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Investigation of Preeschool Teachers' Questioning' Types*

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Abstract

This study is a discourse analysis in the context of early childhood education. The aim of the study is to detect the preschool teacher's questioning typologies in the classroom. To put it differently, discourse-cognition relations were plumbed in the context of learning and teaching in the period of early childhood. The participants are a preschool teacher and 15 students. As part of this study, the teacher's questioning typologies during in-class discourses were determined. The subjects of the in-class discourses which were video-recorded were specified beforehand. The data were analysed theory-based and data-tendency coding catalogues. The data which obtained by recorder were analysed thorough specific coding catalogues (in seconds or minutes). Then the teacher's questioning typologies were proportioned so as to make inter-implementation comparisons. The teacher applied to seven higher categories of questioning: "communicating", "monitoring", "evaluating", "challenging", "seeking for evidence", observations-comparison- prompting to prediction", "prompting to concluding/ inferencing". It was determined that communicative questioning typology was used more than the other categories) that required high cognitive demand. From this point of view, the teacher's questioning in class is mostly lower level (comprehension, remembering). It is aimed that the obtained evidence of teacher's questioning will contribute significantly to the vocational education actions

Keywords: Discourse Analysis, Teacher Questioning, Teacher Training, Preschool Teaching

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Introduction

Questioning is one of the effective learning methods frequently preferred by teachers to achieve learning-teaching objectives. Children are born with a sense of curiosity and start to ask questions at the moment they speak and to make sense of the world through various questions they ask. Supporting children's sense of curiosity, and the improvement and diversification of their existing emotions are closely associated with the typology and cognitive level of questions from teachers (adults) (Cheminais, 2008; DeVries, Zan, Hildebrant, Edmiaston and Sales, 2002; Dantonio,1990; MacNaughton and Williams, 2004; Savage,1998; Soysal, 2018; 2019). Essentially, engaging children in educationally significant discussions is the goal of many curricula (Boyd and Galda , 2011; Haves and Matusov, 2005). In line with this goal, questions are used as a tool for knowledge creation and learning (Blatchford and Mani, 2008; Chin, 2007; Storey, 2004; Soysal, 2018).

It is important in many aspects to study the questions preferred by teachers in the instructional processes. First, by asking questions, the teacher gives the learners the opportunity to motivate to think, to reveal their curiosity, to prompt their thoughts and to be a partner in expressing themselves (Jegede and Olajide, 1995). Furthermore, through questions, educators can engage learners in processes such as revealing their existing thoughts, deepening, critical thinking, dreaming, problem solving,

predicting, and hypothetical reasoning (Sosyal, 2019). In addition to these processes, since questions are designed to get an answer from the learners by their nature, they can reveal discursively important verbal statements, and thus, they may also significantly affect learners' language development (De Rivera , Girolametto and Weitzman, 2005; Haves and Matusov 2005; van Kleeck, Vander Woude and Hammet, 2006; Yolder, Davies, Bishop and Munson , 1994; Zucker, Justice, Piasta and Kaderavek, 2010).

Teacher's questioning has been a research subject with regard to the improvement of in-class instruction for more than 100 years (Cadzen, 1988; Soysal, 2018). The teacher uses questioning in the classroom as an instructional tool and also for purposes such as starting, continuing and summarizing the course (Johnston, Halocha and Chater, 2007; Vogler, 2005). Teacher's questioning is also an important opportunity to help the child build his/her own knowledge and to reveal the existing thought (Morgan & Saxton, 1991; Cheminais, 2008). Questioning at different cognitive levels contributes to critical thinking (Sanders, 1966). Qualified questions also support children to make cognitive contributions to the discussion (Lee, Kinzie, & Whittaker, 2012). Furthermore, since children give more complex answers to the questions that are more cognitively challenging for children, these questions may be more useful for the language development of children (Gall, 1970). Therefore, teacher's questioning allows children to think effectively and supports them to search for a solution to the problems in a discursive way (Wilen, 1991), which indicates that properly planned and asked questions evoke learners' cognition (Duschl, 2008). In other words, teacher's questioning for probabilistic thinking ensures that the answers are also in this direction (Chapell, Craft, Burnard, & Cremin, 2008). For instance;

Teacher: Do you have any idea how an earthquake occurs?
Student: When the objects under the ground move, the ground also moves, then the earthquake starts to occur.
Teacher: So what makes those stones move?
Student: If something heavy jumps, then the ground moves.
Teacher: Do you mean that "the stones under the ground move when something heavy moves"?
Here, the teacher asks the learners to deepen ("What makes the stones move?") and clarify (Do you mean that "the stones under the ground move when something heavy moves"?) their answers.
Teacher: However, look now, S4 says that if the earthquake occurred when the volcanoes erupted, it would come to our home and could demolish our houses? What do you say?
Student: But it erupted and did not come to our homes.
Teacher: Moreover, our homes would melt away from the heat.

Different typologies of teacher questions are presented here. For instance, teacher requests a simple explanation from learners with the question "Do you mean that "the stones under the ground move when something heavy moves"?". As a response to this question, learners usually give a single-word "yes" or "no" responses. However, for the question "However, look now, S4 says that if the earthquake occurred when the volcanoes erupted, it would come to our home and could demolish our houses? What do you say?" learners must assess discourses of their friends, judge, and form a new evidence-based claim. This demonstrates that the question must be answered with a higher cognitive effort. As demonstrated by samples, the possible cognitive efforts that would be created by learners change as typology of question changes. The purpose of the study is to test this cognitive interpreting based on typology-demand relationship and data-based perspective.

When teacher's questioning is examined in terms of the cognitive demand it contains, the questions asked in in-class instruction may be at different cognitive levels (low, medium, high) (Chin & Osborne, 2008 Klein, Hammrich, Bloom and Ragins, 2000). For instance, "What are lava like? So, is it hard or fluid?" this question is a questioning typology that requires learners to predict at a simple level. Therefore, children will answer this question by making a simple comparison. This question is at the comprehension level in terms of the cognitive demand it contains. However, the teachers may ask learners to evaluate the outcome or their own discourse at the end of the process or may reveal the epistemological and ontological contradictions within students' answers. "There are no dinosaurs today, but earthquakes continue to happen. So, are dinosaurs the cause of earthquakes?" for this question, students need to think about the contradiction in the answers, which indicates that it is a questioning typology that requires a high level of cognitive demand. Therefore, teachers should consider the structure and distribution of their questions before in-class applications (Morgan & Saxton, 1991; Goodwin, Sharp, Cloutier, & Diamond , 1983).

Therefore, it is important for teachers to develop and maintain questioning strategies during all activities in order to raise creative, productive and researching individuals who use critical thinking skills effectively. Studies reveal that preschool teachers frequently use questioning strategies, however, they do not use these strategies effectively, and they mostly used low cognitive level, closed-ended, reminder and recognition questions (Blatchford and Mani, 2008; De Rivera , Girolametto and Weitzman, 2005; Good and Brophy, 1970; Massey, Pence, Justice and Bowles, 2008; Wragg and Brown, 2001; Zucker, Justice, Piasta and Kaderavek, 2010; Tsung-Hui and Wei-Ying, 2008). Furthermore, it is observed in the studies that the cognitive level of teacher's questioning generally remained at the level of comprehension and recall (Massey, 2004; Dovigo, 2016; Bay and Alisinanoğlu, 2012). Therefore, early childhood educators should be aware of what types of questions they use during their activities and should know how to use them in a combination in changing situations. Furthermore, they should also be aware of what kind of cognitive demand (Bloom) these question types require in order to present the questions in a certain rhythmical order. In brief, teachers should be professional interrogators in instructional processes (Wilen and Clegg, 1986). Because, teachers should make evaluating questions that require high level cognitive demands (evaluating, creating) relevant in the classroom for learners to engage in higher-level cognitive processes such as critical thinking and evidence-based reasoning (Storey, 2004).

Preschool teachers should be aware that they use questioning typologies and should know which type of question to prefer in changing situations. Furthermore, they should also be aware of what cognitive level these typologies correspond to for the planning of questions. In brief, they should know the Bloom Taxonomy in general terms. Studies indicate that teachers generally prefer questions that require low level cognitive demand (comprehension, recall) (Gall, 1970). The most important reason for this is that they have no idea about the questioning typologies and the cognitive demands they contain. Because all these in-class applications require significant cognitive demands (Soysal, 2018). Studies also emphasize that teachers' questions that require high cognitive demand are important in revealing the cognitive outcomes of learners (Oliveira, 2010; Soysal, 2018). Because the fact that cognitive outcomes of learners are at a high level (analysis, evaluation, creation) largely depends on the cognitive demands of the teacher (Joyce and Showers,1983; Storey, 2004).

In conclusion, teacher's questioning typologies contribute positively/negatively to students' cognitive contributions in the classroom. This mutual effect creates the "discourse-cognition" relation (Gee & Green, 1998). By addressing teacher's questioning, the discourse can be explained as follows: the teacher creates and maintains learning opportunities for learners by using various types of questions to continue classroom teaching or to support various instructional purposes (Gee & Green, 1998). Cognition refers that learners make a cognitive effort while answering various questions of teachers. The degree of this effort is determined by the cognitive level and typology of teacher's questioning (Gee & Green, 1998).

In Turkey, teacher's questioning in early childhood has not been examined in a discursive context. When the international literature is reviewed, classroom discourse mostly researched in primary education and beyond (Chin, 2006; Mortimer & Buty, 2008; Grace & Langhout, 2014; van Kleeck, Vander Woude and Hammet, 2006). Studies conducted in early childhood indicate that the number of studies in pre-school period should increase (Goodwin & Kyratzis, 2007; Sands, Carr, & Lee, 2012). Recent studies on preschool children are remarkable (Massey, 2004; Dovigo, 2016; Harlen, 1999). Furthermore, studies show that children may engage in conversations getting deeper and deeper (with adults or peers) from the age of three (Dorval and Eckerman, 1984; Garvey, 1984; Massey, Pence, Justice and Bowles, 2008). In this context, it is considered that the study will contribute to the field by investigating the teacher's questioning typologies through discourse analysis in early childhood. Early childhood educators should be aware of questioning typologies, should know the cognitive level involved in these questions, and should be aware of what situations to use them. Therefore, it is critical to investigate the teacher's questioning typologies and the cognitive demand they contain in early childhood.

The aims of this study are as follows:

> to determine the questioning typologies used by preschool teachers in instructional processes
>
> to determine the proportions of questions used by preschool teachers in instructional processes

Justification for the Study

Studies demonstrate that teachers can frequently use questions that require low levels of cognitive demand or remain at the level of "understanding-remembering" in terms of possible intellectual effort created by learners ("How many days are there in a week?") in class (Bay and Alisinanoğlu, 2012; Blatchford and Mani, 2008; De Rivera , Girolametto, and Weitzman, 2005; Dovigo, 2016; Gall, 1970; Storey, 2004; Massey, Pence, Justice, and Bowles, 2008; Wragg and Brown, 2001; Zucker, Justice, Piasta, and Kaderavek, 2010; Tsung-Hui and Wei-Ying, 2008). Teachers might not have the conscious awareness of monitoring their own questions and analyze cognitive demands embedded in them. This lack of conscious awareness usually leads to teachers asking questions with low cognitive levels (Storey, 2004; Massey, Pence, Justice, and Bowles, 2008). In other words, the activity of asking questions in the class includes quite complicated processes for teachers and educators. Bringing in effective question-asking skills to teachers or candidate teachers during in-service and pre-service periods depends on thorough and qualitative knowledge on in-class question-asking activities. Thus, thorough analysis of question-asking activities can present prototype information for teachers and teacher educators that are exterior readers of this study.
Pre-school teachers and teacher educators have very limited information on question types that would trigger and sustain true intellectual acquisition in class and possible cognitive demands these might contain (Storey, 2004; Blatchford and Mani, 2008). Also, when relevant literature is examined, it was noted that studies usually studied teacher questions in the process of a few in-class applications (e.g.; Öztürk-Samur and Soydan, 2013). In this study longitudinal observation was conducted on typologies of teacher questions and possible level of cognitive demands they include for one semester, thus it is possible to acquire more realistic and thorough findings. As an important point, studies on question typologies and studies that directly or indirectly covered cognitive demands of questions usually involved participants at primary or secondary school levels. Also, generally they were observed to have been conducted in science and mathematics education areas (e.g.; Pontecorvo and Sterponi, 2002; Pimentel and McNeill, 2013; Martin and Hand, 2010), while only a limited number of studies were observed to include pre-school period or context (e.g.; Dovigo, 2016). Thus, this study researches answers to the following questions:

> How do question typologies used by pre-school teachers in instructional processes vary?
>
> How do proportions of questions used by pre-school teachers in instructional processes vary?

Theoretical Framework

Researchers have conducted various studies to prove the possible relationship between teacher questions and cognitive state of learners and tried to characterize teacher questions as a result (Aschner, 1961; Soysal, 2018). In a traditional classroom, the teacher generally uses questioning to evaluate student's knowledge (Soysal, 2018; 2019). In these classrooms, the teacher usually asks the students to recall their prior knowledge, seeks a scientific idea, or asks them to find the answers in the teacher's mind (Chin, 2007). The teacher is considered as the authority of knowledge and students accept what the teacher says without discussing their opinions (Van Zee and Minstrell, 1997b). Therefore, teacher's questioning is perceived as a challenge and a threat to students in this classroom (Baird and Nortfield, 1992). In these classrooms, the teacher usually talks more than the children. Teacher's questioning is generally closed-ended, and learners' responses are expected to be accepted in a single reality since it is assumed that the teacher knows the correct answer. Teachers' responses to the questions are usually in the form of wrong or right (Mehan,1979; Wells and Arauz, 2006). Therefore, children can mostly answer such questions as "yes" or "no" and the teacher decides the course of the discussion.

According to studies, researchers agree that teacher's questioning must improve thinking skills instead of imposing correct information to learners (Blatchford and Mani, 2008; De Rivera, Girolametto, and Weitzman, 2005; Dovigo, 2016). As described in detail in the previous section, teacher has some certain responsibilities in in-class processes. While fulfilling such responsibilities the teacher can consciously or unconsciously engage learners in many situations with questioning. For instance; with questioning teacher

can motivate learners to think, give them opportunities to express themselves, and use questioning at varying levels at appropriate time to invite learners to high level thinking processes (Jegede and Olajide, 1995; Dovigo, 2016; Johnston, Halocha, and Chater, 2007; Klein, Hammrich, Bloom, and Ragins, 2000; Soysal, 2018). Thus, it is critical to determine questioning typology directed by teachers in class.

Socratic Education Model

Socratic philosophy of education exists by revealing the potential of the individual. This method aims to teach learners new knowledge through a series of questions they know in advance. The basis of philosophy is that everything in the human mind is known in advance and knowledge is revealed by questions. It can be defined as the way of teaching how to philosophize, not philosophy. It is referred as the art of forcing the learner to freedom and aims to reveal ignorance by getting rid of prejudices. Socratic thinking is considered as one of the most important strategies of today's critical thinking. Socrates argues that knowledge exists in human beings from birth and emerges by recalling it. This method consists of two stages, including ironie and maeutik. In the ironie step, the learner finds out that he/she has no concern with the questions asked. In the maeutik step, learner will be able to access accurate knowledge (Verseyni, 2007).

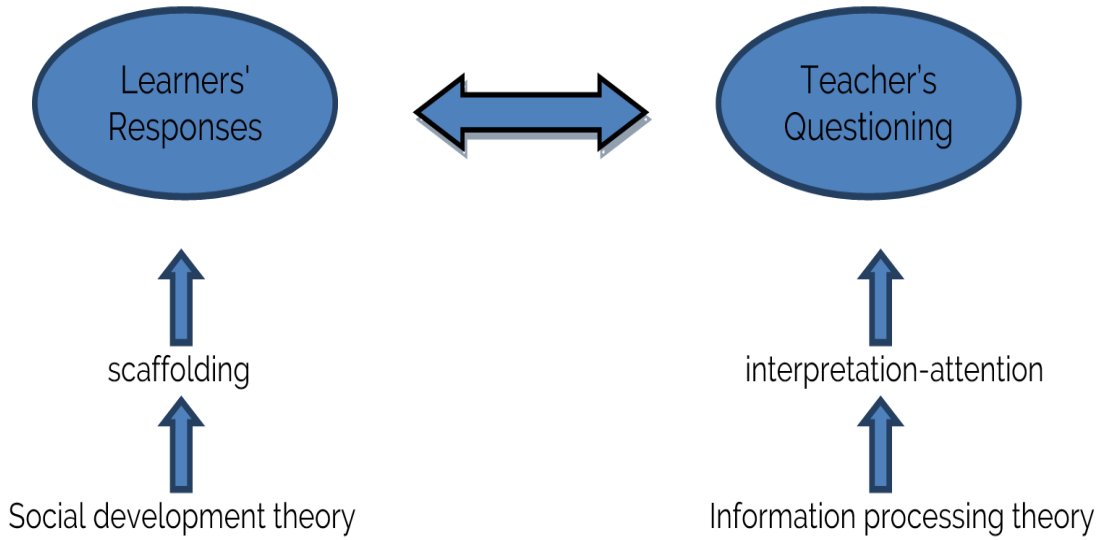
For children, philosophy is a program led by Matthew Lipman, inspired by the philosophies of Plato and John Dewey, inspired by the Socratic method (Murris, 2008). In the program for it, discussions are made with directed discussion plans and games using directed programs. The concepts such as truthfulness, honesty, freedom and justice are addressed in these discussions. Thus, it improves children's thinking abilities and reasoning skills and contributes to the development of their cognitive skills. This method, which forces learners to think critically, is considered as a powerful education method (Sue , 1991).

Vygotsky's Learning and Teaching

Vygotsky (1987) emphasized that social interactions have an important place in the development process of individuals, which suggests that children's cognitive development is affected by the structure and content of social interactions. Vygotsky (1987) considered that each individual has a zone of proximal development. This zone of development refers to the range from what children can do without getting help to what they can do with help. Jerome Bruner describes the teacher as "scaffolding" in the zone of proximal development (Wood, Bruner and Ross, 1976).

For instance, if the learner encounters a challenging question and cannot solve that question on his/her own, the teacher may act as a scaffold by supporting him/her (tips, strategies, etc.). The teacher can use the questions as an effective tool in the scaffolding method by requesting the learners to detail, justify or explain their answers. Teacher's scaffold questioning continues according to the learners' responses, and in this context, adjusted support is provided to the group with questions (van de Pol, Volman, Oort and Beushuizen, 2015). Learners' responses can be explained by the information processing model (Atkinson and Shiffrin, 1968). In order to answer the questions, learners must first pay attention to and understand the question through "sensory record" (Broadbendt Gathercole, 1990). Then, the part of interpreting and making sense of the question in "short-term memory" is started. Finally, regarding the question asked from the long-term memory, the meanings found appropriate to the curriculum material will be recalled. According to Vygotskian perspective, mental development refers to the process of transforming meanings in social contexts into individual structures (Vygotsky, 1978; 1978; 1987). Vygotsky argued that learning takes place from sociality to individuality. In this context, he did not consider language only as a means of communication, but claimed that language was related to various intellectual orientations. Vygotsky considers that language cannot be only a means of communication,

Graphic 1. *Question and Answer Path*



according to him, considering language only as a means of communication shallows his position in learning and teaching. Individuals reveal pedagogical knowledge from their own perspectives through various intellectual orientations. Thus, they can expand, change or verify each other's claims in the process of discussion. Therefore, since learners will employ knowledge from sociality to individuality, each of them will understand-internalize the knowledge differently and originally. What the new mental state of learners after instructional processes will be is related to the ability to internalize the knowledge. Learners restructure each other's mental states together with linguistic elements on the social platform. For the completion of instruction, the outcomes should be internalized and adapted or reduced to subjective situations (Vygotsky, 1987).

Furthermore, when Vygotsky's ideas about learning and mental development are examined closely, two facts appear: "spontaneous concepts" and "scientific concepts". Spontaneous concepts include the knowledge acquired by people through their daily experiences, and the language-thinking system (John-Steiner and Mahn, 1996). With spontaneous concepts, people acquire knowledge directly or indirectly without being involved in formal processes and make sense of life from their own perspectives (John-Steiner and Mahn, 1996). However, scientific concepts require formal processes and are structured in company with a direct instruction. In brief, scientific concepts are realized through deliberate thinking (Vygotsky, 1987). For instance, children are very creative in making sense of the "things" that exist in their minds. While they can attribute various and creative meanings to the existence of the sun ("The thing that gives warmth", "A yellow ball" etc.), for educators, they can attribute the existence of the sun to the continuity of life on earth, which also indicates that every linguistic system is linked to a thinking system. In brief, our intellectual systems determine the speech systems. In this context, within the scope of study, it was considered that daily languages and intellectual systems of the learners included incomplete or unstructured knowledge. In the study, the teacher improved the discourses presented by learners offer intuitively through questions and attempted to bring it closer to the language of science, and also, he enabled them to utilize these systems at appropriate times. In this context, it can be said that the teacher continued the instructional processes by using the questioning in the classroom as part of the social interaction (Dantonio, 1990; Fairbain, 1987). Along with the combination of social language and scientific language in the classroom, learning takes place and a pedagogical tension occurs. This tension begins to occur when the teacher forces the learners to transform their daily language into the scientific language. At this point, the teacher guides the learners with his/her questions. In this study, the cognitive level of the questions used by the teacher in classroom activities was examined in detail. In other words, the systematic approach aimed in the study is as follows: how the teacher initiated, maintained and completed the processes of guiding learners from social language to scientific language by cognitively examining the questions asked during classroom discussions was examined, and the cognitive level of the questions in Bloom's Taxonomy was determined.

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In a traditional classroom, the teacher generally uses questioning to evaluate student's knowledge (Soysal, 2018; 2019). In these classrooms, the teacher usually asks the students to recall their prior knowledge, seeks a scientific idea, or asks them to find the answers in the teacher's mind (Chin, 2007). The teacher is considered as the authority of knowledge and students accept what the teacher says without discussing their opinions (Van Zee and Minstrell, 1997b; Wells and Arauz, 2006). Therefore, teacher's questioning is perceived as a challenge and a threat to students in this classroom (Baird and Nortfield, 1992). In these classrooms, the teacher usually talks more than the children. Teacher's questioning are generally closed-ended, and learners' responses are expected to be accepted in a single reality since it is assumed that the teacher knows the correct answer. Teachers' responses to the questions are usually in the form of wrong or right (Mehan,1979; Wells and Arauz, 2006). Therefore, children can mostly answer such questions as "yes" or "no" and the teacher decides the course of the discussion.

Dialogic and Monologic Talks

Teacher's questioning was categorized by the researchers in terms of including dialogic and monologic conversations (van Boveen, 2015). Monologic conversations mostly progress as monophonic and generally involve the speech processes of the teacher. In classrooms where closed-ended questions are preferred, discussion usually progresses as a monologue (Mehan, 1979; Wells and Arauz, 2006). Because in these classrooms, the focus is on the correct and scientific information provided by the teacher. For instance, ("You say that snow is formed when the cold season comes, but this is not acceptable information!") or ("All you have said are completely irrelevant to the subject!"). When these discourses are examined closely, it is observed that they contain only the voice or authority of the teacher. Furthermore, the person here who decides on the accuracy of the information is the teacher, and he/she determines its decision according to the proximity of the provided answer to his/her correct information (Mcmahon, 2012). On the other hand, dialogic conversations are structured with open-ended questions and mostly involve teacher-student and student-student interaction. Furthermore, through "dialogic" conversations, children have the opportunity to "think together" and "understand with the voices of others" (van der Veen , Van Kruistum, and Micheals, 2015). Dialogic relations are also closely related to the extent to which children are accepted by others. Moreover, "peer conversations" increase with dialogic conversations, and the teacher begins not to

be considered as the only authority in the classroom. Unlike, in a classroom with high peer interaction, the topics and roles may vary fluently, however, the teacher determines the rhythm of this verbal interaction with medium and long term educational goals (Dorval and Eckerman, 1984). Furthermore, in classrooms with dialogic interactions, the teacher directs the child to give more personal and detailed answers that encourage the child to give something. Accordingly, the reasoning and arguments in the dialogic processes are not the product of the individual, but of the group resulting from mutual negotiations.

To put it in detail, the interactions in the learning environments can be grouped under certain headings. They can be categorized as non-interactive-autocratic, interactive autocratic, non-interactive-dialogic, interactive-dialogic (Mortimer and Scott, 2003). In the first one, non-interactive-autocratic category, there is no interaction between the learners and the teacher, and the management is entirely in the hands of the teacher. The teacher transfers the information and the learners directly accept the information provided and transmit it to their long-term memory (Chin, 2007, Mcmahon, 2012). The teacher desires to obtain generally accepted scientific information. For instance, he asks questions such as "What is an earthquake?" that require clear information, and he demands a memorized definition in return for it. Therefore, monologic interactions are mainly dominant in this category. The teacher takes an evaluative role and tends to evaluate the answers by judging (Olivera, 2010; van Booven, 2015). In the interactive-autocratic category, there is a social interaction between teachers and learners, however, the presence of dialogue is not enough to make the process dialogic. In brief, dialogic conversation is not just a mutual interaction, it is the presence of alternative ideas in instructional processes. If the teacher accepts alternative ideas while providing the targeted gains, it can be said that there is a dialogic interaction here. In brief, although there are no different voices, a dialogic phenomenon can be mentioned in the presence of alternative ideas. In the interactive-autocratic category, the teacher guides the learners with questions, may choose the prominent answers, or eliminate the answers that he thinks are irrelevant. For instance, "We're not talking about it right now, are we?", "Did you hear what your friend said?" (Kawalkar and Vijapurkar, 2013). Another category is non-interactive-dialogic. Although there is no verbal interaction between the learners and the teacher, the teacher may present various alternative ideas to the learners. In the interactive-dialogic category, there are both a social interaction and alternative ideas. For instance, learners may be asked to explain the ideas that exist in the background of the responses, such as "Can you explain to us why you think thunder blows volcanic mountains?" (Pimentel and Mcneill, 2013). Furthermore, in this category, the teacher can consider learners as co-evaluators and share the authority with them. For instance, "Your friend claims that lava causes earthquakes. Do you agree?". With this question, the teacher assigned an epistemic authority task to the learner and asked him to decide whether the answer was correct or incorrect (Pimentel and McNeill, 2013). In this category, the teacher uses the “we”-voice instead of “I”-voice, which is instructive, in in-class instructional processes. For instance, "We didn't quite understand what you mean. Can you explain a little more?". The teacher may act in an "argumentative-challenging" way with the questions in this category (Christodoulou and Osborne, 2014). With these questions, it is revealed that the existing answers of the learners are inadequate and they are directed to give more extended answers. "Dinosaurs do not live today, but earthquakes still occur. So, could dinosaurs be the cause of the earthquake?". With these questions, the teacher can reveal the ontological, epistemological or conceptual contradictions within the learners' answers, thus he can pull them to an instructively acceptable platform. However, this method of persuasion should progress dialogically, because it should be in the form of an invitation to a reasonable conversation process with the method of revealing the cognitive contradictions within the learner's response, not the truths that the teacher believes in himself. Furthermore, it can direct learners to provide reasonable evidence to support their answers through teacher's questioning. "Your friend says that the power of sound can blow the volcanic mountains. Then can you persuade us?" (Jadallah, et al., 2011). Moreover, in this category, the teacher can follow where the discussion takes place, what will happen next or what has just happened through his questions. "Let's talk about the earthquake first. Can we move on to the landslide later? "," Let's go back to our topic, but we haven't reached any conclusion for now, right?", Learners can also watch where the argument takes place with these moves. Thus, learners can keep their mental vitality alive in the process.

Closed and Open-Ended Questions

Teacher's questions were basically classified into two sub-categories as closed and open-ended. While the dialogues progressed in the initiation-response-evaluation (IRE) pattern in closed-ended questions, they progressed in the initiation-response-follow up (IRF) pattern in open-ended questions (Sinclair and Coulthard, 1975; Mehan, 1979). IRE questions are based on predicting the "correct" answer in adults' minds by assuming a passive role for children and basically preserving the argument made by the teacher (Wells, 1993; Lee , 2007). IRF questions connect learners to the process by explaining their own thoughts and making them think about the process. Unlike IRE questions, the learner responds more to the teacher feedback in the "IRFRF" chain, which provides the opportunity to structure the discussion on the basis of learners' claims while exploring them. When the questions are open-ended, students use a more diverse vocabulary and more complex sentence structures (Molinari, Mameli and Gnisci , 2013). Furthermore, open-ended questions are effective in supporting children's skills such as inferencing and predicting.

Teachers mostly use the IRE structures. The main purpose of these questions is to give children a passive role in in-class processes and direct them to find the correct answer in the mind of the authority, provided that they do not go beyond the argument made by the teacher (Wells, 1993; Lee, 2007). Learners' responses to these questions usually consist of one-word, "yes" or "no" (Mehan, 1979; Wells and Arauz, 2006). The accuracy of the answers from the learners is also decided through the explanations on the teacher's agenda that are close to the scientific language. Although the quality of the interaction is impaired in the process, the authority continues to ask questions until the answer in its mind is reached. Therefore, the essential point in these classes is the transfer of knowledge (Chin, 2006; 2007; Soysal, 2018;2019),

which was named as a pedagogical game ("know what's in my mind") by Olivera (2010). IRE questions continue until the desired teacher answer is received, although the quality of interaction with the learner is impaired (Mehan, 1979). Therefore, IRE questions require "convergent thinking" as a control element. On the other hand, IRF questions require "divergent thinking" in a broad context. Studies on teacher's questioning generally focused on IRE or IRF sequences. Studies show that ideas are expressed more easily in classrooms where open-ended questions are used, and consequently, cognitive outcome can be at higher levels in these classrooms (Boyd and Rubin 2006; Deshmukh, et al., 2019). Another classification involves explaining open-ended and closed-ended questions in another context as asking "contingent questioning" (Boyd and Rubin, 2006). Contingent questions involve more complex processes than the "open and closed" classification. In contingent questioning, the teacher uses the information in the learner response and plans the next question accordingly. Accordingly, the questions were classified as open-ended, closed-ended, open-ended-contingent, closed-ended-contingent. Researchers argued that the fact that the questions were cognitively high was due to the fact that they contained contingent questions rather than whether they were open or closed-ended (Boyd and Rubin, 2006; Molinari et al., 2013). Moreover, the sequence of question typologies should also be investigated to follow learner responses (Gall, 1970). Sequencing indicates the questioning technique of the teacher and is an effective strategy. Thus, by determining with what kind of questions the teacher started and continued or ended the course, awareness can be raised about how the cognitive level of the questions should be followed in the discussion.

Method

Research Approach

This study includes an analysis of the preschool teacher's questions on the basis of minutes and/or seconds. In this context, the teacher asked questions for various purposes. The main purpose of the study was to determine the typologies of a preschool teacher's discourses (instructional and pedagogical) in the classroom. The data to be obtained from the teacher's in-class discourses within the course were deciphered. The data were analyzed through systematic observation, which is a branch of the sociocultural analysis approach, to determine how the meanings structured in the classroom were linked to the teacher's questioning typologies (Mercer, 2004). The data were analysed theory-based and data-tendency coding catalogues.

A qualitative approach was preferred to find an evidence-based answer to research questions. Within the context of the study, how the meanings realized in a certain period of time were connected to the teacher's questioning typologies were examined. In brief, teachers' questions were analyzed in depth using a case study approach (Mercer, 2004). To this end, within the scope of the study, the cognitive levels of a preschool teacher's discourse (instructional and pedagogical) in the classroom were determined, questioning applications", "strategies" or "typologies" were detected, and the "cognitive demands" that were hidden or directly embedded in them were determined. The participants of the study consisted of a preschool teacher and 16 children. 10 activities of the teacher were video recorded. The subjects of the practice were science activities (natural disasters, states of matter, etc.) and Turkish-language activities. The discourses to be obtained from the in-class applications of the teacher within the scope of the course were deciphered. The data were analyzed through systematic observation, a branch of the sociocultural approach (Mercer, 2004). Systematic observations were carried out in two stages: coding and counting. Teacher's questions were analyzed in two categories as "typology analysis" and "cognitive demand analysis". The data collected with the video recorder were analyzed analytically on the basis of sentences through the catalogs created.

Participants

The participants of the study consisted of a pre-school teacher with 13 years of early childhood education experience, and 16 children. The school where the application took place is located in the Marmara region of Turkey, a major city of Turkey, and in a district with a medium-high socio-economic level. The applications were carried out in classrooms that were arranged separately for each type of activity (Turkish-language, science activities). The researcher participated in some negotiations with the participating teacher and had the opportunity to observe the teacher. The prior knowledge of the teacher about the determined subjects was arranged with the participating teacher. He was provided with professional support on how to conduct discussions. Therefore, he gained an awareness of the importance of the questions he posed in in-class applications. A total of 10 activities of the teacher were recorded. The implementations took a total of 368 minutes.

In-Class Implementations

The in-class applications of this study progressed with learner-centered activities in the questioning process, and learners were supported to make their own reasoning. Possible relations between discourse and cognition were examined in an instructional environment created in this context. A total of 10 applications were carried out within the scope of the study. The applications were designed based on the learning outcomes in the pre-school education curriculum.

Data Collection Processes

The data were collected through a video recorder placed in the classroom for discursive analysis of classroom practices, and technical processes were also arranged. All teacher-student conversations negotiated during an activity hour were deciphered. All teacher-student conversations negotiated during an activity hour were deciphered. In deciphers names of learners and teachers were kept hidden. Camera records were placed in class to ensure all teacher questionings were clearly understood. Also, in order to discriminate between voices of students and teachers speaking at the same time, applications were recorded using two cameras. In addition, an assistant teacher accompanied teacher during applications in class next to the researchers. Assistant teacher provided technical assistance to participant teachers while also helping in preparation of shooting environment.

Learners were accustomed to be video recorded through pilot studies. Thus, the situation known as Hawthorne effect that could be described as change in actions and attitudes due to being watched did not take place. Learners' families and teachers were informed before the video-based data collection processes started, and consent forms were signed by their families on behalf of each student. İstanbul Aydın University Ethics Board decision numbered 2020/01 and dated 28/01/2020 declared that data collection tool and data collection processes used in this study would not violate a possible ethical situation for participants or cause physical/psychological damage to persons.

Ethics Committee Permit Information

Ethics Board that Conducts the Assessment: Istanbul Aydın University
Date of Assessment Decision: 28.01.2020
Assessment Document Number: 88083623-020

Data Analysis

This study includes minute and/or second based analysis of teacher's questioning typologies directed for various reasons during early childhood period and possible cognitive demand created on the side of learners. Thus, all verbal and non-verbal moves of teacher and students in an activity process were recorded. Speeches of teacher in the scope of activities were deciphered by preserving the essence and raw data were acquired. The acquired data were analyzed through systematic observation that is a branch of sociocultural analysis approach to determine how meanings created in class are linked to teacher's questioning typologies and cognitive demands it contains (Mercer, 2004). Systematic observations were carried out in two stages: Coding questioning typologies and counting the questions coded. Teacher's questioning typologies were coded and these codes were placed in the specified categories. This coding was implemented for each application. Teacher's questioning typologies were analytically analyzed through theory-based and data-tendency coding catalogues on the basis of sentences (in seconds or minutes). Teacher's Questionings Coding Catalogue is a coding catalogue formed to theoretically determine which functional purposes are served by questions (Soysal, 2018). In the study this catalogue was used to determine typologies of questions and data-based new codes are formed and assigned for questions that could not be placed in any categories or sub-categories during analysis. These could be listed as the following: searching for information, referring to pre-learning. Studies on categories and descriptions of TQCC are presented on Graphic 2.

Table 1. *In-Class Applications and Their Content*

In-Class Applications	Application Time	Application Content
1. Professions	45	Process that started with introduction of professions (police, teacher, cook, pilot, doctor, etc.) was discussed in sub-topics such as what they do and its benefits to the society.
2. Our World and Continents	36	Discussed in sub-topics such as "Formation of the world and continents", "Location of our country between continents.
3. Natural Disasters	46	Discussed in sub-topics such as "What are natural disasters?", "Which events do we call natural disasters and why?", and "Why does earthquake take place?"
4. What would happen if we had two heads?	47	Discussed in sub-topics such as "What would happen if we had two heads?", "Can this happen in reality?", "How would we have felt if we were in their position?"
5. Hibernating animals	52	Discussed in sub-topics such as "Which animals hibernate?", "Why do they hibernate?"
6. What is disability?	47	Discussed in sub-topics such as "Who are called disabled?", "Which situations create a disability?", and "How would we have felt if we were in the position of disabled people?"
7. Gravity	35	Discussed in sub-topics such as "Would falling to the ground differ for heavy and light balls?", "Why do balls fall to the ground?", and "What is gravity?".
8. Seasons and formation of snow	11	Discussed in sub-topics such as "How do seasons form?", "Why does it rain or snow?" and "How does snow form?".
9. Heavy and light stones	31	Discussed in sub-topics such as "What is weight?", "How can we find weight of stones?"
10. States of matter	10	Discussed in sub-topics such as "What is steam and how does it form?", "What are the states of matter?"

Graphic 2. *Teachers' Questionings Coding Catalogue (TQCC)*

Category	Codes	Discursive functions	Related studies
Communicating	Deepening	Teacher wants the answer given to be deepened.	Pimentel & McNeill (2013), Leach & Scott (2002)
	Asking for explanation	Teacher wants to learn the detail under answer given or wants further explanation.	
	Restructuring	Teacher restructures answer of the student in a way everyone would understand.	
	Concretization	Teacher requests concrete situations, examples, and analogies for answers given.	
	Seeking alternative discourses	Teacher wants to find alternative "answers, discourses" in class.	
	Searching for information	Teacher requests "simple recalls" from students regarding pre-learnings.	
	Referring to pre-learnings	Teacher makes "references" to concepts discussed in previous classes.	
Monitoring	Meta discourse development	Teacher wants students to rethink on previous student ideas.	Van Zee & Minstrell (1997a), Simon et al. (2006); Mortimer & Scott (2003)
	Focusing	Teachers draws attention of students to a particular answer.	
	Monitoring-1 (instant)	Teacher makes a reminder on what is discussed in class at that instant and the where the discussion was.	
	Monitoring-2 (retrospective)	Teacher makes a reminder on what was discussed a while ago in class and where the discussion was.	
	Monitoring-3 (prospective)	Teacher makes a reminder on what will be discussed in class after a while and where the discussion will be.	
	Summarizing	Teacher categorizes and summarizes answers.	
	Selection-elimination	Teacher selects some of the answers, ignores some, categorizes and summarizes.	
	Testing change of mind	Teacher directs students to think if their previous opinions have changed.	
Evaluating	Student discourse	Student wants students to evaluate what each other said.	Christodoulou & Osborne (2014), Simon et al. (2006)
	Teacher discourse	Teacher wants learners to evaluate what he/she said.	
	Situation	Teacher asks that a situation, event, claim created by him/her would be evaluated.	
Challenging	Devil's advocate	Teacher reveals epistemological, ontological, and conceptual challenges in student claims.	Christodoulou & Osborne (2014), Simon et al. (2006), Jadallah et al. (2011)
	Challenging by monitoring	Teacher compares student ideas that lack internal consistency.	
Seeking for Evidence	Using evidence	Teacher questions if students have sufficient and appropriate evidence about what they say.	Oh & Campbell (2013), McNeill & Krajcik (2011)
	*Referring to EBR	Teacher directs students to *Evidence-Based Reasoning situation.	
	Awarding evidence	Teacher awards and reinforces evidence based reasoning.	
Obs-Comp-Pred	Comparison	Teacher wants learners to compare situations, examples, claims, etc.	Mortimer & Scott (2003), Soysal (2018)
	Prediction	Teacher wants students to make predictions.	
	Observation	Teacher wants learners to make instant observations or share their observational experiences.	
Inferencing	Finalization	Teacher wants learners to arrive at a conclusion.	Mortimer & Scott (2003), Soysal (2018)
	Assumption prompting	Teacher wants students to make probabilistic or contingent reasoning.	

TQCC contains seven categories and 28 different codes that can characterize teacher questionings or discursive (pedagogic) functions. With TQCC all teacher questionings that could be asked in class could be analyzed in a broad variety. Also it has the functionality that can detail and capture all functions of teacher questionings. TQCC is formed to be have both theory-base and data-tendency (Mercer, 2010; Soysal 2018; 2019). In other words, when TQCC was being formed analytic codes developed with theoretical studies were used while new codes with data-tendency were also added.

Detailed explanation of coding processes is presented below:

> T: Why do you think disability is permanent? (Communicating-Deepening)
>
> S: Because they might lose a limb in the accident. That is why it becomes permanent.
>
> T: However, look now, S4 says that if the earthquake occurred when the volcanoes erupted, it would come to our home and could demolish our houses? What do you say? (Challenging-Devil's advocate)
>
> S: But it erupted and did not come to our homes. (Discussion obtained "What is Disability?" application. Application time: 42 Application sequence: 7).
>
> T: Look S7 said in order to be called a disabled he/she must have a big accident and lose a limb in that accident. Do you agree? (Evaluating-student discourse)
>
> S: Yes, but for example we can call a person with no arm no legs, who cannot hear a disabled too. (Discussion obtained from "What if We Had Two Heads?" application. Application time: 47 Application sequence: 4).

Validity and Reliability

In order to ensure the validity of the coding catalogs used, new sub-categories were created for the questions that could not be encoded in any sub-category after the in-class applications (searching alternative discourses, searching for information, referring to pre-learning). In order to increase the reliability of the codes assigned for each question, the intra-video and inter-video codes assigned were compared and their similarities were interpreted. Furthermore, inter-coder consistency was calculated as 95% for coding errors that may arise from the researcher. The necessary negotiations were performed for the conflicting codes. Moreover, expert evaluation (in science education) was performed to prevent incorrect coding that may occur due to the bias of the researcher (Creswell, 2003). Furthermore, researcher, the participant teacher and the field expert had deep discussions to follow the interactions related to the discussions, and thus, it was possible to observe more deeply for which purpose the teacher used his discourses (Lincoln and Guba, 1985).

Results

The questioning typologies used by the teacher during in-class applications are presented in this part of the study. In the sub-categories described above, how often the teacher used questioning typologies in different categories is presented cumulatively. When all in-class applications are examined, teacher's questioning typologies are as follows:

Table 2. *Ratios of Instructional (Discursive) Functions of Teacher's Questioning in In-Class Applications*

Category	Sample Discourses	Ratios
Communicative	"Do you say that the it will not affect the earthquake because it is so far away?"	46.9%
Monitoring	"Now Ayşe said that the lavas get hot under the ground and move the stones. And she has also previously said when something too heavy jumps, the stones move and an earthquake occurs."	17.3%
Evaluating	"She said I think it may occur in both of them, do you agree?"	7.9%
Challenging	"Dinosaurs do not exist in the world today, but earthquakes occasionally occur. Then, is dinosaurs the cause of earthquakes?"	6.1%
Seeking for Evidence	"How do you know that this is so?"	3.3%
Observation	"What could margarine be like?"	2%
Comparison	"With which fingers do you feel more cold?"	2%
Prediction	"Well, do you think what they consume can provide energy for a long time?"	7%
Inferencing	"So lava is a moving thing? It can move under the ground."	7.3%

Teacher's Questioning for Communicating Purposes

The questions included in this questioning typologies and their answers served for the establishment of a healthy intellectual communication in the teacher-student and student-student interactions in the classroom. To this end, the teacher used "deepening" questions to learn the ideas in the background of learners' responses or to express supporting claims. A section taken from in-class applications is presented in Table 3. The teacher asked a probe question to find out the deep "reason" in response to the learner's short answer in Line 2. With the "asking for explanation" questions, the teacher asked the learner to explain his discourse in a more understandable way. As it can be seen in line 7 in Table 3, the teacher requested a new explanation for the learner's discourse which was not semantically clear. In parallel with the "asking for explanation" questions, the "restructuring" questions also aimed to present the learners'

responses to the group in a format that could be understood by the teacher. The answer provided by the learner in line 11 was presented to the group more clearly in line 12. With the "concretization" questions, the teacher requested the learners to re-explain the answer with concrete situations or analogies. For instance, ("You said two-headed people may face some difficulties. Can you give an example? What challenge may they face?"). Thus, the claims presented could be materialized. With the questions of "seeking alternative discourses", the teacher resorted to search for other reasonable and scientific answers that would ensure the continuity of the discussion. For instance, ("Does anyone have any other ideas? How does the air cool?"). The questions of "searching for information" ask learners to make simple recalls, the main purpose of which is to recall information from long-term memory. For instance, ("What warms our world?"). With questions in this category, the teacher aimed to probe the learners' responses and to take their answers to a more understandable platform. Thus, learners were able to actively participate in the processes. Furthermore, the formation of a common language in the classroom depends on the presence of communicating questions. Therefore, the teacher attempted to listen to the learners' claims before criticizing them and to reveal the ideas in the background of their answers. The significant condition for benefiting from activities in classroom discourse is the interpretation of the discourse by other learners and the formation of a holistic spoken language

Teacher's Questioning for Monitoring Purposes

Teacher questions for monitoring purposes were chosen to ensure that the group would be adhered to the process instructively and cognitively. To this end, with "monitoring (instant)" questions, the teacher could share where the discussion was that moment with learners (Table 4, Lines 1-3 and 9). Similarly, the teacher checked "what was talked for a while ago" (Line 26) with "retrospective monitoring"

Table 3. *Sub-typologies of the Teacher's Questions in the "Communicating" Category*

Turns at talking	Discourser	Discourse	Teacher's questioning typology	Brief explanation
	T*	Is an earthquake a natural disaster?	The process begins with a closed-ended question	-
	S1**	No	-	-
	T	Why not?	Communicating-Deepening	Asks for deepening behind the learner's answer.
	S2	Yes		
	T	If no, can you explain "why" no? because I did not understand.	Communicating-Deepening	-
	S1	Because earthquakes do not save us.	-	-
	T	Is it a natural disaster because it does not save??	Communicating-Asking for explanation	Wants to learn the detail or explanation behind the learner's response.
	S3	It also puts us into trouble.	-	-
	T	"Puts into trouble." Can you explain to us what you mean?	Communicating-Asking for explanation	Wants to learn the detail or explanation behind the learner's response.
	S3	I mean, our belongings are broken when an earthquake occurs. We also get into trouble. And if our belongings are broken, we will be sad.	-	-
	S4	When the underground stones move, they also move above the ground, then earthquakes start to shake.	-	-
	T	You mean "underground things move when something heavy moves"?	Communicating-restructuring	The teacher restructures the answer so that the whole class can understand.

*T: Teacher; **S: Student (The dialogues in Table 4 were obtained from the "Earthquake and Natural Disasters" implementations. Application Time: 46 minutes, Application Sequence: 3).

questions. The teacher could also check what would be talked "after a while" with monitoring questions (e.g.; "Let's talk about it a little later?"). He attracted the attention of the group to a specific answer provided by "focusing" questions, the main purpose of which was to ensure that they think about an answer which was considered important for discussion. In line 5, the teacher could draw attention to a specific answer provided with the "focusing" question. With "selection-elimination" questions, the teacher could highlight some answers, however, he ignored some of them and threw them back (e.g.; "Some of your friends say that lava can affect ground shaking. We can continue on this topic, how about it?"). Thus, the answers that were important for the discussion could be examined again. With the questions of "testing change of mind", he could notice and reveal the learners whose minds changed during the discussion. Thus, he could create an awareness in learners that their claims may change in the face of another, more reasonable discourse. An example of the questions of "testing change of mind" asked by the teacher is presented in Line 11 in Table 5. Furthermore, with the "meta discourse development" questions, the teacher could make the learners think again about their answers. Thus, the learners could reconsider the appropriateness or scientific appropriateness of their answers. Metacognitive thinking ability is critical for the development of self-regulation skills. Therefore, it is

Table 4. *Sub-typologies of the Teacher's Questions in the "Monitoring" Category*

Turns at talking	Discourser	Discourse	Teacher's questioning typology	Brief explanation
	T	Can we go back to our topic? We haven't come to a conclusion for now, right? // Your friend says lightning causes the lava to heat up and the volcanic mountain erupts. Your other friend says it explodes because of the loud noise. Elif had previously said that they explode due to lavas and an earthquake occurs, right? //Do you think it could be the cause of the eruption of volcanoes?. Do you think they trigger the earthquake?	Monitoring-instant // Monitoring-summarizing // Meta-discourse development	The teacher recalls what was discussed at that moment. // Collects the answers given. // Allows learners to reconsider their answers.
	S1	Planets collide, so an earthquake occurs.	-	-
	T	Look, your friend says something different, which answer is right now, I couldn't understand. Can you support me?	Monitoring-instant	The teacher instantly recalls the things discussed.
	S2	Planets are not side by side.	-	-
	T	Your friend says they are not together, so they do not affect each other. Look, there are different ideas?	Focusing	The teacher focuses the students' attention on a specific answer.
	S3	Volcanoes explode when they encounter with meteorite, then cliffs collide and encounter meteor and volcanoes flow.	-	-
	T	When the meteorites hit each other, the volcano starts to flow, right?	Communicating-Asking for explanation	-
	S4	Excuse me? Planets stand in very different places.	-	-
	T	Now, this is not our topic, we are talking about something else, but now. Do earthquakes occur when meteorites encounter? Do you agree with S5?	Monitoring (instant) // Evaluation - student discourse	-// Asks the student's answer to be evaluated by other learners.
	S5	They stand side by side and some stand apart.	-	-
	T	Is this what causes the earthquake? Do planets collide? // Do you agree with your friend?	Communicating-Asking for explanation // Evaluation - student discourse	-
	S6	I think it is right.	-	-
	T	Would you explain it to us then??	Communicating-Asking for explanation	-
	S6	(No answer).	-	-

(Table 4. Cont.)

S5	Since there are suns and mountains of volcanoes, the lava gets hot and the volcanic mountain erupts.	-	-
T	The lava is underground but can it warm it? // Could the sun be hot enough to warm it harm the earth?	Challenging (devil's advocate)// observations-comparison-prompting to prediction	The contradiction in the student's answer is revealed. // Students are asked to make simple predictions.
S5	Our life ends.	-	-
T	Yes. So is the sun the cause of the eruption of volcanoes? // Think about it this way, if the sun had blown volcanoes, there would be no living things around it, the temperature would be high, but people are alive right? // What do you think about this subject?	Communicating-Asking for explanation // Challenging (devil's advocate)// Evaluation (teacher discourse)	-//-// The teacher asks that to an event created by him would be evaluated by the learners.
S7	Trees dry at very high temperatures.	-	-
T	Right? But we see hey are alive, we know.	Challenging (devil's advocate)	-
S6	But sea creatures also live.	-	-
T	But we are talking about something else right now. Now S6 thinks the sun warms the volcanoes and makes them explode. Shall we talk about this? // It could happen on planets that are close to the sun. // Can we survive at very high temperatures?	Monitoring (instant) // Challenging (devil's advocate) // observations-comparison-prompting to prediction	
S	No.	-	-
T	There is life on planets that are too close to the sun.	Non-code discourse	-
S4	Is there no people living there??	-	-
T	Yes, we are not discussing that issue now. Shall we focus on the subject? Let's talk about whether the existence of planets will cause earthquakes and will the sun heat volcanoes. Actually, S2 explained this at the very beginning. She said "As the lava moves underground, the lava moves outward and an earthquake occurs. Some tremors occur as these lavas move outward" Shall we discuss this topic?	Monitoring (instant) // Monitoring (retrospective)	-// The teacher recalls what was discussed a while ago.

(The dialogues in Table 4 were obtained from the "Earthquake and Natural Disasters" implementations. Implementations Time: 46 minutes, Application Sequence: 3).

important for preschool children to develop a meta-cognitive perspective.

Teacher's Questioning for Evaluation Purposes:

With the questions for "evaluation" purposes, the teacher asked the group to evaluate the learners' discourse, the teacher's discourse or a situation that occurred during the negotiation. With the questions in this category, learners could be openly invited to the evaluation processes. Thus, cognitive interactions within the group increased. Furthermore, the exchange of ideas among learners was also increased and the conversations in classroom practices were supported to be more student-student centered. With "evaluation (student discourse)" questions, the teacher ensured that the discourse was evaluated by other learners by presenting it (see Table 6, lines 1-3-11). With "evaluation (teacher discourse)" questions, the teacher opened his own discourse to evaluation. With the questions in this category, in-class processes were not maintained by a single authority, and anyone with a logical explanation could share the authority, which also raised the focus of the learners on the process and encouraged them to make arguments on the level of logic. As it can be seen in Line 18 in Table 6, the teacher presented his own discourse for the evaluation of the learners. With "situation" assessment questions, the teacher asked the group to evaluate the situation arising during the negotiation. (e.g.; "Now we claim that the disappearing waters return to the earth in the form of rain. Does everybody think like that?"). With these types of teacher questions, it can be ensured that cognitive interactions between learners increase.*Teacher's Questioning for Evaluation Purposes:*

With the questions for "evaluation" purposes, the teacher asked the group to evaluate the learners' discourse, the teacher's discourse or a situation that occurred during the

Table 5. *Sub-typologies of the Teacher's Questions in the "Evaluation" Category*

Turns at talking	Discourser	Discourse	Teacher's questioning typology	Brief explanation
1.	T	Now, S said that the temperature of lava increases underground and causes the stones to move. And before, when something heavy jumps on the earth, the stones move and an earthquake occurs. // Which one do you find right?	Monitoring-retrospective // Evaluation-student discourse	The teacher recalls the topics discussed a while ago. // asks learners to evaluate what each other says.
2.	S	It could happen in either case.	-	-
3.	T	She said it could happen in either case, what do you think?	Evaluation-student discourse	asks learners to evaluate what each other says.
4.	S1	I agree, I think so.	-	-
5.	T	Then, the earthquake may be due to the temperature that activates both underground. You say it may also occur due to the weight moving over the ground?	asking for explanation	-
6.	S1	Yes.	-	-
7.	T	We experienced an earthquake the other days. So, did a too big object jump?	challenging-devil's advocate	reveals the contradiction in the learner's answer.
8.	S2	No.	-	
9.	T	Do you think something heavy moved??	observations-comparison-prompting to prediction	asks learners to make simple predictions.
10.	S3	I think it moved under the ground because we didn't see anything high coming out.	-	-
11.	T	So, the things moving on earth do not cause earthquakes, right? Do you think so, S??	Monitoring-testing change of mind	directs learners to think about whether their mind has changed.

(The dialogues in Table 5 were obtained from the "Earthquake and Natural Disasters" implementations. Implementations Time: 46 minutes, Application Sequence: 3).

negotiation. With the questions in this category, learners could be openly invited to the evaluation processes. Thus, cognitive interactions within the group increased. Furthermore, the exchange of ideas among learners was also increased and the conversations in classroom practices were supported to be more student-student centered. With "evaluation (student discourse)" questions, the teacher ensured that the discourse was evaluated by other learners by presenting it (see Table 6, lines 1-3-11). With "evaluation (teacher discourse)" questions, the teacher opened his own discourse to evaluation. With the questions in this category, in-class processes were not maintained by a single authority, and anyone with a logical explanation could share the authority, which also raised the focus of the learners on the process and encouraged them to make arguments on the level of logic. As it can be seen in Line 18 in Table 6, the teacher presented his own discourse for the evaluation of the learners. With "situation" assessment questions, the teacher asked the group to evaluate the situation arising during the negotiation. (e.g.; "Now we claim that the disappearing waters return to the earth in the form of rain. Does everybody think like that?"). With these types of teacher questions, it can be ensured that cognitive interactions between learners increase.

Teacher's Questioning for Challenging Purposes

With the questions in this category, the teacher aimed to reveal the epistemological, ontological and conceptual contradictions in the answers given by the learners. For instance, ("So let's throw the stones on the ground into the water and let it grow to form continents. Will it be?"), ("Look, your friend says dinosaurs cause earthquakes. There are no dinosaurs today, but earthquakes still occur."). Here, the teacher revealed the contradiction in the student's answer and refuted the claim by proving it. Furthermore, with these types of questions, students' ideas without internal consistency can be revealed by comparing ("Well, do volcanic mountains erupt every time there is thunder?"), ("But you just said nothing jumped above the ground but an earthquake occurred."). Here, students' discourses that do not have internal consistency were revealed.

Teacher's Questioning for the Purpose of Seeking for Evidence

With teacher's questioning for the purpose of seeking for evidence, the availability of sufficient evidence for the learners' claims was examined. With the questions in this category, the teacher directed the learners to present evidence and also encouraged them to use evidence in their

reasoning. With these questions, the teacher directed the learners to present scientifically valid evidence to help their answers. For instance, "Well, why are you saying that thunder lead to the explosion of volcanic mountains? What makes you think like that?".

Teacher's Questioning for Observation-Comparison-Prediction Purposes

With teacher's questioning in this category, the learners were asked to compare the situations, examples, and claims. For instance, ("With which fingers do you feel more cold?"), ("Is foot fracture an obstacle?"). Here, the teacher directed the learners to compare and determine whether a foot fracture was an obstacle. Learners may also be asked to share their observational experiences or make instant observations ("What is the weather like now?"). They can also be asked to predict ("Why do we wear glasses?"), ("Well, what would the traffic be without a traffic police there?").

Teacher's Questioning for Inferencing Purposes

With teacher's questioning in this category, the group was asked to make an "inference" based on the topic under discussion. The "finalization" questions ask learners to reach a conclusion based on the activity. For instance, ("So, are all professions retired at the end?). In this question, the teacher invited the learners to come to a conclusion based on the spoken situation. "Assumption-prompting" questions ask learners to make a probabilistic reasoning about the event that exists. For instance, ("Then do we know the old people from outside?"). In this question, the group is asked to make hypothetical inferences based on the spoken subject.

Discussion, Conclusion and Suggestions

The teachers used questioning typologies at certain intervals for various purposes such as initiating, continuing and summarizing the discussion in the classroom. When teacher's questioning typologies were examined, they were determined as communicating (46.9%), monitoring (17%), evaluating (7.9%), challenging (6.1%), seeking for evidence (3.3%) observation (2%), comparison (2%) , prediction (7%), inferencing (7.3%) questions. When the results of the study were evaluated, it was observed that the teacher mainly asked communicating questions and used less questioning typologies requiring a high level of cognitive demand, such as evaluation and creation (evaluation (situation/teacher/student discourse), challenging). As it was explained, "communicating" questioning typologies include demands such as deepening the answers of the learners and ensuring that the speech can be monitored instantly in in-class applications. This questioning typology is included in the level of comprehension in Bloom's Taxonomy. In other words, teacher's questions generally (46.6%) require low-level cognitive demand and such questions increased the speaking time (Martin & Hand, 2009). However, the insufficiency of questioning typologies requiring a high level of cognitive demand, such as "challenging" (6.1%) and "evaluation" (7.3%), was also remarkable. In other words, almost half of the teacher's questions require (low) level of cognitive demand such as deepening, asking for explanation, and restructuring. In the studies, it was revealed that there was an increase in the problem solving skills of children who were subjected to cognitive questioning at a high cognitive level (Turner & Durrett, 1975). Therefore, teacher's questioning plays a very critical role for the improvement of teaching and for a cognitively balanced course.

It is observed that teachers are not aware of which discursive purposes their questions serve while performing in-class instructional activities in the preschool period (Cochran, 2005). It is aimed that the results obtained will contribute to the professional development activities of teacher's questioning. It is considered that teachers will be motivated to professional development and change processes and adopt learner-centered instructional processes by showing them their questioning typologies and their proportions through professional development programs.

The most important result from the above data-based interpretations is whether the teacher is mostly aware of which discursive purpose his questions serve in the instructional processes in the classroom (Cochran, 2005), which may have led to the teacher's failure to use his questions homogeneously. This may also have caused certain questioning typologies (e.g.; communicating and monitoring) and the others frequently preferred during the applications (challenging and evaluating) to remain in the background. So, the cognitive level of teacher's questioning was low ("81.62%") during the applications, except for a few applications, which may cause the cognitive states of the learners to be at similar levels accordingly. However, a more cognitively productive classroom environment was achieved by using certain categories (monitoring and evaluation) together on the basis of applications. Productive classroom can be defined as an environment where learners take each other seriously and think and elaborate together (van der Veen, van Kruistum and Michaels, 2015). Similarly, as can be seen in the study, the way for teachers to achieve a productive classroom environment is to use the questions in combination, which can be seen in the application named "Natural Disasters" in a data-based way. Based on all these results, it can be said that teachers' use of questions with varying degrees of harmony will contribute to the cognitive states of the learners.

As it was explained in detail in other chapters, it can be said that early childhood educators are generally unaware of questioning typologies and the cognitive demands that arise due to these typologies (Oliveira, 2010). This situation also led to similar results in the study and caused the teacher questions to remain mostly at the level of comprehension-recall ("81.62%"). Accordingly, teachers' awareness of asking question strategies can be increased through various vocational development programs (Dantonio, 1990; Fairbain, 1987; Joyce & Showers, 1983). If, questioning typologies and cognitive demands that change accordingly and are embedded in the questions are presented to teachers on the basis of evidence through development programs, they will be motivated to their vocational development and adopt learner-centered instructional processes (Otto & Schuck, 1983; Sitko & Slemon, 1982). The main way for teachers to be motivated for vocational development programs is that they have the belief and awareness that the strategies they use can affect the cognitive states of the learners. Accordingly, it is necessary to provide support for the change of

epistemological beliefs of the teachers as well as improving their questioning skills. Because, in order to get a permanent and desired result from vocational development, the teacher should be first aware that the questions asked will affect the differentiation in the cognitive effort levels of the learners.

It is considered that the results of the study are important in terms of being the first study examining teachers' questioning typologies with the perspective of discourse analysis in the context of pre-school education in our country, and that they are also useful in terms of revealing the importance of questioning in pre-school education.
When the results of the study are examined, some recommendations are offered. early childhood educators should include more questioning in the activities in the daily schedule, should have a general knowledge about the cognitive level of the questions to be asked, should increase the frequency of questions requiring high-level cognitive effort such as evaluating-creativity (high) as well as comprehension-recall (low) questions, and they also should consider the cognitive development levels of children while asking questions.

For researchers, it is recommended that the levels of teacher's questioning, their status according to Bloom's Taxonomy, and the effect of questions on learners' cognitive outcomes should be examined with a discourse analysis perspective in early childhood education. In addition to the examination of questioning typologies, it is necessary to seek for evidence for their questions, and they should be subjected to a professional development program so that teachers can engage in this process, and consequently, it is recommended to examine the changes in the cognitive levels of the questions.

Institutions and organizations responsible for training pre-school teachers should be provided with in-service seminars to improve teachers' questioning skills. Furthermore, academics training early childhood educators should also be provided with in-service training to improve questioning skills.

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