



## KINDERGARTEN TEACHERS' REPRESENTATIONS FOR THEIR SOCIO-COGNITIVE PRACTICES DURING THE NATURAL SCIENCES ACTIVITIES<sup>1</sup>

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**Abstract:** The aim of the current paper is to investigate the traces of socio-cognitive influences in kindergarten teachers' representations about the practices they tend to follow when they develop Natural Sciences activities in kindergarten. A quantitative approach was used, with the research tool being an electronic questionnaire that was completed online by 94 kindergarten teachers served in public Kindergartens. The questionnaire was firstly used in a pilot survey where receiving feedback it was further developed for the main research. Research analysis showed that kindergarten teachers' representations concerning their teaching choices and actions of their students are characterized by practices that are influenced by the socio-cognitive teaching strategy. These practices are followed from both teachers and their students from moderate to large extent.

**Key words:** Early childhood science education; kindergarten teachers' presentations; teaching practices; socio-cognitive teaching strategy

### 1. Introduction

In the last decades, there seems to be an increased interest in the field of education, in exploring the representations of teachers and their connection with teaching practices and strategies. Indeed, a close connection exists between the enhanced practices and the representations that teachers have on various educational issues and the way they interpret and understand the world (Fang, 1996). However, there seems to be limited data on kindergarten teachers' representations for the practices they tend to follow while developing Natural Sciences activities.

Exploring teachers' representations of their practices in the development of Natural Sciences activities in kindergarten can help us gain a deeper understanding on both the way the teachers themselves perceive their work and the variety of influences their teaching strategies get that ultimately shape the practices they tend to follow. Undoubtedly, the exploration of teaching practices and strategies is particularly important, as it enables teachers to reflect on the effective practices for promoting learning as well as the extent to which they seem to adopt these actions in practice (Vartuli, 1999). The data that will emerge is likely to help teachers moving toward this direction.

The current paper is part of a larger study on kindergarten teachers' representations on teaching practices in Natural Sciences activities. It also aspires to explore the representations of kindergarten teachers for their practices in relation to a particular approach which emphasizes the social and cognitive nature of teaching processes.

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## **2. Theoretical Framework**

### **2.1. Teaching strategies for Natural Sciences in Preschool Education**

According to Ravanis (2017) the main didactic approaches for Natural Sciences, at the preschool education level, arise from the dominant pedagogical currents and can be classified as follow: (a) those based on the Empirical Framework. These are teaching strategies that are influenced by behavioral theoretical currents, are particularly attractive to teachers, and are based on the idea that intelligence develops through the senses (Conezio & French, 2002); (b) those based on the Piagetian framework. According to the pioneering teaching strategy, based on Genetic Psychology and Epistemology, the construction of intelligence and knowledge takes place through the individual involvement and interaction with teaching materials, objects and the wider environment, as the child creates his/her personal action plans (Kamii & Lee-Katz, 1979; Ravanis, 1994); (c) those based on the Socio-cognitive framework. The socio-cognitive approach is dominated by perceptions which suggest that the development of cognition is not only the result of the active involvement of subjects with objects, but also arises from the relationship between individuals, who cooperate and share reasoning, thus communicate and interact with each other (Ravanis & Bagakis, 1998) and (d) those based on the Socio-cultural context. This is a rather new trend in teaching Natural Sciences and has its roots on Vygotski's theory. This strategy emphasizes the mental structure of children's thinking based on a historical, social and cultural context and the relationships that develops both between peers as well as between children and adults, in every evolving situation in daily reality (Fleer, 2015; Fragkiadaki & Ravanis, 2016).

### **2.2 Kindergarten teacher practices based on the teaching strategies of Socio-cognitive framework**

According to Socio-cognitive framework, a key feature of the practices followed by teachers during the development of Natural Sciences activities in kindergarten, is the didactic utilization of children's representations of the concepts, phenomena and materials of the natural world, both in the design and implementation of teaching activities (Hodson & Hodson, 1998). Therefore, children's representations are detected and obstacles that do not allow the approach of new knowledge are identified. It is these obstacles that the well qualified teacher has to turn them into teaching goals. The overcome of the obstacles is achieved through appropriate activities that favor the transition of children's thinking from their original representations to the formation of others, compatible with the models of the Natural Sciences, such as activities of exploration, discovery and experimentation with teaching materials, in order to control the functionality of their representations. The teacher adapts his / her teaching whenever he / she considers it is necessary, thus following a flexible teaching process and instructively transforms the teaching content into knowledge suitable for his/her students, adapted both to the level of children's learning difficulties as well as their social references and experiences. Consequently, the teacher guides, mediates, supports and facilitates the educational process, with a more demanding role though, due to the requirement of taking into account his/her student representations (Hodson & Hodson, 1998; Kambouri-Danos, Ravanis, Jameau, & Boilevin, 2019; Ravanis, 2017).

### **2.3 Students' action according to the Socio-cognitive approach**

The main feature of the students' action during the development of Natural Sciences activities in the Kindergarten, according to the above-mentioned teaching strategy, is their active engagement in the educational process and the transformation of their initial representations on the concepts, phenomena and materials of the natural world through experimentation. More specifically, students are asked to formulate and communicate their mental representations of the concepts, phenomena, and materials of the physical world in the classroom, to make predictions and hypotheses that they would explore, and to use multiple systems of representation in order to reconstruct their thought (Ravanis, 2017). In addition, they test their original ideas by engaging in exploratory practices and participate in experimental processes through different ways and techniques, based on the possibilities offered by the diversity of teaching subjects. The experimental process is mainly used to test students'

representations and consequently lead them to draw conclusions. The usage of the cognitive mechanism of conflict becomes apparent, as experimental data that contradicts the pre-existing ideas of the students are displayed to them, in order to make them change their representations to others compatible with the scientific ones (Kada & Ravanis, 2016).

#### **2.4. Kindergarten teachers' representations about the practices they follow in the development of Natural Sciences activities in a Socio-cognitive framework**

In recent years, research into the representations of kindergarten teachers about their practices in developing Natural Sciences activities indicate that teachers seem to claim that they follow practices which clearly fall into the socio-cognitive framework.

More specifically, according to a study carried out by Kavalari, Kakana & Christidou (2012) which examined the teaching strategies followed by kindergarten teachers in science activities, it was found that a relatively small portion of kindergarten teachers followed a 'modern' according to the researchers' approach, which was based on students' predictions. According to this approach, experimentation and observation were used in a systematic manner, in order to lead students to check their predictions and draw conclusions, by discussing and recording their views. The role of the teacher, according to the above-mentioned approach, was to facilitate students' explorations, provide the appropriate teaching materials and equipment and follow procedures that facilitate learning such as collaborative learning, symbolic representation, etc.

Regarding the detection of students' initial representations and their subsequent didactic utilization in line with the socio-cognitive teaching framework, as Kambouri (2016) found out while teachers often recognized the importance of identifying children's initial ideas and preconceptions (erroneous concepts) about a scientific subject they were going to teach, they barely had the time to do so, both in planning and implementation of the activities.

Moreover, in a research carried out by Papandreou & Kalaitzidou (2019), it was found that while kindergarten teachers often stated that they follow practices of detecting students' initial representations at the beginning and end of teaching process, they actually used them solely for introducing later activities and not for facilitating their students to overcome learning obstacles.

However, there seems to be limited research data examining the representations of kindergarten teachers about the practices they follow in the development of Natural Sciences activities in Kindergarten and specifically on the influence of the socio-cognitive approach on their teaching methods. The present study endeavours to fulfill this knowledge gap.

#### **2.5. Research objective and question**

The aim of the current paper is to investigate the traces of socio-cognitive influences in kindergarten teachers' representations about the practices they tend to follow when they develop Natural Sciences activities in kindergarten. The main research question regards the exploration of socio-cognitive approaches that are detected both on representations of kindergarten teachers and on young children's activities.

### **3. Methods**

#### **3.1. Research instrument and procedure**

Initially a questionnaire was developed to detect the representations of kindergarten teachers about the practices they follow in the development of Natural Sciences activities in Kindergarten. Given the fact that there has never been carried out a corresponding research in Greece, as the existing literature suggests, the questionnaire had to be developed from point zero.

A pilot study was carried out for getting feedback for the questionnaire tool. As the participants provided feedback at this stage of the research, they were excluded from the final sample of the study. For the purposes of the main research, a digital form was given to the questionnaire and was electronically sent to the emails of Kindergarten teachers who served in public schools along two

Greek prefectures. All the participants took part in the research voluntarily and anonymously. Having completed the questionnaire, the researchers collected and processed the data.

### 3.2. Participants

The sample consisted of 94 kindergarten teachers who served in public kindergarten schools in Greece. The majority of participants were women (97.9%). Almost 73.4% of the participants were up to 49 years old while 52.1% had up to 15 years' work experience. A relatively satisfactory number of participants held a master's degree (27.7%), while 79.8% of the participants had attended a formal training in Natural Sciences.

## 4. Results

In what follows, the results of data analysis are presented based on the frequencies of kindergarten teachers' responses compatible with the detect of socio-cognitive framework influences on their representations for the practices they follow during the development of Natural Sciences activities.

### 4.1 Kindergarten teachers' representations about the practices they tend to follow regarding teaching strategies on concepts and phenomena of Natural Sciences

Table 1 below presents the percentages of teachers' responses, while in the following text teachers' representations are analyzed and an attempt is made to identify the traces of the socio-cognitive strategies enhanced by them.

**Table 1.** Percentages (%) of kindergarten teachers' responses for the socio-cognitive approach practices they follow in the development of Natural Sciences activities

Practices' kindergarten teachers		1 Not at all	2 Slight extent	3 Moderate extent	4 Large extent	5 Great extent
Preparation of the educational process	Designing goals / activities /communication framework based on initial students' mental representation	0%	4,3%	31,9%	44,7%	19,1%
Implementation of activities	Detection of students' mental representation	0%	3,2%	26,6%	48,9%	21,3%
	Grouping of students' mental representation	1,1%	7,4%	41,5%	35,1%	14,9%
	Flexible teaching course	0%	3,2%	29,8%	43,6%	23,4%
	Implement activities that promote the transition of thinking from initial students' mental representation to the formation of others close to the scientific one	0%	2,1%	42,6%	40,4%	14,9%
	Knowledge of students' mental representation	0%	9,6%	41,5%	39,4%	9,6%
	Knowledge of teaching object	0%	1,1%	28,7%	37,2%	33%
Use of teaching material	Providing to students materials for experimentation to test the functionality of their ideas.	0%	9,6%	41,5%	39,4%	9,6%

The practices of socio-cognitive teaching strategy that are detected in kindergarten teachers' responses are closely related to the preparation of the educational process, the development of activities and the usage of teaching material.

Regarding the preparation of the educational process, 44.7% of kindergarten teachers stated that they plan the goals, the activities and the communication framework by taking into account the initial

mental representations of the students to a large extent, with the main tendency of the responses being from moderate to large degree ( $M = 3.79$ ,  $SD = 0.802$ )

Regarding the development of activities, almost half of kindergarten teachers (48.9%) stated that they follow to a large extent practices that involve the detection of students' initial representations ( $M = 3.88$ ,  $SD = 0.774$ ). 43.6% of them stated that they use activities in a flexible manner ( $M = 3.87$ ,  $SD = 0.806$ ) while 37.2% and 33.0% considered to hold large and great respectively in-depth cognitive understanding of Natural Sciences ( $M = 4.02$ ,  $SD = 0.084$ ). In addition, 41.5% and 35.1% of kindergarten teachers stated that they follow from a moderate to a large extent respectively practices of grouping students' mental representations ( $M = 3.55$ ,  $SD = 0.875$ ). Furthermore, 42.6% and 40.4% considered that they also follow from a moderate to a large extent respectively, the implementation of activities that favor the transition of students' thoughts from the initial ideas and reasoning to the formation of others that are closer to the scientific ones ( $M = 3.68$ ,  $SD = 0.751$ ). Finally, 41.5% and 39.4% of kindergarten teachers stated that they hold from a moderate to a large extent respectively, basic understanding of the initial mental representations of students ( $M = 3.49$ ,  $SD = 0.082$ ). Judging from the above, it can be concluded that teachers seems to adopt from a moderate to a large extent strategies that are based on the socio-cognitive approach.

Finally, in terms of the usage of teaching materials, 41.5% of kindergarten teachers stated that they tend to provide their students with materials of experimenting and controlling their representations to a moderate degree, with the main tendency of their answers being from a moderate to a large extent though ( $M = 3.67$ ,  $SD = 0.90$ ).

#### 4.2. Kindergarten teachers' representations regarding the socio-cognitive approach practices followed by their students in Natural Sciences

Table 2 below presents the percentages of teachers' responses, while in the following text teachers' representations about their students actions are analyzed and an attempt is made to identify the traces of the socio-cognitive strategies enhanced by them.

**Table 2.** Percentages (%) of kindergarten teachers' responses for the socio-cognitive approach practices followed by their students in Natural Sciences activities

	Practices	1 Not at all	2 Slight extent	3 Moderate extent	4 Large extent	5 Great extent
Implementation of activities	Students test their initial mental representations for concepts, physical phenomena and materials through experiments.	1,1%	10,6%	35,1%	33,2%	20,2%
	Students make predictions and hypotheses that they investigate	1,1%	7,4 %	36,2%	36,2%	19,1%
	Students lead to conclusions and theory, through the testing of their mental representations.	1,1%	10,6%	37,2%	38,3%	12,8%
	Students announce to the class their mental representations about concepts, physical phenomena and materials	1,1%	10,6%	36,2%	34%	18,1%
	Students have alternative ideas before engaging with classroom activities.	5,3%	22,3%	41,3%	22,3%	8,5%
Use of teaching material	Use of teaching materials for experimentation to test the functionality of their ideas	0%	13,8%	39,4%	36,2%	10,6%

The practices of socio-cognitive teaching strategy that are detected in the answers of the kindergarten teachers' responses regarding the actions of their students, are closely related to the development of activities and the usage of the teaching material.

Regarding the development of activities, 38.3% of kindergarten teachers stated that their students largely follow practices that leads them to conclusions compatible with Natural Sciences models through checking their initial representations for a number of concepts, phenomena and materials ( $M = 3.51$ ,  $SD = 0.092$ ), while 35.1% stated that their students follow to a moderate extent practices such as using experiments to check their own initial representations ( $M = 3.61$ ,  $SD = 0.099$ ). Interestingly, 36.2% of kindergarten teachers stated their students make assumptions and predictions which they try to verify in a moderate and/or great extent ( $M = 3.65$ ,  $SD = 0.912$ ). In addition, 36.2% and 34% pointed out that their students announce their initial representations in the classroom from a moderate to a large degree respectively ( $M = 3.57$ ,  $SD = 0.097$ ), while 41.3% stated that their students hold to a moderate degree alternative ideas for the concepts of natural phenomena ( $M = 3.06$ ,  $SD = 0.103$ ). It is noteworthy, however, that almost 22.3% of kindergarten teachers believe that their students hold to a small degree any kind of representations. Judging from the above, it can be concluded that teachers seems to believe that their students adopt, from a moderate to a large extent, actions that are based on the socio-cognitive approach.

Finally, in terms of the usage of teaching materials, 39.4% of kindergarten teachers stated that their students tend to use to a moderate degree materials of experimenting and controlling their representations, with the main tendency of their answers being from a moderate to a large extent though ( $M = 3.44$ ,  $SD = 0.862$ ).

## **5. Discussion and conclusion**

The aim of the current article, which is part of a larger study, was firstly to explore the traces of socio-cognitive influences in kindergarten teachers' representations about the practices they tend to follow when they develop Natural Sciences activities in kindergarten and secondly the traces of socio-cognitive influences in the representations of kindergarten teachers for the practices followed by their own students.

The results of the data analysis showed that there is a tendency in the representations of kindergarten teachers, from moderate to large extent, to implement practices that take into account students' initial representations of concepts, phenomena and materials of the physical world. Specifically, it seems that at the heart of any didactic planning and preparation of educational process implemented by kindergarten teachers lie practices that take into account students' mental representations i.e. designing of goals, activities and communication framework. During the development of these activities, there are adopted practices such as the detection and grouping of students' initial representations (learning barriers) for concepts, phenomena, and materials of the physical world. On these practices, flexible teaching processes are used which are often adapted whenever deemed necessary. These practices encourage and guide the transition of children's thinking from the original representations and reflections to the formation of others, compatible with the scientific ones. Regarding the usage of the teaching material, kindergarten teachers state that they provide their students with materials that can help them to experiment and control the functionality of their own representations. Finally, teachers consider that they hold to a great extent an in-depth cognitive understanding of both the subject matter to be taught and the representations of the students related to it. Besides, the detection of the initial representations and their didactic utilization seems to be practices that are considered highly important by kindergarten teachers for overcoming the obstacles of their students (Kambouri, 2016; Papandreou & Kalaitzidou, 2019). However, whether they are eventually implemented in the classroom or not is something that needs to be further explored, as it has been found that either teachers often do not have the necessary time to carry them out both during the planning and implementation of the activities (Kampouri, 2016), or that they do not use them didactically in the subsequent activities even if they seem to have detected them in advance of teaching process (Papandreou & Kalaitzidou, 2019).

Regarding kindergarten teachers' representations about the practices followed by their students in the development of activities in the Natural Sciences, the analysis showed that teachers hold the view that their students take action, from moderate to large extent, that lie at the heart of the socio-cognitive framework. More specifically, it seems that during the development of these activities the implemented practices are closely related to the formulation of the students' initial mental representations in the classroom as well as to the active participation of the students in the educational process. During this enactment, students make predictions and hypotheses which then try to verify and finally check their own initial representations, via their participation in experimental procedures. Through the control of their representations they are led to conclusions and assertion of the related theory. Regarding the usage of teaching material, it seems that students use the teaching material in order to control their original representations.

Judging from the above, it can be concluded that kindergarten teachers' representations concerning their teaching choices and actions of their students are characterized by practices that are influenced by the socio-cognitive teaching strategy. On these practices emphasis is placed on the active participation of students, in the didactic utilization of their initial mental representations and predictions, in the implementation of experiential activities and in the experimentation with teaching materials. This finding is consistent with findings from other studies, which also explored the representations of kindergarten teachers about the strategies they tend to follow when they develop Natural Sciences activities. According to them, teachers often adopt practices that involve the detection of students' initial representations (Papandreou & Kalaitzidou, 2019), as well as experimenting processes that enhance the verification of students' predictions and the drawing of conclusions (Kavalari, Kakana & Christidou, 2012).

Important limitations of the present study are the small size of the sample, the method of convenient sampling that was used, as well as the fact that volunteers were asked to present their practices is an issue that usually leads to response biases. Undoubtedly, using a larger and more representative sample would help to draw safer conclusions. What is more, the combination of quantitative data along with qualitative techniques of recording kindergarten teachers' representations would help to confirm the initial quantitative results.

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