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Infant, primary and secondary teachers' conceptions of learning and teaching and their relation to educational variables

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Abstract
It has been established that teachers' conceptions of learning and teaching influence their instructional practices. Several authors maintain that these conceptions are based on certain implicit assumptions that give rise to different theories. Our view is that people have multiple alternative theories which they use depending on the context and the demands of the task. The main purpose of this study was to find out whether such representational plurality exists in teachers' conceptions and, if it does, whether this plurality can lead to the identification of different representational profiles. We were also interested in studying some of the teaching practice variables that might influence the nature of the representational profiles. Our results, obtained by means of a dilemma questionnaire answered by 1074 teachers from different educational levels and knowledge domains and with different ranges of experience, are consistent with the assumption of representational plurality, as they show that the same teacher may hold different conceptions that set up a conceptions profile. Moreover, the combination of the responses in each profile is not random. Teachers at the more advanced levels and with more teaching experience manifested more traditional conceptions. Furthermore, some knowledge domains were associated with certain conception profiles.

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Concepciones de enseñanza y aprendizaje de profesores de infantil, primaria y secundaria y la relación con las variables educativas

Resumen
Se ha comprobado que las concepciones de aprendizaje y enseñanza de los profesores influyen en su práctica docente. Varios autores sostienen que estas concepciones se basan en ciertos supuestos implícitos que dan lugar a distintas teorías. Nuestra visión es que la gente dispone de multitud de teorías alternativas que pueden utilizar en función del contexto y las exigencias de la tarea. El objetivo principal del presente estudio es averiguar si esta pluralidad representativa existe en las concepciones de los profesores y, de ser así, si puede conducir a la identificación de distintos perfiles representacionales. Nos interesamos, asimismo, por el estudio de algunas de las variables de la práctica docente que pudieran influir en la naturaleza de dichos perfiles. Nuestros resultados —obtenidos mediante un cuestionario de dilemas realizado por 1074 profesores de distintos niveles educativos, ámbitos de conocimiento y experiencia— coinciden con la suposición de la pluralidad representativa, pues revelan que el mismo profesor podría forjar concepciones distintas que conforman un perfil de concepciones. Además, la combinación de respuestas en cada perfil no es aleatoria. Los profesores de niveles más altos y los más experimentados manifestaron unas concepciones más tradicionales. Igualmente, algunos campos de conocimiento se asociaron a perfiles de concepciones concretos.

The educational research accumulated in the past few decades has convincingly shown that if we want students to achieve better learning, teaching practices must adopt more complex formats in which teaching is not confined to the more or less elaborate transmission of established knowledge, but takes the students' knowledge and capabilities into account in order to modify them, foster cooperation through more dialogical learning spaces and promote metacognition and self-regulation by students of their own learning. With their manifold variants and theoretical interpretations, these fundamental assumptions of the so-called constructivist approach have most undoubtedly had a notable influence on the educational policies implemented in different countries in order to bring about the changes our societies need.

However, the studies conducted on the educational practices and the teaching and learning methods continue to show a more or less general predominance of more traditional teaching practices, based essentially on the transmission of knowledge to pupils by the teacher. Thus, following an examination of teaching practices in 23 countries, the Teaching and Learning International Survey (OECD, 2009, p. 88) noted that "in the classroom, teachers in all countries put greater emphasis on ensuring that learning is well structured than on student-oriented activities which give them more autonomy. Both of these teaching practices are emphasized over enhanced learning activities such as project work. This pattern is true in every country". Similar results have been found by research looking more carefully at the teaching and learning practices in very different domains, such as mathematics (e.g., Bar Tikva, 2010), science (García & Mateos, 2013; Porlán & Martín del Pozo, 2004), reading and writing (Mateos, Villalón, De Dios, & Martín, 2007; Mateos, Solé, Martín, Cuevas, Miras, & Castells, 2014) and even music learning and teaching (López-Íñiguez, Pozo, & De Dios, 2014; Marín, Scheuer, & Pérez Echeverría, 2013).

Even though there are certainly many other causes that help explain the gap between the theoretical models upheld in educational research and the actual teaching and learning practices in the classroom, one of the most important factors hindering the passage from theory to practice is that those constructivist assumptions briefly sketched above often come into conflict with the teachers' own beliefs and assumptions about what their job should be, and which is the best way to foster learning in their students. As a consequence, teachers have deeply rooted —often more implicit than explicit conceptions— from their own experiences, first as students and then as teachers, rather than their theoretical training, about what society expects from them and the best way to achieve these goals. Several studies have shown the influence of teachers' conceptions on their instructional practices (e.g., Fernández, Tuset, Pérez, & García, 2013; Olafson & Schraw, 2006; Trumbull, Scarano, & Bonney, 2006) and the relationships between these same conceptions and students' learning beliefs and practices (Bar Tikva, 2010; López-*Íñiguez* & Pozo, 2014; Mateos & Solé, 2012) but also the differences between teachers' and students' beliefs (Könings, Seidel, Brand-Gruwel, & van Merriënboer, 2014). Different studies have shown also that teachers' conceptions are very often not only far from the constructivism which dominates teaching and learning theory (e.g., Bautista, Pérez Echeverría, & Pozo, 2010; Rivero, Azcárate, Porlán, Martín del Pozo, & Harres, 2011), but are even incompatible with some of its assumptions (Case, 1996; López-Íñiguez, et al., 2014; Pozo, Scheuer, Mateos, Pérez Echeverría, Martín del Pozo, Mateos, Martín & De la Cruz, 2006).

Thus, we assume that in order to change educational practices it is necessary to change teachers' conceptions and beliefs about how to foster learning, which means we need to investigate in detail what these conceptions are, how they are organized and what variables affect them. Concretely, in

this study we set out to explore the main conceptions held by teachers about teaching and learning, as well as what the effect of some variables (stage, experience and knowledge domain) on these conceptions.

Teaching conceptions as implicit theories

In the past few decades, researchers have shown a growing interest in getting to know the conceptions about learning and teaching not only of teachers, but also of students. These studies have been carried out using widely differing theoretical and methodological approaches (Pérez Echeverría, Mateos, Scheuer, & Martín, 2006a). In our theoretical approach, we assume that these conceptions should be viewed as implicit theories about the nature of knowledge and the psychological processes enabling knowledge to be generated and transformed. Teachers and students would acquire, in the framework of their *intuitive psychology* (e.g., Strauss & Ziv, 2012), implicit beliefs about how they learn each of these types of knowledge and how it could be better fostered, which are sometimes in contradiction with the scientific models generated by educational research in the last few decades. Therefore, to overcome these learning and teaching conceptions will require a process of conceptual change (Scheuer & Pozo, 2006).

In assuming that these conceptions are the product of implicit theories we hold that, rather than constituting isolated beliefs or ideas, they are organized in accordance with certain implicit principles. What are these assumptions that organize ideas in the form of implicit beliefs? From conceptual change models (e.g., Vosniadou, 2008, 2013) we identify three types of principles or assumptions differentiating students' and teachers' implicit theories from the scientific theories held by researchers: *epistemological* principles (about the nature of knowledge and the mechanisms through which knowledge is acquired and changed), *ontological* principles (concerning the type of entities on the basis of which we interpret this knowledge, its acquisition and its transmission) and *conceptual* principles (the forms of organization or conceptual structures our implicit theories end up adopting).

Based on these dimensions we can identify different *implicit theories* about learning that synthesize or condense these different assumptions and, in turn, restrict the specific representations in the different domains of teaching practice. In particular (table 1) we propose three implicit theories: direct, interpretative and constructive (Bautista, et al., 2010; López-Íñiguez, et al., 2014; Pozo et al., 2006; Scheuer, De la Cruz, Pozo, & Neira, 2006a).

The *direct* theory views learning as a faithful copy of reality or the model presented. In its most elementary version, this theory conceives learning as a copy of results or behaviors, without the mediation or intervention of any psychological process being necessary. This type of theory is close to a certain *naïve behaviorism* which sees learning as an associative or merely reproductive process through which learning turns out to be a mirror of the world facing the learner. From this standpoint, faithful reproduction of the contents taught is considered to be the best proof that students have actually learned. In studies carried out with children aged four and five years old, it has been found that this theory is the first one children form when they represent to themselves their own activity of learning to draw or write (Scheuer et al., 2006a). Although these conceptions undergo a process whereby they become increasingly complex, the findings of various studies suggest, as mentioned at the beginning, that in more complex versions, and perhaps

Table 1 Assumptions of the different theories about learning and instruction

	Directory Theory	Interpretative Theory	Constructive Theory
Epistemological	*Ingenuous realism*	*Interpretative realism*	*Constructivism*
	Knowledge reflects reality in an evident and objective way	Knowledge reflects in an evident and objective way. However, the subject plays an important and active role in the knowing process	Knowledge is a construction by the subject, who builds their own personal models (which can be more or less appropriate) to interpret reality
Ontological	*States and products*	*Actions and processes*	*Complex systems*
	Learning is conceived of in terms of states or static products (i.e., academic contents)	Learning is conceived of in terms of actions and processes (i.e., cognitive, motivational, etc.), which are externally managed	Learning is conceived of in terms of complex systems (i.e., self-regulation processes) internally managed by the learner in order to build and develop abilities or strategies
Conceptual	*Simple causality*	*Lineal multiple causality*	*Interactive causality*
	A direct and linear relation is established between learning conditions and learning outcomes	A direct and linear relation is established between learning conditions, learning processes, and learning outcomes	A complex and interactive relation is established between learning conditions, learning processes and learning outcomes

Adapted from Pérez Echeverría et al., 2001; Bautista, Pérez Echeverría, & Pozo, 2010.

in synthesis with other theories, this is a conception that persists in many older pupils and even in teachers (e.g., Bautista, et al., 2010; Bar Tikva, 2010; OECD, 2009).

The *interpretative* theory shares —along with the realist conception— the epistemological assumption that the fundamental object of learning is achieving the most exact copies of reality possible, but differs from it in that it conceives of learning as the result of the subject's personal activity which, in turn, requires a number of mediating processes. In accordance with this theory, the goal of learning is to imitate reality, but this is almost never possible to do exactly, as it requires the learner to set in motion complex mediating processes (attention, memory, intelligence, motivation, etc.) which make it very difficult, if not impossible, to achieve exact copies in many domains. In this case, learning is conceived of as a *process* requiring mental activity on the part of the learner, but the ultimate goal of learning is still to interiorize, as accurately as possible, the cultural products that constitute the essential contents of school activity. Where as the previous theory bears a certain similarity to behaviorism, this theory is closer to information-processing models. In one of the earliest studies in this field, Strauss and Shilony (1994) found that this stance was predominant among secondary school teachers, a finding that has been corroborated by more recent studies (Pérez Echeverría, Pozo, Pecharromán, Cervi, & Martínez, 2006b).

The assumption regarding learner's cognitive activity is shared, in turn, by the *constructive*[1] theory, which admits the existence of multiple types of knowledge, as it breaks the correspondence between acquired knowledge and reality. For such construction to take place the psychological processes must be oriented more towards regulating the subject's cognitive function than to mere appropriation of previously established knowledge. On this view —which is close to the constructivist approaches that predominate in their multiple variants in today's educational research— the goal of learning is not so much interpreting an already existing reality (the knowledge that is to be learned) as constructing a person who can metacognitively manage their own learning through their knowledge and competences, thereby achieving this object of learning. Our previous studies have shown that this theory, which is dominant in both research and teacher training today, instead of being implicit, like the conceptions discussed above, is acquired rather explicitly in formal instruction or teacher training contexts. However, as already noted above, in spite of this explicit instruction, these constructive conceptions seem to have a limited presence, not only among students, but even among teachers (Bautista, et al., 2010; Pérez Echeverría et al., 2006b).

Previous research has systematically shown that instead of a single theory for all domains and situations, people always have multiple alternative representations (Bautista, et al., 2010; Olafson & Schraw, 2006). However, this *representational plurality* does not necessarily imply that these diverse representations constitute a disorderly and inconsistent mixture, but that different *representational profiles* can be identified (Bautista, et al., 2010; López-Íñiguez, et al., 2014) involving the integration of different implicit theories. Thus, one of the aims of this study was to find out whether such representational plurality exists in teachers' conceptions and, if it does, whether this plurality can lead to the identification of different representational profiles or patterns. This would provide a more detailed understanding of how transition occurs from these simpler implicit theories to constructivist conceptions.

However, in addition to ascertaining the theories which predominate in teaching conceptions and how they are organized into profiles, we think it is also important to study certain teacher and educational context variables that may influence these conceptions. Most of the research in this field, which by its very nature is more descriptive, is based on studies of relatively small samples. In our case, we set out, basing ourselves on the three theories outlined above and the representational profiles arising out of them, to investigate the influence of different variables on teachers' conceptions of teaching and learning using a very large sample.

Relation between teachers' conceptions and teacher variables

In so far as teachers' conceptions are influenced, among other things, by their training and certain features of their practice, we would expect to find some relation between some of these variables and type of conception. Of these factors, the educational level at which teachers teach, their teaching experience and the subject area they teach are especially important. Several previous studies have looked at the role played by one or more of these three factors in shaping different types of teacher conceptions.

Studies focusing exclusively on one educational stage are more common than those comparing teachers' beliefs at different levels. The two studies that have made such comparisons (Fives & Buehl, 2010; Rubie-Davies, Flint, & McDonald, 2012) found that elementary and primary school teachers displayed stronger efficacy beliefs with regard to classroom management and student engagement than intermediate, middle and high teachers. The results of previous research with teachers in Spain point in the same direction (Martín, Mateos, Martínez, Cervi, Pecharromán, & Villalón, 2006; Pérez Echeverría et al., 2006b): primary teachers hold more sophisticated learning and teaching conceptions than secondary teachers.

However, many more studies have concentrated on the effect of teaching experience on teachers' conceptions. At any rate, the results of the studies are inconclusive. In some cases, no clear differences were found as a function of experience (Porlán & Martín del Pozo, 2004; Norton, Richardson, Hartley, Newstead, & Mayes, 2005). Contrariwise, in other cases more experienced teachers displayed more complex conceptions with regard to different teaching dimensions (Fives & Buehl, 2010; Prosser, Ramsden, Trigwell, & Martin, 2003; Rubie-Davies, et al., 2012). Lastly, some studies have obtained different results, with more experienced teachers holding more traditional conceptions than less experienced teachers (Bautista, et al., 2010; Castejón & Martínez, 2001; Tsai, 2002). It seems, therefore, that although the classical studies of experts and novices have tended to show that in almost all contexts expert professionals have more advanced and more sophisticated conceptions, models and practices than novices, in the case of teachers there is little evidence to support this assumption.

Since all these studies employed cross-sectional designs, one of the factors that might explain these discrepant findings might lie in the fact that different levels of experience correlate with belonging to different generations that have undergone different initial teacher training. The study by Alger (2009) is interesting in this connection. Using a retrospective approach, the latter found that more experienced teachers reported more traditional conceptions about teaching at the beginning of their careers than at present, whereas younger teachers held more complex conceptions from the start. Moreover, as most of the studies did not use representative random samples, the results may have been influenced by the fact that the teachers in question were operating in different practice contexts.

The relation between knowledge domain and conceptions has been the object of various studies also with controversial results. Some studies seem to point to domain specific beliefs (Buehl & Alexander, 2005; García & Mateos, 2013; Karimi, 2014; Señoriño, Vilanova, García, Natal, & Lynch, 2013), whereas others assume that these conceptions are essentially the same in all domains (Schommer-Aikins, Duell, & Barker, 2002). In studies of the epistemological beliefs and learning and teaching beliefs of teachers of different disciplines, Pecharromán and Pozo (2008) found that secondary school social sciences teachers manifested more constructivist conceptions than ethics and natural sciences teachers. Similarly, García and Vilanova (2010) found that university lecturers in different scientific disciplines hold different epistemological beliefs. Of special interest for our study is the finding by Norton et al. (2005) which, compared with arts and social sciences teachers, science teachers conceive teaching more as knowledge transfer than a learning facilitation process.

A previous study by our team (Martín, Pozo, Cervi, Pecharromán, Mateos, Pérez Echeverría, & Martínez, 2005) looked at the conceptions of education professionals who were not specialists in any area of the curriculum, but were experts in the field of educational psychology and learning difficulties. It found that these professionals held more sophisticated teaching and learning beliefs than both primary and secondary teachers.

In conclusion, most of the evidence regarding the domain variable supports the hypothesis that the specific domain exerts an influence on teachers' epistemological conceptions and their teaching and learning conceptions. One of the aims of this study will be to confirm this hypothesis with a large sample. In addition, we want to ascertain the relationship between teaching experience and teaching and learning conceptions. Finally, this paper aims to confirm the assumption that teachers in infant and primary education hold more complex conceptions, closer to constructivism, as they will be more inclined to focus teaching on the development of students' capacities and not only on the transmission of knowledge.

Method

Participants

A total of 1074 teachers from 90 schools in Spain participated in the study. They were not selected randomly, but by an incidental sampling. The participants took part in the research because they were part of a school assessment network. Of the 90 schools, 56 were state-run and 34 state-subsidized or completely private[2]. Most of the 66 primary schools (36) have two groups in each level (22 teachers on average); 26 schools, only one group per level (12 teachers) and three schools have three groups (40 teachers). From the 30 secondary schools, 12 have two groups in each level (25 teachers on average); nine have three groups (30 teachers) and nine, four or five groups (50 teachers). Over 80% of the teaching staff in all the infant and primary schools took part in the study, and an average of 50% of the teachers in the secondary schools.

The conceptions profile and the stage analyses were performed on a total of 1074 teachers, 201 of whom were infant teachers, 399 primary teachers and 474 secondary teachers. The number of participating teachers was reduced after performing correlation analyses between profiles and variables. This decrease was due to the fact that some teachers failed to provide some of the identification details (educational level, specialty or knowledge domain, length of teaching experience). The teaching experience of 1069 teachers (99.53%) and the specialty or knowledge domain of 1012 teachers (94.2%) were analyzed.

Instruments

To assess the type of conception held by the subjects, a dilemma questionnaire was constructed each of whose 36 items described a scenario or situation requiring the respondent to evaluate a problematical decision for which three alternatives were presented, each corresponding to one of the implicit theories described above (direct, interpretative and constructive). The participant had to choose the one they considered most appropriate. In particular, respondents were asked to give their judgment on dilemmas to do with different aspects of importance in the teaching and learning process (the relationship between learning contents and acquiring competences; the role of motivation; assessment processes; and the differences between teaching concepts, procedures and values).

To facilitate administration, the 36 items were divided into two parts: (A) and (B), with 18 items in each, and given to independent samples. The items for teachers at all educational levels were identical apart from minor adaptations of terminology and the use of situations appropriate to the reality of each stage. Within each questionnaire, the items were arranged in random order. Similarly, the response choices corresponding to each of the theories mentioned within each item were also presented in a random fashion. Subjects were asked to mark only one choice per item, the one they would be most in agreement with if such a situation were to arise in their school. Some examples of these dilemmas are given in Appendix.

The questionnaire was subjected to an expert validation system. Three experts (over 20 years of school teaching experience and teachers of didactic in initial teacher training) were asked to identify the type of theory to which each of the response options to the dilemmas corresponded. Inter-judge agreement was 0.87. In addition, the reliability analyses produced the following results: Primary Questionnaire part A,

α: 0.710; Primary Questionnaire part B, α: 0.724; Secondary Questionnaire part A, α: 0.701; Secondary Questionnaire part B, α: 0.729.

Design and procedure

This is a retrospective ex post facto study (Cohen, Manion, & Morrison, 2011; León & Montero, 2003). The dependent variable is the teacher's conceptions profile and the independent variables are the educational level at which they teach (infant school, primary, secondary); length of teaching experience (split into three tranches: 1-10, 11-20 and 21 or more years); and specialty, i.e. the knowledge domain of the subjects taught or the type of duties carried out in the school (guidance and attention to diversity, professionals who work as support teachers or educational psychologists; infant schoolteachers (3-6 years); general primary school teachers; specialists in natural sciences, social sciences, physical education, foreign languages, language and literature, mathematics, music, religion).

The questionnaires were handed out to the teachers in each school and they were given a week to return them in a sealed envelope to be posted in a box situated well away from the head teacher's office. The teachers were informed about the research aims and the confidentiality guarantee of data. Optical reader sheets were used for the replies.

Data analysis

To establish the typology or profile of the conceptions, a k-means cluster analysis was conducted on the replies of all the participants in accordance with the number of replies they had chosen corresponding to each theory. The results of the *cluster analysis* were confirmed using the *cross-validation* method (Everitt, Landau, & Leese, 2001). The cluster analysis was performed again on these two subsamples and the kappa coefficient found to verify the degree of agreement between this classification and the original. The kappa index was 0.8, which supports the validity and consistency of the classification used for the analyses. A chi-square test was used to analyze the relation 1 between the conceptions profiles and the teacher variables.

Results

Teachers' learning and teaching conceptions profiles

On the basis of the k-means cluster analysis, three groups were obtained reflecting three learning and teaching conceptions profiles among the teachers surveyed; interdirect, interconstructive and constructive. Figure 1 gives the prototypical number of responses corresponding to the three learning theories assessed by the questionnaire (direct, interpretative and constructive) in each of the three profiles obtained.

The interdirect profile included those who gave a high proportion of interpretative and direct responses, and very few constructive responses; the interconstructive profile included those who based themselves essentially on interpretative and constructive theory, with very few direct responses; and the constructive profile included those whose replies were mostly constructive, although they also gave some interpretative responses.

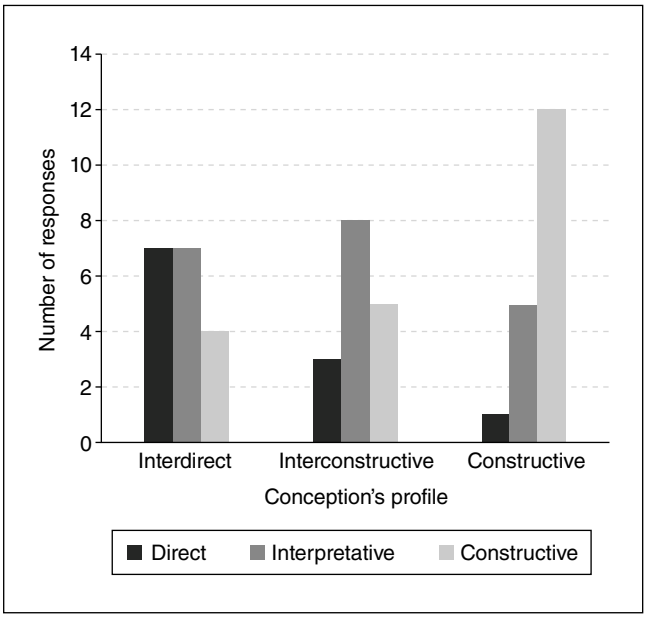

Figure 1. Prototypical Responses Corresponding to the Three Learning Theories in the 2 Different Profiles.

The distribution of the 1074 participants in accordance with the three profiles identified was as follows: The highest proportion of teachers is in the interconstructive profile (41.8%), with a slightly smaller proportion having a constructive profile (38.5%), while the smallest proportion are those with an interdirect profile, although this still includes 19.7% of the teachers surveyed.

The relation between learning and teaching conceptions profiles and teacher'variables

Educational stage

The level in the school system at which the teachers work was found to be significantly associated with both variables, $x^2(4) = 22.762$, $p < .01$, Cramer's V = .10. As shown in figure 2, in accordance with the adjusted standarized residuals analysis, there was a higher proportion of constructive teachers (47.8%) and a lower proportion of interconstructive teachers (35.3%) in infant school than would be expected in a random sample; more constructive profiles (42.9%) and fewer interdirect profiles (14.3%) were found in primary schools than would be expected; and in secondary schools there was a higher proportion of interdirect teachers (22.2%) and a lower proportion of constructive teachers (32.5 %) than would be expected in a random sample.

Length of experience

The results of the analysis conducted to detect a possible relation between 'teachers' length of experience and their conceptions profiles revealed that there also exists a

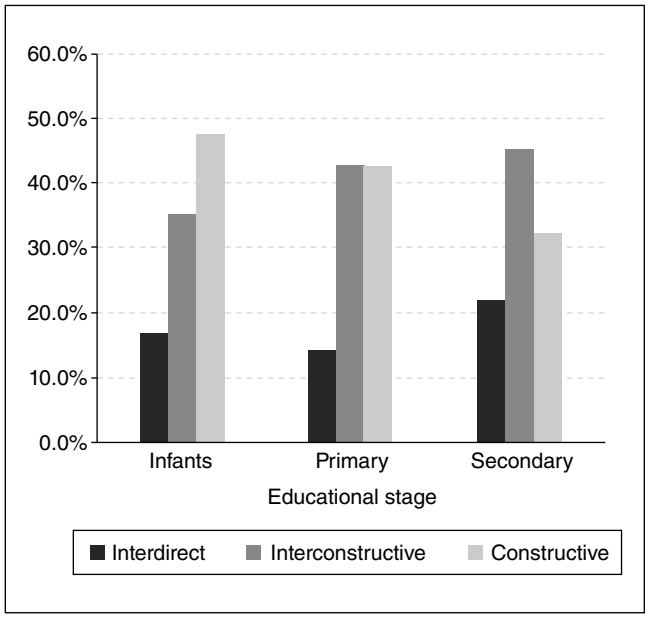

Figure 2. Distribution of conceptions profiles by educational stage.

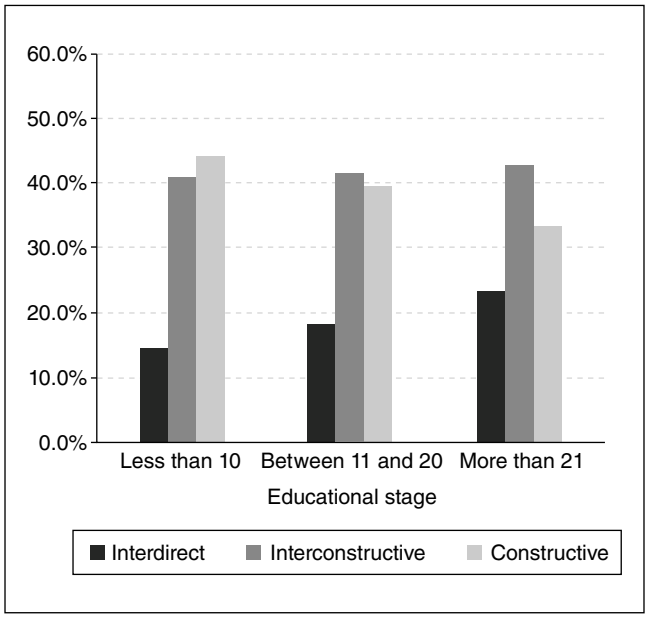

Figure 3. Distribution of the conceptions profiles in each length of experience group.

significant association between the former (1-10, 11-20 and 21 or more years) and the latter, $x^2(4) = 20.792$, $p<.01$, *Cramer's V* = .08. More constructive profiles (44.3%) and fewer interdirect profiles (14.6%) were found in the least experienced group (10 years or less) than expected. What is more, within the least experienced group, only 3 of the teachers with just one year's experience (two in primary and one in secondary school) had an interdirect profile, representing 5.1% of the total of this group. In contrast, among the most experienced teachers (those with 21 or more years' experience), fewer constructive profiles (33.6%) and more interdirect profiles (23.4%) were found than would be expected on a random distribution.

Interaction between educational stage and length of experience

The analysis of the relation between educational level and conceptions profiles within each length of experience group (table 2) found a significant association in the novice group, $x^2(4) = 12.086$, $p<.05$, *Cramer's V* = .12, and the intermediate group, $x^2(4) = 13,12$, $p<.05$, *Cramer's V* = .14. As shown in table 3, novices in primary education were more constructive than expected, whereas novices in secondary education were more interconstructive and less constructive. Among the intermediate length of experience group (11-20 years), infant school teachers had a higher proportion of constructive profiles, while secondary school teachers had more interdirect and fewer constructive profiles. Among the veterans, however, no significant correlation was found between the level at which they taught and their conceptions profile.

Professional specialty

In this analysis, teachers were grouped together in accordance with their professional specialty (the specialty or department to which they belonged) without making any distinctions as

Table 2 Relation between Educational Level and Conceptions Profile in Each Length of Experience Group

Experience Group	Level	Interdirect n=193	Interconstructive n=455	Constructive n=421	N total 1069
1-10 years	Infants	10.5% (n=6)	33.3% (n=19)	56.1% (n=32)	57
	Primary	13.5% (n=28)	36.7% (n=76)	49.8%* (n=103)	207
	Secondary	16.8% (n=32)	47.9%* (n=91)	35.3%* (n=67)	190
11-20 years	Infants	13.5% (n=10)	36.5% (n=27)	50%* (n=37)	74
	Primary	15.1% (n=16)	48.1% (n=51)	36.8% (n=39)	106
	Secondary	25.3%* (n=37)	46.6% (n=68)	28.1%* (n=41)	146
More than 21 years	Infants	26.2% (n=17)	36.9% (n=24)	36.9)% (n=24)	65
	Primary	14% (n=12)	53.5% (n=46)	32.6% (n=28)	86
	Secondary	25.4% (n=35)	38.4% (n=53)	36.2% (n=50)	138

*$p < 0.5$.

regards educational level in the case of those groups of professionals working at different levels. Comparisons were made with support teachers dealing with special needs and pupils with learning difficulties (special needs teachers, hearing and language teachers, and school psychologists), infant school teachers (those who have completed infant teacher training), general primary school teachers, foreign language teachers, music teachers, PE teachers, religious education teachers, language and literature teachers in secondary schools, mathematics teachers in secondary schools, geography and history teachers in secondary schools, and sciences, biology and physics teachers in secondary schools.

A significant association was found between conceptions profile and professional specialty, x2(20) = 69.827, $p<.01$ *Cramer's V* = .19. As shown in table 3, more constructive and fewer interdirect profiles were found among professionals working with special needs than would be expected on a random pattern; infant school teachers were more constructive and less interconstructive than would be expected; music teachers were less interdirect; religious knowledge teachers were more interdirect and less constructive, and mathematics teachers in secondary schools were less constructive and more interdirect than expected. With a marginal probability (adjusted standardized residual value of 1.9) general subject primary school teachers were more 12 interconstructive and less constructive than expected.

Lastly, it should be pointed out it was not possible to interpret the interactions between specialty and educational level (association between educational level and conceptions profile among teachers with the same professional specialty) and between specialty and length of experience (association between length of experience and conceptions profile among teachers with the same professional specialty) due to the fact that the expected frequencies less than 5 were over 20% of the total.

Discussion and conclusions

The first result that deserves to be commented on is the finding of consistent profiles corresponding to different ways of conceiving of the nature of teaching and learning processes. The data obtained are consistent with the assumption of *representational plurality*, as they show that one and the same person —in this case a teacher— can hold different conceptions that co-exist and are activated depending on the problematic situation with regard to which the teacher has to take a decision. These results coincide with what has been found in previous studies (Bautista, et al., 2010; López-Íñiguez, et al., 2014). The combination of the responses in each profile is not random. Subjects did not emerge in whom direct and constructive positions co-exist in equal proportion. On the contrary, the profiles display a progression corresponding to the nature of the assumptions shaping the theories.

The pattern displayed by the profiles is consistent with the implicit theories approach in that the constructive profile is not as frequent as might otherwise be expected in view of the dominant position of the constructivist learning approach in the theoretical discourse. Fewer than 40% of the participants have a constructive profile, which, it must be remembered, includes some interpretative theory responses. However, from the implicit theories standpoint this is no surprise, bearing in mind that it is a conception founded on complex epistemological, ontological and conceptual principles that are contrary to the more intuitive theories on the basis of which we usually represent learning processes to ourselves unless we have undergone explicit instruction questioning them. The proportion of each type of response in this profile (one direct, five interpretative and 12 constructive) displayed a higher degree of consistency than in the other two profiles. Two thirds of the responses corresponded to the most elaborate theory. These results suggest that the constructive theory is itself constructed explicitly in connection, as pointed out in the introduction, with formal instruction, which may afford it a higher level of coherence and consistency.

It is also worth highlighting that, in the face of the dilemmas, nearly 20% of teachers manifested stances corresponding to a way of conceiving of learning that accords with a realistic epistemology. In this profile, 14 out of 18 responses corresponded either to the direct theory (seven) or the interpretative theory (seven), which share a concern to ensure that learning appropriates the *correct* form of knowledge corresponding to an *objective truth*. We should

Table 3 Relation between professional profile and conceptions profile

Professsional Profile	Interdirect n=182	Interconstructive n=422	Constructive n=408	N total 1012
Special Needs Specialists	4.9%* (n=5)	38.2% (n=39)	56.9%* (n=58)	102
Infants	16.9% (n=34)	35.3%* (n=71)	47.8%* (n=96)	201
General Subjects, Primary	17.9% (n=26)	49% (n=71)	33.1% (n=48)	145
Music	6.3%* (n=4)	49.2% (n=31)	44.4% (n=28)	63
Physical Education	14.7% (n=17)	37.9% (n=44)	47.4% (n=55)	116
Religion	35.4%* (n=17)	39.6% (n=19)	25%* (n=12)	48
Language, Secondary	20% (n=16)	36.3% (n=29)	43.8% (n=35)	80
Mathematics, Secondary	31.1%* (n=19)	50.8% (n=31)	18%* (n=11)	61
Geography and History, Secondary	25.5% (n=14)	45.5% (n=25)	29.1% (n=16)	55
Foreign Language, Secondary	17.9% (n=12)	52.2% (n=35)	29.9% (n=20)	67
Sciences, Biology, Secondary	24.3% (n=18)	36.5% (n=27)	39.2% (n=29)	74

*$p < 0.5$.

probably not be surprised that it is difficult to accept that a school's essential goal is not to teach true knowledge, but to help pupils to understand that knowledge is always a construction and therefore a perspective. *Folk pedagogy* (Olson & Bruner, 1996) is much closer to the view that school is the place where false ideas are got rid of, which is cognitively simpler and emotionally safer, as it does not force the subject to face up to the uncertainty involved in a perspectivist stance. Similar results have been found in other studies (Pecharromán & Pozo, 2008; Porlán & Martín del Pozo, 2004). The OECD Teaching and Learning International Survey (2009) is especially interesting from this point of view, as it provides evidence of the gap between teachers' explicit reports —which are mostly constructivist— and the actual practices the teachers themselves say they use, which depart from this learning approach.

The validity of the profiles found is reinforced by the fact that the likelihood of their presence in certain groups is not random, as it is associated with certain characteristics that are extremely important with regard to education. The three hypotheses regarding the relation between conceptions profiles and teacher variables are confirmed. Educational level is one of them. The trend displayed by the data is clear: the higher up the educational ladder one goes, the smaller the proportion of teachers with more sophisticated learning and teaching conceptions. This result coincides with what has been found in previous studies (Fives & Buehl, 2010; Martín et al., 2006; Pérez Echeverría et al., 2006b; Rubie-Davies, et al., 2012). The explanation of this trend cannot be derived from the study data. Nevertheless, certain interpretations may be noted. One of these concerns the different initial training received by each of the teacher groups, with a great deal of emphasis placed on the psychopedagogical foundations of educational practice in the case of the infant and primary school teachers, and with special emphasis on the teaching of their particular subject in the case of secondary school teachers.

In addition to the quality of the teacher training, the difference in the profiles of those teaching at different levels may also be attributed to other features of these levels. The greater pressure on grades in secondary school, the greater number of different teachers who teach each class, with the greater unfamiliarity with the pupils this involves, and the increased weight given to particular subjects in the curriculum may be features of this level contributing to a type of teaching practice in which it is harder to apply constructivist learning principles. In accordance with the implicit theories approach, such theories are learned to a large extent by taking part in activity contexts that correspond in fact to principles that are gradually and implicitly appropriated by the subject. Practices do differ between the different educational levels and it is likely that this, in interaction with the diversity of training backgrounds, influences teachers' conceptions at each stage of schooling.

With regard to length of experience, the greater likelihood that teachers who have been working for less than 10 years will hold more sophisticated conceptions, while those who have been in the profession for over 20 years are more likely to have a more traditional take on learning, is consistent with the findings of several studies that have looked at this variable (Bautista et al., 2010; Castejón & Martínez, 2001; López-Íñíguez, et al., 2014; Tsai, 2002). This result may be due to a generational shift in which a multiplicity of factors comes together. No doubt the training the two groups received was substantially different, but so too was the educational system they joined and the society of which this system was a part. This interpretation of the generation gap receives support from the results of the analysis of the interaction between educational level and length of experience, as the only experience group in which there are no differences between educational levels is the one comprising teachers who have been working in education for over 20 years. In the other two experience groups, on the other hand, infant and primary school teachers are more constructive, while secondary school teachers are less constructive.

In our view, these same factors are behind the differences found between the different professional specialties or curriculum areas. The group formed by school psychologists and special needs teachers consists of professionals with more training in typical and atypical development who work on a daily basis with pupils with learning difficulties and with diversity in all its dimensions, which helps them become aware of the complexity of learning processes, which otherwise may be wrongly conceived of as simple or spontaneous. This might explain the significantly greater number than expected of teachers belonging to these specialties who hold constructive theories, which is consistent with the findings of a previous study (Martín et al., 2005). By contrast, mathematics teachers and, almost to a greater extent, religious education teachers, teach an area of knowledge in which reality is often conceived of in a realist fashion, in which a supposed truth might be discerned with certainty. A realist conception of learning underlies both the direct theory and the interpretative theory, which considers that absolute objectivity can be achieved and views learning, therefore, in a less complex way. Conversely, it might be thought that teaching an artistic subject, such as music, which is not undertaken in school for the purpose of training expert instrumentalists, but of introducing pupils to this language by means of varied, open-ended activities which it is hoped they will enjoy, would be less likely to be approached on the basis of realist assumptions. Although some of the expected differences between specialties were not found (e.g., between social and natural sciences), those between mathematics teachers and music teachers were in the same direction as in other studies (Norton et al., 2005).

From all the results as a whole, certain implications can be drawn for educational practice. First, with regard to initial training: although the official discourse of teacher training courses adopts an approach to teaching and learning based on constructivist assumptions, these assumptions do not appear to maintain a similar influence on teachers' conceptions once they are actually working. The explanation as to why this happens is outside the scope of the data and the aim of this article, but we do think it important to place this concern on record, since it might lead, among other things, to a review of whether sufficient attention is paid to the need to favor processes of conceptual change by making the implicit theories explicit and establishing a connection between theory and practice in course curricula that goes beyond technical rationality (Schön, 1987). If our theoretical assumptions are correct, the shift from simpler learning and

teaching conceptions to a constructive view would require a real conceptual shift similar to that students must face in order to learn in different knowledge domains. And, in consequence, teacher training activities would need to be designed on the basis of an approach aimed at fostering this conceptual shift instead of as transmission spaces for new theories and teaching practices.

However, in spite of the difficulty of distinguishing in our results between the influence of training and the influence of experience, the findings point to the fact that conceptual change does not occur only in initial training. A teacher's entire professional development involves a progressive redescription of the representations they gradually construct about what it means to learn and teach. In accordance with the approach concerning the relations between cognition and action —conceptions and practices— set out in the introduction, the way in which schools are organized has a clear influence on the teachers who practice their profession in them. Changes in practices could help to modify conceptions if they are accompanied by a process of reflection (school in-service training; collaborative staff meetings) that helps teachers to achieve the awareness that conceptual change requires.

The research has an important limitation considering that the participants were not selected randomly, but by an incidental sampling. The results must therefore be interpreted with some caution. The study certainly faced other limitations that pave the road for suggestive future lines of research. First, it would be necessary to untangle the influence of initial training from that of the experience once the teacher joins the profession. This requires studying participants in which these two variables have different values. On the other hand, if our hypothesis about the importance of school practices is correct, consistent differences ought to be found between teachers belonging to different schools. We think this line for continuing research is also highly suggestive and promising.

Appendix: Examples of dilemmas

Before beginning a lesson or unit, it is important to assess the pupils' prior knowledge, because:

(a) That way we will know the mistaken or naïve ideas the pupils have and will be able to understand why they are wrong and so avoid them interfering with their learning
(b) That way the pupils themselves can take into account what they know and what they think, and will understand better the differences with other theories and models
(c) That way we will be aware of what they do and do not know, and be able to concentrate on teaching them what they don't know

Some teachers think assessment can influence pupils' motivation. Those who hold such an opinion put forward different arguments and propose different assessment strategies

(a) If the performance achieved by pupils is not assessed and graded, they will stop making an effort. Marks are a necessary stimulus for all pupils, whether their marks are good —as this gives them an incentive to continue making an effort— or whether they are bad —as this motivates them to do better and not be left behind
(b) To motivate them they have to be helped to identify their successes and the mistakes they make, and to think about what they have done to achieve their successes and what they can do to overcome their difficulties
(c) As they are not going to learn the same as the others, pupils who are unable to reach an adequate performance level should be reassured and encouraged whenever they achieve some success, however small, in order to stimulate their efforts

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