INQUIRY PEDAGOGICAL CONTENT KNOWLEDGE OF MEXICAN BASIC EDUCATION TEACHERS IN A SPECIAL PROGRAM

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Abstract

This paper is addressed to document and analyze the inquiry PCK (I-PCK) of the K-6 science teachers of PAUTA (Program 'Adopt a Talent', from Mexican Academy of Sciences, which has the objective of improving science learning process in Mexico's basic education). The authors believe that it is important to document PAUTA teachers' I-PCK in order to understand what the teachers known about inquiry, what activities they perform, and how they promote the development of scientific abilities in their students.

The methodology used to document PCK is based on the Content Representation (CoRe) offered by Loughran *et al.* (2004) using a set of central ideas and activities that PAUTA´s teachers should possess. A literature search was made to determine the central ideas that teachers use while guiding their students within inquiry activities.

The research results show that the teachers have six of the seven elements of the inquiry understandings and all of the inquiry abilities mentioned by NRC, suggesting that they have a general idea of inquiry that resembles those from the National Science Education Standards.

Another finding is that the main difficulties experienced by the teachers involve the way in which activities are designed and that some of the advantageous teacher´s actions are unknown by them, so it seem plausible that these limitations could be diminished with a specific modification of the session structure and training.

The analysis of the information obtained by the inquiry-CoRe (I-CoRe) provides information regarding the teachers' knowledge related to scientific inquiry that will be profitable for teachers' training.

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Introduction

Traditionally, science teaching in México has had the long term goal of training students to become the scientists of the future. However, nowadays this goal has evolved to make its priority to teach students how to cope with the world's needs, as well as to know today's impact of science and technology in society. These needs include developing "citizens capable to make informed decisions regarding different aspects that affect their everyday life, like the environmental care and the use of new technologies" (SEP, 2006).

In this context, recent studies in science education have shown that there are important deficiencies in Mexican students´ knowledge that should be taken into account if the education is to be improved. For instance, results regarding PISA-2006 science examination (Díaz-Gutierrez *et al.*, 2006) show that more than half of Mexican' students have the minimum performance; that is, 51% of the students obtained grades 0 and 1 — being 6 the highest one. Regarding science teachers knowledge, some researches (Flores and Barahona, 2003; García-Franco *et al*, 2006) have shown that they have insufficient domain of the content and that their learning conceptions are close to the positivist school, that is, far from the recent learning conceptions of knowledge construction and development of competencies.

In an effort to improve science education The Mexican Science Academy (Academia Mexicana de Ciencias, A.C.) has developed a program, called "Program Adopt a Talent" (Programa Adopta Un TAlento; PAUTA), to provide a complementary science and mathematics education —the Program provides extra-scholar workshops— directed to remarkable children and adolescents that are studying in elementary and secondary schools. PAUTA's main goal is to develop scientific abilities in their students using a constructivist framework. To do that the Program has implemented the recommendations made by The National Science Education Standards (NSES), which states that "Teaching science through inquiry allows students to conceptualize a question and then seek possible explanations that respond to that question" (NRC, 1996).

Scientific Inquiry

Scientific inquiry is a concept that Dewey presented for the first time in 1910; it is logical to think that many interpretations of it have occurred during the hundred years gone up to date. In this research, scientific inquiry has as a goal to form individuals to: be capable of analyzing a problem; commit with an investigation; be able to collect, document and analyze evidence and data during the research; be able to make inferences with the data and the results; be able to share with others relevant information; and communicate with their pairs during the whole process. This interpretation is based on the social constructivist epistemology. The learner is the constructor of his/her own knowledge and the teaching activities have to be carefully structured by the teacher in order to assure that the student can be guided through the learning process.

The National Research Council present a specific definition of inquiry, in which teachers can and should promote the curiosity and the development of the students' abilities regarding to inquiry.

> Inquiry: The diverse ways in which scientists study the natural world and propose explanations based on the evidence derived from their work. Inquiry also refers to the activities of students in which they develop knowledge and understanding of scientific ideas, as well as an understanding of how scientists study the natural world (NRC, 1996: 23).

This statement makes clear that there are two different subjects that can perform inquiry activities: the scientist and the students. Related to the students it is expressed that, to be coherent with inquiry, their education should provide three forms of comprehension and scientific abilities (Hodson, 1998). The students need to learn:

1. Content: the basic concepts and principles of science;
2. Abilities: they should acquire scientific reasoning and abilities; and
3. Context: they must understand the nature of science as a particular growth of human development.

The NSES conjugate this three forms of comprehension it two specific ways: the understanding of inquiry and the practicing of the abilities in scientific inquiry that the students require.

The understanding refers to students been able to comprehend inquiry process (shown in Table 1):

Table 1. Understandings for comprehending inquiry (NRC, 1996).

1. That research involves questioning and answering questions and to compare their answers with information already known about the world; 2. That different kind of questions suggests different types of scientific researches; 3. That scientists develop explanations using their observation —evidence— and what they already know about the world —scientific knowledge; 4. That mathematics are important; 5. That instruments give more information than the one obtained if only the senses are used; 6. That scientific explanations make emphasis on the evidence, have a logic coherence in their arguments and use scientific principles, models and theories; and 7. That scientists make public their research´s findings and describe them in a way that allows another scientists to reproduce, review and formulate question about them.

The abilities in scientific inquiry (cognitive abilities, according to Millar and Driver, 1987) require that students merge scientific knowledge with their critical thinking in this process, in order to develop their understanding of science.

According to the National Research Council the learner needs to develop the five abilities mentioned in Table 2.

Table 2. Inquiry abilities (NRC, 1996).

1	Engages in scientifically oriented questions
2	Gives priority to evidence in responding to questions
3	Formulates explanations from evidence
4	Connects explanations to scientific knowledge
5	Communicates and justifies explanations

PAUTA has designed activities (García-Franco *et al,* 2008) for children in kindergarten and primary school (K-6) with specific actions and questions that the teacher must perform to promote the children development of science abilities. In this context, the program PAUTA is concerned with the teachers' proper knowledge of scientific inquiry, because there is a relationship between how much a student learn and the teachers' degree of knowledge (Bybee, 2004: 7). In this case the student abilities development is promoted by activities that depend on what the teacher knows about scientific inquiry.

Martin-Hansen (2002) defines four types of inquiry: Open or full inquiry, in which the student selects the problem and conducts its own research. Guided inquiry, in which the teacher usually chooses the question to be solved and the student may decide how to approach it. Coupled inquiry, which is a combination of the first two, the teacher decides the first question but the student can propose another questions related to the first one. And structured inquiry (also known as directed inquiry), it is an inquiry mainly directed by the teacher where the student must follow the instructions.

PAUTA activities can be located within guided inquiry in which the learner: clarifies the question provided by teacher; is directed to collect certain data; is guided in the process of formulating explanations from evidence; is directed toward areas and sources of scientific knowledge; and is coached in turning out the communication.

The research goal addressed in this study is to document and analyze the Pedagogical Content Knowledge (PCK) concerning inquiry of the science teachers on the program PAUTA in order to discover what is needed to improve the science teaching-learning process in it. It is important to document what the instructors known about inquiry, how they establish activities with these characteristics, and how they promote the development of scientific abilities in their students.

The Pedagogical Content Knowledge on inquiry (I- PCK)

The Pedagogical Content Knowledge

The research framework for this study is based in the PCK that was proposed in 1986 and 1987 by Shulman when he published the basic knowledge that a teacher should have, presented in seven categories (a to f) and they have been arranged by the authors in four aspects:

Content

a. Content knowledge

b. Curriculum knowledge

Pedagogy

c. General pedagogical knowledge

Pedagogical content knowledge

d. Knowledge of learners and their characteristics

Context

e. Knowledge of educational contexts
f. Knowledge of educational ends, purposes, and values, and their philosophical and historical grounds

The first aspect corresponds to the knowledge of the discipline, the second to the general didactics, the third is the interaction between the thematic content and the pedagogy, related also to know the alternative conceptions of students; and the fourth is about the context in which a given professor should teach a specific content.

The Pedagogical Content Knowledge (PCK) is a type of knowledge that teachers should have because they must know and understand the science topics as well as how to teach that specific topic in an effective way. From 1986, year in which the concept "PCK" was presented, several researches have made their focus in this concept. Recently, Kind (2009) mentions that many teachers are well qualified in their disciplinary knowledge, but it does not guarantee they will teach a given topic in an effective mode. Kind mentions the importance of clarifying the PCK arguing that the concept is "hidden" in two ways: first, PCK is tacit —most of the teachers do not become aware that they are using it to prepare their lessons, and more over, they cannot realize how their own PCK is conformed because it has not been explicit or simply because they have not thought about it— and second, because teachers are not familiarized with the concept.

Several authors (Loughran *et al*, 2004; Kind, 2009; Garritz *et al*, 2010) acknowledge the importance of documenting outstanding teachers´ PCK in order to improve education.

The methodology for documenting I- PCK

The methodology used in this research is based on the procedure to document PCK, which is known as "content representation" (CoRe) offered by Loughran, Mulhall and Berry (2004). These authors proposed a framework which first question is addressed to disclose the teacher most important ideas or concepts of a given topic and a subsequent set of eight questions that have to be answered for each one of the central ideas mentioned.

"Scientific inquiry" was the topic selected for the documentation of PCK in this study (the authors have used the acronym I-PCK for it). In this research the aim is to reveal a set of central ideas and activities on inquiry that PAUTA´ teachers should know. It was decided that it was convenient to choose a given set of central ideas instead of letting each teacher select his/her own. So a literature research (Schwab, 1978; NRC, 1996; 2000; Bybee, 2004; Lederman, 2004; and Khan, 2007) was made to determine so.

These ideas (Table 3) are the pedagogical activities associated with the inquiry process (Garritz, Labastida-Piña, Espinosa-Bueno & Padilla, 2010).

Table 3. Selected set of pedagogical activities for teaching through inquiry.

A. Identify and consider questions that can be answered through inquiry;
B. Define and analyze properly the question to be solved and identify its relevant aspects;
C. Gather bibliographic information to be used as evidence;
D. From evidence, develop explanations to the posed question;
E. Think about everyday problems and display relevant historical aspects;
F. Design and conduct a scientific investigation through a set of actions; and
G. Communicate by means of argumentation what has been learned through inquiry.

Another important adjustment made to the I-CoRe (CoRe on the inquiry activities) is that instead of the eight questions proposed by Loughran *et al.*, in this research it was adapted to only four, those mentioned in Table 4:

Table 4. Questions included in the I-CoRe.

1. Why do you consider important to promote that the students develop this activity?
2. What are the difficulties or limitations of promoting this activity?
3. What teaching examples and procedures do you use for engaging students with this activity? and
4. What are the specific ways for ascertaining students' understanding around this activity?

The I-CoRe was made to register I-PCK of PAUTA´s teachers on science activities for children inscribed in extra-scholar elementary activities. Finally, the questionnaire had three parts; the first with two open questions; one referring to the characteristics of the PAUTA program, and the other focused on the understandings on inquiry. In the second part, it was asked to select the pedagogical activities that the teacher believed that he or she promoted with his/her children (from the list of Table 3); and the third one in which they had to answer the four questions mentioned in Table 4 for each activity they selected. This last part is the most closely related with Loughran *et al.* CoRe.

Nine teachers of the PAUTA Program completed the questionnaire, which will be referred as "subjects" from now on.

Results & Analysis

Inquiry and PAUTA

For the analysis of the results three sections are proposed: 1. The context, the understanding of PAUTA activities; 2. Inquiry, the concept, the understanding of inquiry; and 3. The pedagogical activities.

For the first section, a set of key elements has been proposed for the analysis of the open question. Then, those elements for all the answers were grouped in categories. In the analysis´ results each key element is related to its categories and the ones with higher answer frequency or the ones that contain relevant information are presented and discussed.

The Context: What characteristics does a PAUTA activity have?

The key elements for the first question are: the concept, the goal, the relation with science, the relationship with constructivism, the role of the teacher, and the learners.

The concept: What is a PAUTA activity?

Some teachers believe that it is "an activity in which the student construct or reinforce a concept", some others that it is "the experimentation of scientific topics", and finally, that it is "an activity in which the children learn to develop their attitudes and abilities".

The teachers express that a PAUTA activity is one in which concepts are constructed by means of the development of cognitive and meta-cognitive abilities as well as attitudes for science while experimenting. In this general response the authors can find the importance of the development of abilities that will be discuss forward in this paper.

An interesting response was provided by subject 6:

> The activities for elementary school children's have been designed in order to contain the following characteristics: To focus on a science topic in a sequence composed by three activities: construct and reinforce a concept; present a problem to solve, so students can be motivated; and promote the development of abilities. I think PAUTA spaces that are created with the students represent something more than only science activities. These are spaces where they feel comfortable and happy; where they are told that their opinion is valid and important; where they may express themselves (even though some are bashful or are not used to do it); where they learn to work in teams, which implies to listen their pairs, respect their opinions; where a problem is to be solved and they can use the material given to find the solution, where they write down their ideas; where they can dialogue, play and argue.

In this response the inquiry elements are clearly identified: a problem is presented, they can experiment with the materials, they can argue, they write down and share their ideas.

The goal: Which is the goal?

According to five teachers, the goal of a PAUTA activity is to "construct knowledge and concepts by means of the development of cognitive and metacognitive abilities for science".

The relation with science: How is a PAUTA activity related to science?

The development of abilities is always written as "scientific abilities" by seven teachers. It also it can be found in five teachers that they address to "science" activities.

The relationship with constructivism: How does a PAUTA activity relate to constructivism?

Constructivism is the epistemological base of the *PAUTA* program; therefore it is interesting that four persons mention that is a method and four more only mention the word or the implication when explaining that the student "constructs" knowledge or a concept. There are also some imprecise explanations that will require a future complementary interview, for example, the teacher 3 explained “The constructivist method is used, in it a children is guided to reason by questions”

The role or the teacher: What is the teacher’s role?

Only two teachers mention this key element, and they think that the most important activities that a teacher must do is to ask and to guide.

The learners: To whom are these activities directed to?

Most of the teachers express that this activities are for the children. For example, the subject 6 expressed that “It is important that the teacher transforms the classroom into spaces of growth that promote students´ motivation”.

Inquiry, the concept: What do you understand by inquiry?

The key elements for this second question are: the concept, the process, and the subjects.

The concept: What is it?

Regarding to inquiry, the study shows that there are different understanding of the concept. Three subjects explained that is a research: “inquiry refers to searching or finding answers to a selected topic. … I think that inquiry is a synonym of research.” According to five of the subjects, inquiry is “the process that involves making question in the right moment and using the answers as information to analyze the problem” (Subject 2), meanwhile four subjects responded that “inquiry can be performed by observation, to obtain the most possible amount of information from a phenomena or an issue that we have thought, by experimentation, and by bibliographic consults” (Subject 7).

The process: How inquiry is performed? What has to be done?

According to five teachers, it is by “making questions” (Subject 5), “... it is the process of making adequate question to the children in the adequate moment.” (Subject 2). According to four persons, by “experimenting or carrying out trials (Subject 4)”, and two more think that by “thinking about something and making inferences”

The subject: Who does inquiry?

Most of the teachers mention that the children do inquiry; a couple of teachers also include researchers and teachers.

From the elements above, it can be said that the inquiry is understood as a research, as a process of making and answering questions, and it is also understood as a process that involves finding out or discovering something. It is performed by children by making questions, experimenting or carrying out trials, and thinking about something and making inferences.

In the factors for understanding the inquiry definition of Table 1, the authors can relate the issue 1 to the results in which it is explicit that teachers considered the process of questioning and responding as part of inquiry.

Related to the issues 3 and 6 in Table 1, there are present some elements that may suggest that teachers have some clarity. For example, subject 7 responds “observation, to obtain information, experimentation, and bibliographic consult", but it is not fully explicit what the subject ideas and understandings are.

It can also be noticed that in this question responses there are absent the other issues in Table 1 (2, 4, 5 and 7).

The pedagogical activities

The subjects selected which pedagogical activities of Table 3 they believe each one of them promote while guiding activities with children. Table 5 shows the selection.

Table 5. Teacher's selection of the pedagogical activities, the filled spaces mark that they promote such activity.

ACTIVITIES/SUBJECTS	1	2	3	4	5	6	7	8	9
A. Identify and consider questions that can be answered through inquiry;	■	■	■	■	■	■	■	■	■
B. Define and analyze properly the question to be solved and identify its relevant aspects;	■	■	■	■	■	■		■	■
C. Gather bibliographic information to be used as evidence;					■	■			■
D. From evidence, to develop explanations to the posed question;	■	■	■	■	■	■	■	■	■
E. Think about everyday problems and display relevant historical aspects;	■		■		■	■	■	■	■
F. Design and conduct a scientific investigation through a set of actions;		■		■	■		■	■	■
G. Communicate by means of argumentation what has been learned through inquiry.	■	■			■	■	■	■	■

The first thing to notice is that only two teachers expressed that they promoted all the pedagogical activities when working with children, two have selected six of them, three have selected five and two have selected four.

It is also noticeable that only two of the pedagogical activities (A and D) are mentioned by all of the teachers, while the least mentioned is activity C. The three teachers that selected them are the only ones that conduct two types of activities: the one with elementary students, in which none explicit bibliographic search is developed; and with junior high school students, were this activity is promoted.

It is important to remark that while in the second question some of the elements of the understanding of inquiry were not clear or present, in this third part some of them are asked explicitly, so the authors can complement some aspects here. From the pedagogical activities marked, it is expected to obtain more information about the following factors of Table 1: 3 and 6. And no information is expected about 2 and 4 issues because there is not a clear relation of them with the pedagogical activities.

Related to the four questions on each of the seven central activities for inquiry, the authors gathered in a sentence all similar answers given by the teachers and counted them to search for the most frequent ones. In this way the authors constructed a matrix that contains in the rows the seven activities and in the columns the four CoRe questions, writing in each cell the generic sentences. This matrix shows the results obtained for a fictitious teacher that represents the statistical mode of teachers' responses and is presented in table 6.

The difficulties of promoting pedagogical activities can be summarized in 4 groups of answers, in relation to:

1) The teachers or the design of the session with children: a. to propose adequate questions, for example: vocabulary, concepts and level (A, B, D); b. to select adequate historic or everyday examples evident to the students (E)
2) The circumstantial context of a session with children: a. The number of students (D, G); b. Duration of the activity (D)
3) The students: a. Sometimes they cannot differentiate the relevant aspect (B); b. Students do not know how they can use a library (C); c. Some kids do not argument because they are timid or are afraid of giving wrong answers. (G)
4) The pedagogical activity: a. The complexity in the comprehension of "Design and conduct a scientific investigation"

For ascertaining students' understanding about the pedagogical activities there are some general answers: Asking and questioning (A, C, E), Observing and listening to them in each team (A, B, C, E, F, G), Checking if it is clear what they have to do (C, E). There are also some specific strategies shown in the results that enhance the richness of PKC: "Evaluate if theirs explanations take in account the evidence" (D) and "By the reasoning and richness of arguments each student presents during the activity" (G).

Important didactical and social elements are present in other teachers' responses:

1) About the ambience and space: promote an ambiance of confidence, so they can ask (B); seating in a circle make the participants more focused in the discussion held and on the comments that any student do (G).

2) About the activity timing and content: At the end of the activity, I mentioned that there is more information about the session, and I suggested that they can look in books they can find them in a library (C.), To make a previous selection and formulation of the questions, it is necessary to listen carefully and understand the students responses and opinions (E).

3) About other strategies: Presenting examples of argumentation (G); to let students observe everything that is around them and promote that they relate the activity with day to day experiences (F).

Table 6. The matrix form of I-CoRe. The final "s" presents the number of the subject that answered in a similar form.

	1. The importance of promoting that students develop this activity	2. The difficulties of promoting this activity	3. The specific ways for ascertaining students' understanding around this activity	4. The teaching examples and procedures do you use for engaging students with this activity
A. Identify and consider questions that can be answered through inquiry;	Because it can help to solve a problem s2,s4,s9 Because it promotes the reasoning and the reflection s2,s5,s9	To propose adequate questions (vocabulary, concepts, level) s3,s4,s6,s8	Asking and questioning s3,s5,s8,s9 Observing the students´ actions and discussion held in each team s9	With questions formed from basic to complicate s3,s5,s9 With the students' answers s3,s9
B. Define and analyze properly the question to be solved and identify its relevant aspects	Because once the problem is understood they understand what they have to do and it is possible to find an answer s1,s2,s3,s5,s8	That the problem is not clear or well formulated s1,s4,s6,s8 Sometimes the students can not differentiate relevant aspects s4,s5,s9	Observing the plan that the students have made s3,s4,s5,s6 Checking if it is clear what they are about to do s1,s8,s9	Verify that they understand the problem s3,s6 Promote an ambiance of confidence, so they can ask s1,s9 To ask the students s5,s8
C. Gather bibliographic information to be used as evidence	Because we can learn more about the fundaments for the different concepts of the activity, by promoting the discussion. S5 It is important that the students have a context so they can identify what can help them to solve the problem S9	This activity should be at the end of an activity, so the construction of a concept does not get interrupted. s5 The students do not know how can they use a library and what can they find in it s6, s9	In the visit to the library, they consulted the books. First in a superficial way and then they look for certain concepts. s5	At the end of the activity, I mentioned that there is more information about what the session was, and I suggest that they can look for it in books, that they can find in a library s5

Table 6 (continuation). The matrix form of I-CoRe

	1. The importance of promoting that students develop this activity	2. The difficulties of promoting this activity	3. The specific ways for ascertaining students' understanding around this activity	4. The teaching examples and procedures do you use for engaging students with this activity
D. From evidence, to develop explanations to the posed question;	The student can understand what happened during the experiment and that allow them to explain what they did to solve the problem based on the evidence obtain in the experimentation. [meta-cognition] s7, s8	Duration of the activity s1,s8 Number of students s1 ,s7 The students do not understand the problem or the questions s4,s5	Observing and orienting with questions s4, s5,s9 Listening to the students' discussions. s1, s2,s7 Evaluate if the explanations take in account the evidence s5, s3	Asking them to explain what they have done s5,s3, s1
E. Think about everyday problems and display relevant historical aspects	By involving students in everyday problems, it is achieved a better understanding of the relationship between science and the world. s5, s7, s8, s9	The election of the historic or day a day examples can be evident to the teacher but not necessarily to the students s9	Listening to their participations s2, s7, s8 Asking the students about what they understood and how they think they can solve a similar problem. s3	Asking the student to share something that they have lived or seen. s2, s5, s9 To make a previous selection and formulation of the questions. It is necessary to listen carefully and understand the students responses and opinions s7, s8

Table 6 (continuation). The matrix form of I-CoRe

	1. The importance of promoting that students develop this activity	2. The difficulties of promoting this activity	3. The specific ways for ascertaining students' understanding around this activity	4. The teaching examples and procedures do you use for engaging students with this activity
F. Design and conduct a scientific investigation through a set of actions;	Because it allows students to develop their knowledge, their skills and their learning process. It also allows them to solved different scientific and everyday problems. s4,s8	The complexity in the comprehension of a research and of the process that it involves. s4, s5, s7, s8	With the students´ responses of science's questions (cognitive and metacognitive) and their comments. s4, s5 Observing how students manipulate the materials, their notebook, and their work in teams s4, s8	To let the students observe everything that is around them and promote that they relate the activity with day a day experiences. s4 When the activity is at the end, I ask to search for more information. s5
G. Communicate by means of argumentation what has been learned through inquiry.	The students share the findings and the mistakes done during the activity s1, s2, s5 When the students share what they have learned, it allows that other kids to exchange their opinions, to evaluate and to reformulate their ideas. s1, s2 s5, s8, s6	Some kids do not argument because they are timid or are afraid of giving a wrong answer. s5, s7, s9 It is difficult to listen to each one of the students s1,s6,s9	Observing what are the students doing en their team s5, s8 By the reasoning and the richness of their arguments that each student express during the activity. s1, s6, s7	Seating in a circle the make the participants more focused in the discussion held and on the comments that each student do. s1,s2,s6,s7 Presenting examples of argumentation. s9

The importance to promote the pedagogical activities was always referred to the student benefit, for example, for activity D: “The students can understand what happened during the experiment and that allowed them to explain what they did to solve the problem based on the evidence obtained in the experimentation. [metacognition]”.

Another example, of students´ aspects in the pedagogical activities´ responses, is that some students´ abilities (Table 2) are present; Table 7 contains in the first column the number of the ability and in the second the pedagogical activities and the sentence involved.

Table 7. Inquiry abilities of Table 2 present in responses related to pedagogical activities.

1	In A: “To propose adequate questions is fundamental to promote the process of asking and questioning.” And in B: “It is important because once the problem is understood they understand what they have to do and it is possible to find an answer.”
2	In D: “While doing this activity the students can understand what happened during the experiment and that allowed them to explain what they did to solve the problem based on the evidence obtained in the experimentation.”
3	In D: “Evaluate if the explanations take into account the evidence.”
4	In C: “It is important that the students have a context, so they can identify what can help them solve the problem.” And in E, “By involving students in everyday problems, it is achieved a better understanding of the relationship between science and the world.”
5	In G, “It is important that the students share the findings and the mistakes done during the activity, when the students share what they have learned, it allows other kids to exchange their opinions, to evaluate and to reformulate their ideas.”

Closing remarks

The analysis of the information obtained by the I- CoRe allows to understand and to know what the components of the teachers’ knowledge are. With the review of this information one can identify the teachers’ conceptions that are alike to inquiry, and the ones that are not.

Some key findings are that (the context) PAUTA activities involve the construction of concepts and the development of abilities and attitudes.

Inquiry (the concept) is a methodology that contains questioning, experimenting, thinking, discovering and communicating. The information obtained in the I-CoRe revealed that teachers have, at least, six of the seven elements of the inquiry understandings mentioned by NRC (see Table 1), suggesting that they have a general idea of inquiry that resembles with the one that mentions the NSES.

The teachers I-PCK contains several aspects related to students —like the students' benefit and the students´ abilities— but mainly, the information is concerning didactics, content and pedagogical content knowledge.

An important finding is that the difficulties of promoting the pedagogical activities can be arranged in four groups of related answers: to the teachers or to the design of the session with children; the circumstantial context of a session with children; to the students (abilities, knowledge, and attitudes/personality); and to the pedagogical activity. That half of the difficulties resides in the teachers and in the activity design or context (content and timing), propose that this limitation could be diminished with a specific modification of the session's structure and training.

Other important general finding is that all the teachers —when referring to the specific ways for ascertaining students' understanding around an activity— answer that they use a question-explanation method with their students. It is remarkable that only some of them expressed that they also pay attention to their students' behavior and actions during the activity; the authors believe that this last issue should be improved by taking action in the teachers training sessions. There is also another important incorporation, which is to be made: the analysis of the student's research notes as another element of evaluation.

The teachers´ I-CoRe contains valuable information regarding its two fundamental aspects: inquiry´s abilities and understandings of inquiry. The authors of this study believe that I-PCK of remarkable subjects can be shared if it is documented and analyzed and by this means it may enrich the knowledge and provide valuable tools to other teachers.

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