

Personal metaphors of prospective secondary economics and science teachers

Lucía Mellado^a, María Luisa Bermejo^b and Vicente Mellado^{b*}

^aSpanish National University for Distance Education, Madrid, Spain; ^bUniversity of Extremadura, Badajoz, Spain

(Received 26 November 2011; final version received 30 May 2012)

Using the responses to open questions, this qualitative study examines the personal metaphors expressed by prospective secondary education teachers, 46 science graduates and 41 economics graduates. The metaphors are classified into the four categories of Leavy, McSorley, and Boté: the behaviourist/transmissive, the cognitivist/constructivist, the situative, and the self-referential. The results showed most metaphors to fall into the behaviourist/transmissive category, followed by the cognitivist/constructivist, self-referential, and situative categories, although some teachers expressed metaphors framed in more than one category. Of the 129 metaphors detected in the study, only one, of a chemistry graduate concerning the equilibrium between reactants, was associated with the prospective teachers' specific undergraduate education. The rest were expressions of their overall vision of teaching and learning, regardless of the speciality.

Keywords: economic; metaphors; science; teacher education

Introduction

A metaphor is the replacement or transposition of an idea or concept with one that, for the emitter, has a certain objective or subjective similarity (Marcos, 1993). In the words of Lakoff and Johnson (1980) a metaphor involves 'understanding and experiencing one kind of thing in terms of another' (p. 5). Metaphors are not only a resource for expression. They also have a deeper meaning as they constitute an essential mechanism of the mind (Martínez, Saulea, & Huber, 2001), which structures much of an individual's conceptual system by means of metaphorical relationships (Lakoff & Johnson, 1980). Indeed, this is a fundamental principle of thought and action (Aubusson, Harrison, & Ritchie, 2006). A metaphor acts as a lens, a screen, or a filter of who we are and how we see ourselves in a given situation (Saban, 2010). One finds metaphors to be present in the context of the discovery of scientific knowledge, especially in the context of explanation and communication (Pramling, 2009).

In education, teachers are guided by images and metaphorical patterns of thought, which can be regarded as *blueprints* of professional thinking (Martínez et al., 2001). All teachers elaborate an idiosyncratic body of professional practical thinking on the basis of their own particular experience and their interaction with their social environment. It is difficult to access this thinking and endow it with meaning, since teachers have certain perceptions about their profession that are difficult to articulate and express in a structured

*Corresponding author. Email: vmellado@unex.es

way through rules or principles. Previous studies indicate, however, that teachers' personal metaphors can help one access this thinking.

Methodologically, the study of metaphors in educational research has been advocated as a powerful tool to stimulate and foster teachers' continuing education and professional development (Aubusson et al., 2006). Metaphors provide a holistic view of life in the classroom (Duit, 1991), helping to model and build bridges with prior experience (Zhao, Coombs, & Zhou, 2011).

Metaphors and pre-service teachers

The language that teachers use to speak about their conceptions, roles, and professional activity is usually not literal and structured, but symbolic and metaphoric in nature. The metaphors used in this language have shown themselves to be a means of articulating the thinking of the teaching community and of establishing *bridges* between practical knowledge and the narrative that describes life in the classroom. They help to give an overall organisation and articulation to a teacher's conceptions, roles, and practical knowledge, and allow one to discover the implicit referents that sustain the teacher and that have a powerful influence on his or her teaching behaviour in the classroom (Boujaoude, 2000; Briscoe, 1991; Gurney, 1995; Tobin & LaMaster, 1995). For Tobin and Tippins (1996), metaphors may be regarded as a source of reflection, and as *seeds* that *will germinate* into new ideas and knowledge.

Prospective teachers have conceptions and attitudes about teaching and learning, which are the fruit of the many years they themselves spent at school, either accepting or rejecting the roles of their teachers (Briscoe, 1991). Prospective teachers usually present many contradictions: they may have teacher-centred conceptions while seeing themselves as pupil-centred (Simmons et al., 1999). The findings of Saban (2004) with Turkish pre-service teachers showed that their metaphors about themselves were less teacher-centred and more pupil-centred than their images of both their former and their mentor teachers. Several studies have found that teachers do not easily change their conceptions, and even less so their educational practices (Mellado, Ruiz, Bermejo, & Jiménez, 2006). Conceptions and practices are often out of phase with each other, and even plainly in contradiction, especially for novice and pre-service teachers, and changes in one are not necessarily accompanied by a change in the other (Brown & Melear, 2006; Da Silva, Mellado, Ruiz, & Porlán, 2007; Vázquez, Jiménez, & Mellado, 2010).

Metaphorical thinking helps teachers reflect on their ideas, their roles, and their practice, and re-conceptualise them in a metacognitive self-regulatory process (Aubusson et al. 2006). Leavy, McSorley and Boté (2007) pointed out that metaphors represent a vehicle that can 'bridge the gap between theory and practice' (Mostert, 1992, p. 9., cited in Leavy et al., 2007, p. 1220). Teachers make changes in their conceptions and educational practices when they are able to construct new roles by way of a process of critical reflection at the same time as adopting or constructing new metaphors that are compatible with the changes (Russell & Hrycenko, 2006; Tobin, Tippins, & Gallard, 1994). Thomas and Beauchamp (2011) used personal metaphors to examine the development of primary and secondary teachers from the end of their teacher education through their first year teaching, and pointed out that new teachers make a shift from seeing themselves as ready for the challenge, to adopting a survival mode.

Tobin and Fraser (1989) advocate introducing a variety of metaphors during initial teacher education. This would allow prospective teachers to understand their potential, reflect on their own metaphors, and develop new metaphors consistent with the teaching models they want to implement (Leavy et al., 2007; Pinnegar, Mangelson, Reed, & Groves,

2011; Volkmann & Anderson, 1998). The practicum is important in this process for the prospective teachers to be able to reflect on their own practice. The metaphors used during the practicum constitute a catalyst for reflection (Russell & Hrycenko, 2006), and can help teachers understand and self-regulate their roles.

Teachers' personal metaphors can express quite clearly whether a class is centred on the pupils and learning or on the teacher and content. This is important because the National Science Education Standards (National Research Council, 1996) notes that the pupil-centred orientation is both an indicator of the implementation of various strategies of inquiry and a tool for the effective implementation of those strategies. Alger (2009) analyses the evolution of these metaphors in novice and experienced secondary teachers.

Affective aspects are very important for all teachers, but especially so for prospective teachers (Bell & Gilbert, 1994; Hargreaves, 2005). Metaphors are a powerful tool with which to bridge the cognitive and the affective worlds, and can help teachers become aware of their feelings and emotions. Teachers' metaphors have a major affective component since teachers construct them on the basis of personal experience. When the teacher analysed in Tobin and Tippins (1996) says that his class is a *hell*, he is expressing not just an academic assessment, but something that affects his feelings and that will mark his attitude towards the class for the remainder of the course if he is unaware of what the metaphor signifies and of the negative consequences that it could have. Social aspects are also fundamental, and metaphors are important resources that can structure social life in classroom (Tobin, 2006). Ben-Peretz, Mendelson, and Kron (2003) note the importance of context in the formation and evolution of teachers' metaphors.

Numerous studies have examined the personal metaphors of teachers of different educational levels, both pre-service and experienced (Buaraphan, 2011, 2012; Leavy et al., 2007; Martínez et al. 2001; Saban, 2010; Zhao et al., 2011). The context and the teachers' own backgrounds as pupils at school themselves are known to influence their metaphors (Ben-Peretz et al., 2003; Briscoe, 1991). But it remains unknown as to what extent the educational traditions of prospective secondary school teachers' undergraduate specialities might influence their formation of personal metaphors. However, teachers' educational strategies do depend strongly on the material being taught, and teachers develop specific knowledge, which Shulman (1986) termed Pedagogical Content Knowledge, that is specific to how each particular subject is taught, and is a form of reasoning and educational action by means of which teachers transform the subject matter into representations that are comprehensible to the pupils.

The influence of the subject they are going to teach on teachers' personal metaphors is a relatively unexplored field in research. René and Stofflett (1996) note that teachers' metaphors are not strongly associated with their subject matter; rather they are more closely linked to their views of teaching and learning. However Saban, Kocbeker, and Saban (2007) reported that, in Turkey, pre-service English teachers produced more *facilitation-oriented* metaphors while pre-service computer science teachers produced more *transmission-oriented* metaphors.

Our interest is to compare the metaphors of pre-service secondary teachers between those trained in sciences and those trained in economics, so as to determine the possible influence of the content of these studies on the metaphors generated by the two groups of graduates. While the personal metaphors of science teachers have been analysed in various studies taking different methodological approaches (Boujaoude, 2000; Bradford & Dana, 1996; Powell, 1994; Ritchie, 1994, 1999; Tobin & Espinet, 1989; Tobin & Lamaster, 1995; Tobin & Tippins, 1996; Tobin et al. 1994; Volkmann & Anderson, 1998), there have been no previous studies of the personal metaphors of prospective teachers of economics.

Purpose of the study

The objectives of the present study were therefore:

- (1) To determine the personal metaphors of a sample of prospective science and economics secondary teachers at the end of their initial teacher education.
- (2) To classify the personal metaphors of the sample into four categories: behaviourist/transmissive, cognitivist/constructivist, situative, and self-referential.
- (3) To determine the reasons and explanations they give for identifying themselves with those metaphors.
- (4) To identify the relationship of the metaphors of the two groups of teachers with their undergraduate education in science or economics.

Methods

The research was conducted during the 2010/2011 academic year with a sample of university graduates during their Master's degree course in Secondary Teacher Education, a postgraduate course aimed at the educational preparation of future secondary school teachers. The sample comprised 46 participants in the Master's course of Secondary Science Teacher Education and 42 participants in the Master's course of Secondary Economics Teacher Education. We used ethical procedures in researching human participants.

The distribution of the Science sample was as follows: by gender, 21 men (46%) and 25 women (54%), and by age, 36% between 21 and 25 years old, 46% between 26 and 30, and 18% 31 or older. By degree speciality, most had graduated with Licenciaturas (until the implementation of the European Higher Education Area with its four-year first degree courses, in Spain the first degrees were Diplomatura and Licenciatura courses of three and five years, respectively) in Biology (33%) or Chemistry (28%), followed by Physics and Environmental Sciences (11.3% each), and Mathematics and Veterinary Science (7.4% each). The others had done other degrees in Science or Engineering.

The distribution of the Economics sample was as follows: by gender, 8 men (19%) and 34 women (81%), and by age, 43% between 21 and 25 years old, 33% between 26 and 30, and 24% 31 or older. By degree speciality, most had graduated with Diplomaturas in Business (33%), followed by Licenciaturas in Business Administration (27%), Economics (18%), and Law (9%), and Diplomaturas in Tourism (9%) and Labour Relations (6%).

The data collection procedure consisted of an anonymous questionnaire which, in addition to gender, age, and undergraduate degree course, asked for responses to two open questions:

- (1) When you teach in a secondary school classroom, what metaphors would you identify yourself with?
- (2) Explain the reasons that lead you to identify yourself with those metaphors.

With respect to the analysis of teachers in the field of science education research, there have been numerous models proposed. Martínez et al. (2001) categorised teachers' metaphors of learning into three main types: behaviourist/empiricist (learner as passive recipient, motivation depends on external reinforcement, and teacher as transmitter of information), cognitivist/constructivist (learner as active agent in the construction of knowledge, a process that is fundamentally individual and whose motivation is intrinsic;

and teacher as facilitator), and situative or socio-historical (learning is situated in the context in which it is constructed and is the consequence of participation in the activities of a community of practitioners; motivation in this case arises from the commitment of the educational community). Leavy et al. (2007) analyse pre-service elementary teachers' metaphors about teaching and learning. They maintain the three categories of Martínez et al. (2001), but find that some metaphors are difficult to classify in those categories and hence add a fourth: the self-referential. This last category consists of egocentric metaphors focused on what teaching represented for the participants as individuals, and does not refer to components of the practice of teaching.

In the present study, we keep basically the four categories of Leavy et al. (2007): the behaviourist/transmissive, which has the added characteristic of being teacher and content centred; the cognitivist/constructivist; and the situative, both of which may be considered as within the constructivist tradition being pupil- and learning-centred, the former with an emphasis on individual learning and the latter on social issues; and the self-referential for self-centred metaphors.

A descriptive analysis was made of the frequencies in each category in both samples of prospective teachers, and we shall discuss the reasons why they identify with their metaphors, contrasting what we found with the metaphors identified in earlier studies in the literature. No inferential or correlation analyses were performed using statistical packages, so that we shall not be considering any significant differences between the two samples.

Discussion of results

According to Roth (1993), some metaphors have a fine structure that allows different interpretations to be made of them based on different beliefs. These metaphors have been described as *two-edged swords* (Ritchie, Aubusson, & Harrison, 2006), and, to extract the richness and connotations of each of these, one would have to delve into the particular context in which they are used and into the meanings they are assigned by each teacher. For instance, the *gardener* metaphor could mean that the teacher prepares the ground for learning, with fertiliser, irrigation, and motivation, and so on, or, on the contrary, it could mean that the teacher prunes and limits any initiative that the pupil might have.

The category to which a metaphor will be allocated will be determined by the meaning the teacher gives to it. In some cases, however, the teacher did not explain the meaning sufficiently. We then assigned the metaphor to the category that we believed to be the best fit.

The numbers of prospective teachers who expressed no metaphor were 3 in the Science Group (6.52% of the sample) and 2 in the Economics Group (4.76% of the sample). The remaining 43 prospective science teachers expressed 62 metaphors: 32 proposed a single metaphor, and 11 various metaphors. The remaining 40 prospective economics teachers expressed 67 metaphors: 21 proposed a single metaphor, and 19 various metaphors.

Table 1 summarises the 62 metaphors expressed by the prospective secondary science teachers, with the number of teachers who proposed each metaphor given in parentheses.

Table 2 summarises the 67 metaphors expressed by the prospective secondary economics teachers, with the number of teachers who proposed each metaphor given in parentheses.

For the prospective science teachers, 41.9% of the metaphors were behaviourist/transmissive, 24.2% cognitivist/constructivist, 12.9% situative, and 20.9% self-referential.

Table 1. Metaphors expressed by the prospective Science teachers.

Transmissive	Constructivist	Situative	Self-referential
Open book (4)	Facilitator	Images in the mind	Farmer
Transmitter (2)	A bird	Shepherd of a flock	Sponge
Training camp sergeant	A good tree	Elder brother as guide	Lynx
Commander	Peace in the jungle	Eye-glasses	Ostrich
Crystal	Captain of a team	Signposts	Phoenix
Petrol station	Pastry cook	Beacon that lights the way	Mastiff
Transparent	The image they want to perceive in the mirror	A pilot boat	Better to be an ant than a cricket
The old oak	Tailor	Friend that guides	Like the crown of a pine tree
Cook	Educator		Cars
Fair judge	Balance between reactants		Lost like a boat adrift
Talkative parrot	Theatre director		Like a 500 euro note
Well of wisdom	Cement for a construction		Rainbow Warrior
Sun that shines light on their concepts	Either you are moving or obsolete		Walk like a turtle to arrive like a cheetah
Google	A feline		
Translator of the book	Friend (trust and understanding)		
Light and airy like a summer afternoon			
Authority (2)			
Peacock			
Elder brother/sister as wisdom			
'Better a bird in the hand than two in the bush' (2)			

For the prospective economics teachers, 34.3% of the metaphors were behaviourist/transmissive, 26.8% cognitivist/constructivist, 14.9% situative, and 23.8% self-referential (Figure 1).

In the study by Leavy et al. (2007), 49% of their pre-service teacher participants expressed behaviourist metaphors, 24% constructivist metaphors, 9% situative metaphors, and 18% exclusively self-referential metaphors.

In the following, we shall discuss the reasons our prospective teachers gave for identifying themselves with their metaphors, contrasting these reasons with the metaphors identified in previous studies in the literature.

Behaviourist/transmissive

Common to science and economics

Some of both groups say directly that the teacher is a transmitter of knowledge, a classical metaphor identified in many studies (Gurney, 1995; Powell, 1994; Tobin & Espinet,

Table 2. Metaphors expressed by the prospective Economics teachers.

Transmissive	Constructivist	Situative	Self-referential
Open book (2)	Facilitator	Guide (2)	Pandora's box (hope and joy)
Transmitter (2)	Matchmaker in education	Lodestar	Worker ant
Priest	Invisible support	Lighthouse	Patient like a turtle
Encyclopædia(2)	Clothes peg	Elder brother as guide	Solid and insistent like a cow
Clear as water (3)	Window onto the world	Orienter (3)	Chameleon that adapts
Computer	Motor of motivation	Grandfather (counsellor)	Smart like a fox
Fair judge	A shoulder to cry on (comprehensive)	Springboard for them to find their dreams	Eyes of a hawk
Balanced scales (2)	Novelist (imaginative and creative)		White dove transmitting peace
Fountainhead of knowledge	Children are pearls that shine when they smile		Farmer
Container	Children are like windows to the soul		Hen to her chicks
Role model (2)	Get to the source of the problem		Flexible
Lucid like a light bulb	Like the clouds and stars		Fish in water (2)
Paper clip	Elder brother (comprehensive)		Father (respect and affection)
Leader of the pack	Friend (trust and understanding) (3)		Practical and useful (2)
Elder brother (model)	Teacher of the world (cultural diversity)		
Legal like a norm	Open to the needs of pupils		

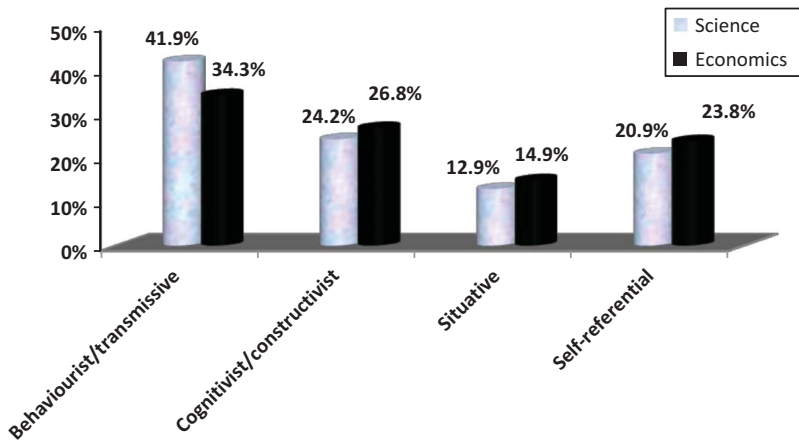


Figure 1. Percentages of metaphors in the four categories for the prospective Science and Economics teachers.

1989). Teachers of both groups identified themselves with an open book, meaning that they give clear explanations like an open book. In both groups, there appeared the metaphor of elder brother, in the sense of someone with greater knowledge and who is a model. Both groups use visual sensory metaphors, characteristic of behaviourist teaching in which light emerges from the dark – the light being the knowledge that the teacher transmits. Thus there is reference to clarity, crystal, transparency, Sun, lucidity, and so on. In the context of evaluation, there arose the metaphor of a fair judge who would act justly, but sternly when necessary (Ben-Peretz et al., 2003). A variant was that of the balanced scales in dispensing justice. Also for Lorsbach, Tobin, Briscoe, and Lamaster (1992), evaluation in this metaphor is conceptualised in terms of reward and punishment, and pupils are classified rather than evaluated.

Science

There were various metaphors that stress the teacher's explanation, as a talkative parrot. Other metaphors in which the teacher's role is one of possessor of the required knowledge are those of a well of wisdom or a petrol filling station full of information where the pupils will fill up their deposits of knowledge and wisdom, of an old oak filled with wisdom, of the Sun that shines light on their ideas, of transparency in the clarity of explanations, of clarity and lightness like a summer afternoon, or, adapting to these times of Internet, of the teacher being like Google, or even of the teacher in a more secondary role as translator of the textbook. Directly related to the teacher-centred class are the metaphors in which the prospective teachers see themselves as the Sun, which sheds light on things, or as a peacock (Buaraphan, 2012). These metaphors are usually linked to others in which the pupil is seen as a tabula rasa, a blank page, empty receptacle, or sponge. Some roles are identified with military metaphors such as a commander or a training camp sergeant (Bradford & Dana, 1996). The teacher is the authority in the class, and decides what to do, and how and when to do it. These metaphors embody a conception of the pupil as obedient and submissive, like a foot soldier (Saban, 2010).

Economics

Here, too, there were various metaphors that stressed explanation on the part of the teacher. One respondent identified himself with a priest or a preacher (Ritchie, 1999; Tobin & Espinet, 1989). Three prospective teachers identified themselves with water, explaining that they would give explanations that are clear and transparent like water, and another would be as lucid as a light bulb in his explanations. Other metaphors that highlight the role of the teacher as possessor of knowledge are those of the teacher as a fountainhead of knowledge, as a container (Buaraphan, 2011), as an encyclopædia, as a recycling bin for knowledge, or, adapting to new technologies and training in specific skills, as a computer. The teacher is a role model for pupils, and the leader of the pack.

Cognitivist/constructivist

Common to science and economics

The metaphor of the teacher as facilitator of learning (Boujaoude, 2000; Buaraphan, 2011; Tobin & Lamaster, 1995) and of the pupils as in the process of constructing their learning was used explicitly in both groups.

Science

The metaphor of the educator, giving a broader dimension to the teacher's work, is very common in teachers with this orientation (Treagust & Harrison, 2000). Also in this category is the metaphor of a tree, which is explained as providing shelter and good fruit, and that of making peace in the jungle. One teacher identified himself with a tailor who makes suits to measure, fitting the needs of each pupil. Another metaphor is an image they want to see in the mirror which can reflect feelings like self-concept and self-esteem. One prospective teacher would like his pupils to see him as captain of the team to establish a relationship of organisation and collaboration with the pupils. Another uses a metaphor of theatre director, a metaphor similar to that of a director of dance described by Leavy et al. (2007). The cement in construction expresses the most effective way to learn new knowledge – by basing it on knowledge acquired earlier, an essential aspect of constructivism. A metaphor that reflected the undergraduate training of a prospective chemistry teacher was the equilibrium between reactants. In the literature, one finds the metaphor of the catalyst which does not react, but helps the reaction of the other components: 'Teaching is like the catalyst in a chemical reaction. It will help the reaction to proceed at a quicker rate to produce more and better yields. But it is the reaction itself that produces the results' (Boujaoude, 2000, p. 179). One of the teachers identified himself with a bird able to reach everybody and teach them that it is possible to achieve anything, similar to the metaphor of the watchful bird (Bradford & Dana, 1996). A feline metaphor was explained in the sense of an animal that is agile, independent, caring, with a determination to overcome inequalities and injustices. The metaphor of the pastry cook is explained as someone who wants to motivate pupils and put some sugar in their lives. One of the prospective science teachers put it as: 'Either you are moving or obsolete.' The literature counts as constructivist those metaphors that involve change, transformation, or evolution (Gurney, 1995; Russell & Hrycenko, 2006).

Economics

One of the prospective economics teachers referred to the role of invisible support, a metaphor close to that of the scaffolder described by Pinnegar et al. (2011). With the same sense as the metaphor of the catalyst, here there was a metaphor of the teacher being a matchmaker in education, explained as the teacher helping the pupils learn by bringing them and the content close together. Metaphors related to the pupils are those of a shoulder to cry on, where pupils can go to when they have a problem, of the children being pearls that shine when they smile, or of getting to the source of the problem in the sense of looking for the causes in each child individually. One prospective teacher defined himself as a teacher of the world, explaining that the sense was of recognising and respecting the pupils' individuality and cultural diversity. Two teachers cited a window: one makes an identification with a window onto the world, and the other said that children are like windows to the soul. Lorsbach et al. (1992) observed that when one of their teachers changed from a metaphor of a fair judge to one of a window in the pupil's mind, she also changed the climate in her classroom and her form of evaluation. The metaphor of the novelist was explained in the sense that the teacher has to be imaginative and creative. While not indicated explicitly, this metaphor may also have a sense of teacher as storyteller to motivate pupils. Indeed, this is also the sense of the motor of motivation.

Situative or socio-historical*Common to science and economics*

Some teachers of both groups identified themselves as guide (Gurney, 1995). Other research has shown the teacher and pupils to be making a journey (Whitcomb, Borko, & Liston, 2008) in which the teacher guides and encourages the pupils to discover new paths (Boujaoude, 2000; Buaraphan, 2011; Ritchie, 1994). In both groups there occurred the elder brother metaphor and a friend, explained as being a guide.

Science

Some metaphors identified with this role of guide were a beacon that lights the way and a pilot boat. Another metaphor of this type was of eye-glasses to decipher the signposts along the path, or signposts to help the pupils find the way, or the shepherd of a flock, explaining that the intention was to guide the pupils, not to make them into a flock of sheep, but into people who think for themselves.

Economics

Three prospective teachers identified themselves with the metaphor of orienter, also in the sense of guide. This meaning is also clear in metaphors of a lodestar (Leavy et al., 2007), lighthouse, and springboard to help the pupils find their dreams.

Self-referential

Common to science and economics: A self-referential metaphor has a highly personal meaning according to the explanation that the particular teacher gives. As noted by Zembylas (2004), teachers' metaphors are especially well suited to expressing their emotions. Some of the animal metaphors were used to express emotions. In both groups, there occurred the metaphor of the ant to express the teacher's non-stop work and dedication, in one group set in opposition to the cricket. Some teachers identified themselves as farmers, caring for the children (Buaraphan, 2011). This metaphor had been noted by Powell (1994), and has the same sense as that of animal keeper (Ben-Peretz et al., 2003), very different from animal trainer.

Science

Examples of animal metaphors used to expressing emotions were that of the mastiff explained as identified with tranquillity, of an ostrich to reflect the fear of giving classes, of the lynx always being alert, or of the phoenix explained as representing rising again when self-esteem is low. Others expressed a certain anguish – being lost like a boat adrift, analogous to metaphors of the floating cork (Tobin, 2006) or that of paddling like mad (Russell & Hrycenko, 2006). Another feeling is patience, expressed by a metaphor of walking like a turtle to arrive like a cheetah. The metaphor of the sponge was explained by the prospective teacher as indicating his attitude of constantly learning.

Economics

There were many animal metaphors relating to emotions or actions: chameleon to express flexibility and continuous adaptation to the pupils and the circumstances of the class

(Boujaoude, 2000; Buaraphan, 2011; Tobin et al. 1994), solid and insistent like a cow until the pupils understand, smart as a fox, patient as a turtle, with the eyes of a hawk, a white dove to transmit peace, a hen protecting her chicks, a metaphor that is rather one of infant school than of secondary school teachers. Two teachers identified themselves with a fish in water, to indicate how comfortable they feel in the classroom and how they want their pupils to feel.

Implications and conclusion

Most of the prospective secondary science teachers were able to conceptualise their roles in the form of metaphors. More metaphors were expressed by the prospective economics teachers than by the science group, despite being fewer in number.

In both groups, the category with most metaphors was the behaviourist/transmissive, followed by cognitivist/constructivist, self-referential, and situative. However, some respondents expressed metaphors that corresponded to more than one category, or hybrid metaphors which, according to their meaning, could be classified into various categories.

That there were more metaphors in the behaviourist/transmissive category is a reflection of this being the commonest type of teaching in schools. A significant proportion of the metaphors, however, corresponded to the cognitivist/constructivist category, in which teachers see themselves as educators and facilitators and the pupils as active learners who, little by little, construct their own meaningful learning. This implies that there has been progress on the part of these future teachers in identifying themselves with active and changing roles, and in regarding their pupils as being an essential part of the teaching process. Another result was the small proportion of situative metaphors. This may in part be because they are harder to express, and also because prospective teachers have an individualised vision of learning at the expense of metaphors of this type which refer to a social and collaborative form of learning. A large proportion of the metaphors in the self-referential category represented animals. With these expressions, a few words are capable of communicating content of great complexity. When we were young, we liked to hear stories involving anthropomorphic animals, and probably had one animal that was our favourite. The prospective teachers identified with one or more characteristics of their favourite animal to carry out their role in the classroom, adding an affective meaning to the metaphor.

The fourth objective of our study was to identify the relationship of the metaphors of the two groups of teachers with their undergraduate education in science or economics. We failed, however, to find any such relationship. Of the 129 metaphors detected in the study, only one, of a chemistry graduate concerning the equilibrium between reactants, was associated with the teachers' specific undergraduate education. The rest were expressions of their overall vision of teaching and learning, regardless of their speciality. This is coherent with the finding of René and Stofflett (1996) that teachers develop metaphors grounded in their personal histories as learners and educators, and that their metaphors are not associated with subject matter. It is possible that, since these students had not yet done their practice teaching, neither had they yet taken on the role of a teacher of a specific subject.

With respect to the implications, we believe that the study of metaphors is important in the context of initial teacher education. If, as indicated by Tobin and LaMaster (1995), metaphors form part of the reference systems that support teachers' conceptions and approach to their teaching, initial teacher education programs should consider analysing student teachers' metaphors, their changes, and their relationship with teaching practice.

It is necessary to convert metaphors into an instrument for teacher education, so that the prospective teachers can become aware of their own metaphors and how they are related to their conceptions, attitudes, and feelings, and to their actual classroom practice, and then, in a metacognitive process, to gain the capacity to control and self-regulate changes in their metaphors.

Acknowledgements

This work was financed by Research Project EDU2009-12864 of the Ministry of Science and Innovation (Spain) and the European Regional Development Fund (ERDF).

Notes on contributors

Lucia Mellado is Assistant of Economics at the National University Distance Education, Spain. She is a graduate in Economics and Law from Carlos III University, Spain.

Maria Luisa Bermejo is Associate Professor of Psychology of Education at the University of Extremadura. She is a graduate in Philosophy and Psychology and PhD in Psychology of Education.

Vicente Mellado is Professor of Science Education at the University of Extremadura, Spain. He is a graduate in physics and PhD in Education.

References

- Alger, C-L. (2009). Secondary teachers' conceptual metaphors of teaching and learning: Changes over the career span. *Teaching and Teacher Education*, 25(5), 743–751.
- Aubusson, P.J., Harrison, A.G., & Ritchie, S.M. (2006). Metaphor and analogy. In P.J. Aubusson, A.G. Harrison & S.T. Ritchie (Eds.), *Metaphor and analogy in science education* (pp. 1–9). Dordrecht: Springer.
- Bell, B., & Gilbert, J. (1994). Teacher development as professional, personal and social development. *Teaching and Teacher Education*, 10(5), 483–497.
- Ben-Peretz, M., Mendelson, N., & Kron, F.W. (2003). How teachers in different educational contexts view their roles. *Teaching and Teacher Education*, 19(2), 277–290.
- Boujaoude, S. (2000). Conceptions of science teaching revealed by metaphors and answers to open-ended questions. *Journal of Science Teacher Education*, 11(2), 173–186.
- Buaraphan, K. (2011). Metaphorical roots of beliefs about teaching and learning science and their modifications in the standard based science teacher preparation programme. *International Journal of Science Education*, 33(11), 1571–1595.
- Buaraphan, K. (2012). Educational supervisors' metaphorical roots of beliefs about teaching and learning. *Educational Research and Review*, 7(12), 282–291.
- Bradford, C.S., & Dana, T.M. (1996). Exploring science teacher metaphorical thinking: A case study of a High School science teacher. *Journal of Science Teacher Education*, 7(3), 197–211.
- Briscoe, C. (1991). The dynamic interactions among beliefs, role metaphors, and teaching practices: A case study of teacher change. *Science Education*, 75(2), 185–199.
- Brown, S.L., & Melear, C.T. (2006). Investigation of secondary science teachers' belief and practices after authentic inquiry-based experiences. *Journal of Research in Science Teaching*, 43(9), 938–962.
- Da Silva, C., Mellado, V., Ruiz, C., & Porlán, R. (2007). Evolution of the conceptions of a secondary education biology teacher: Longitudinal analysis using cognitive maps. *Science Education*, 91(3), 461–491.
- Duit, R. (1991). On the role of analogies and metaphors in learning science. *Science Education*, 75(6), 649–672.
- Gurney, B.F. (1995). Tugboats and tennis games: Preservice conceptions of teaching and learning revealed through metaphors. *Journal of Research in Science Teaching*, 32(6), 569–583.
- Hargreaves, A. (2005). Educational change takes ages: Life, career, and generational factors in teachers' emotional responses to educational change. *Teaching and Teacher Education*, 21(8), 967–983.
- Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. Chicago, IL: Chicago University Press.

- Leavy, A.M., McSorley, F.A., & Boté, L.A. (2007). An examination of what metaphor construction reveals about the evolution of preservice teachers' beliefs about teaching and learning. *Teaching and Teacher Education, 23*, 1217–1233.
- Lorsbach, A.W., Tobin, K., Briscoe, C., & Lamaster, S.U. (1992). An interpretation of assessment methods in middle school science. *International Journal of Science Education, 14*(3), 305–317.
- Marcos, F. (1993). *Diccionario básico de recursos expresivos [Basic dictionary of expressive resources]*. Badajoz, Spain: Universitas Editorial.
- Martínez, M.A., Sauleda, N., & Huber, G.H. (2001). Metaphors as blueprints of thinking about teaching and learning. *Teaching and Teacher Education, 17*(8), 965–977.
- Mellado, V., Ruiz, C., Bermejo, M.L., & Jiménez, R. (2006). Contributions from the philosophy of science to education of science teachers. *Science & Education, 15*(5), 419–445.
- National Research Council. (1996). *The national science education standards*. Washington, DC: National Academic Press.
- Pinnegar, S., Mangelson, J., Reed, M., & Groves, S. (2011). Exploring preservice teachers' metaphor plotlines. *Teaching and Teacher Education, 27*, 639–647.
- Powell, R. (1994). From field science to classroom science: A case study constrained emergence in a second-career science teacher. *Journal of Research in Science Teaching, 31*(3), 273–291.
- Pramling, N. (2009). The role of metaphor in Darwin and the implications for teaching evolution. *Science Education, 93*(3), 535–547.
- René, T., & Stofflett, R.T. (1996). Metaphor development by secondary teachers enrolled in graduate teacher education. *Teaching and Teacher Education, 12*(6), 577–589.
- Ritchie, S.M. (1994). Metaphor as a tool for constructivist science teaching. *International Journal of Science Education, 16*(3), 293–303.
- Ritchie, S.M. (1999). The craft of intervention: A personal practical theory for a teacher's within-group interactions. *Science Education, 83*(2), 213–231.
- Ritchie, S.M., Aubusson, P.J., & Harrison, A.G. (2006). Metaphorically thinking. In P.J. Aubusson, A.G. Harrison, & S.T. Ritchie (Eds.), *Metaphor and analogy in science education* (pp. 189–195). Dordrecht: Springer.
- Roth, W.M. (1993). Metaphors and conversational analysis as tools in reflection on teaching practice: Two perspectives on teacher-student interactions in open inquiry science. *Science Education, 77*(4), 351–373.
- Russell, T., & Hrycenko, M. (2006). The role of metaphor in a new science teacher's learning from experience. In P.J. Aubusson, A.G. Harrison, & S.T. Ritchie (Eds.), *Metaphor and analogy in science education* (pp. 131–142). Dordrecht: Springer.
- Saban, A. (2004). Prospective classroom teachers' metaphorical images of selves and comparing them to those they have of their elementary and cooperating teachers. *International Journal of Educational Development, 24*, 617–635.
- Saban, A. (2010). Prospective teachers' metaphorical conceptualisations of learner. *Teaching and Teacher Education, 26*(2), 290–305.
- Saban, A., Kocbeker, B.N., & Saban, A. (2007). Prospective teachers' conceptions of teaching and learning revealed through metaphor analysis. *Learning and Instruction, 17*, 123–139.
- Simmons, P.E., Emory, A., Carter, T., Coker, T., Finnegan, B., Crockett, D., Richardson, L. et al. (1999). Beginning teachers: Beliefs and classroom actions. *Journal of Research in Science Teaching, 36*(8), 930–954.
- Shulman, L.S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4–14.
- Thomas, L., & Beauchamp, C. (2011). Understanding new teachers' professional identities through metaphor. *Teaching and Teacher Education, 27*(4), 762–769.
- Tobin, K. (2006). Why do science teachers teach the way they do and how can they improve practice? In P.J. Aubusson, A.G. Harrison, & S.T. Ritchie (Eds.), *Metaphor and analogy in science education* (pp. 155–164). Dordrecht: Springer.
- Tobin, K., & Espinet, M. (1989). Impediments to change: Applications of coaching in high school science teaching. *Journal of Research in Science Teaching, 26*(2), 105–120.
- Tobin, K., & Fraser, B.J. (1989). Barriers to higher-level cognitive learning high school science. *Science Education, 73*(6), 659–582.
- Tobin, K., & Lamaster, S.U. (1995). Relationships between metaphors, beliefs, and actions in a context of science curriculum. *Journal of Research in Science Teaching, 32*(3), 225–242.
- Tobin, K., & Tippins, D.J. (1996). Metaphors as seeds for conceptual change and the improvement of science education. *Science Education, 80*(6), 711–730.

- Tobin, K., Tippins, D.J., & Gallard, A.J. (1994). Research on instructional strategies for teaching science. In D. Gabel (Ed.), *Handbook of research on science teaching and learning* (pp. 3–44). New York: MacMillan.
- Treagust, D.F., & Harrison, A.G. (2000). In search of explanatory frameworks: An analysis of Richard Feynman's lecture 'Atoms in motions'. *International Journal of Science Education*, 22(11), 1157–1170.
- Vázquez, B., Jiménez, R., & Mellado, V. (2010). Los obstáculos para el desarrollo profesional de una profesora de enseñanza secundaria en ciencias experimentales [*Obstacles to the professional development of a secondary school science teacher*]. *Enseñanza de las Ciencias*, 28(3), 417–432.
- Volkman, M.J., & Anderson, M.A. (1998). Creating professional identity: Dilemmas and metaphors of a first-year chemistry teacher. *Science Education*, 82(3), 293–310.
- Whitcomb, J.A., Borko, H., & Liston, D. (2008). Why teach? *Journal of Teacher Education*, 59(1), 3–9.
- Zhao, H., Coombs, S., & Zhou, X. (2011). Developing professional knowledge about teachers through metaphor research: Facilitating a process of change. *Teacher Development*, 14(3), 381–395.
- Zembylas, M. (2004). Emotion metaphors and emotional labor in science teaching. *Science Education*, 88(3), 301–324.

Copyright of Asia-Pacific Journal of Teacher Education is the property of Routledge and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.