain questions from the report prepared by the students (*Q1: State the theme chosen in the previous report to work on the children’s ideas, which will then serve as a basis for the development of the future project.; Q3: Explain the instrument designed to collect the children’s ideas, and what the purpose of each of the questions posed is; Q5.2.1: Treatment of the data obtained: System of categories created, low inference descriptors, and frequency of appearance, ...*). Similarly to that used by Cooper (2009), this instrument serves as a guide for the student teacher for the tasks and steps to follow in the process of determining their children’s learning demands. The last two questions (*Q5.2.4: Conclusions. Reflection on the interpretation of the data. Establish specific educational implications for the teaching proposal; and Q7: How do you value the work that you did in terms of your training as early childhood education teachers?*) aim to provoke reflection and self-analysis of the students’ learning. Other authors have used reflection and analysis scripts that were effective in the learning acquired by prospective teachers for the elementary levels of education (Rivero, Solís, Porlán, Azcárate & Martín del Pozo, 2017).

#### Data Analysis Instrument

In order to analyse the quality of the papers presented by the PECTs, a qualitative method of analysis was followed. A first version of the rubric was designed, on the one hand, supported by the work of Porlán, Martín del Pozo, Rivero, Harres, Azcárate and Pizzato (2011) and Solís Ramírez, Porlán, Martín del Pozo and Siqueira Harres (2016); and, on the other, establishing new categories that emerged from the students’ responses. This first version was progressively improved through a process of finding consensus with the categorisation of the most conflicting responses. For example, in the category 3.1., Level 2, the phrase “*Does not specify the meaning of the maximum category*” was changed to “*Does not specify the meaning of all or some of the categories*” in order to include responses similar to the example shown below in the Results section within that category (3.1, Level 2). The final version is shown in Appendix A.

The responses to the reports were grouped into the different categories created, triangulating the data, and with the three authors checking the coding, first individually and then in pairs for the analysis of the three batches of reports that were established. Agreement was reached on the questions where discrepancy was found (< 5% of the cases), so that 100% agreement was finally reached on the doubtful responses.

#### Results

We shall present the below results in accordance with the different dimensions analysed.

Regarding the themes (Figure 1), it is noticeable that the prospective teachers tend to choose titles which, despite not being taken literally from the curriculum, still do not arouse the children’s interest. Thus, more than 40% of the reports analysed are at Level 2, with such titles as: “*Discoveries and inventions*,” “*Traditions*.” Only 19% are at Level 3, where the title given to the themes to study is considered to be motivating and concrete. Examples are: “*The computer*,” “*What do you think happens in the stomach when we eat?*” A considerable 38% are at Level 1 of formulation, using titles for their proposals that reproduce those of the curriculum, with no attempt to connect with the children (e.g., “*Recycling*,” “*Difference between living beings and inert beings*”).

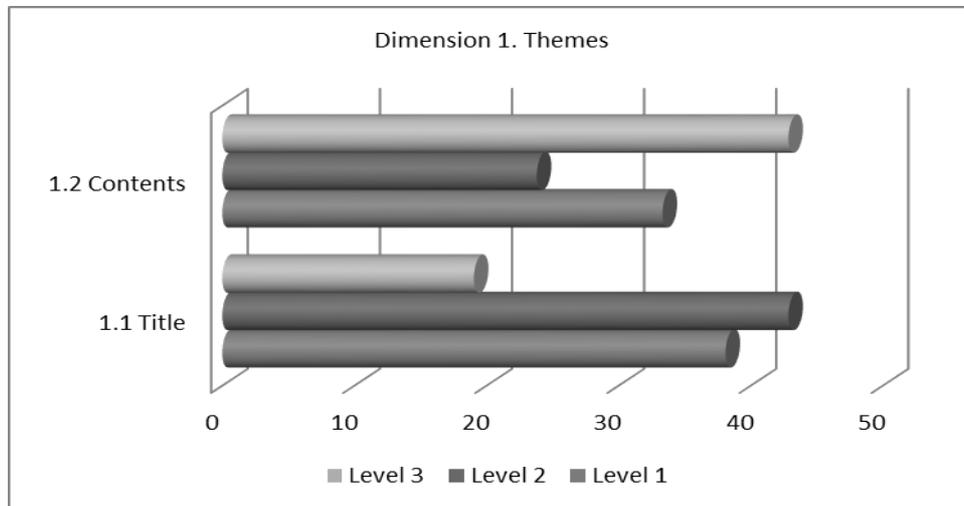
In terms of the content dealt with, about 60% of the reports were about traditional school content, formulated in a way that does not connect with the child’s everyday reality. In some cases, they are taken literally from the curriculum (33.3% Level 1), such as “*Family*,” “*The seasons*.” Others, while not literal, are still not content that is close to the children’s everyday experience (23.8% Level 2), such is the case for “*Gender equality*.” Nevertheless, more than 40% of the reports were

about content that, although related to the curriculum, is closer to the children’s everyday life, and therefore appears to be more motivating (Level 3), such as “Cinema,” “Aquatic animals,” and “Traffic fines.”

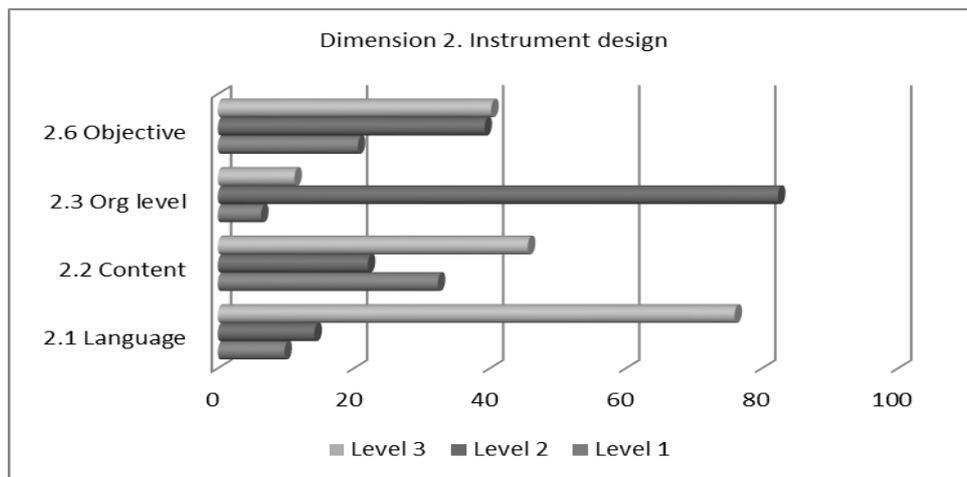
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“Aquatic animals,” and “Traffic fines.”

When focusing on the design of the instrument (Figure 2), we found that, out of a total of 204 questions put forward by the prospective teachers, 76% use language appropriate to the children’s age (Level 3) (e.g. “How do we know summer has arrived?”, “Do you need money to go to the cinema?”, “Who do you pay?”). In addition, the content of 45.6% of the questions seems to be related to fuller meanings and broad, connected concepts (Level 3) (e.g., “Why do glass bottles go in the green container?”). Nevertheless, a significant number of the questions were found to be related less to concepts, but rather to specific data (names, dates, etc.) or standard definitions (32.3% Level 1) (e.g., “Do you know the date of each national or local holiday?”, “How long does a season last?”).



**Figure 1** Frequency of the levels of formulation for the categories 1.1 and 1.2 by report. There is a total of 21 reports.



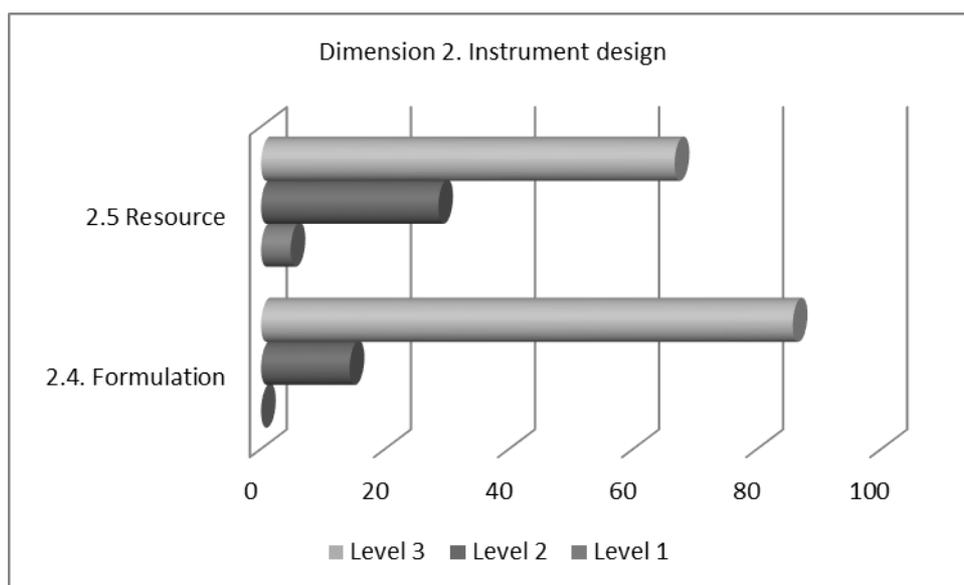
**Figure 2** Frequency of the levels of formulation for the categories 2.1, 2.2, 2.3, and 2.6 by question. There is a total of 204 questions.

As regards the level of organisation of the reality to which the questions refer, there is a clear predominance of questions that refer to the mesocosm (82.4%), whether or not directly perceptible for the children (Level 2) (“*What happens when we swallow some food that is bad?*” “*How do you know summer has arrived?*”). This may be due to the students’ belief that children at the early childhood stage are unable to relate the mesocosm to the closer levels of the macrocosm and the microcosm (Level 3).

Finally, in 40.2% of the cases, the formulation of the objectives of the inquiry represented by the questions is clear and concordant with the issues proposed (Level 3) (e.g., Question: “*Can you learn with a mobile phone?*” Objective: “*To see if the child knows the educational uses that a mobile phone can have.*”). Nonetheless, with a very similar percentage, the objective either repeats the question affirmatively or does not specify the desired school content (39.2% Level 2) (e.g. Question: “*Do you know what recycling is? What is it for?*” Objective: “*To see if the child understands the concept of*

*recycling as well as its usefulness.*”). There are many occasions when the objectives do not correspond to the questions (20.6% Level 1) (e.g., “*How long does the stomach take to digest food?*” Objective: “*To see whether they relate the resting time after having eaten a meal with the actual time it takes the stomach to digest it*”).

The type of questions asked and the communicative resources (photographs, drawings, diagrams, etc.) used in the designs of the instruments (Figure 3) were other elements studied within Dimension 2. Accordingly, the instruments designed by the 85.7% of the prospective teachers use predominantly open questions (Level 3, category 2.4), typically combining a reasonable number of issues with other resources such as drawings, diagrammes, etc. (66.7% Level 3, category 2.5). The fact that the levels with greater complexity are those that appear more often could be due to the ease and creativity that the students show when designing suitable materials for early childhood children.

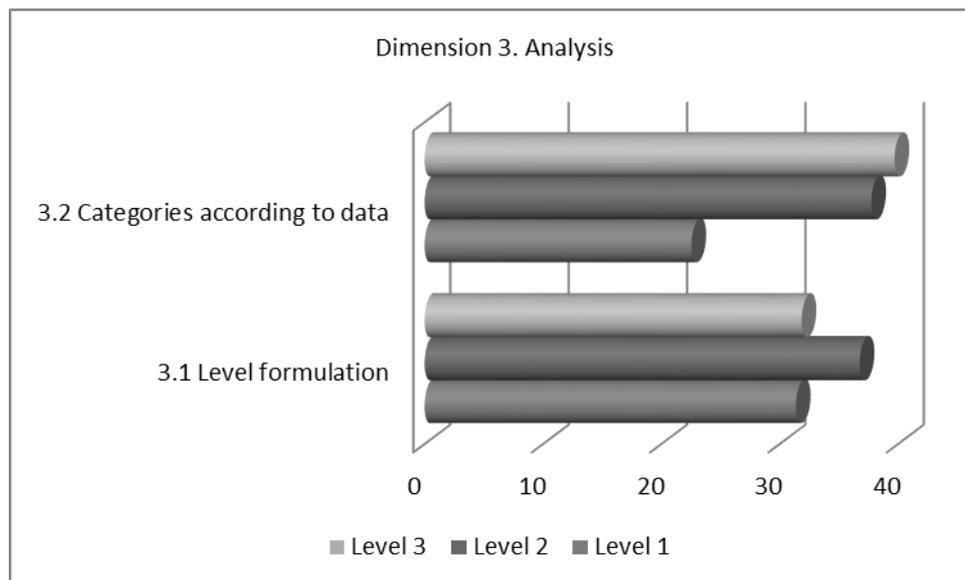


**Figure 3** Frequency of the levels of formulation for the categories 2.4 and 2.5 by report. A total of 21 reports.

The third dimension studied refers to the quality of the PECTs’ analysis of the children’s ideas (Figure 4). With regard to the levels of formulation for each concept (category 3.1), the results show the difficulty the PECTs have when carrying out the process. Although 31.9% of the questions analysed are able to formulate levels of complexity following clear criteria (Level 3) by using the responses the children give, in 36.8% of those questions, formulated levels are not increasing in complexity or they do not specify the

knowledge for each category (Level 2). The 31.3% of the questions are analysed establishing closed or open levels, but without any clear criteria of complexity (Level 1). Below is one example of the categorisations made by the students:

Example of Level 2: In response to the question “*Is recycling good or bad? Why?*,” the levels determined were: i. Do not answer. ii. They respond but do not give reasons for their response. iii. They respond providing reasons to support their response.



**Figure 4** Frequency of the levels of formulation for the categories 3.1 and 3.2 by question. A total of 204 questions.

Similarly, although 39.7% of the questions analysed established categories that make sense according to the data obtained (Level 3, category 3.2), in a major proportion of them (37.8%) not all of the categories created are related to or make sense according to the responses or the data obtained (Level 2). In 22.5% of the questions, the categories established do not really match the data (Level 1).

The final dimension analysed concerns the educational value of the work carried out. In relation to category 4.1, the PECTs seldom (23.8%) declare that they will take into account the demand for learning that was investigated in their educational proposal design (Level 3, Example 1), although in 38.1% of the reports it is possible to sense an educational implication in their conclusions (Level 2, Example 2).

Ex. 1. Bearing in mind the previous data on the children's prior ideas, and thus about the knowledge they have of recycling, this was used as the basis for the development of a project about this theme. The prior ideas obtained after interviewing the children are going to be taken into account in developing a series of activities for our project "Recycling" that are based on the different levels which they have attained. (Report Group 12. Level 3)

Ex. 2. The completion of this study can be of help to us in the future as we have learned to analyse the children's prior ideas and from this, we shall be able to teach the chosen topic taking into account their previous knowledge. (Report Group 7. Level 2)

More positively, in regard to category 4.2, in more than 60% of the reports, the PECTs consider the work they did to be useful and applicable for their future as teachers (Level 3), and fewer than 30% consider it to be useful but too complicated to

implement, or do not openly declare its transferability (Level 2). Below, we present two fragments extracted from the reports in which the students give their opinions regarding the transfer of the work they carried out:

We believe this is a good way of working with the children's prior ideas, and that it could be of use to us as teachers in the future, as well as now as students (Report Group 5. Level 3).

We consider it to be appropriate and original to know what knowledge our young children have before going deeper into a particular topic and to take advantage of the great imagination and the many great responses they can provide us with. However, we note that the process of collecting data through the tables and matrix which allows us to analyse the children's ideas is quite a complicated process and it takes a long time to see the levels the children have reached, therefore it would be difficult to implement in a class. (Report Group 15. Level 2)

### Discussion

As argued for throughout this paper, it is fundamental that teachers structure their work around their children's ideas as their action is required to help them overcome their difficulties (Sickel, 2017). In view of this, we establish what difficulties PECTs find when diagnosing and analysing the ideas of children between three and six years old, and how they value the educational implications of the process. This is important for teacher educators, who are able to make use of this information to adapt their teaching proposals. It could improve the quality of the teacher training, as is stated by several authors (Early & Winton, 2001; Mavuru & Ramnarain, 2017; Timur, 2012).

This study has allowed us to verify that prospective teachers have difficulty in selecting

themes that go beyond what is set out in the curriculum, and are more directly linked to children's everyday realities. They remain anchored in traditional curricular content, and are unable to break away and propose topics that may be more attractive to the children. We find that a certain reluctance to break with traditional teaching exists, coinciding with the idea defended by Pringle (2006) that teachers tend to teach in the same way they themselves were taught. It is therefore essential to break away from this model in initial teacher training, and provide our students with the skills and strategies that can lead them to create their own teaching model.

With respect to the design of the instrument to detect children's ideas, the prospective teachers show a great capacity to adapt to the children's language, and to make use of different resources to facilitate their children's contact with and understanding of the topics. In accordance with Solís Ramírez et al. (2016), in this way, they surpass the so-called level of academic culture to that of the culture of age, using a language that is closer and more approachable for early childhood children. This aspect is particularly favourable because it demonstrates the PECTs' ability to gain understanding from their children and to be capable of designing resources that are attractive to them.

It is also noticeable that the questions the PECT put to the children relate mainly to the mesocosm. This may be linked, on the one hand, to the difficulty they often have in understanding scientific content (Cruz-Guzmán et al., 2017; Timur, 2012) and, on the other, to the consideration that some content cannot be dealt with in early childhood education, as the children at this stage are not prepared for it (Kambouri, 2016). Initial teacher training is once more the key to overcoming these obstacles. Prospective teachers must improve their scientific knowledge because, unless they master the subject they have to teach, they are not going to be able to teach it in an innovative way. We therefore consider it important to give greater weight to science subjects in initial teacher training so that they can compensate for the lack of scientific background with which they begin university.

In order to achieve this, as teacher educators, we propose having continuous feedback with PECTs in every scientific explanation they design for their future pupils. It is sometimes the case that they do not recognise their mistakes if we just give them the marks without that valuable information. Experimental activities, model simulations, videos, interactive books, augmented reality, etc. should be implemented so as to ensure meaningful learning. In addition, it is important to clearly set out the facts, namely that: i) a deeper knowledge of the content is necessary to teach it properly; and ii) nowadays it is easier to improve our scientific

knowledge, not only with formal education, but we can also access scientific information more easily than a few decades ago. If we are able to awaken these needs and motivations, we can without a doubt improve the quality of the teacher training.

In our study, the prospective teachers found it very hard to analyse children's ideas. The difficulty they had in categorising the responses fundamentally stands out, with a tendency to create closed categories that they generally link to answers that are "right" or "wrong." This may again be related to the dominance of a traditional teaching model in which there are no alternative responses, closed and pre-defined concepts pre-dominate, and "misconceptions" are not seen as ideas that can be helped to evolve during learning. The PECTs' lack of mastery of the content (Kerr et al., 2006) makes it particularly difficult for them to determine categories and levels of complexity in the children's responses.

If prospective teachers encounter these obstacles at this stage of their training, in the future it will be difficult for them to take their children's ideas into account when planning their teaching, because if they are unable to organise the responses they get from the children and determine the different levels or stages of knowledge these represent, then they will not be able to offer the children the means to advance to higher levels. In this regard, we consider it essential to implement a process of feedback with the prospective teachers during this type of practical work that they do on their courses. Once they have prepared a system of categories and begin to analyse their data, by reflecting with them we may be able to provide them with instruments which they can use to correct their mistakes, i.e., give them advice on the scientific content involved, on classification techniques, on restructuring the system they have created, and on using low-inference descriptors. In this way, we would be helping them to overcome the obstacles they encounter and guiding them in their real and effective consideration of these ideas in planning their future educational proposal.

In addition to everything mentioned above, it should be noted that, at the theoretical level, the prospective teachers seem to be clear that the work they carried out ought to have a direct impact on the design of the educational proposal they make. This, however, is restricted to the declarative plane, reflecting the dominance of theoretical didactic knowledge. We therefore consider it necessary to work with the prospective teachers in direct contact with early childhood children so that our students can learn about the children's actual ideas and ways of thinking, and try to connect their aforementioned didactic knowledge with the practical classroom reality. Maybe in this way, the abandonment of constructivist methods that many in-service teachers present could be avoided.

Kambouri (2016) notes the lack of time that practicing teachers dedicate to considering their children's ideas, and hence the low educational implication of those ideas.

Finally, it is notable that the prospective teachers value very positively the work they carried out, considering it to be useful and applicable for their professional practice. They particularly value the learning they derived from direct contact with the children and their ideas, the recognition of their own capacity to listen, and the satisfaction they felt from taking on the role of teacher during the development of the work. In this sense, the present results coincide with those of Pringle (2006) with regard to the positive assessment of the approach to the children's conceptions, but differ in the sense that the prospective primary teachers of her study found that activities designed to determine children's ideas were unrealistic due to the lack of time available.

Initial teacher training must therefore move forwards by offering prospective teachers the opportunity to gain increased depth in their own scientific knowledge and by facilitating their direct contact with the reality of the early childhood classroom.

#### Authors' Contributions

The three authors provided data, because they teach the above-mentioned subjects. Then, the three authors checked the coding, first individually and then in pairs for the analysis of the three batches of reports that were established. They wrote the manuscript, in this way: FRM Introduction and Methodology, MCG Abstract and Results and MPG Results and Discussion. All authors reviewed the final manuscript.

#### Notes

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- ii. DATES: Received: 31 October 2017; Revised: 20 June 2018; Accepted: 19 February 2019; Published: 31 May 2019.

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**Appendix A: Rubric for the Analysis of the PECTs' Reports**

Dimensions	Categories	Levels of complexity		
		Initial level (L1)	Possible level (L2)	Reference level (L3)
1. Themes	1.1 Title	Literal appearance in the curriculum or no title	Not literal from the curriculum, but still does not motivate the children's interest	Very motivating and concrete
	1.2 Content	Conventional. Literal appearance of the theme in the Decree (Education Legislation)	Not literal from the curriculum, but still does not motivate the children's interest	Related to the curriculum but linked to content closer to the children
2. Design of instrument to detect the children's ideas (adapted from Porlán et al., 2011; Solís Ramírez et al., 2016)	2.1 Language used	Not appropriate for the age of the children	Some language appropriate for the age of the children, and some not	Appropriate for the age of the children (accessible, close, everyday, etc.)
	2.2 Content of the question	The content relates to data, names, standard definitions, etc.	The content relates to data, names, standard definitions, etc. but also with meanings	The content is related to more comprehensive meanings and broad concepts
	2.3 Organization level of the reality to which the question refers (?)	Macrocosm, microcosm, and what is not commonly noticeable	Mesocosm, whether or not directly perceptible by the children	The question relates the mesocosm with the closer levels of the macrocosm and microcosm
	2.4 Formulation of the question	Predominantly closed	Open and closed questions	Predominantly open
	2.5 Communicative resource	Only text and many questions (more than 15)	Only text and less than 15 questions, or drawings, characters, etc. and more than 15 questions	Texts, drawings, sketches, characters, etc., with a reasonable number of questions
	2.6 Purpose of the question	The formulation of the objective is not suited to the question	Repeats the question affirmatively. Does not specify the school content desired	The question has a language that is clear and related to the inquiry objective
3. Analysis of the children's ideas about the selected theme	3.1 Formulation of the levels of complexity	Closed levels (yes or no, right or wrong, etc.) or open but formulated without clear complexity criteria	The levels are not always ascending in complexity. Does not specify the meaning of some or all categories	Complexity levels formulated following clear criteria
	3.2 Category system - data relationship	Little relationship between categories and data. The categories do not match the data.	Relates some categories and the data analysed	The categories created make sense according to the data
4. Didactic usefulness	4.1 Educational implication of their analysis	Does not specify at any time what impact there is knowing the children's obstacles when designing the learning proposal	An educational implication of their findings is implied	For the design of their educational proposal they state that they would take into account the learning demand that they investigated
	4.2 Transfer	Is not useful or is not detected	Is useful but complex to carry out; its usefulness is implied	Useful and manageable