# In quest of teaching quality in pre-school science: teachers' views of factors influencing their work

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## Abstract

*This study explores experienced early years teachers' views of factors that may influence the quality of their teaching performance in science. Planning for the improvement of science instruction should take these into consideration, as teachers usually hold strong personal beliefs about what they view as good teaching. The study was carried out in Greece. Six teachers of the lower grades of education participated: one from early primary and five from pre-primary education, all with long experience in teaching science. One take-home written task, one group interview and one questionnaire constructed by the teachers themselves were used for data collection. Qualitative analysis of teachers' written protocols, interview and the questionnaire revealed a significant number of findings, which were organised into four broad themes related to: teacher, student, situational factors and initiatives for personal professional upgrading. A significant number of teacher-related factors concern different categories of teacher knowledge.*

*Teachers also consider that the quality of their teaching in science can be influenced by other teacher characteristics such as emotions, personality, motivation and attitude. Teachers also mentioned a number of situational factors, but they believe that some of the situational difficulties can be overcome depending on the teacher characteristics. Student-related factors include ideas of concepts and phenomena, interest in the subject (can be triggered by teacher), attitude (can be influenced by teacher), motivation (can be developed in class), singularities and emotions. While findings should be interpreted within the limits of a small-scale exploration study and a study of teachers coming from a single country, they may be used to guide research of early years teachers' views and experiences in other countries as well. This would produce a pool of interesting and useful information that could contribute to a holistic approach to the improvement of science instruction in early years education.*

**Keywords:** Early years' science, teachers' views, pedagogical content knowledge, affective and emotional factors, teacher's personality-related factors

## Background

In this paper we present and analyse the views of in-service teachers of the lower grades of education concerning factors affecting their teaching in science. Research has shown that early years teachers have weak background knowledge in science (e.g. Kallery & Psillos, 2001), have problems in implementing the science curriculum (Kallery & Psillos, 2002), and give science lessons that are fragmentary in character and fail to promote children's understanding and scientific thinking (Kallery *et al*, 2009).

The importance of teachers' knowledge and its relation to teaching practices has been stressed by researchers and educators (e.g. Shulman, 1986). Still, events in the classroom do not entirely spring from teachers' personal characteristics and the qualities they bring into the classroom, while aspects of their work that are outside their control, such as the influence of situations, have often been overlooked (what is called *attribution error*) (see Kennedy, 2010). Social psychologists, Kennedy

(2010) notes, tell us that teacher behaviour tends to be more influenced by the situations they face than by their own personal qualities although, as she observes, some teachers are better able than others to accommodate situational strains they may face in their work.

Other researchers (e.g. Van Driel & Berry, 2012) note that the development of teachers' knowledge, especially Pedagogical Content Knowledge (PCK), is not a linear process and could be influenced by teachers' specific professional contexts and support for professional development, and that teachers hold strong personal beliefs about what they view as good teaching. What is needed is a closer examination of individual teachers' views on what they think can influence their practices in the classroom. Planning for the improvement of science instruction should take these views into consideration.

It was against this background that the present work was undertaken. Specifically, the research questions leading the present study are:

1. What factors do expert early childhood teachers believe influence the quality of their teaching of science?
2. What factors do expert early childhood teachers encounter when performing activities with young children that influence the quality of their teaching?
3. What interactions do expert early childhood teachers perceive exist between these identified factors?

## Methodology and sample

The study was carried out in Greece. Six teachers of the lower grades of education participated, one from early primary and five from pre-primary education, all with long experience in teaching science. The teachers were members of a work group that also included a researcher and science specialist (author of this paper). The partners shared the goal of developing science activities for young children.

The research reported in this paper was designed as a small-scale exploratory study, with data obtained using the following instruments: one take-home written task, one questionnaire constructed by the researcher, one group interview, and one questionnaire constructed by the teachers themselves, as a means of investigating the views of other colleagues on the same issues; this provided valuable data on factors that the teachers consider to have an important influence on science teaching. The instruments are presented in the Appendix. In the written task, teachers were asked to report and elaborate on what they believe may affect their teaching performance in science and what they actually encounter when introducing activities to young children. To supplement and clarify the information derived from the written assignment, a group interview was held. Prior to the interview, the author – who acted as researcher as well as interviewer – conducted preliminary analyses of the teachers' written protocols in order to identify the predominant themes. This assisted the researcher in deciding the focus of the interviews and in forming probing and clarifying questions during their course.

Data were collected in the following order:

1. Teachers completed the written task individually.
2. Teachers constructed the questionnaire.
3. Teachers completed the individual questionnaire.
4. The group interview was held.

## Data analysis and results

Qualitative analysis of the teachers' written protocols, interviews and the questionnaire revealed a significant number of findings, which were organised into four broad themes:

- Teacher-related factors;
- Pupil-related factors;
- Situational factors; and
- Initiatives for personal professional upgrading.

Representative findings for each of the above themes are reported in the rest of the paper.

The ***teacher-related factors*** were organised into five domains:

- Knowledge;
- Affective;
- Emotional;
- Personality; and
- Experiences.

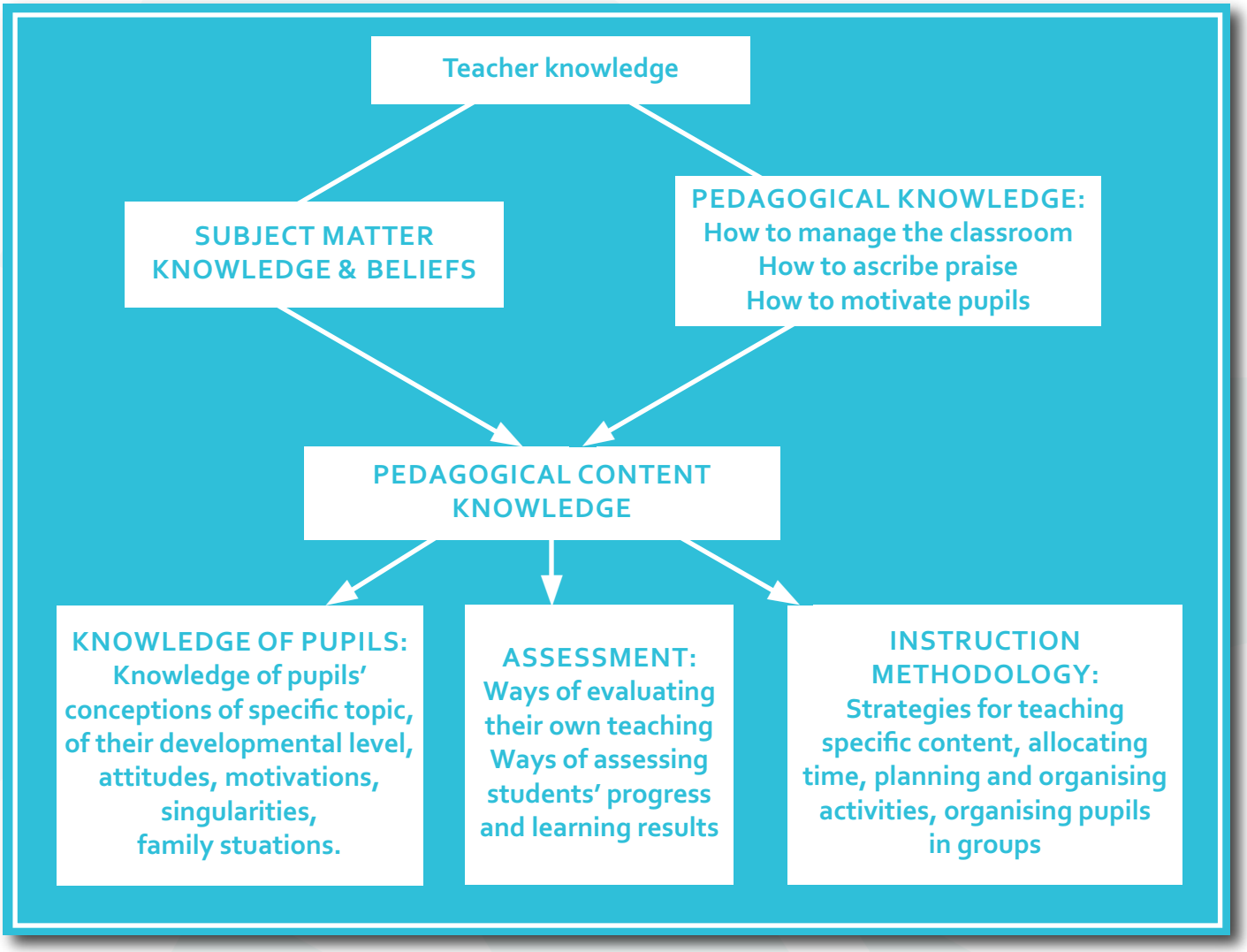


**Figure 1:** Relationships among the factors related to teacher knowledge reported by the participating teachers.

In the domain of teacher knowledge, apart from the explicitly mentioned subject matter knowledge, teachers spoke of a number of other factors comprising two categories of teacher knowledge: Pedagogical Knowledge (PK) and Pedagogical Content Knowledge (PCK). These factors and their interrelationships are presented in diagram form in Figure 1 above.

Three of the reported teacher-related factors belong in the affective domain: *Interest, Motivation* and *Attitude.* In their interviews, teachers noted that these factors can increase their effectiveness when planning and delivering activities. Emotional factors include rewards (joy coming from children's successes and interest in science activities), sureness, safety, anxiety, fear and disappointment (see also Zembylas, 2004).

Teachers elaborated on these factors. They related 'sureness' to their own subject matter knowledge and their knowledge of the children. 'Safety' was related to their knowledge of the subject and knowledge of teaching methodology and 'anxiety' was related by the teachers to the level of their knowledge of the subject (degree of sufficiency) and to situational factors.

Teachers talked about 'fear' and related it to insufficient knowledge that may lead to unsuccessful science activities and also to difficulty in managing the class.

The teachers found 'disappointment' a very important factor, which may hinder their motivation for work and which may be stemming from their unsatisfactory performance in the activities, from situational factors such as the acceptance and recognition of their work by other colleagues and by parents.

Teachers' experiences were distinguished as those coming from their years of work (contributing

| Themes | Findings |
|---|---|
| ***Student-related factors*** | ❍ Ideas of concepts and phenomena<br>❍ Interest in the subject (*can be triggered or stimulated by the teacher*)<br>❍ Attitude (*can be influenced by the teacher*)<br>❍ Motivation (*can be developed in class*)<br>❍ Students' singularities<br>❍ Emotions |
| ***Situational factors*** | ❍ School infrastructure: available physical space for science activities, available materials<br>❍ Available time for science<br>❍ Number of students in class<br>❍ The curriculum (*flexible, explicit or very broad*)<br>❍ Teacher manuals and teacher guides (*existence, coherency and consistency*)<br>❍ School situation (*communication and collaboration with the rest of the staff*) |
| *Initiatives for personal professional upgrading* (concerns teachers' initiative regarding participation in a work group yielding the following advantages contributing positively to their teaching) | ❍ Collaborate with specialist in the subject<br>❍ Participate in the development of instructional materials<br>❍ Participate in research (*the teacher as researcher*)<br>❍ Reflect individually and collectively, interact and communicate<br>❍ Overcome difficulties |

**Table 1:** Student, situational and teacher initiative-related factors.

positively) and those from their own schooling (mostly contributing negatively).

Classified as teachers' personality-related factors were: communication style, creativity, flexibility, taking initiatives, self-esteem, sense of responsibility and confidence.

Teachers consider that the way they communicate with children, but also with parents, can affect the quality of their work.

Regarding flexibility, teachers related this to their ability and readiness to handle situations that may arise, such as responding to children's difficult science questions and other difficulties during activities. They noted that these require good knowledge of the subject, as well as availability of alternatives, especially in cases of unexpected activity outcomes. They also mentioned responsibility and related it to their professionalism.

An overview of the most interesting factors falling under the other headings is presented in Table 1 above.

Concerning the ***student-related factors,*** as these are presented in Table 1, teachers believe that the most important of these, which can affect their teaching in science, are the students' ideas of concepts and phenomena, their interest in and attitude towards the subject, their motivation, their singularities and their emotions.

They noted that students' interest in the subject can be triggered or stimulated by the teacher, that students' attitudes can also be influenced by the teacher and that teachers can motivate students

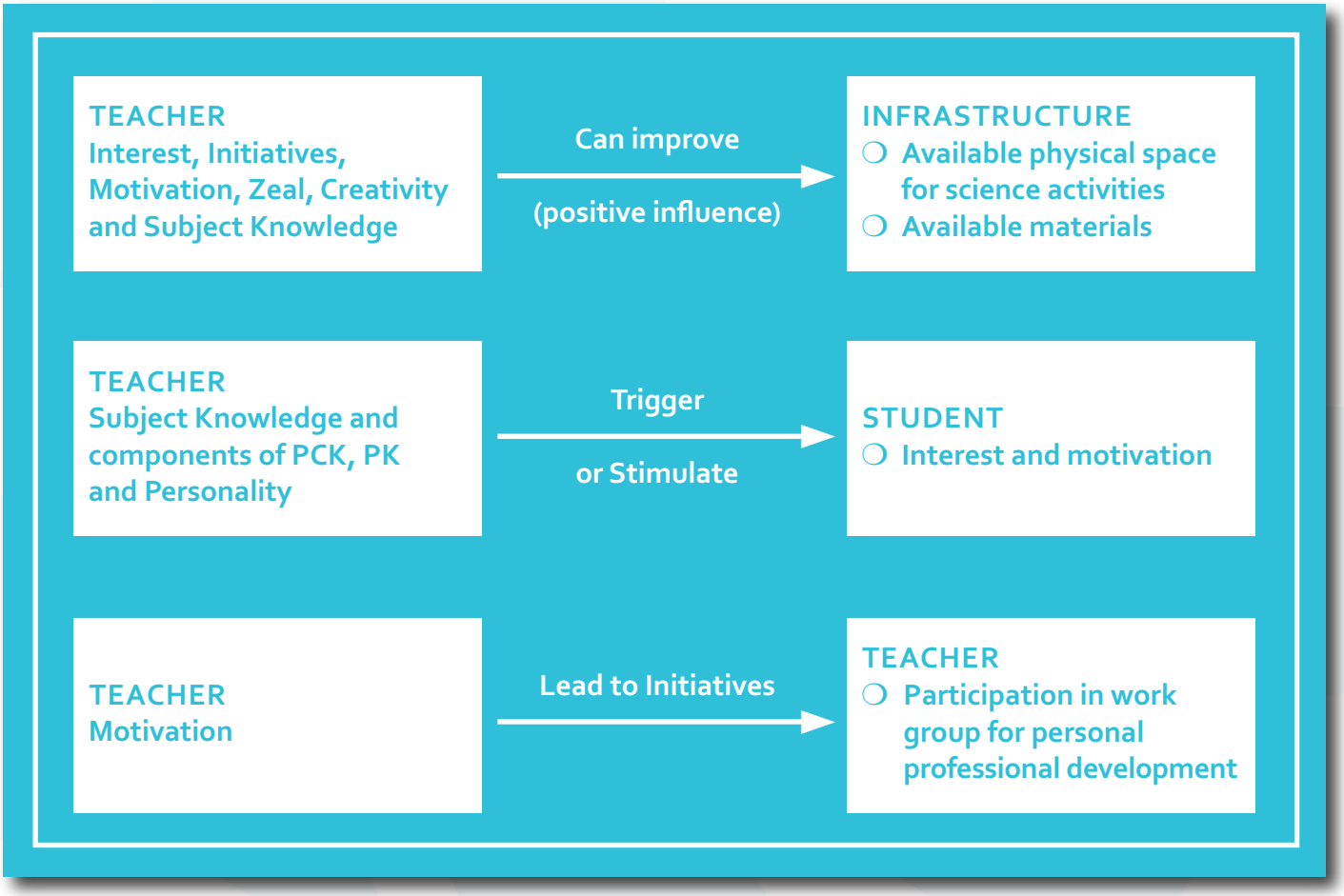


**Figure 2:** Interactions between factors expressed by teachers.

in class. They explained that students' singularities are related to students' personal characteristics and the problems stemming from them or from family situations.

Teachers referred to the students' emotions and the great significance of these for the quality of their work. Teachers said that emotions can, for example, be positive, such as their enthusiasm for the activities. In such cases, the emotions, as they stated, act supportively, but can also be negative and can be related to the students' personal problems.

Of the most important ***situational factors***, as shown in Table 1, teachers referred to the available physical space for science activities, available materials and time assigned to science activities, specific characteristics of the curriculum that either support or make their work in science difficult, the existence and quality of teachers' manuals, and finally the number of students in class.

Teachers also referred to specific situations in school, and specifically to the level and quality of communication and collaboration with the rest of the staff.

Regarding ***initiatives for personal professional upgrading,*** the teachers consider that participating in a work group where they can collaborate with a specialist in the subject and, within the group, participate in activities such as development of instruction materials, act as researchers, interact and communicate with the other members of the group and have the opportunity to reflect, lead to factors that they consider to be advantages that can contribute positively to their teaching in science.

In their essays and interviews, teachers pointed out several interactions between the various factors, stating that their views about these interactions sprang from their own experiences; the most interesting of these interactions are presented in Figure 2. One of the important findings, as shown in the factor interaction diagram, is that the teachers believe that several of the situational difficulties can be overcome depending on the teacher's knowledge, interest, motivation, initiative-taking and personal work.

## Conclusions and implications

The present study provides some insights into experienced early years teachers' views of what can potentially influence the quality of their work in science. The teachers consider that a variety of factors can contribute either positively or negatively to their teaching, most of them relating to the teacher him/herself, while a significant number of them concern different categories of teacher knowledge. As can also be gathered from the relationships between factors expressed by the teachers, it seems that they recognise their knowledge as playing a primary role in several of these relationships. They also consider that the quality of their teaching in science can be influenced by teacher-related characteristics such as emotions, personality, motivation and attitude. Teachers do mention situational factors, but do not seem to agree fully with the view that teacher actions and behaviours are more influenced by the situations they face than by their own personal qualities. Indicative of this is the view expressed by the teachers, springing from their own experiences, that some of the situational difficulties can be overcome depending on the characteristics of the teacher.

The research methodology employed in this study, with the combination of the four tools reported, was fruitful in making it possible to collect interesting data. While findings should be interpreted within the limits of a small-scale exploration study and a study of teachers coming from a single country, they may be used to guide research of early years teachers' views and experiences in other countries as well. This would produce a pool of interesting and useful information that could contribute to a holistic approach to improvement of science instruction in early years education.

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