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QUESTIONING AS A MEDIATION TOOL FOR COGNITIVE DEVELOPMENT IN EARLY SCIENCE TEACHING

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Abstract. *In this article are presented the results of an empirical study, which tried to find the explanation for the relatively unsatisfactory results of Slovene pupils in the Trends in International Mathematics and Science study (TIMSS) in the area of early natural science. Questions from teachers and those from children in the process of teaching the school subject of Environmental Studies in the first grade of nine-year primary school were examined and also the communication that the teacher, as a mediator of a learning process, initiates with children. More precisely: the quantity and quality of teachers', and consequently also of children's questions. 18 teaching hours in two elementary schools were observed and recorded with the defined protocol during the teaching of three thematic topics. The results show that teachers ask too many questions and that those questions are at lower taxonomic levels. The research also showed that children seldom ask questions and that these are also generally at lower taxonomic levels. These types of questions cannot be used as a mediation tool and consequently do not stimulate the cognitive processes of pupils.*

Key words: *cognitive development, early natural and social science education, questioning, primary school.*

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Introduction

The results of TIMSS research from 2003 (TIMSS, 2003) showed that Slovene pupils have a good self-image regarding their knowledge of natural sciences; unfortunately, they do not know as much as they think they do. Their knowledge is mainly factual – descriptive; they grasp the questions at lower taxonomic levels, while they attain higher level knowledge less often than their coevals around the world. They have difficulties with research work and with the process of understanding. Most children can neither write down the explanation of a phenomenon nor use diagrams in reporting on natural findings (Japelj Pavešić et all, 2005).

How successful pupils solve the TIMSS' test exercises is also influenced by the cognitive level on which the question is posed and thus also reflects the pupil's ability to solve problems with the help of higher cognitive (thinking) processes. Among the countries compared, the greatest difference lies between knowledge at the first level (knowing the facts) and at the second (understanding of concepts) cognitive level; between the second and third levels (inference, substantiation, analysis), the difference is small. It can be concluded that Slovene pupils in early natural science adopt knowledge mainly on the level of verbal understanding, including basic concepts and facts that they cannot use in solving more exacting exercises.

Such results left many in the professional public in Slovenia guessing what could be the reason. The **curriculum** for the subject of Environmental Studies (that is the name for the school subject which covers **early natural and social science teaching** in the Slovene curriculum) is based on constructivist and humanist theories of learning and teaching which both place the pupils and their cognitive development at the centre of attention. Its **goals** and **didactic recommendations** aim to ensure that the outcome of lessons in natural science and the humanities in Slovene schools should be not only reproductive knowledge but also development of the ability to think on the higher cognitive levels (Krnel, 2005).

The Environmental Studies Curriculum

In Slovene 9 year's compulsory school, the natural sciences are taught as special school subjects that are designated differently at different levels of schooling. Specialized school subjects, such as physics, chemistry and biology are taught in the last three years (ages 12 – 14); at the ages of 9 – 11, the natural sciences and technics (technology) are taught as a single school subject: *Natural Science and Technics.* In the first triennium, which means at the ages of 6 – 8 Slovene curriculum does not divide natural and social science education. Both fields of knowledge are taught within the frame of the school subject, called *Environmental Studies (ES)*. We must point out that this subject covers topics from the natural and social sciences and should not be confused with the subject of *environmental education*, as the international English speaking audience might expect.

Environmental (ecological) education, in the international meaning of the word, is defined in the Slovene curriculum as a cross-curricular topic and integrated as a general teaching goal; however, it is important to point out that the main focus on ecological education takes place in the frame of natural science education and in the first triennium in the frame of ES. In short: ecological education in first triennium is cross-curricular, but it is mainly taught in ES. In recent years environmental education, environmental awareness and the development of ecological responsibility within the school curriculum has received careful attention from the scientific community (Erdogan, Usak, 2009; Erdogan, Marcinkowsky, Ok, 2009; Erdogan, Kostova, Marcinkowsky, 2009; Baba, Fraser, 2004), but there has been far less attention paid integrated social and natural science education, which is the subject of our study.

The purpose of the subject Environmental studies in the first triennium is to show the complexity, variety and intertwining factors which are present in the human, natural and social environment. It includes elements from different scientific fields – natural, technical and social sciences. The subject Environmental Studies consists of 315 hours in the first triennium; altogether, there are 105 hours in a school year; 3 hours per week and three days of activity (3 times for 4 hours) annually (Krnel, 2005, p.5). The subject matter is divided into ten units connected in terms of content and goals, which have been progressively structured from one school year to another. These units are as follows: Who I Am, You and Me, You and Us, My school and Me, We Celebrate, My Past, Once there was, Nature and Me, Health and Me, I Look Around, What I Can Do. Environmental Studies classes represent a continuation in the direction of the child´s spontaneous exploration of the world and the discovery that phenomena and processes are co-dependent and intertwined in the natural and social environment. The knowledge gained through direct experience in the environment or through the media is expanded and deepened during these classes (Krnel, 2005).

In the curriculum for the subject Environmental Studies (ES) (Krnel, 2005) goals are primarily defined with expressions relating to processes: pupils familiarize themselves with; pupils recognize; pupils develop; pupils experience and pupils distinguish. The goals defined in terms of processes point to the fact that the authors of the curriculum mainly took learning processes as a starting point. They were oriented towards the development of the child's abilities and skills rather than towards "knowledge". Therefore, if the goal of the first triad is (defined) to be the development and mastery of methods such as observation, comparison, classification, organizing, measuring, research, application, creative use of evaluation, then the effects of applying these methods should be the development of different dimensions of a child's cognition.

In the curriculum *didactic recommendations* guide teachers in organizing lessons by suggesting methods, procedures and teaching instruments. The curriculum for Environmental Studies places greater emphasis in planning the lessons on the experiences and ideas of the pupils. Special attention is paid to the pupils' activities within the teaching process, where they can develop their ideas and make new discoveries in the course of concrete activities. The role of the teacher is to lead the pupils and guide them towards various activities. "Unlike in the traditional school, the teachers' attention here is redi-

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rected from the program to the students. Teachers should monitor the development and progress of their students. The curriculum merely presents the means to achieve the desired or anticipated goals" (Bezjak, 1996, p. 14-15).

At this point we can conclude that observation and analysis of the curriculum for ES does not provide answers to the question of why the TIMMS results show relatively low levels for the thought processes used by Slovene pupils in solving test exercises. Obviously, we must seek answers elsewhere. Could the problem originate in the constructivist model of learning? For an answer, we must address the following questions: Where does pupils' knowledge of the world come from? How does pupil's cognition develop? Do pupils have to communicate with others in the learning process?

The Constructivist Concepts and Question as a Mediation Tool

The Constructivist theory is based on J. Piaget (1951, 1952, and 1954) and his research into the universal mechanisms of child' development. He assumed that the human child has a genetically transmitted readiness to construct knowledge from every encounter with the physical world. In Constructivism, universal developmental changes are believed to come about through a general cognitive mechanism for processing information. Vygotsky (Vygotsky, 1987) assumed, however, that education constitutes cognitive growth, meaning that the child would get support at sensitive stages – "zone of proximal development", from engagements with more experienced others. In social situations, parents and siblings, and later peers and other adults, would take responsibility for the child's developing mind. In last decade of 20th century B. Rogoff pointed out the social context in which cognition occurs. In her research she observes the "generic individual as the basic unit of analysis and adds social factors as external influences" (Rogoff, 1998, p. 680). Specifically, the documentation of what teachers do, say and think, alongside pupils' interactions is critical for determining how participation changes over time. According to Rogoff (1998), research into a child's cognitive development also needs to include detailed observations of teacher interaction. The research focus may be on how pupils influence each other and, equally important, on how what the teacher says and does influences thinking. Social factors as external influences indicate not just pupils and their interactions with each other and the learning environment, but also mediation by other cultural tools, such as the teacher and his questions (O'Loughlin, 1992). In other words, the constructivist model of teaching is based on cognitive conflict between a child's existing scientific concept and a problem in the learning environment that cannot be solved with the content of existing scheme. In the social cognitive model a teacher by mediations in the learning situation, draws the child's attention to the facts that generate cognitive conflict and to those that can generate a possible solution to the problem. The most frequent form of such teacher mediation in school is questioning by the teacher. Some research shows more than 80-100 questions per teaching unit (Marentič- Požarnik, Plut, 1980; Hus, 2001).

With different kind of question we raise different process in the pupils mind. From this point of view, it is crucial **what kinds of questions** are used during teachers' mediation of the cognitive process. Not every teacher question stimulates pupils' cognitive processes. The connection between questions and cognition development should be observed with the aid of classification of questions from the perspective of those cognitive processes the question aims to initiate in the student. Sometimes a question is used as a tool for initiating the thinking process; sometimes questions can guide the process. Research into the questions that teachers ask in the classroom has been mostly connected with reading comprehension research. Much of this body of research has traditionally focused on the development of skill hierarchies or taxonomies designed to delineate levels of questions. The assumption has been that questions based on the lower levels of the taxonomy encourage literal thinking, while questions based on higher levels of the taxonomy encourage inferential and evaluative thinking (Barrett, 1976; Bloom, Engel- hart, Furst, Hill, & Krathwohl, 1956; Pearson & Johnson, 1978; Raphael, 1986; Thompson, Gipe, & Pitts, 1985). The use of teacher questions can encourage children to think critically and creatively. Recent research suggests that questions should be part of the support structure, or scaffolding, that teachers use to enable readers to interact with increasingly complex and sophisticated texts and to reflect on the text along ever-expanding dimensions (Dole, Duffy, Roehler, & Pearson, 1991).

For the needs of the present study we shall focus on three promising taxonomies, the taxonomy of Pearson and Johnson (1978), the taxonomy of T. E. Raphael (1982, 1984, 1986) and the taxonomy of Pečjak (Pečjak 1995, Pečjak, Gradišar, 2002).

Pearson and Johnson's taxonomy is designed to capture the relationship between information in the text and that which must come from the reader's store of prior knowledge. It classifies relations that exist between 'questions' and 'responses'. The data by which a reader generates a response is critical to this taxonomy. There are three kinds of responses: textually explicit, textually implicit and "scriptally" implicit. A response is classified as textually explicit if it is right there on the page. A response is classified as textually implicit if both the question and the answer are present in the text, but at least one step of logical inference is necessary to justify the answer as a reasonable response to the question. In other words, the response is there on the page but is not obvious, as in the case of a textually explicit response. Finally, a response is classified as "scriptally" implicit if the question is derived from the text but the response is not. That is, the data base of the response is in the reader's store of prior knowledge. A reader must use his or her script or schema in order to come up with the answer (Pearson and Johnson, 1978).

For the purpose of investigation Raphael's taxonomy (1984, 1986, 1992) is useful. His taxonomy has four levels: Right There, Think and Search, the Author and You, and On My Own. This provides students with a way to think about questions and answers. **First level questions:** the answer is textually explicit (can be found in the text), usually as a phrase contained within one sentence. Questions on this level often begin with *what, who, when* and *where.* **Second level questions:** the answer is in the text; the answer is implicit; and the student is required to combine separate sections or chunks of text to answer the question. Questions on this level often begin with: contrast, explain or compare. **Third level questions:** these require students to think about what is already known from their reading and experience (schema and prior knowledge) to formulate an answer. Questions on this level often begin with: *How can you conclude? How do you know?* **Fourth level questions:** the student draws on prior knowledge (schema) and what the author has written to answer the question. Questions on this level often begin with: *Do you believe? How would you?* (Raphael, 1982, 1984, 1986).

The third taxonomy which should be mentioned is that of Pečjak (Pečjak, 1995; Pečjak, Gradišar, 2002). She categorizes questions according to the level of understanding the student must attain to be able to answer the question: informative (literal) understanding, interpretative understanding and adaptive, critical, creative understanding.

Thinking on the level of informative (literal) understanding in Pečjaks' taxonomy, a student can answer what, who, when and where questions. These are questions that can be answered by remembering what was explicitly mentioned in the text. On the level of interpretative understanding, a student can answer questions that require conclusions. And on the level of adaptive, critical, creative understanding, a student can answer questions that require the adoption of new knowledge in unknown situations, which require a student to argue the advantages of proposed solutions to the problem, or to discuss what the cause is and what the consequences are.

A closer look at the selected taxonomies shows that most question taxonomies have a dichotomous character. So, the first category of Pearson and Johnson's taxonomy (textually explicit) does not, in fact, involve any inference but literal comprehension. This, then, means that Pearson and Johnson's taxonomy has only two types of inference: text - explicit and text – implicit, which correspond to 'propositional' and 'pragmatic' inferences, respectively. Similarly, Raphaels' taxonomy also has two groups of questions: in the first there are questions that can be answered by "looking in the text", and in the second there are questions with answers that can be "found in students head«. Pečjaks' taxonomy also reveals a dichotomy, since on the first level a student must remember, and on the next two levels, he must think. The first group of questions in such taxonomies with a dichotomous character could be called **questions on the lower cognitive level,** and the second group of questions could be called **questions on the higher cognitive level.** Lower cognitive level questions require only a reproduction process for the answer. Higher cognitive questions engage higher cognitive processes and create new knowledge and new levels of cognitive skills.

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Methodology of Research

The study is based on a descriptive and causal-nonexperimental method of empirical pedagogical research (Sagadin, 1993). The descriptive method is indicated in the frequency of type and quality of teachers' questions and the students' answers, the causal-non-experimental method in the empirical verification of differences in the thematic units and schools.

Aim and Hypothesis of the Research

The curriculum for Environmental Studies (ES) emphasizes the importance of questions during the lessons. In the didactic recommendations it is mentioned that the activities in the first grade with smaller children should be led. A teacher should ask questions, so that children can learn to ask questions. The questions should be of that kind that children can find answers for themselves by testing, research or finding the information in the literature (Krnel, 2003). The learning plan expects the teacher to be the mediator in the education process (O'Loughlin, 1992). The research of the presented study therefore focused on the question how many questions a teacher asks during lessons and what kind of thinking processes encourage in the children (level of questions); how children answer questions; how often they ask questions and what the typology of their questions is. It was stated from the following hypothesis:

H1: In Environmental Studies a teacher asks between 80 and 100 questions per lesson.
H2: Questions at lower level prevail; questions at higher levels do occur but they are rare.
H3: The pupils mostly answer the teacher's questions correctly.
H4: The pupils ask few questions.
H5: The questions of pupils during Environmental Studies are at a lower level.

Main aim of the research is to find out, if the quantity and quality of questions in early science class, that don't encourage the thinking process, are/could be the reason for bad results, Slovene students reach in the international tests, which measure the natural science knowledge

Description of the Sample

For our research two primary schools from the Maribor region were selected randomly. The only restriction is that chosen schools were among the first to opt for implementation of the new curriculum for the subject Environmental Studies (ES). Their teachers were also among the first to participate in teacher training according to the constructivist model for teaching ES.

At each of these two selected elementary schools (school A and school B) one class of the first grade was chosen for observation. This means that according to Slovene legislation the students were between 5.8 and 6.8 years old on the 1st of September in relevant (= first) school year. Our observation took place in April and May.

Data Collection and Analysis

The observation was performed during the teaching of three thematic topics; one in social science and two in the natural science field. For each of these topics a teacher planned three school hours of 45 minutes each. Thus, the research team observed 9 hours of class interaction at each of two schools. All together 18 hours of school lessons were observed, classified according to the protocol, described and evaluated.

Data about the quantity and quality of questions in student – teacher communication were collected during the observation on the base of a protocol described below. ES lessons with following topics were observed: We Celebrate, The Garden and The Orchard (the relationship between observed social science and natural science teaching was 1:2). According to teachers' plans, each topic lasted three school hours. For this research the qualitative and quantitative observation were used.

Description of the Instrument – Protocol

For the data collection about the quality and quantity of teachers' and student's questions during the ES lessons, Pearson & Johnson's taxonomy, Raphael's taxonomy and S. Pečjak's taxonomy were adopted. Considering that all these taxonomies have a dichotomous character, our protocol questions were divided into two groups:

- questions on the lower cognitive level and
- questions on higher cognitive level.

The lower cognitive level questions in the used protocol required only a reproductive process for the answer. These were questions that could be answered with pure date recall from the text or from the teachers' lesson. To be precise, these are questions such as:

- What do plants need for growth?
- Who works in a garden?
- Give me the word for his profession?
- When do we celebrate Independence day?
- Where do we plant lettuce?
- Count at least three meadow flowers, etc.

The higher level cognitive questions, according to used protocol, were these that engaged higher cognitive processes and created new knowledge and new level of cognitive skills. To be precise, these are the questions such the following:

- What's the difference between a plum and an apple tree?
- Why do you think that fruit trees need spraying?
- How do you use secateurs in the orchard, etc.

The data were collected by the research team, which comprised researchers (the authors) and two **assistant researchers.** The assistant researchers were specially trained for these tasks. They had received literature about cognitive development in the social environment, the mediation role of teachers' questions and the taxonomies of the questions. Subsequently they participated in a training unit for classifications of the questions according to different taxonomies and according to the protocol of the present research. The assistant researchers observed 18 hours of ES lessons. They used a tape recorder to record the teaching units; later they transcribed the communication during lessons and drew special attention to questions asked by the teachers and children. After that, they labeled teachers and children's questions according to the protocol.

Subsequently, the whole research team checked the selected data and preliminary results and solved any problems arising at that stage of research. Some teachers and children's questions couldn't be classified. In these cases the transcript of the lesson was consulted and the question was classified with the help of the context in which it was used.

Statistical Analyses and Data Presentation

The statistical analyses are simply and indicated in the frequency of type and quality of teachers' questions and the students' answers, where in tables are:

N - number of questions
f - frequency in %

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Data from the study are shown in the form of simple and contingent tables where we recorded the absolute and percentage frequencies. First, tables showing the topics individually for each school were made, later followed by the comparative tables for both schools according to each category. These are also shown under the results of the research.

Results of the Research

The Number and Level of Questions during Environmental Studies Lessons

The quantity and quality of questions during all three topic at all 18 lessons were observed, to establish how often a teacher asks a pupil an individual question. Then these questions were sorted on the dichotomy principle into lower cognitive level questions that keep the pupil on the actual level of cognitive development, and higher cognitive level questions, which encourage higher thinking processes, support the development of logical thinking and inference as well as guiding pupils towards creative thinking. The results are presented in next Tables, where means:

- TOPIC 1: We Celebrate
- TOPIC 2: Garden
- TOPIC 3: Orchard

Table 1. The number and the level of teacher's questions shown by topic and school.

Cognitive level of questions per school		Thematic topics							
		Topic 1		Topic 2		Topic 3		Together	
		N	*f (%)*	*N*	*f (%)*	*N*	*f (%)*	*N*	*f (%)*
Higher level	A	12	5.1	11	12.62	5	6.94	28	7.10
	B	3	1.23	13	13.4	5	5.1	21	4.80
Lower level	A	223	94.9	76	87.36	67	93.06	366	92.90
	B	240	98.77	84	86.6	93	94.9	417	95.20
Total	A	235	100.00	87	100.00	72	100.00	394	100.00
	B	243	100.00	97	100.00	98	100.00	438	100.00

The teachers/aids both schools together asked 832 questions (394 at school A in 438 at school B). On average the teachers/aides asked 46 questions per lecture. The percentage of questions at the lower cognitive level is the highest (94.1%) in both schools. Slightly more questions on this level were asked at School B, where pupils were also asked more questions. By asking lower cognitive level questions teachers ensured that alternative, additional and single meaning questions dominated. Among higher cognitive level questions (5.9%) the most often asked questions those about understanding and usage. The highest number of questions was asked in the first topic: We celebrate, where pupils were learning about more difficult (abstract) concepts, like holiday, artist, gallery and therefore additional questions were needed.

Pupils' Answers to Teacher's Questions

For all three topics the pupils' answers to the teacher's questions were marked and sorted qualitatively, to establish how many questions pupils could answer, how many answers were correct and how many incorrect.

Table 2. Pupils' answers shown separately by topic and schools.

Answer per school		Topic 1		Topic 2		Topic 3		Together	
		N	*f (%)*	*N*	*f (%)*	*N*	*f (%)*	*N*	*f (%)*
Correct	A	158	67.23	65	74.71	69	95.83	292	74.10
	B	188	77.37	80	82.47	85	86.74	353	80.60
Incorrect	A	19	8.09	2	2.3	0	0	21	5.30
	B	14	5.76	1	1.03	3	3.06	18	4.10
No answer	A	58	24.68	20	22.99	3	4.17	81	20.60
	B	41	16.87	16	16.50	10	10.20	67	15.30
Total	A	235	100.00	87	100.00	72	100.00	394	100.00
	B	243	100.00	97	100.00	98	100.00	438	100.00

(Thematic topic spans Topic 1, Topic 2, Topic 3 and Together.)

A look at the data in Table 2 suggests that the teacher's questions in all three topic were too easy since more than three-quarters of answers are correct. In comparison, it seems that the number of incorrect answer is negligible. It is interesting to compare the results for numbers of correct and incorrect answers is each topic. It is evident that the teacher's questions in the natural sciences topics were much easier than those in the social sciences. In the natural sciences topics, there were no incorrect answers. The percentage of questions to which pupils did not know the answers in social and natural sciences is no different.

This is a positive finding since it implies that teachers in sociology units as well as in the natural sciences are asking questions in a balanced way. However, the frequency of questions (Table 1) shows that pupils don't have enough time to think (and to find solutions) because the teacher asks the next question too fast (and this is mostly an easier question).

Hypothesis 3, that pupils mostly answer the teacher's questions correctly can be ratified. This is in logical correlation with Hypotheses 1 and 2 (with the number and quality of questions asked on the teacher's part). Teachers asked too many questions; therefore the answers were possible only by quick response without thinking.

Pupil's Questions – Quantity and Quality

From the transcript of the tape recordings of the lessons and from the Hopkins protocol that was in use there were also observed the quantity and quality of pupil's questions during the lessons. Pupils asked few questions during lessons; in all 18 hours they asked only 41 questions (18 questions in school A and 23 questions in school B). On average this means only two pupils' questions per learning unit. All questions were those from lower level.

These data can be interpreted in many ways. First one could say that this as a consequence of the rule, "As teachers do so pupils". The data in Table 1 show a prevalence of lower cognitive level questions. The correlation between the number of teachers' questions and the number of questions that pupils ask must also be pointed out. If a teacher asks more than 35 questions in 45 minutes, there is no time for questions from pupils. The hierarchy of relationships in school is not in doubt: the teacher's words are more important than the pupil's words. Pupils may speak only when a teacher plans it; all other speeches by pupils are treated as disturbance.

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Discussion

Comparing a child who learns in the real world and a child who learns in the school environment gives us the opportunity for discussion about the results of present investigation. In the natural world, learning comes from the child's curiosity, where certain information in the existing thinking concept is missing or is incompatible with this concept. A child forms a question and accepts answers from adults in such a way that the new knowledge is compared with the existing thought concepts. Apparently there is a difference in school during Environmental studies lessons. Pupils seldom ask questions, which means that their existing concept/ existing thought scheme does not come in contact with the new knowledge. A pupil with "school" knowledge creates a parallel thinking scheme. This means that it does produce the cognitive conflict in which conditions are created for the development of higher thinking processes.

The results of the study showed that the implementation of the curriculum is more important than the curriculum. The teachers we observed did plan and perform at the outer realization level the experiments and practical work, as required in the didactic recommendation of the curriculum. However, the questions that should have directed the child's thinking in the didactic situation were not at the higher level that could develop the child's ability to think on higher levels but were mainly reproductive, deciding and organization questions. These questions were answered correctly by the children who did not need to draw upon more demanding thinking processes. We can conclude that the new concept of teaching on the realization level does not contribute to the development of higher thinking processes by pupils. If teachers don't know; don't understand the theoretical (constructivist) starting points on which the curriculum is based, if they only take over the form, if they don't understand to which process goals (cognitive functions) the achievement of operational goals is directed, then these will produce no significant changes in the area of development of higher cognitive processes by pupils.

How is it possible that Slovene elementary teachers don't know and don't understand the constructivist basics of a learning plan for early science teaching and their process goals? These teachers were obliged to participate in training before the implementation phase of this learning process during which training they learned the exact content that now represents the core problem.

The reason probably lies in the method of teacher training. The teacher trainers forgot that the teachers' knowledge is also "constructing". Thus teachers, too, acquire new knowledge only in such way as to compare it with existing thinking schemes. In the case of early science teaching, teachers should confront the classical constructivist theory of teaching, the Piaget theory that they learned during their studies and their pedagogical experiences with the newest – cognitive theories (Rogoff, 1998) that stress the importance of social interaction during learning and pupils' cognitive development. In this way the teachers could recognize the importance of this social interaction, of what teachers' do, say and ask during the process of their pupil's investigation of the world, acquisition of new knowledge and in the process of his/her development of thinking capabilities. In other words, teachers would learn that, in a social model of cognition development, the teachers' mediation in the learning situation draws the child's attention to the facts that generate a possible solution to the problem. They would than realize that the most powerful and most frequently used form of mediation in school involves teachers' and students' questions.

In the pre-implementation process of the curriculum for the subject Environmental studies, Slovene teachers did participate in thorough training. Paradoxically, the training for the constructivist teaching model of early science was not based on the constructivist method of teacher training. The teachers were set in a classic traditional situation in which they built a parallel thinking scheme. So in learning "knowledge about a new concept of acquiring knowledge", they did not change their previous didactic concepts.

The results show that there is much to be done in the area of teacher training. Teachers need to acquire skills in asking questions during Environmental Studies lessons if we want to follow one of the most important goals of the lesson, and this is "teaching children the important basic skills: how to form questions and how to find answers for them". If pupils are expected to ask more qualitative questions that lead to exploration (questions of higher cognitive level), then the teachers themselves should ask more questions at a higher cognitive level and fewer questions at a lower level.

Conclusion

By observing lessons in Environmental Studies in the first class at the selected schools, it was discovered that the percentage of questions at the lower cognitive level is the 94.1%, (alternative questions, additional and single meaning – recall questions), which required short, simple answers. There were few questions at a higher cognitive level, which could have encouraged the development of logical thinking and directed pupils to creative work. Among higher cognitive level questions (5.9%) the most often asked questions those about understanding and usage. A look at the data suggests that the teacher's questions were too easy since more than three-quarters of answers were correct. It is evident that the teacher's questions in the natural sciences topics were much easier than those in the social sciences. However, the frequency of questions shows that pupils don't have enough time to think (and to find solutions) because the teacher asks the next question too fast (and this is mostly an easier question).

The correlation between the number of teachers' questions and the number of questions that pupils ask must also be pointed out. If a teacher asks more than 35 questions in 45 minutes, there is no time for questions from pupils. If the pupils rarely asked any questions during lessons, all their questions were on a lower cognitive level. The hierarchy of relationships in school is not in doubt: the teacher's words are more important than the pupil's words. Pupils may speak only when a teacher plans it; all other speeches by pupils are treated as disturbance.

The results show that there is much to be done in the area of teacher training. Teachers need to acquire skills in asking questions during early science class, if they want to follow one of the most important goals of the lesson, and this is "teaching children the important basic skills: how to form questions and how to find answers for them".

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