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Matrix for the Analysis of Teaching Practice by Graduate Students

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Abstract

Procedure outlined in this article is part of a mixed qualitative research that aims to assess impact of the Masters in Basic Education with specialization in Science (MEB-RCTS) in educators. Categorial matrix, indicators and codes designed for analyzing video recordings of educational activities by students, are applied at the beginning and the end of their studies because it is considered that the intervention is an ongoing process. Data are processed through indexing and transcription techniques. Written report are generated from key points and focal events categorized into four argumental lines: 1) Co-construction of curricular content of Biology, Physics and Chemistry. 2) Social, literary and material Technology. 3) Instructional framework of scientific competences. 4) Teacher responses to the conditions of school environment. Comparable narrative descriptions are generated with relevant quotations from verbal and nonverbal interactional phenomena. Results obtained in process will be compare with the others stages: profile entry and exit, needs of beneficiaries, content of thesis, survey and interview graduates, allowing assess transformation of their agency and training skills involved in graduate school.

Teaching practice, graduate students, curriculum evaluation, video research, science teachers

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Matrix for the analysis of teaching by graduate students

This is a mixed qualitative research in 5 stages intended to evaluate the impact in the professional development of the students from the Master in Basic Education with specialization in Reality, Science, Technology, and Society; MEB-RCTS for its initials in Spanish (UPN, 2010; Gómez, Rodríguez y Ruiz, 2015; De la Riva, Rodríguez, Ruiz y Paz, 2015).

The students are preschool, elementary and middle school science teachers working in Mexico City and Mexico State. The MEB-RCTS is a professional oriented graduate program, so it is outstanding that the student-teachers combine the workdays in the classroom with reflection and analysis sessions in the graduate program. This gives a broader perspective of the educational phenomenon and the possibility to make a formative intervention. As the students acquire a graduate education, their teachers' competences in the teaching of science are improved, and the teacher meets the learning necessities of the classroom.

Before entering to the MEB-RCTS the student-teachers already have a professional practice and a set of competences from that community. They share the traditions of the profession, an explicit common core professional knowledge, a value system organized in institutional levels, which takes place in the same reality. The practice is problematized and a mediation tool is designed parting from this background through collective debates in seminars, tutorial comities and intergenerational encounters that allow the student-teacher to re-signify the practice.

The student-teachers reconsider their intervention projects continuously as they produce abundant evidence of their progress. Some of the evidences are: the description of the context in which the practice is developed, the learning characteristics and changes in the beneficiaries (kids and teenagers students going through basic education), and the knowledge; abilities and attitudes that the teacher builds along the process. The evidences are present in the different written versions of their theses. Within the evidences, those that depict their reflective thoughts and decisions are outstanding; and they become a valuable information source for the investigation of the MEB-RCTS's impact.

While in the first stage (population characterization), second (knowledge) and fourth (written production) the data for the investigation is taken from individual cases, the third (practical) and fifth (focus interview) analyze the group situations.

Objective

The third stage of the research tries to answer the question: How the practices of the beneficiary teachers change with their studies in the graduate program? Its objective is to evaluate the impact of the program in the improvement of the student-teachers practices.

Method

This article shows the material made during the third stage, in respect with the design process of the matrixes for the characterization and analysis of the teaching practice in the intervention.

The first step is to characterize the practices, their changes and the improvements in relation with the competences intended in the graduate profile.

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It is focused in the teaching activities as interactive systems in which persons, objects and events take place to support a learning environment of scientific contents in a specific context. These interactive systems are complex, dynamic and difficult to grasp at first stance, which makes insufficient an individual analysis of each of its components.

Intervention is an on-going transformational process that is constantly re-shaped by in own internal organizational and political dynamic and by the specific conditions it encounters or itself creates, including the responses and strategies of local and regional groups who may struggle to define and defend their own social spaces, cultural boundaries and positions within the wider power field. (Long, 2001, p.27) (Cited by Engeström, 2011, p. 604)

It becomes necessary with these characteristics that the analysis units are interactive systems with a spatial, temporary and situational delimitation. The demarcation that the student-teachers make from their own reality is taken as a reference. For example the intervened and analyzed practices, the authentic problems experienced every day in the classroom, those related with the student's necessities like health; environment, the interest in science, the collaborative participation in inquiry activities and the experimentation and understanding of natural phenomena, the application of scientific concepts, the adaptation of the working materials, etc.

In order to take the classroom problems to the seminars different technics have been used, as well as instruments in agreement of the current MEB-RCTS teachers; usually a field diary, class videotapes, checklist, and the observation checklists. For further scrutiny it is needed a diagnose that highlights the different aspects, necessities, deficiencies, absences, barriers, best practices, mediation types, styles, etc.

The videos are used to problematize, make a diagnostic and depict the changes in their practices. For our research these videos are useful to portray their practice and to evaluate if those changes are an improvement and attributable to the MEB-RCTS.

In the third stage, the analytical units are thematic. They take as criteria the notion of activity whether they require one or more videos.

In this case activity is understood as a teaching sequence with a thematic and organizational unity. Each activity involves a new instruction series by the teacher and the theme, the working material or the procedure followed by teacher and students change. Inside a classroom several activities can coexist (Gálvez, Rockwell, Paradise y Sobrecasas, 1981, p. 17).

The activities take into account the curricular pedagogic principles, the school's specific organization and the teacher´s experience. The school activities can relate with other activities forming cycles. Furthermore, those activities' cycles can take place in one or more class sessions. The activity cycles are a form of intertextuality because the meanings built along an activity are connected with the meanings of other activities. In order to delimit each analysis unit the written materials that give it context are checked. This information and the video transcript is the first step to obtain the data. In this research, the *transcription* is understood as an interpretative and representational process (Green, Frankiz y Dixon, 1997, p. 172) taking into account the theoretical perspective that leads the analyst to pick the events recorded in the video, translates them in transcripts, descriptions and meaningful narrations for the research objectives.

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The hypostheses and their categories

Hypothesis 1 In order to understand the teaching practice it is necessary to take into account the context that supports it. In other words, the material, temporal and spatial dimensions of the practices is where the meanings are built by the subjects and where they express their intentionality. The main problem is a social one because it is related with the relationship and influence with the Others influence while the learning activities are done. In this conception of situational learning, the *structural resources* that give the teacher opportunities and limits become relevant.

H1 The meaning of the activities rely on its position in the sequence of the class guided by the teacher. This position gives context to the construction of "scientific facts", explanations, evidences, the relationship of the practical activities (to experiment, "give examples") with the "more theoretical" activities (search concepts in a book), etc. It implies the distinction and understanding of the relation between the content activities with the work organization and the participation; its sequence, how simultaneity and rhythm influence the easiness or difficulty that the students have while being in the class and how they appropriate the knowledge.

Although the session or class duration varies often, the teachers organize the set of activities in introductory, development and closure parts. This organization is repeated continuously until it forms routines.

Hypothesis 2 The events that take place inside the basic education classrooms during the science class have a relation with the historical and contextual aspects that determine the curricular project and institutional conditions that conform the educational practices.

The teacher pretends to emulate the cases, scientific roles, their procedures and instruments.

Following Shapin and Shaffer (2005) the scientists require a material technology, a literary technology and a social technology. The material technology involved in the construction and operation of the machines so they can reinforce the perception; to constitute the perceptible objects and to produce them intellectually. The literary technology allows socializing the produced phenomena, checking their plausibility parting from the already given knowledge, as well as the credibility and reliance that offers to the witnesses; which allows to put an end to the controversies and generate accords. The social technology incorporates the proper linguistic practices and conventions. Shapin and Shaffer (2005: 44) consider "the scientific method as a crystalized form of social organization and as a mean to regulate the social interaction inside the scientific community." In this sense the school imitates and applies this technology to validate and legitimate the knowledge, as well as to grant; for example, the compatibility between empirical data, evidences and facts that conform the discussion and concepts in the free text book (in Mexico the basic education students get for free a set of books whose contents correspond to the mandatory curriculum).

H2 The social becomes content. The process of knowledge construction, even in natural sciences subjects and in the experimental activities with and expected "objectivity" in the procedure, implies a negotiation of the meanings and the modification of the sociocultural context, as it generates the conditions that benefit or obstruct the learning. The objective materiality, time and space interact with the subjective ones.

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The teachers mediate and represent the academic and the normative, and in this case "the scientific". The students require time and experience to understand the dynamic, and to be able to participate corporally and discursively in it.

Several authors have studied the relation of the social with the cognitive and the linguistic; especially how the basic education students interpret the contextualization keys to answer the questions made by their professors in science classes. Considering this we have to hold as true Lemke's affirmation that to master a subject, as specialized as science, means to master its specialized forms of language use (Candela, 1997, p. 37).

(…) kids cannot learn science only from the perceptive experience, but they also have to learn how to describe the experience in the scientific discourse, stressing the school scientific discourse (…) Not only they have to learn how to talk but also how to participate in the social organization of the academic task in the classroom: how to take turns, how to ask for the words, how to listen, what to say, how to say it and to whom direct the discourse (Erickson, 1982). (Candela, 1999:40).

The students' social participation appears to impact in the explications and experiences with the phenomena. This relationship is similar to the social and contextual condition in which the Scientifics work. Therefore, this research considers that there are contact points between the things happening in the science classes and the things done by the Scientifics through the translations done between science diffusion and the curricular designers.

Hypothesis 3 The central objective of the Program for International Student Assessment (Programa para la evaluación Internacional de Estudiantes/PISA) is to measure the degree in which the 15 years old students, who also find themselves at the end of the compulsory education, are able to turn to the things they have learned when they encounter new situations in school level as well outside from it. This means it aims at estimating the level of essential abilities and competences required for their full participation in society (INEE, 2008).

PISA's evaluation model is centered in the concept of literacy (aptitude or competence, although in different countries it has been translated as culture, formation, alphabetization or ability). In Mexico this concept has been managed as competence and it is defined as a complex action system that includes the intellectual abilities, the attitudes and other non-cognitive elements, such as motivation and values, acquired and developed by individuals in their life; and indispensable to effectively participate in several different social contexts (INEE, 2008, p. 31).

The definition of Scientific Competence has three dimensions: Processes, Application Areas and Content. The Processes are the "activities that have demonstrate in function of the types of tasks that the students will find in real life" (p.31). They consist in identifying scientific themes, or in other words, to apply the scientific knowledge in a specific situation to explain, describe or interpret the phenomena, predict changes, recognize descriptions, explications and proper predictions. The capacity to use scientific evidence requires interpretation, elaboration and communication of conclusions and the identification of the underlying suppositions, proves and reasoning (INNE, 2008, p. 32). The Processes have six performance levels. But according to INEE's data (2012),

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In Mexico, the distribution finds itself far away from the average present in the OCDE. In Mexico 2% of the students are in the highest levels, while in the OCDE's average 29% of the students are in the same level. In the intermediate levels (2 and 3) Mexico presents 51% of its students, compared to the 54% of the OCDE's average. In the lower levels (1 and Under level 1) the OCDE's average concentrates 18% of the students, a striking difference with the 47% in Mexico. (p.6)

In our country, an evaluation that explains the conditions of these results does not exist yet. Nevertheless, studies about science learning in basic education, especially in elementary school, demonstrate that that the kids need to understand, explain and argue in order to learn (Giordan, 1982; Driver, Guesne y Tiberghien, 1985; González 2007; Candela, 1997, 1999). In addition, the students refuse to accept the knowledge even going against the teacher's affirmations, they discuss their knowledge in a social practice trough the empirical evidence that comes from the class activities as well as their experiences from outside the school in order to convince the others that their version is valid and look for accords. For Jiménez-Aleixandre (2010, p.11) to argue is the capacity to relate explications and proves that "could be defined as the observations, facts, experiments, signs, demonstrations, reasons, as they try to demonstrate that a sentence is true of false" (Jiménez-Aleixandre, 2010, p. 20).

Even with current PISA's results, there are not many studies that specify which actions promote the mentioned processes in the students. Therefore, the hypothesis works in an explanatory level.

H3 In respect to which are the effects of the teaching actions in the production of affirmations, explications and arguments in the students.

Hypothesis 4 The actions developed by the teacher have their basis in their formation, initial and permanent, whose tendencies run in parallel to the educational politics from each period. In the first part of the twentieth century were valid the paidocentrism, the positivism, and the scientific contents were acquired through its "method". In the seventies, the use of the lab emphasized the inductive thinking (López, 2003, p. 378) with Bruner. Also in the seventies, the meaningful learning from Ausubel motivates the necessity of a scientific culture. It is in this period that terms like "scientific alphabetization", "science for everyone" or "science, technology and society" appear (López, 2003, p.379). In the eighties, the debate intuition/systematization of information complements, with authors like Piaget and Vigotsky, the Constructivist propositions with a cognitive turn. These ideas are imply in the current ones, in the recognition of the previous ideas and the conceptual change. These tendencies affect the official curriculum, especially the teaching profile and the reach of the institutions, the traditions and the practices of each school center.

The MEB-RCTS takes into account these tendencies because it looks to form in the field of science teaching, especially with the requirements of the current Basic Education Reform. In the graduate profile (UPN, 2012) the resignification and the transformation of the work in the classroom stand out, as well as planning. It takes into account the specific students' necessities and the school's context, and the revaluation of their role as a fundamental educational agent.

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With the competences, it looks for the reflection on the social importance of the science, the scientific contents that work in the school, and the learning psychological theories that have affected their teaching, the psychopedagogic perspectives for the curricular analysis, to generate the mediation and research tools.

In the MEB-RCTS operation underlay assumptions shared in this research. First, that there are modifications in the practices of the student-teachers' practices. Second, that these modifications are a consequence of their studies in this Master program. Third, these changes "improve" the teaching and learning processes. Fourth, that the experience of the intervention is professionally formative. Therefore, the fourth hypotheses compares the characterization of practice with the teaching exercise that correspond with the expected competences in the MEB-RCTS (UPN, 2010).

H4 In the practice during the intervention teaching actions present themselves and reflect the exercise of the expected competences in the MEB-RCTS.

Results

The results are presented in the next section and use the matrixes from the case of an student-teacher that will be used as codification model (Derry, Pea, Barron, Engle, Erickson, Goldman, Hall, Kochmann, Lemke, Gamoran y Sherin, 2010, p. 21). It is deep-rooted in the disciplined observation that leads to the refinement of the categories and allowing a trustworthy codification of the new characteristics of the phenomenon, where it will be useful to consider, ahead in the research, their quantification.

The case corresponds to a fifth grade group from elementary school by thirty students (As, Ao, Aa) from which sixteen are girls and fourteen boys. The teacher (Ma) has as purpose to recognize the previous ideas that the students have about concepts like environment and responsible consumption, to formulate a problem and to do an intervention afterwards. The expected learning in the official program is to argue the importance of the responsible consumption given the environmental implications of the satisfaction of the human necessities.

Co-construction of curricular content of Biology, Physics or Chemistry

A transcription of the dialogue of the teacher and the students. The following colors are marks of the type of activity: Content, Organization of teaching tasks, and Organization of the participation. Then the fragments are put together and codified. In respect with the space and time, a description of the stage and a narration of the things that happened to give a full depiction of the situation are done.

MATRIX TO OBSERVE ACTIVITIES AND THEIR CONTEXT	
Indicators	Obtained codification
Types of Activities 1) Contained	As: Enumeration of actions and examples. Ma : Closing sequences with short definitions
2) Tasks	It is clear the sequence of tasks.
3) Participation	They are clear rules of individual participation, team and group .
Routines	Question and Answer, enumeration, sequence of activities .
Interruptions	Murmullan when a subject seems funny.
Uso del *espacio-tiempo*	Furniture organized by teams, teacher leads class control from the front of classroom.

Figure 1

In this case, Content activities cover the development in three concepts: environment, consumption and responsibility. The definition of environment mentions the objects that it contains; the students mention: nature, animals, plants, ecosystems, trees, grass, and water. The teacher includes humans and everything that is around us; she affirms, "Everywhere there is environment" establishing in a relationship of equality the container and the contained.

The definition of Consumption consists in the actions that the students mention: throw away the garbage, eat food, and take water, "the consumption of everything we need". From the last affirmation the teacher asks what else do they need. The students make a list: air, oxygen, sun, water, food, light, plants. The teacher questions if we consume plants and a student says "spinach". The teacher questions where do we consume energy. The students confuse the energy consumption as food and as the energy used to cook. A student proposes that there is also an energy consumption when they eat, although neither he nor his classmates explain these affirmations furthermore.

In respect with the types of consumption besides eating, the students combine actions and objects of consumption: the animals and plants consume water, energy and electricity. The teacher leads de dialogue to the other actions besides eating: breathing, resting. The teacher asks where this happens; the students mention the bed and the couch. Then she asks if they eat themselves (uses an absurd) to affirm afterwards, "Consumption is not only to ingest". They keep enumerating studying, light, water, lunch, colors, cases, tables, notebooks, chairs, clothes, uniforms, glasses, pull over, shoes, T-shirts, water television, internet that "cannot miss"; bathroom, pet, and the teacher complements "to make you company", "everything is a part".

With responsibilities, they work too with the enumeration of actions: to bring homework, make the bed, take care of a pet, fold the clothes, and wash the dishes. The teacher defines responsibility with other word "obligation"; a student says "duty". The teacher asks for expressions that have the meaning "this person is responsible". The students say to do their duties, compromised, to do the things by themselves, "to be conscious of the consequences". The teacher relates consumption and complements "sometimes we buy thing but we are not conscious". Then she enlists the causes: taste, necessity, mode, fun, "is attractive to us", "is our favorite toy", and "we have lots of fun".

The teacher asks them to define responsible consumption: to eat well, "is what we really need". The teacher questions again "Then, do you buy what you really need?" "Do you think it is important to consume responsibly?" The students say no and give examples, "we could end with a species". Then the students make a new list: chicken, lamb, coat, shrimp, rabbit, and deer. The teacher asks about the "animals that should not be consumed": deer, a girl affirms "I have tried it already", the children keep mentioning the animals that consider repulsive instead of those that are in risk of extinction: rat, spider, cow, scorpion, and cockroach. A student gives a pertinent example, "Whales, because, for example, in Japan they eat them", "no, in China". Nevertheless, other students keep saying those animals that they find repulsive: snakes, insects. The teacher tries to focus them in the question:

Ma: Well, and which animal do you think is in danger of extinction and we should not eat it, no matter the case, and neither have it as a pet because it is also there. Right?

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The students answer: shark, bear, panda, turtle, wolf, porpoise, polar bear, and hedgehog. The teacher changes the example to the energy consumption to come to school: car, bus, taxi, public transportation. The teacher asks them to define the actions needed to take in order to have a responsible consumption, "Ways to consume for not consuming too much". The students enlist actions: fill bottles with water, open the blind and turn off the lights, bring their own lunch. A student mentions reuse, and the teacher ask which are the Three R's, recycle, reuse and reduce. Teacher questions if "They can be done?" and clarifies that "to recycle requires another process". She also questions why people buys products. The students answer: taste and reward. The teacher asks, "What do the people do so I buy things?" to which the students respond: poster, slogans, famous people appear, someone attractive. The teacher asks what does the text in the back of a junk food product say as she shows it. The students answer: ingredients, nutritional information, calories, to know what is in it, quantities, and if it is nutritious. Finally, she asks for the problems it can cause and the students respond: cardiac problems and diabetes.

In regard with the Organization of the teaching tasks, the class lasts 50 minutes in the videotape, from which the first 18 were dedicated to work with the concepts. From minute 19 to 39, the group, organized in different teams, made an anti-advertisement poster. From minute 40 onwards the teams exhibited their posters to the rest of the group.

The questions done by the teacher are complementary. She writes on the board so the student can infer the answer that, mostly, is a single word. She works with the three concepts and the same routine. She points out when she needs one single student to answer or the whole group, rising their hands to take turns for speaking.

The teacher repeats what the students say. When she considers a question is incorrect, she asks the other ones if they agree. The students answer with negations or take as granted that an alternative answer is needed. When the teacher considers that the concept has been already defined ends the questions and answers' sequence and makes a different question or gives a short definition. In less occasions is the student who gives a short definition. The group forms four teams according to their affinities and the teacher gives them a product so they can do an anti-advertisement poster. The students ask if they are doing it well.

On the other hand, with Organization of the participation, the teacher brings a guide to the class and focus the children's attention to the front of the classroom through questions, she supervises the work in teams, and when she asks a student to respond, she does it insistently. For the direct calls of attention, she requests that the students rise their hands and she asks twice that they remain silent when they start talking and interrupting each other. The pronunciation error in "dishes" is taken as a joke, as well as "your cousins' the pigs". Although the teacher is not the permanent teacher, she was trustworthy enough to encourage an active participation, the group looks well integrated and they are respectful with each other.

It is notable that the teacher encourages the co-construction (Rockwell, 2000, p. 20) of the concepts when she boosts the students' interaction with her and with each other. They mediate the definitions verbally, as well as their written representation, the use their local, personal, and school knowledge. They transform the definitions and apply those definitions in several examples.

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Social, literary and material Technology.

In the transcription, the use of materials and the combination of technologies are color marked, extracted and poured into the matrix.

MATRIX TO OBSERVE OBJECTS AND REPRESENTATIONS Indicators Obtained Coding	
Translation	Teacher combines verbal language, gestures and writing on the blackboard. Students answer questions with short answers, equipment and build a poster exhibit.
Objects	Blackboard, leaves held together with tape, bags of junk products and markers, written symbols, simple enumerations, few complex ideas.
Representation	Poster with an anti-advertisement that describes true characteristics of product.

Figure 2

The teacher asks and writes on the board while, with her voice intonation and her gestures, cheers her students to participate. She relates the students' previous knowledges with the concepts through the objects and actions enumeration, and close the ideas with short phrases. These lists of objects and actions depict systemized data but few logical relations of inclusion within these elements existed.

The teacher repeats the things said by the students sometimes with a question tone. The teacher repeats the complete answers that are the most complete and make a closure of the ideas. Sometimes the teacher changes the sense using a negative form and takes as given that the whole group understands it. Although the ideas are complete, they are not concepts, they do not look to do a system and they do not look either to contradictions within them.

Instructional framework of scientific competences

This research takes for base the instructional frame of McNeill and Krajcik (2012) to evaluate the scientific explanations.

Variations of Instruccional Frame for Scientific Explanation (McNeill and Krajcik, 2012, P. 35) (Fragment)	
Complex Level	Variation 4 1. Affirmation -a statement that answers the question 2. Evidence -data scientific evidence supporting -data need to be appropriate -data need to be sufficient 3. Reasoning Multiple components -a justification why the evidence supports the claim using scientific principles Each piece of evidence may have a different justification why it supports the claim 4. Rebuttal -describes alternative explanations, and provides evidence and inconsistent reasoning why the alternative explanation is not appropriate

Figure 3

The research found the teacher's questions made during the class. Some questions are rhetorical and use them as a mean to maintain the students' attention and for them to give alternative questions (or correct ones). With others, the aim is that the students think about the things they say (for example if the humans are part of the environment).

The teacher mentions most of the closure ideas; the students mention some:

Aa: It is important because sometime those things that we don't need end up in the garbage and there are some children that cannot buy them and we are wasting them.

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Ma: Exactly

Aa: And we don't use it

Ao: Because, for example, if we are not responsible of the things we eat, right now, I'm speaking about animal consumption, then we could end with a species.

There are questions that are not complete (the children explain and argue), for example when the girl mentions the deer as an animal consumption. The children mention animals that usually are not a part of the daily diet because they consider them dangerous or repulsive. The students do not appear to understand the ethical sense that the teacher is looking for.

There are affirmations with a complex logical structure that are not clear (oil consumption as energy, or to cook the food and the food to produce energy in the body). Other examples are:

Ma: What pollutes the most, your car or the public transportation?

Ao: Both of them, both of them

Ma: With both of them. However, what is the difference with the public transportation and your own car?

Ao: In public transportation, you, you pay.

Aa: Sometimes, but there is always more people (the idea more people can use the public transportation)

Ao1: Well the candies say, in the ingredients, that they have artificial colorants and this can be harmful for you.

Ao2: I say that the candies are tasty but when you start to analyze properly the nutrimental information, you are not going to think the same as when you bought them just for pleasure or because you liked them.

Ma: Do you recommend them or don't you, Team 1?

Aos: Noo, well, only once in a while.

Ao1: Well it is not recommendable to eat them every day. We advise to eat them, for example, one day each month or something like that, but not so often.

Ao2: Once per month or per week because if you eat them every day you can get sick.

Although the teacher promotes that the students justify their questions, these are enumerations of "causes" or "variables", which do not relate one with the other, developed through examples. This could integrate explications partially, but not argumentations.

Teacher responses to the conditions of school environment

This research uses a matrix based in the curriculum or competences' list from the MEB-RCTS. In respect with the Didactical Competences, the observation is that the teacher plans her activities ahead and orientates the students towards the already set contents so it does not lose the objective and get to the intended point.

She also gives instructions clearly for the activities to be done by the students, has a good group control, which allows her to complete the class as she had planned it, but it is not clear if she handles the Environmental contents theoretically because she does not get into details. The emphasis in the intervention done by the teacher lays in her invitation to the students to say everything they know and to apply it to an authentic problem.

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The teacher keeps a friendly and trustworthy communication with the students. She respects their opinions and invites them to keep participating; the vocabulary she uses with them is the proper one for their age and context. Even though she is not the permanent teacher, the students know the code she uses, like rising their hands to take turns and to do what she asks for.

Regarding the MEB's Competences, the teacher showed leadership, oral and written expression abilities. She retrieved everyday knowledge, psychosocial and affective aspects. She also planned taking into account the specific necessities of her students and the school's context. She uses the resources within her reach, includes everyone in the activities and promotes collaborative working. The sense of the school's work responds to already known routines.

In concern with the RCTS's Competences, the teacher plans and implements an educational intervention in the classroom. She applies partially the processes that characterize the sciences and their research methods (explanation, variables and argumentation). Although she aims at arriving to clear definitions, she did not contrast the scientific contents at the school with the definitions. She considers the possibilities of the school's context and the students' specific necessities, and interprets ordinary situations partially in a scientific way.

She also recognizes the importance of the everyday knowledge for the construction process; nevertheless, those notions are not structured logically in concepts, as well as complete and pertinent models.

Conclusions

The development of the research instruments, in this case the matrixes for the videotaped observation of the teacher's practice during the intervention process, allows obtaining qualitative information about the qualitative characteristics of this professional practice. These characteristics are comparable to those stated in the graduation profile, the evaluation of their knowledge, their written thesis and their opinions. The triangulation involves their limits, because the formation has mediate effects and therefore, it would be necessary to do a longitudinal follow up with the next generations. In the other hand, the continuous changes in the educational reform have to be taken into account, as well as the graduation profiles, especially because the intervention's methodology implies an identity with the student-professor and the researcher and mediator.

The use of matrixes by the researchers in collaboration with the students (auto-observation) help to make visible the best practices, the agency of the actors when they face the problems and focusing in authentic problems, in the sense that they overcome prefabricated, linear or exclusively evaluative models, which contribute little to the satisfaction of the educators and their beneficiaries' necessities. It has a relation with the distinction between short-term goals (for example the appropriation and application of the scientific concept) and the long-term goals (like the processes of argumentation and formation of scientific attitudes, which also can be transversal).

It also has a relation with the knowledge from the student-teacher with the capacities and abilities that the students have and the superior level intended to reach.

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This research agrees with Engeström (2011, p. 602) in the proposition that the theoretical problem that underlays in the intervention is one of causality, because it needs a methodological and ethical vigilance over the agency's empowerment process. It requires the whole research team to do a critical work (8 members) and not only the application of the observation protocols. It requires sensibility and respect, since the actors trust in the person that is watching them, and it must be clear that the intention of the observation is to understand the things that are happening in order to know, and codify the phenomenon and build the proper instruments. The search for an individual deficit and an efficient rationality are not the goals.

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