Lacueva, Aurora, Imbernón, Francisco y Llobera, Rosa (2004). Fishes: a didactical unit in an uncommon school. *RELIEVE*, *v. 10,* n. 2. http://www.uv.es/RELIEVE/v10n2/RELIEVEv10n2_3eng.htm

e-Journal of Educational Research, Assessment and Evaluation

RELIEVE

Revista ELectrónica de Investigación y EValuación Educativa

FISHES: A DIDACTICAL UNIT IN AN UNCOMMON SCHOOL

[Los peces: Una unidad didáctica en una escuela "diferente"]

by/por

Article record
About authors
HTML format

Aurora Lacueva lacter@cantv.net
Francisco Imbernón fimbernon@ub.edu
Rosa Llobera rllobera@d5.ub.es

Ficha del artículo
Sobre los autores
Formato HTML

Abstract

In this case study we describe and interpret a didactical experience centered on the theme "Fishes" and developed in a first-grade classroom of an innovative school. We systematically recorded the experience, collected documents, and interviewed the principal, the teacher and the students. Seven categories were used for the interpretation of data: learning connected to the real world, availability of sufficient resources, excessive narrowness of the theme, openness vs. structure in the didactical work, children as protagonists, a rich school life beyond the classroom, and the multi-faceted relation between school and home. The article outlines and discusses children's learning achievements.

Keywords

Educative innovation, science education, democratic education, didactics, elementary school education.

Resumen

En este estudio de casos se describe y se interpreta reflexivamente una experiencia didáctica centrada en el tema "Los Peces", y desarrollada en un primer grado de educación primaria dentro de una escuela innovadora. Se llevó un registro sistemático de lo sucedido, se recopilaron documentos y se realizaron entrevistas. Para la interpretación de lo observado, se trabajó con siete categorías que intentan destacar importantes características de la experiencia: un aprendizaje vinculado al mundo exterior, disponibilidad de suficientes recursos, la excesiva delimitación del tema en estudio, apertura frente a estructura en el trabajo didáctico, niños y niñas protagonistas, una escuela de rica vida más allá del aula, y la multifacética relación escuela-hogar. El artículo aporta consideraciones acerca de los aprendizajes logrados por los estudiantes.

Descriptores

Innovación educativa, enseñanza de las ciencias naturales, educación democrática, didáctica, educación primaria.

Purpose of the study

In this research study we keep track of the work of a first-grade teacher throughout a whole didactical unit focused on the topic of Fish, which allows us to point at interesting elements present in the teaching of science to small children, while also hinting at other more advanced and complex practices that could be carried out. Besides, we strive to emphasize the importance of the school context in which this specific educational initiative takes place. We believe that by highlighting positive educational practices and by reflecting on them, we can contribute to a better understanding of school learning and of the processes and situations that favor it, while providing interesting suggestions for the daily work of teachers and their educators. We think that this research approach can be the framework and/or pave

the way for the development of more ambitious initiatives of joint work with teachers on the basis of complex action-research (Carr & Kemmis, 1988; Lacueva, 2000b; Koch & Burghardt, 2002).

Perhaps there are many other schools where activities similar to the ones conducted in "alternative" schools like this one are carried out, but these are isolated and certainly sporadic initiatives. In fact, some of the characteristics of the school and the classroom we present here can be very common today, at least in rich countries. Yet what is really important —and can be appreciated in this case— is the combination and synergy among features of different nature, and the systematic effort simultaneously made on different grounds day after day, month after month, and year after year.

Method

This is a case study along the lines of what Stenhouse (1991) has called "educational case studies" referring to those aimed at improving the educational practices and striving for the development of theory and/or the refinement of prudence —in the Aristotelian sense of the expression— through a systematic and reflective account of experiences. This case was chosen, together with other two we do not present here, after having consulted twelve educational experts, visited twelve schools, participated in two seminars where classroom experiences were presented and looked through three pedagogical journals (two regional and a national one).

We observed the teacher in question throughout the development of the whole didactical unit. We took field notes, revised pieces of work produced by the students and educational material handed out; we filmed one class session and recorded another one, took photographs and sketched the classroom plan. We also made a semi-structured interview to the teacher both at the beginning and at the end of the whole experience and interviewed three couples of students at the end. Additionally, we held several more informal conversations with the teacher, three of which were particularly long, taking over thirty minutes each. The teacher gently acceded to keep a weekly diary of her work following a structure we suggested to her. And we held two conversations with the principal of the school (one of them also attended by the Head of Studies) in order to obtain general information about the institution.

Chart 1. Data gathering procedures

1. Researcher's field notes (taken in each class session and during previous visits or additional meetings with the teacher).
2. Field diary including further notes and initial interpretations added afterwards.
3. Transcription of everything written on the blackboard.
4. Gathering of all the material handed out by the teacher.
5. Compilation of photocopies of the students' pieces of work.
6. Gathering of other material offered by the school (School Project, students' journals, parents' and teachers' journal…)
7. Records of the content presented on boards and exhibitions both inside and outside the classroom.
8. Sketching of the classroom plan.
9. Photographs from the outside of the school and its inside areas, classroom, and children carrying out activities in the latter.
10. Audio recording of one class session.
11. Video recording of one class session.
12. Use of a structured guide to gather basic data about the school, the classroom, the teacher and the students.
13. Semi-structured interviews to the teacher (at the beginning and at the end).
14. Semi-structured interviews to three couples of children (at the end of the project).
15. Informal conversations with the teacher who was subject of study (taken record in the field diary).
16. Weekly teacher diary.
17. Two conversations with the school's principal (one of them attended by the Head of Studies).

Chart 2. Base documents used for the interpretation

19 records in field diary and additional notes.
9 sets of material handed out by the teacher in class.
59 pieces of work produced by the students.

1 transcription of a concept map made in class.
1 initial and 1 final record of answers to a knowledge inventory made by the teacher.
1 initial and 1 final pictorial record of the fish parts made by the teacher.
1 structured guide with basic data about the school, the classroom, the teacher and the children.
1 classroom plan.
1 transcription of the initial interview made to the teacher.
1 transcription of the final interview made to the teacher.
2 records of informal conversations with the teacher (others are included in the field diary of the corresponding day).
2 records of informal conversations with school authorities.
3 transcriptions of interviews made to students.
4 teacher weekly diaries.
1 planning of the didactical unit.
1 commentary on observed class sessions addressed to the teacher (by request).
1 handcrafted book made of the children's written contributions about St. George's Day (The Day of the Book): "Rodolins" (Catalan word for "rhyming couplets").
2 recent issues of the students' journal.
1 publication with texts written by the winners of the school year poetry contest known as "Floral Games".
2 recent issues of the School Newsletter for the parents.
1 issue (the most recent one for that moment) of the parents' and teachers' journal.
1 School Project.
(The transcriptions of the audio and video recordings are included in the field diary records).

Once we had transcribed and codified all the information, we organized it and interpreted it in two ways. First, we used the narrative to generate a summarized global account of the observed experience, which allowed us to have a general articulated appraisal of the whole process. For spatial reasons we only include here a flowchart of it. In addition, we used broad categories presented in the form of main topics that we proposed based on our study of the gathered data and our theoretical ideas. The interaction between theory and data interpretation enabled the delimitation of the used categories in a dynamic and recurrent manner —the latter emerging as the most important features observed from our perspective. Then, we marked and put together all the information available in the gathered data in relation with each category.

This systematic search for information related to each category and to different aspects within each category was carried out paying attention not only to elements that confirmed our interpretations, but also to those opposing them. We not only paid attention to the most frequent and "typical" aspects, but also to rare or atypical ones. We bore in mind that in a study like the one we conducted, the data interpretation and critical judgments are present from the very beginning and play a role throughout the whole data gathering process, although the interpretative and evaluative work becomes more intense and systematic after the field work, when it is written down more thoroughly.

In our study we present three text types: particular descriptions, general descriptions and assertions and orienting commentary (Erickson, 1998), which intertwine in order to give birth to overriding ideas that orient pedagogical work.

We cannot thoroughly give account of every detail we observed in each of the hours we were present in the classrooms, so we had to make generalizations within the case we were analyzing, giving rise to the general descriptions based on the study of the gathered data. In this sense, the relative frequency with which a situation occurs can be particularly clarifying. We have tried to quantify this kind of information insofar as possible for the purpose of this study.

Our account also includes certain examples presented in detail and as lively as possible: These would be the particular descriptions, which provide direct evidence that supports our general descriptions and interpretations, while also making the research report clearer and more enjoyable to read. Here, we often include quotations taken from the researcher's and the teacher's diaries, the pieces of work written by the students and the interviews made to the children and the teachers. This makes the description more authentic, interesting and understandable. Besides, we give the reader the opportunity to reflect on their own on these pieces of information we had selected.

The assertions and orienting commentary refer to the entire researcher's interpretations and evaluative reflections —from the most specific ones linked to certain particular descriptions, to the most abstract theoretical considerations. In this case, this text type would also include the reflections and proposals for future pedagogical action. In the assertions and commentary, the interpretation becomes explicit and is backed up with the theory, while there are also fewer connotations than in the other two text types. In our report, we have tried to combine all these three text types, so that they reinforce and enrich themselves one another.

As pointed out by Stake (1998), the logical process followed to get to these assertions, interpretations and judgments is often unclear. A study of this kind is not just a description of what has been observed, but it goes beyond this, based on the observations to generate interpretation, evaluation, and, in our case, "lessons" and better guidelines for future action. The interpretative process is built on our previously structured theoretical ideas and also on those new ones we construct or reinforce during the research study and driven by it. To produce our interpretations we also make use of our practical knowledge and of what we have learned from researchers who have conducted similar work.

Based on Eisner (1998), we would say that the interpretation tries to explain —or, perhaps, to explore— the meaning of the described situations, while the evaluation incorporates a value judgment about them, especially in terms of their educational impact. The borderlines between description, interpretation and evaluation are not completely sharp, but it is useful to differentiate between these three dimensions when conducting qualitative research.

After the interpretative and evaluative data analysis, we devote a whole section to the consideration of the information that helps determining any possible learning of the students in the observed didactical unit. We analyzed evidence from different sources and of different nature, trying to give an answer to this question, which is always difficult and complex. Finally, we present our conclusions and give our proposals for future work.

Chart 3. Categories used for data interpretation

1. School learning connection to the real world
2. Availability of resources
3. Narrowness of the studied theme
4. Openness vs. structure in the didactical work
5. Children as protagonists
6. School life beyond the classroom
7. Relation between school and home

We tried to ensure the scientific rigor of the research study by applying the following criteria (Guba, 1983): prolonged engagement, persistent observation, triangulation (of sources, methods and theoretical approaches), gathering and use of reference material and structural corroboration.

We observed a total of 22.5 class hours during 14 days distributed in four actual working weeks, as the teacher was sick one week and we could not make any observations. The class sessions were held in Catalan with some remarks in Spanish, so we had to translate what we wanted to quote in this paper. [T.N.] The school's name, so as that of the teacher, and of the students have been changed to guarantee confidentiality. The research work was carried out between February and March 1999.

Base data

The school we studied is located in a middle- to lower-middle class neighborhood in northern Barcelona, capital city of Catalonia, Spain. It is a state school with a very singular history: It emerged in the nineteen sixties as a cooperative of worried parents and teachers, who wanted the children to receive an education that was more democratic, culturally-enriching and more linked to the Catalonian traditions. With the establishment of democracy in Spain, the school —along with other similar schools with which it formed a coalition— asked to be incorporated to the network of public schools, for its founding members favored high-quality public education.

The school provides the three levels of pre-school education plus the six years of elementary schooling with only one section in each grade. The school's name was chosen by the students in one of its first years of existence and corresponds to a story character. For the purposes of this paper we have named it "The Three Bears".

The building is an ad-hoc thee-floor structure with spacious light classrooms and appropriate rooms to conduct specific activities, such as laboratory, library, computer hall, music hall, language laboratory, audiovisual equipment centre, play room, gym, sport court, dining hall, plastic arts workshop, special education classroom (there is integration, but complementary work is conducted with specialized teachers) and school psychologist office (who comes some days in the week). There are two playgrounds, one of them very large, with shrub gardens, trees, decorative plants and grassed areas that make up a pleasant atmosphere for children's leisure where they can run and play freely. The smaller playground has a play structure mainly used by the pre-school children. The school is located next to a natural park. It also has a spacious terraced roof.

The first-grade classroom is very spacious and bright, with drawings and signs stuck on the walls and shelves for books and other material, including a tape recorder. It is furnished with tables and small chairs that are arranged in different ways depending on the activity to be carried out.

The teacher we observed in our study, whose name will be Marta Montblanc for the purpose of this article, had been working as a teacher for 31 years when we conducted our observations, 26 of which she had spent on this school (not always in the same building). She has always been considered an "innovative" teacher. She first got a secondary level degree in teaching and, years later, she took a distance course on teacher education known in Spain as "Magisterio", which is a short higher education degree program. She has attended several congresses on pedagogical matters and has also presented papers in a few occasions. She has as well given courses at summer teaching schools. She has two publications on educational issues and in that school she merits the highest respect as a key member of the community for her knowledge and experience.

We observed a first-grade course made of 17 students (9 boys and 8 girls), all of them between the ages of 6 and 7. They had all attended pre-school and, according to the teacher, were already used to the presence of strange adults in the classroom, especially student teachers of the city's universities, who were doing their practice or thesis.

There were two girls of Latin American origin and the rest were students from Spanish families. In most of the cases, one or both parents spoke Spanish as their mother tongue. Almost all of their parents were staff employees, even though there were some professionals and also manual workers.

The development of the didactical unit

The didactical unit "Fishes" is always part of the first-grade program at this school. Mrs. Montblanc explained to us that, in principle, they base their work on the Official Curriculum from the Autonomous Community of Catalonia, but that they also use the curricula of other regions of Spain. In this case, they also used that of the Autonomous Community of Madrid, which orients the teacher in a precise way. Based on both curricula, they develop their own School Curriculum Project. For the daily planning, they partially consider the "Ciencias 6-12" program as well, which is an adaptation of the second version of the United States SCIS elementary science program (SCIS II), developed by the Regional Government of Catalonia.

Below we present a flowchart of the didactical unit, in which it can be appreciated that many and varied activities were carried out. There are differences in terms of the place where they are conducted, the number of participants, the degree of structure, the duration of each activity,

the variety of elements, the complexity of the requirements, among other factors. We will later on reflect on their quality more thoroughly.

Chart 4. Flowchart of the didactical unit "Fishes"

<table>
<tr><td colspan="3">Beginning, Part I: Previous Knowledge Inquiry – Inventory and Drawings
(February 23)</td></tr>
<tr><td colspan="3">Beginning, Part II: "What would we like to know about fish?"
(February 24 and 25)</td></tr>
<tr>
<td>Book examination
(February 26)
(March 9)
(March 15)
(March 18)
(March 22)

Paper fish, clay fish
(March 2)
(March 9)

Resources brought by the children
(As from March 10)

Dictionary use
(March 10)

Listening to stories about fish
(March 12)
(March 17)
(March 22)

Singing a song about fish
(March 17)

Classifying
(March 17)

Video on fish
(After March 22)</td>
<td>The fish tank
Setting up the fish tank
(February 25)
Adding the fish
(March 9)
Observing the fish tank
(As from March 9)

Visit to the aquarium
Preparing the visit
(March 10)
Which are fish?
(March 11)
The visit
(March 11)
Oral and written retrospective accounts
(March 11 and 12)

Fish wall chart
(March 10)
(March 15)

Describing a sardine
(March 16)

Observing and reporting comparisons
(March 16)
(March 17)

Fish dissection
(March 18)

Visit to two fish shops
(March 19)

Revision of question list on "What would we like to know about fish?"
(March 22)

Inventory of achieved learning
(March 22)

Group reading of an informative text
(March 22)

Concept map
(March 22)</td>
<td>Drawing and/or filling names on a drawing
The fish outer body parts, the fish inner body parts
(February 23)
The fish tank
(February 26)
The fish outer body parts
(March 9)
The aquarium
(March 11)
The fish outer body parts, more details
(March 12)
Fish bone structure
(March 15)
Fish internal anatomy
(March 15)
The fish as protagonist of a story
(March 16)
Certain moments of another story about fish
(March 17)
A fish shop and its products
(March 19)
The fish outer body parts, the fish inner body parts
(March 22)

Writing names
Fish names
(February 23)
Names of fish and non-fish species
(March 11 and 19)

Completing phrases about fish characteristics
(March 22)</td>
</tr>
</table>

Interpretative analysis of the pedagogical work

Based on our theoretical ideas, we analyzed and reflected on the collected data and were able to organize them in seven main categories, which helped to go deeper into some of the key aspects of the pedagogical work. Obviously, as in any research study of this kind, there were many elements that were left aside: Classroom life is extremely complex.

Learning connected to the real world

This school is systematically trying to open up to the world beyond its walls by offering the children learning experiences that stand back from the formalities, artificiality, idle rituals and banalizations typical of the "traditional" educational forms (Ramos, 1999). According to our observations and conversations, the development of a didactical unit in that school always implies a direct familiarizing contact with other environments and people and/or the creation of mini-environments within the classroom and the school that reproduce some aspect of real life. Observing, comparing, listening to explanations, posing questions are all actions that are present in this contact with the outside world. As the teacher explained to us, in another didactical unit previous to "Fishes" the students had visited a farm. In the didactical unit called "The House" they heard to explanations and observed the tools used by two of the fathers —a builder and an electrician. And when they had to study the stars, they went to the planetarium. For "Fishes", as already said, they visited an aquarium and two fish shops. Apart from that, they set up the fish tank in the classroom and observed the dissection of some fish.

This kind of contact with the real world provides enriching and varied experiences that increase the children's knowledge and facilitate school learning. Different studies have demonstrated, for instance, that when it comes to the learning of biological concepts, children who have pets or who take care of small animals in the classroom are endowed with significant basic knowledge that help them use their new scientific knowledge in a more flexible way, make more valid analogies and predictions, and generalize more than those who have the same formal knowledge, but lack the practical experience (Hatano & Inagaki, 1997).

The fish tank remained in the classroom for the rest of the year. The children observed it very often as they entered or left the classroom and during the breaks. The teacher left some magnifying glasses next to it that could be used to make observations. Different unforeseen events called the children's attention provoking questions and raising their interest. Mrs. Montblanc made several explanations and exchanged ideas with the pupils regarding the fish tank: how to use the thermostat, how fish food is prepared, what is the purpose of the small recipient called "breeding trap", etcetera. One day, a fish was found dead and the teacher could even discuss with the children different possible hypotheses for this, exchanging ideas with them in a very fluid way. She also used this micro-environment to make an evaluation activity towards the end of the unit.

(Field notes synthesis, several sessions)

Having the children exposed to a variety of real environments and experiences also adds a significant emotional component to the learning process, as they commonly raise the children's attention and interest for their authenticity, novelty and complexity.

We enter the classroom. The children hang their jackets up on their respective hangers.

Suddenly, some of them cry out:

—The female has given birth!... And there are babies!

Crowd gathering, enthusiasm, excitement. They all go to see fish tank. Very quickly, the teacher tells them to form a line; the last in line is crying.

(Field diary, March 10)

The contact with guides and other staff working on the visited places outside the classroom lets the students learn from different experts and not to depend only on their teacher's knowledge and perspective. External experts make the children's learning process richer, as they possess knowledge, experiences and points of view the teacher cannot have.

The children are very excited when they arrive to the aquarium; they crowd around the different tanks and exchange remarks on what they see. Then, they listen to the explanations of the guide, which are simple and entertaining —adapted to the children's age. At the end of the tour, the guide generates more action by feeding the fish, thereby awaking the students' interest in observing. The children have the possibility to pose their questions: —Is the sea horse a fish? Do fish have a tongue? Do fish sleep?

The guide also shows to us a big shark's jaw and a lobster's shell.

—It is dead—says one girl.

—No, it is not dead— explains the guide— As lobsters grow, they shed their shell as if they changed clothes. When their shell does not fit them anymore, they struggle out of it and hide under rocks until a new bigger shell hardens upon their soft body. It is like their armor.

(Field diary, March 11)

Chart 5. Learning connected to the real world

□ Visit to the aquarium.
□ Visit to two fish shops.
□ Conversations with experts: aquarium guide, fish shop women.
□ Creation of mini-environments inside the classroom: fish tank.
□ Direct observation of real subjects: fish dissection.

Availability of sufficient resources

The teaching staff at "The Three Bears", and specially Mrs. Montblanc, makes sure that a variety of resources are made available to the students to benefit their learning process. This is possible thanks to the financial support of the regional community government, which is responsible for the educational matters. In the first place, we need to mention the numerous books that the children were able to use throughout the didactical unit: informative books with beautiful and compelling illustrations, some of them destined for more advanced students, but whose good illustrations, titles and brief subtitles in large print the teacher took advantage of, as well as story books. Those children who finished an activity before the rest of the group could go to the reading corner and read a book on their own. Mrs. Montblanc was a good reader example to the children; she often referred in her explanations to specific books (even those brought by the children) as the source where she had found that particular information, or she would make photocopies of some interesting pages of those books to hand out to the students. Sometimes, when she showed them a book, she stopped at the table of contents to make an emphasis on its usefulness. The dictionary was used in the classroom, as the teacher asked the students to help her to look for the word "fish" and then read to her the definition they had found. It is important to say that it was a picture dictionary for small children. The teacher regularly visits book stores that have educational books and other state resource centers, where she buys books, wall charts or any other material using the money from a school fund. This is how she got a colored poster of the fish anatomy, which she had not used in previous years, thereby making a contribution to the didactical unit.

The fish tank also proved to be a very important resource that allowed the direct observation of fish, snails and weed for a large period. We are not very much in favor of this kind of artificial environments, where sensitive living beings are kept trapped. Yet we admit that, when prudently used, they can be very useful for the children's learning.

Apart from all this, the children had available a great variety of material to work with:

ordinary and wax crayons, markers, water-color painting, construction and bond paper, child-safe scissors, glue, among other school implements. In other environments like the plastic arts workshop and the laboratory there were other additional resources that favored the children's quality work.

Mrs. Montblanc was able to make photocopies in the school to be handed out to her students for the development of certain activities. In fact, she made a lot of them: sheets of paper with drawings to add names and other simple and structured paper-and-pencil activities. There were also computers and printers that could be used by the teacher, yet not inside the classroom. On one occasion, a group of pupils went with the student teacher to type on computer a collective essay about their visit to the aquarium, which was later on published in the school journal.

It is very remarkable how the families make their contribution to the range of resources needed for each didactical unit, which are systematically requested by the teacher. For the "Fishes" unit, there were varied and useful contributions: Beautiful books and appropriate videotapes were lent by the students and their parents. The fish used for the dissection exercise were also provided by the children's families and, even though there were basically sardines, some parents also sent larger and more expensive fishes.

Chart 6. Availability of resources

- Informative books.
- Story books.
- Photocopies.
- Wall charts.
- Videotapes.
- Fish tank in the classroom.
- Ordinary and wax crayons, markers, watercolor painting, construction and bond paper, child-safe scissors, glue.
- Laboratory resources: knife, large scissors, trays, running water.
- Resources in the plastic arts workshop: clay, rollers, awls, palette knives, forks, boards.
- Computers, printers.
- Resources contributed by the children's families: books, videotapes, toy fish, fish for the dissection exercise.

When there is a wide range of resources, it is possible to make more and different activities and offer the students more thorough and varied information sources, together with a more stimulating and challenging work environment. The resources offer the tools that foster the children's reflective thinking and action: A whole history of culture and civilization, and new possibilities for doing and thinking enter the classroom with each resource that is incorporated (Alberti, 1977). At the same time, by asking the students to contribute with some resources that will then be used, they are taught that a good learner also constructs his/her own working environment and searches for useful working tools (Claxton, 2001).

Excessive narrowness of the theme

We found the theme of "Fishes" to be excessively narrow for a didactical unit at an elementary education level. It can certainly be a starting point, but not a "key" focus, since it does not allow for sufficient ramifications and facets at this level, even though fish was taken in that school's planning as an example of a wider topic, namely "Living beings". Mrs. Montblanc told us at the beginning of the didactical unit that it was aimed at studying what living beings were, their characteristics and life cycle, what a vertebrate was —using fish as an example—; and then studying the most important parts of this animal's body and its functions: breathing, swimming… and also its living environments. Another objective of the didactical unit was to enrich the children's vocabulary, making them learn, among other things, the names of different fish species, as well as knowing that not every water animal is a fish. Regarding the procedural contents, Mrs. Montblanc considered that there were some included in the fish tank maintenance and the fish dissection. As for the attitudes, she highlighted taking care of the fish inside the fish tank, and not mistreating them. In a more general sense, the unit was also aimed at stimulating curiosity (see the "Unit Plan" in the Appendix).

We think these objectives certainly guided the work, as they helped being clear about the goals and pursuing them systematically. Yet, at the same time, the work was subdivided into too much detail for that level, resulting in several excessively structured activities, such as adding the names of the fish organs in drawings or answering simple knowledge questions about the name or parts of a fish, which were too much repeated (See Chart 4).

Aurora Lacueva (AL): *What did you like the least (of this topic)?*

Adriana: *Well… knowing, understanding… uh, well, that I had to know…, many… many… understanding uh... things… (short unintelligible phrase) well… I didn't like… working all… all day with the… the…the topic of fish. (…)*

AL: *Because it was tiresome?*

Adriana: *Yes, because we were all day making fish and fish and fish…*

(Final interview to students Adriana and Oscar)

We believe that at the elementary and even the secondary level of education, it should be given priority to the widest topics, allowing for the consideration of more diverse matters —although with inner relationships—, such as "Sea life". The multiplicity of matters, the ramifications, the links among elements pertaining to this topic make possible the development of more diverse activities, while attracting the interest of more students for more time and providing more complex and integrated approaches to the topic, thereby fostering the children's learning to a greater extent.

The excessive focus on fish probably ends up annoying many children, especially when it comes to the most structured paper-and-pencil activities and the excessive retrospective accounts. This is the impression we had during our observations: There was a lot of attention around the fish tank, in the visits to the aquarium and the fish shops, and during the fish dissection. That was also the case during the discussions and the sessions devoted to the formulation of questions. However, the attention weakened —and in some students frankly disappeared— when they had to do the paper-and-pencil exercises that included adding the names or drawing fish body parts and completing phrases.

Reaffirming specific notions should not be a main concern in the first schooling years. Preference should be given to less repetition of more varied pieces of knowledge, which will be organized, reorganized and consolidated by the student little by little throughout his/her education. Yet it seems that most schools —even occasionally those pursuing a more comprehensive and meaningful education like "The Three Bears"— conceive the students' mind as a big puzzle, in which formal education makes possible that the small pieces are gradually incorporated and fitted in firmly and systematically. We rather favor the approaches that, based on empirical research and critical reflection, see learning as something more fluid and diffuse, as a long process throughout which the different notions consolidate in an intertwined and progressive manner, and where the mental "theories" and "mini-theories" can be widely reorganized (Claxton, 1994; Gallas, 1995). This is the vision of a non-atomistic but gestaltic mind, whose concepts and theories, or mini-theories, have a structure that transcends the simple sum of its constituent parts, and where the ecology of thought determines each specific cognitive process; that is to say, a mind that works beyond cold literalness and formal logic to make intense imaginative efforts through the use of metaphors, metonymies and mental images, and where reason is driven and guided by the energy of emotions; not an abstract mind, but one rooted in our body features and based on preconceptual schemas resulting from our experience with the physical and social world (Lakoff, 1987; Lakoff & Johnson, 1999; Damasio, 1994). Even though some of the features of the observed didactical unit certainly fit with this vision of the learner's mind, both the notional field narrowness and the exaggerated structuring and sim-

plification of some of the activities —which we address in the next section— go against this approach.

Chart 7. Theme narrowness

Fish as an example of a living being
Conceptual knowledge
The fish outer body parts
The fish inner body parts
Body functions, living form
Reproduction
Names of some fish
Fish and other aquatic animals
Procedural knowledge
Fish tank maintenance
Fish dissection
Attitudinal knowledge
Taking care of fish in the fish tank
Curiosity in aquatic animals, especially fish

Openness vs. structure in the didactical work

Throughout the didactical unit we observed a combination of more and less hetero-structured activities, as well as a combination of more comprehensive or focalized ones. Among the more multifaceted and open activities capable of fostering the learning process in very different ways, on the one hand, we can mention the fish tank setting up and observation, the fish dissection, and the visit to the aquarium and to the fish shops. It is true that it was the teacher who actually set up the fish tank and who opened the fish, while the children only observed, but these were complex activities setting the framework for varied learning and arousing the students' interest in the topic. It would have been difficult —yet perhaps not impossible— to let the children participate more in these activities. In fact, the teacher allowed them to participate to a certain extent, by letting them carry the fish tank materials to the laboratory, wash the little stones and placing the devices, while they also had the chance to observe close up and touch the dissected fish. Even though these were comprehensive activities, they were not disorganized, as Mrs. Montblanc made sure that they would keep a clear purpose and a structure, for example by asking questions to the students before, during and after the activity, or by carrying out short concomitant or closing activities, in which the students were asked to evoke certain notions, remember observations, compare the features of living beings, classify, etc.

The teacher proceeds to open the mackerel with some large scissors. The students show great expectation, in some cases also certain disgust. Some children cover their eyes and then start opening their fingers gradually. There was a boy who did not want to see the dissection; the teacher did not force him. The teacher shows the students the opened fish; then, she starts taking out some organs: heart, liver, intestines… She explains that the intestines have the excrement inside, opens them and squeeze them calmly, while the students look carefully and some of them say "Yuck!". The teacher goes on: muscles, spine… —Are there any questions?— says Mrs. Montblanc. The children raise their hands: "Is it true that the bones are small? I once choke on three of them", says Igor; "Why is the heart so small?", asks another child; "I never thought the blood was black", says Adriana, who observed carefully the dissection as she was standing besides the teacher. Mrs. Montblanc answers the questions and poses new ones: "Hearts, in proportion, are not so big, even ours; a few drops of blood will look red (she puts some on her hand and asks for the color), but when there is much blood it looks black…

She takes out the rest of the fish brought to the class and, without opening them, she passes them around, so that all students can observe them and touch them, which they do with a lot of interest, except for the boy that did not want to see, Gilbert B.

Then, Mrs. Montblanc opens the fish and passes them around again; this time they also pay a lot of attention while they observe. Since the teacher had conducted a model observation before, they now know how to observe better, paying attention to more details. Mrs. Montblanc turns around

for a moment to wash her hands and a student girl takes the scissors very quickly and tries to take out the eye of a mackerel. As the teacher shouts to her, she drops the sharp object. Mrs. Montblanc extracts the eye for her: It is amazingly big and profound, and very round. The girl grasps it and examines it, while other classmates gather around her.

(Field notes synthesis, March 18)

On the other hand, there were a number of activities that were very much structured "from the outside", in which it was well prescribed what the children had to do, as was the case of all the paper-and-pencil activities that included drawing, adding names in drawings or completing phrases. Even though these kinds of activities can certainly be useful to focus on certain contents and consolidate achieved learning if used moderately, in this case we believe they were excessively used, which has to do with the excessive focus on a rather narrow topic as "Fishes".

Among the activities that were moderately open we can mention the observations and the making of a comparative chart with the features of male and female guppies, another one of aquatic snails and guppies, the description of a sardine and the realization of a concept map with the assistance of the teacher. The work was additionally complemented with activities related to non-scientific areas, such as listening to stories of fish, singing, or making paper or clay fish.

Some too simple structured activities, like copying or memorizing, could have been fruitfully replaced by more complex activities. For example, instead of drawing and putting names, the children could have constructed a tridimensional model of the fish inner body parts out of waste material like small rubber tubes, small sticks, foam rubber, balloons, polystyrene, cardboard, straws, tissue wrapping paper, play dough, etc. Another possibility would have been making up new endings to the stories instead of summarizing them.

It was a very good initiative to listen to the children's questions at the beginning of the unit ("What would we like to know about fish?") and to give importance to the posed questions by writing them down on large sheets of paper and sticking them on the classroom walls. These questions played a role throughout the development of the unit, even though only to a certain extent. They were considered before going to the aquarium, for instance, and also at the end of the process, when they were asked again to see what the answers of the students were. There was not sufficient time to do this, so it had to be done very quickly. The children's questions were not the focus of the work, but they were taken into consideration. Clear efforts were made to guarantee that the students participated more in their own education and that they valued more highly what they had done and achieved, thereby stimulating metacognition —a key condition for fruitful and lasting learning (Claxton, 2001; Bransford, Brown & Cocking, 2000).

It is worth mentioning that even though Mrs. Montblanc focused her work on the central topic of fish, she strove to diversify many of the activities to address other matters, which enriched the children's preparation to a higher extent and certainly offered something of interest to all the students in her classroom, or almost all of them. For example, Mrs. Montblanc told us that she normally goes with the children by metro or train to visit the aquarium, with the assistance of other (student) teachers, as there are stations of these two transportation means near the school and the aquarium. Yet, considering the weather forecast, it was decided this year that the class would visit the aquarium on a rented bus. As the teacher explains, "the purpose is to see the aquarium, but there are also other new things in this excursion" (Interview 1, Mrs. Montblanc).

The questions that Mrs. Montblanc made to the students about a specific activity usually brought her to other topics she had previously

touched on. For example, singing a song about fish and fishing was a pleasant moment that united the group and also allowed the evocation of something else addressed in the music class. Yet Mrs. Montblanc also took the opportunity of using the songs to make questions about fishing methods and implements known by the children, receiving good answers. This strategy might have been a little bit unnatural sometimes, but in general terms it proved to be interesting and productive. Addressing a topic for a long time facilitates a more varied and solid learning, as there will be more time to exploit different facets of the topic and for the children to reorganize their "mini-theories" about it.

We wonder why a school like "The Three Bears" that is so much concerned about creating a learning-stimulating environment, and a so well prepared, experienced and committed teacher like Mrs. Montblanc, do not try more open and research-oriented educational strategies such as research projects (Blumenfeld et al., 1997; Manning, Manning & Long, 2000; Lacueva, 2000a). They have, in fact, tried these strategies, but they have ended up very disappointed with the results. Either Mrs. Montblanc and the two interviewed authorities did not consider such classroom projects as a positive strategy when this research study was conducted: The teachers explained that the research topics were usually repeated from one grade to another, that the topics addressed were only interesting to the leading children or to those who participate the most in class, and not the majority of the group, or that the students suggest topics about which they already know something, and not new topics they would like to know about. "The idea that all the conclusions would come from the children did not work either", said Mrs. Montblanc. "The teacher has to be clear about the objectives; we cannot work without objectives like in the projects", she added with conviction (Conversation with Mrs. Montblanc, January 27). She dedicates many hours to the planning of the activities with the rest of the teaching staff and then to the preparation of the material that will be used in them.

For these educators there is no much difference between the activities conducted in a project suggested by the children and those that can be proposed by them in a didactical unit that is planned and organized "from the outside". We believe their conclusions are mistaken and are probably the result of a certain way (the only one they have experienced) of approaching classroom projects. It is usually the case that pedagogical trends that are categorically imposed in a hurried and strict manner die out very soon, due to their incapability to adapt to the varied and changing school conditions, their disregard for the complexities faced by the teachers in those environments, and for being an obstacle to a continuous innovation process. As a result, powerful proposals such as children research based on the topics of their own interest are rejected without having being appropriately implemented.

I pose a question about the pedagogical trends that have influenced the school and the principal answers that they have changed with time. At the beginning, it was Freinet; then, the trend for some time was Piaget and Operational Pedagogy; and now, Constructivism.

Aurora Lacueva: *Why was Freinet rejected at a certain moment? Did his ideas not work or did they simply go out of fashion?*

Principal: *I would say it was more a fashion matter. We experienced the boom of Operational Pedagogy. At that moment, everything was done perhaps in an excessively dogmatic and exclusive way with no possibilities of suddenly changing, adding or mixing elements. For example, with Operational Pedagogy we could not use texts. And some teachers said that this might work in science education, but that in mathematics it was rather useful to have a text, but at that moment it was not accepted. There was even a group of teachers who took this trend so much to heart, that when changes were in-*

troduced to Operational Pedagogy in the school, they… they left (…) Now, with Constructivism, we see that many of its postulates are things we were already doing, but intuitively.

(Interview 2 to the principal)

Chart 8. Openness vs. structure in the didactical work

Comprehensive and open activities
Setting up and observing the fish tank (several sessions).*
Fish dissection (1 session).
Visit to the aquarium (5 sessions).
Visit to two fish shops (1 session).
Observation of books (5 sessions).
Observation of videotapes (1 session).
Classification of living beings based on own criteria (1 session).
Raising questions at the beginning of the unit (2 sessions).
Discussion about the resources brought to class (several sessions).
Activities focalized and structured by the teacher
Drawing something requested by the teacher (11 sessions).
Adding names in drawings (3 sessions).
Completing phrases (1 session).
Initial and final knowledge inventory (2 sessions).
Moderately open activities
Wall chart observations (2 sessions).
Describing a sardine (1 session).
Observing and filling out previously designed comparative charts (2 sessions).
Plenary reading of an informative text (1 session).
Using the dictionary (1 session).
Concept map elaboration with the teacher (1 session).
Review of questions raised at the beginning of the unit (1 session).
Other activities (beyond the science field)
Listening to stories about fish (3 sessions).
Singing songs about fishing (1 session).
Making paper or clay fish (2 sessions).
Activities diversification
Activities linking
Why are not there any classroom projects?
* (Not necessarily a whole session in each case)

Children as protagonists

We are used to observe a rather authoritarian atmosphere in schools, with children playing a passive role, having to follow instructions all the time and being closely watched and controlled. As a result of this dependent and constrained role played by the students, many of them develop, with the passing of the school years, the typical "pupil's" way of being and thinking, in which the school is something that has nothing to do with him/her and s/he does not have any responsibility for things happening in the right way, since everything depends on the teachers, who, in order to be good, must be endowed with an almost magical feature known in the teacher slang as "group control", which basically means to be able to control and rule over the rest, even against their will. In "The Three Bears" they have constructed a different kind of environment and way of living based on active participation and often democratic decision-making. Even the young first-grade children have responsibilities and rights, and they take part in some decisions and actions.

Each week there is one different student in charge of the different classroom chores: watering the plants, handing out and collecting sheets and other material, closing the door and turning off the light during the break and at the end of the day, among other things (feeding the fish was also a responsibility of the children they rightly fulfilled). Besides, when a student needs some material or tool, and this has not been handed out to everyone, s/he can go and take it from the respective shelf: Blank sheets of paper, child-safe scissors, rulers, crayons and other implements are within the reach of children, who can simply stand up from their seats and go pick them up by themselves. This was obviously quite different from the typical tense classroom, where handing out some colored sheets of paper or scissors becomes a chaos, because everyone wants to get his/her at the same time, or even because they fear that there will not be enough for everyone, so they shout to the teacher while reaching for them.

The children who have finished their assigned activity can go to the reading corner

without asking for permission and read books they can freely choose, while the other children finish their work. We observed that when the teacher goes out of the classroom, the order inside is generally maintained. The students go up and down the stairs quite calmly and their behavior in the playground is not aggressive or extremely noisy. We believe that assuming power helps them being more serious and responsible inside the school, which they also perceive as theirs and not only the teachers'.

> *The class session is over and everyone goes out of the classroom, including the teacher. I stay with the girl in charge of closing, Gracia, who cleverly pulls a small chair below the switch, gets on it and turns the light off. Then, she gets down off and brings the chair back to its place. We get out of the classroom and Gracia stands on tiptoe to put the key into the keyhole, insists a little until it fully fits inside, turns it twice and pulls it out. While she is finishing, she tells me: "This was hard for me before".*
>
> (Field diary, March 10)

The knowledge already possessed by the children is recognized, appreciated and used in the school. So, when the teacher would start to set up the fish tank, she asked who had a fish tank at home. Igor said he had one and other children said they had little terrapins. Throughout the development of the topic, Igor's interventions in class were remarkable, even though he is a child who rarely speaks in class, according to what the teacher told us; yet, in this case, he could give plenty of useful information due to his interest and knowledge of fish tanks and marine fish, as there are apparently several amateur fisherpersons in his family —fishing being a very much practiced pastime in Catalonia.

The school students regularly give presentations to students of other grades about the topics they have researched on. The students of this class heard a conference on fish when they were on the third level of pre-school education by the children who were then on the first grade of elementary education. This contact among different courses is also favored by other activities, such as laboratory work, which is conducted by children of two consecutive grades, who are mixed to form a single section for that specific purpose.

Furthermore, from the third grade on, the children celebrate a weekly class assembly and elect their delegates before a School Assembly that meets periodically. In this School Assembly, the students' delegates take part together with the principal, the Head of Studies, the Primary Stage Coordinator, and the dining hall manager.

The teachers also participate widely and democratically: They rotate periodically in the directive posts, and those who have already been Principal or Head of Studies return to his/her normal activities as a teacher while another one takes these functions. The teaching staff members (authorities and teachers) meet frequently, conduct planning and take decisions.

Nevertheless, Mrs. Montblanc is concerned about maintaining the order: She often asks the students to be quiet with a peremptory "Shush!" every time the noise surpasses the normal level of acceptance. If a child goes off the point in a discussion, she does not hesitate to cut him/her off immediately. And she scolds those moving too much on their seats or talking too much with the classmates. Yet, the atmosphere in her class is very different to the one observed in those classrooms where the teacher devotes a lot of energy to telling to shut up or be quiet to disobedient and coerced children with no self-discipline.

Practicing democracy and responsibility at school prepares the children for their proper exercise of civic responsibility in the future and fosters a more autonomous and meaningful learning process (Goodman, 2001; Lawson, 1994).

Chart 9. Children as protagonists

- Chores in the classroom: watering the plants, handing out and collecting material, turning off the light, closing the door, taking care of the fish tank.
- Resources within the reach of the children.
- Decisions about the use of their extra free time.
- Recognition of their knowledge: specific interventions, presentations to other class-groups.
- Playing the role of guides when their parents come to visit the classroom.
- Weekly class assembly (starting from third grade).
- Delegates before the School Assembly (starting from third grade).
- Democratic participation of teaching staff.

A rich school life beyond the classroom

Apart from the variety of activities the students carry out within the classroom, the school "The Three Bears", as a whole, offers them organized systematic initiatives that enrich their experiences and help them increase their knowledge, skills and interests. Each schooling grade has different responsibilities within the school, such as making the weather forecast board located at the school's entrance in front of the principal's office, coordinating the activities at the vegetable garden or helping in the dining hall. The first-grade students are in charge of arranging and hanging the lunch menu everyday, which implies choosing the signs that correspond to the main course, second course and dessert of the day from among several signs on which different dishes have been previously written down. This activity helps them practicing their reading skills with a sense of usefulness, while they also collaborate with an informative task of the school.

The school has different environments apart from the classroom that make possible another kind of learning with the support of adequate furnishings and appropriate resources. Every two weeks, for instance, the first-grade students go to the laboratory, which is equipped with stone benches, running water, gas, devices and kits. We think it is better to have the experimental activities within the framework of the general class program, yet, as a first step, we consider this simpler alternative also as valid —an ad hoc teacher guides the children, who make observations and different practical experiments with her about plants, animals, water, electricity, among other topics. The plastic arts workshop is another place visited by the children, but in this case every week: In its large wooden benches, they work with bond and construction paper, clay, watercolor painting, and a wide variety of tools suitable for their age that they have available. So, for example, in the class session on "clay fish", there were awls, ordinary and palette knives, forks —all of them made of wood and not too sharp—, along with boards, rollers and plenty of clay, so that the children could do their crafts. We had the impression that in this enriching environment the proposed activity was too much guided and did not allow for proper self-expression of the children's originality.

There is an international program called "Philosophy for Children" that is carried out in the school. Yet, since it lacks the material for the first grade, the teaching staff has developed it based on a story book they found appropriate: "The children know that in this class they will discuss about things that are not normally discussed in any other class" (Conversation with Mrs. Montblanc).

There are books in each classroom, but the school additionally has a central library that is visited by the children by class-groups for half an hour every week. They avail themselves of this opportunity to return books, borrow some others they will take home, or to glance through or read books while they are there. Appropriate books for them are placed on a bench before they start working, so they can chose what they want more easily. Sometimes the librarian suggests them books.

The play room (which they called "ludoteca" —toy library) is a new environment in the school that stirs up the first-grade students' excitement. The pre-school children also go in there. Normally, the first-grade students go for an hour every Friday afternoon. There, they

enjoy playing in a furnished toy house; a shop with different plastic goods, a scale and a cash register; a mini-hairdressing saloon; a "vehicle repair shop"; a puppet theater; a closet full of clothes, wigs, necklaces and makeup; small wooden cars… everything in a single large lively and colorful room where the children probably spend pleasant moments, whose joy reaches the whole schooling environment: The school is seen as a happy place to have fun, do one's works and also take pleasure with classmates and teachers. We think that this emotionally warm atmosphere favors the development of the formal classroom activities to a great extent.

In "The Three Bears" a journal is published for the students every three months, in which the children from the different grades make their own contributions individually or in groups. There is another biannual journal for parents and teachers and a quarterly newsletter for parents, which includes precise information about services, procedures and events.

A very interesting activity that called our attention was the topic for the school's Cultural Week. Each year, the students all together choose a topic for the school's week. For example, two years before our study they chose "Movies"; the year before, they had chosen "Under the Sea", and the year we were there, they chose "Dinosaurs". Every grade had to contribute with one activity related to that particular topic, and the results would be then exhibited in the different areas of the school: corridors, stairs, entrance hall, etcetera. So, in those days, it was very striking to see an enormous dinosaur made of cardboard and wire as soon as you arrived to the school, which had been made by the students with the help of the plastic arts teacher and one father based on an assembly toy that had been brought by a boy. There were also boards on the walls with brief texts and many illustrations, including drawings of habitats of our planet from the time of the dinosaurs until the present. Dinosaur paw prints on the corridors' floor and on the stairs would guide you to the different exhibitions. There were also film sessions on the topic. An origami dinosaur mobile was made by the sixth-grade students, which took them a lot of time according to the principal. One could also see different types of dinosaurs made by the first-grade children with play dough of varied colors and proudly exhibited by them on the corridor next to their classroom (they told us to see their work). The Cultural Week program included conferences given by the different class-groups to other students, the talk of an expert and a visit to the Museum of Paleontology in a nearby city. This kind of initiative links the children of the different grades, encouraging them to share their studies and to exchange the results of their learning activities on a common topic. It also binds them more to their institution as a whole, making them feel part of a community, while providing them with an additional opportunity to learn beyond the topics addressed in the classroom. We think this is a better option than the sometimes defended idea of a "School Pedagogical Project". A project requires more time and work and it is hard to have all the students of a school committed with one topic to fulfill its demands. Besides, the topics of such projects are often chosen by the teachers and not by the students, reinforcing the passive role of the latter within the institution.

The school vegetable garden —even though coordinated by the fourth-grade students— is a place where all the students of "The Three Bears" spend some time monthly. The first-grade children sow peas. Even though this is a small-scale didactical garden, it bears fruits and the products are consumed by the school community. Apart from this, the large green areas of the school are suitable for certain educational activities that Mrs. Montblanc carries out depending on the season of the year, as she explains: pine nuts, olive tree, magpies, ants (abundant in spring), among others. Several festivities throughout the year create the framework for the development of some interesting activities that link the children with the cultural traditions of Catalonia.

During the time we were in the school, we had the chance to observe how the first-grade children prepared a typical Eastern Catalonian sweet dish called "mona" with the help of some teachers and the school cook: On a basic mixture already prepared, the children added some ingredients, and, once already baked, they brushed it with some beaten egg and decorated it. Additionally, the school takes advantage of the possibility of having the children participate in diverse new experiences offered by other entities outside the school. For example, one morning, the first-grade students took part in the "Spring Festivity" organized by the city government. They planted daisies on a nearby park and received as gifts a small plant and a cute green cardboard cap many of them wore for the rest of the day.

Chart 10. Rich school life beyond the classroom

- Weather forecast board.
- Lunch menu sign.
- School vegetable garden.
- Dining hall assistance.
- Laboratory.
- Plastic arts workshop.
- Play room.
- Library.
- "Philosophy for Children" program.
- Children's journal.
- Cultural Week topic.
- Green areas.
- Celebration of certain festivities: Eastern.
- Taking advantage of experiences offered by other entities: "Spring Festivity".

The multi-faceted relation between school and home

"The Three Bears" is a school that cultivates the relation with the parents by developing facets that are traditionally rarely considered. The parents participate in the Parent-Teacher Association since the school was founded, before it even was a legal requisite. At that time, they enjoyed paritary participation; today the law establishes a 50/50 participation, but there is an additional participation of school authorities. A School Newsletter and a journal are issued for and with the collaboration of the parents, and, as we already said, they are taken into consideration when developing the activities related to the topic of the school's Cultural Week.

On Fridays each 30 or 45 days, the parents and/or guardians are invited to the school to visit the classroom of their child in the thirty minutes before the day of school is over. We witnessed this event in the classroom of Mrs. Montblanc: Several parents and guardians came, especially mothers, grandmothers and a few grandfathers. The teacher told us that even older brothers or sisters come sometimes. Each student guided his/her relative through the classroom, showing him/her what was new (the fish tank, a wall chart with the numbers the children had done together, the resources the children had brought to the classroom specifically to work on the topic of fish, some nice book of the library, their clay works…) and finally his/her own work dossier with his/her latest productions. This activity allows the parents to have better and more thorough knowledge of their children's work at school and of the activities they conduct in it. Besides, the fact that the children are the ones who guide their parents' visit is another opportunity to take them seriously and let them play a major role, as we stressed before. It also helps them gain a metacognitive perspective of their own learning process, as they see all they have done and have to highlight the interesting and more relevant aspects and share them with their parents, also answering to the questions they might pose: what I did, how I did it, whether I like it. Such an activity is certainly rather brief at a first-grade level and there are some students who say very little about their schoolwork, but it is nevertheless carried out.

Another mechanism that contributes to strengthen the school-home relation is asking students to bring from home any resource that could enrich the development of the didactical unit. This homework demands the participation of the parents, who help the students to find something interesting they have at home

and would serve for the development of the topic in question. In the case of the topic "Fishes", we saw how the children brought to school a great variety of elements: rubber fish, felt fish, books, videotapes, postcards… Some resources were certainly more interesting or useful than others, but the teacher valued them all. As the videotapes were too long, Mrs. Montblanc watched them alone first, and chose the parts that were particularly appropriate to be shown in the classroom. This extra work the teacher decided to do was aimed at enriching her students' lives and encouraging their participation and that of their families.

We also consider very positive the activity that was common in this school of inviting fathers and mothers, or any other relative, to talk in the classroom about topics they knew well. For the didactical unit "Fishes", there was no chance to do it, but in the previous unit ("The House"), two parents came to do their presentation —a builder and an electrician. This strategy strengthens even more the relation between the parents and the school, making them feel particularly important regardless of their level of education or recognized expertise. Additionally, the students benefit from the knowledge and views of the expert father or mother. They contribute to make the learning process surpass the school boundaries (Bransford, Brown & Cocking, 2000).

Once a year an interview is arranged between the teacher and the student's parent or guardian, and more than once if it is considered necessary. The parent-teacher relationship and the involvement of the parents with the institution are reinforced with the celebration of some festivities. For instance, in the festivity of the locality's patron saint (Festa Major) the school organizes an event to prepare and eat paella with the active collaboration of the parents.

The school-home relation in "The Three Bears" is characterized by three main elements: sufficient and timely information, open dialogue and diversified collaboration.

Chart 11. Multi-faceted school-home relation

- Participation of parents in the Parent-Teacher Association.
- Newsletter and journal for and with the participation of parents.
- Participation of parents in the school's Cultural Week.
- Collective visits to the classroom to observe the children's work.
- Home resources brought to the school (books, objects, videotapes, postcards, wall charts…).
- Participation of parents as experts.
- At least one yearly interview with each child's parents or guardians.
- Participation of parents in festivities (paella at Festa Major).

What did the children learn?

Given the complexity of each human mind and our scarce knowledge about the way it functions, there is no one who can answer this question with precision. In our opinion, the attempts to do it by means of a pre-test and a post-test of inevitably limited value have little significance. However, we counted on different types of information that offered us some partial answers to the abovementioned question.

On the first place, we need to highlight that the class sessions were very calm and productive: The great majority of the students were busy doing their assigned tasks most of the time and managed to finish them. This might seem obvious for some people, but after having witnessed really chaotic class sessions with 37 to 38 students in public schools of poverty-stricken populations, we appreciated the quiet and laborious atmosphere that reigned in Mrs. Montblanc's classroom. In the first place, there you could find the appropriate conditions to learn something: peace, assiduousness, systematic work throughout the whole day of school and not only in interrupted short periods.

More concretely, we can say that Mrs. Montblanc tried to encourage the oral participation of the students throughout the didactical unit, which she achieved successfully:

Whenever she posed questions to the group, there were students who raised their hands and gave answers. However, not all of them participated spontaneously, so the teacher asked specific students directly from time to time. These questions sometimes demanded very precise answers, such as the name of the fin located on the backs of the fish or of the organ by which fish breathe. Other times the questions were more complex and helped the students remember and organize what they had observed in the visits, or were aimed at eliciting information that was related to the topic, but that the children had acquired outside the school. Sometimes they made the students reflect on a specific matter and make their own contributions. In all the cases, be they open or closed questions, whose answer depended on memorization or reflection, the teacher always received answers, which were not always correct, yet generally enthusiastic: Most of the students paid attention to her questions and showed their will to participate.

"What should we care for when we have a fish tank?" asks Mrs. Montblanc. And the students raise their hands and answer one after the other: "That it doesn't fall to the ground, that the fish do not die, that the table doesn't move, giving the fish small amounts of food, not touching the plants, watching if there are babies, not putting our fingers into the water, checking when the babies have grown to take them out of the 'breeding trap'".

"There are important things still missing", says Mrs. Montblanc. The answers are now more similar among the students: "Not touching the glass, not putting things inside…"

"Will this water be always at this level?" cuts the teacher short pointing at the fish tank water level.

"No, it evaporates", says one girl. And the teacher adds: "And where is the water that evaporates?", and she herself gives the answer showing with her hands the whole room: "All around this place". The girl who had answered before adds: "And then when it cools down it falls back, my grandfather explained to me".

(Field notes synthesis, March 9)

Not only the answers are interesting, but also the questions the children make. When the teacher told them to discuss in groups what they wanted to know about fish, thirty questions emerged, many of which, as we said above, were addressed in one way or the other throughout the unit: how fish breathe, how their bones are like and why they have so many of them, what their heart is like, how they are born and through which part of the mother they are delivered, what they eat, how they swim, how they float, how they sleep, whether the jellyfish is a fish, among others. There were other questions that the teacher said would be answered when they got to "more advanced courses": why is the sea water salty, since when fish exist, whether there are dinosaur fish… However, she commented a little on this last question, because it referred to the topic chosen for the school's Cultural Week, saying that there were dinosaurs in the sea, which was somehow confusing, as dinosaurs are considered to be reptiles.

As the didactical unit developed, there were more correct answers from the students about the different aspects Mrs. Montblanc had planned to cover: definition of living being, vertebrate and fish, fish outer and inner body parts, fish names, differentiation between fish and other known sea animals that are not fish.

This progress could also be appreciated comparing the drawings of the fish outer and inner body parts done by the students at the beginning and at the end of the didactical unit, so as contrasting their written activities. We collected samples of the work of students that the teacher considered to have had a high, a medium and a low level of achievement. We determined that there had been improvements in all these cases: At the end, more outer and inner body parts were drawn and labeled. The children also showed to know the names of

more fishes and the differences between them and other aquatic animals. Only three students from the eight of whom we gathered the initial drawing of the fish outer and inner body put the names of some of the parts, while all of the seven selected students did this in their final drawing, indicating two to fourteen parts and making more realistic and complete illustrations (see the general summary made by the teacher in Chart 12). We should point out that one of the things that three children, from the six who were interviewed, said to be particularly difficult of this topic of "Fishes" was "knowing the fish inner body parts".

Chart 12. The fish outer and inner body parts.
Record of results based on the students' drawings, by Mrs. Montblanc

	INITIAL EVALUATION												FINAL EVALUATION											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Gilbert A.													*	*	*	*	*	*	*	*	*	*	*	*
Gilbert B.	o	o	o	o		o				o			-	-	-	-	-	-	-	-	-	-	-	-
Ainhoa ●		o		o		o							*	*	*	*	*	*		*		*		*
Adriana						o							-	-	-	-	-	-	-	-	-	-	-	-
Oscar													-	-	-	-	-	-	-	-	-	-	-	-
Amèlia ●	o	o	o			o								*	*	*	*	*	*	*				*
Mercè			o	o		o								*	*	*		*		*	*			
Toby			o	o										*	*	*		*		*				*
Igor															*	*	*	*	*	*		*		
Dalia		o	o	o		o								*	*	*	*	*		*		*		
Gracia										o			*	*	*	*	*	*				*		
Ramón ●	o	o				o								*	*	*	*	*		*		*	*	*
Elionor ●		o	o	o		o								*	*	*		*						*
Feli		o	o	o		o								*	*		*	*	*	*		*	*	*
Mateu		o				o								*				*		*		*		
Horaci														*	*	*	*	*		*		*		*
Florencia		o		o									*	*		*		*						
TOTAL	3	9	7	8	0	10	0	0	0	2	0	0	4	13	12	12	9	14	4	11	2	9	3	8

1: Teeth
2: Fins
3: Opercula
4: Scales
5: Lateral line
6: Bones
7: Gills
8: Heart
9: Liver
10: Intestines
11: Swim bladder
12: Anus

● Other parts labeled in the Final Evaluation:
Ainhoa: muscles, skull
Amèlia: ovary
Ramón: muscles
Elionor: muscles

The fish tank of the classroom was carefully observed by everyone in many occasions and any novelties were discussed: the reproduction of snails, the fact that the tips of a plant turned brown, how the fish ate when food was thrown to them, how they moved, the black eggs in the bellies of the translucent females, and, above all, the showing up of the new little fish.

The fish dissection was also observed with concentration by the children, except for a boy who did not want to see this procedure. In that session, the students made different remarks and questions. They referred to the fish dissection in the final interview, although with certain qualms, as it involved seeing blood and handling a dead organism. As Gracia said, "They just look very bad

when they are dead". (Final interview to Gracia and Mateu).

Particular interest was shown by the kids in the visit to the aquarium, during which they posed questions and even made new ones after receiving the answer. The drawings and writings they made afterwards when they were in class included many details about different fish and other marine animals. In the final interviews we had with three couples of students, all of them mentioned the visit to the aquarium as one of the things they liked the most from this didactical unit. They spontaneously talked to us about the names and features of fishes they got to see there. We noticed the comment of a girl, Amèlia, who in the middle of the interview asked us: "Did you know that the sea horse was a fish?"

We think that the students continued making progress throughout the didactical unit in the procedures for working individually, in groups and in general discussions: They were not noisy, they would raise their hands when they wanted to say something, they listened to each other to a great extent, and when they worked in groups, almost all of them participated at least for a while, even though there were some who did not collaborate. Those who did not take part in these dynamics received complaints from their classmates or from the teacher. Additionally, they all shared the responsibility for taking care of the fish tank and many brought resources to class that helped developing the unit. It is regrettable that there was no systematic consideration of important complex procedures, such as hypothesis formulation, experiment designing, results interpretation, and —in another research dimension— of discussions on socio-scientific matters, decision making, implementation of some of the latter, and the subsequent assessment of achievements.

Mrs. Montblanc's pupils fill out a knowledge inventory form at the beginning and at the end of the main didactical units of the year. The children are already familiar with it and know how to complete it. The teacher reads the questions one by one —in this case, nine— and the students put a mark on their sheets: green if they know the answer, orange if they know it partially, and red if they have no knowledge on that matter.

In the case of the didactical unit "Fishes", the initial knowledge inventory served Mrs. Montblanc, as she told us, to "obtain information on what they (the students) think they know about this topic", and she added:

> *Once again, it has been useful thinking about the importance of the children's previous ideas and knowledge to organize myself a topic. This group has greater previous knowledge, because last year they worked on the topic "Under the Sea" for the school's Cultural Week.*
>
> (Teacher diary, first week)

In one of the last sessions of the unit, the students counted the answers they had marked with green in their initial and final inventories to check if they "had learned more things", as one girl said. The amount of green answers had increased considerably and there were very few orange or red ones (see Chart 13). However, we also have to consider, as Mrs. Montblanc explained to us, that sometimes an orange answer can mean more progress than a green one, because it may imply that a boy or a girl who thought s/he knew something very well has realized, in the process of learning, that there is much more to learn than s/he thought at the beginning. This is acknowledged by Poddiákov (1987), when he says that by going deeper into the study of something, certainties can become new doubts, which precisely reflects the complex nature of the learning process.

Chart 13. Record of initial and final inventory results for the didactical unit "Fishes", by Mrs. Montblanc

FISH – K.P.S.I.[1]

1. Do you know if fish are living beings?
2. Do you know if fish have bones?
3. Do you know what is fish body covered of?
4. Do you know how fish breathe?
5. Do you know what the operculum is?
6. Do you know the use of their fins?
7. Do you know how fish are born?
8. Do you know what is needed to set up a fish tank?
9. Do you know the guppies?

	1			2			3			4			5			6			7			8			9		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Gilbert A	o*			o*			o*			o*			*		o	o*			o*			o*			*		o
Gilbert B	o			o			o			o				o		o			o			o					o
Ainhoa	o*			*	o		*		o		o*		*		o	o*			*		o	*	o		*		o
Adriana	o			o			o			o					o	o					o	o					o
Oscar	o			o			o			o					o	o			o			o					o
Amèlia	o*			*	o		o*			*		o	*		o	o*			*		o		*	o	*		o
Mercè	o*			*		o	*		o	o		*			o*	o*			*		o		o	*	*		o
Toby	o*			o*			*		o	o*					o*	o		*	o*			o*			o*		
Igor	o*			o*			o*			o*			*		o	o*			*	o		*	o		o*		
Dalia	o*			*	o		*		o		o*		*		o	o*			*		o	*	o		*		o
Gracia	o	*		o*			o*			o		*	*		o	o	*		*	o		*	o		*		o
Ramón	o*			*	o		o*			o*			*		o	o*			o*			o*			o*		
Elionor	o	*		*	o		*		o		*	o		*	o	o*				*	o		o*		*		o
Feli	o*			o*			o*			o*			*		o	o*			*		o	o*			*		o
Mateu	o*			o*			o*			o*			*		o	o*			*		o		o*		*		o
Horaci	*			*			*			*			*						*			*			*		
Florencia	o		*	*		o			o*	o		*			o*	o*			*		o			o*			o*
Initial Inventory 16 children	16	0	0	9	5	2	10	0	6	12	2	2	0	1	15	16	0	0	5	2	9	7	7	2	3	0	13
Final Inventory 14 children	11	2	1	14	0	0	13	0	1	8	3	3	10	1	3	12	1	1	13	1	0	9	3	2	13	0	1

A: I KNOW
B: MORE OR LESS
C: I DON'T KNOW

o: INITIAL INVENTORY
*: FINAL INVENTORY

It called our attention the careful and reflective attitude the children showed when filling out the test in both opportunities: They worked in silence, giving time to each question, and changing crayons when necessary.

After the final inventory, the teacher talked in a class session again with the students about the questions some had still answered with a red mark ("I don't know") or an orange one ("More or less"): "Do you know what a living being is?", "Do you know how fish breathe?", "Do you know what the operculum is?" In every case, other children explained the correct answer to their classmates.

Mrs. Montblanc (M): - *A living being… What are the main things of a living being?*

(From the six children that appear in the video, Ainhoa raises her hand quickly, but Mrs. Montblanc gives the word to another student in an out-of-sight table).

Student 1 (S1): - *That they eat.*

M: - *They eat? What for?*

S1: *(Says something that did not record well)*

M: - *To live. What else?*

S2: - *They breathe.*

M: - *They breathe.*

S3: - *They live.*

M: - *They live. But in order to live they do all this.*

S4: - *Yes, and…*

M: - *Shush! Don't raise your hand.*

(It cannot be seen, but it must be someone who has already participated in this session).

S5: - *They die.*

M: - *They die. But first, what do they have to do?*

S5: - *They are born.*

M: - *They are born. Very good. They live, and to live they eat and breathe, and they die… And there is something missing…*

S6: - *They are born.*

M: - *They are born, but in order to be born, what do they have to do?*

S7: - *To eat…*

M: - *How can fish be born?*

S8: - *I know, I know… They… They unite. (The student puts both hands together).*

M: - *They unite. Very good.*

(Videotape transcription, class session on March 22)

In the last session used to revise the question list on "What would we like to know about fish?", it was possible to come back to concepts that were part of the teacher's objectives and to other issues posed by the children. The latter made varied remarks to comment on the answers.

The guided collective elaboration of the concept map (Illustration 1) was in fact another knowledge testing form of a bit reiterative nature, but since it was a new activity for the children, they assumed it with interest and participated to a great extent, making very relevant remarks. Even when the teacher wrote the words that were part of the map on the sheet of paper, they followed attentively, probably because writing was something considerably new for them. They occasionally repeated in unison and quietly the word Mrs. Montblanc was writing at that moment: "Oooouuussss" (eggs).

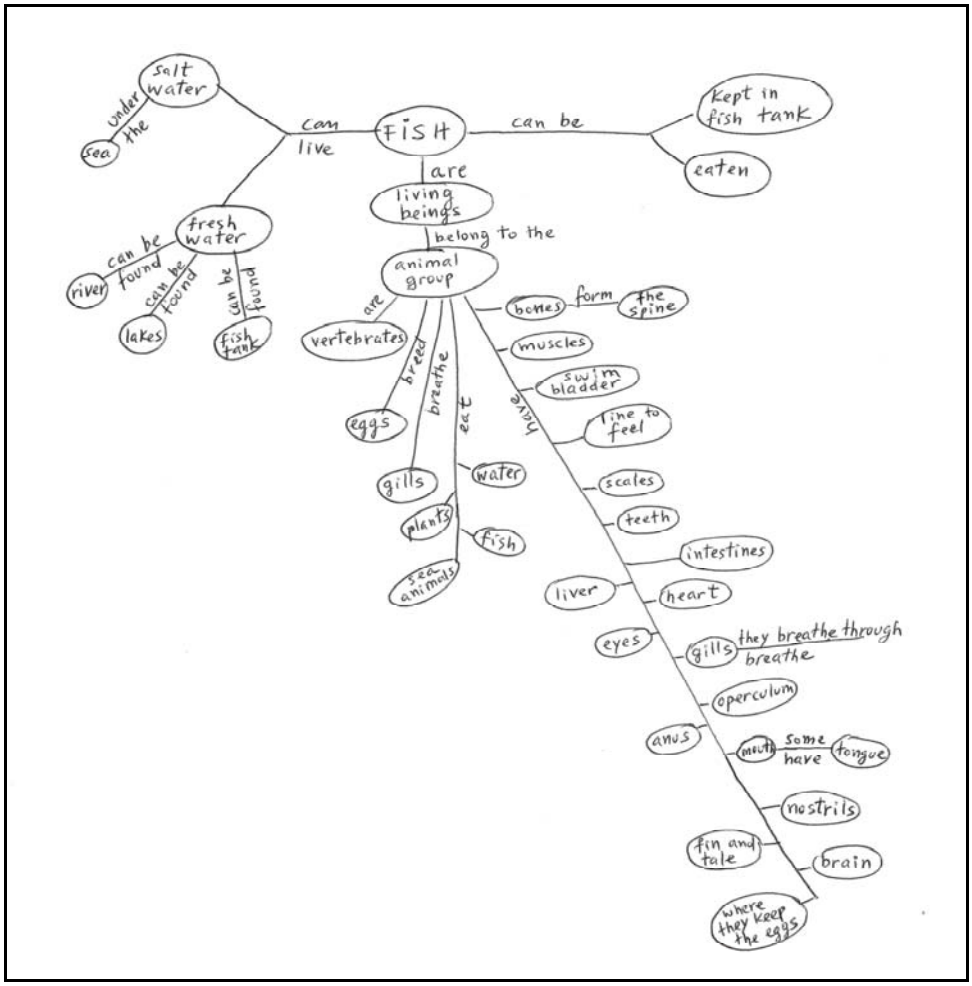

Illustration 1. Concept map on fish, made by Mrs. Montblanc and her students

They were surely still in the course of their learning process. So on March 16, on the third week of work, Mrs. Montblanc asked in written (Activity "Describing a sardine"): "How do you know that a sardine is a fish?", and one team answered: "Because it lives under the sea, because it swims, it has gills, because it has fins". Yet, other students said: "Because I have eaten it and it looks very much like a fish", although they then added that it had fins and a tail.

We have mentioned different elements that orient us about the possible learning the children had achieved during the development of this topic. On this respect, Mrs. Montblanc made the following remarks:

I am surprised to see the knowledge and vocabulary the children are capable of learning.

(Teacher diary, third week)

In general terms, we have met the set objectives and in some cases we have gone beyond them.

(Teacher diary, fourth week)

(...) How much interested they have really become about the topic is something that has surprised me (...) But I think, apart from their motivation, they have also acquired a lot of knowledge. (...) This doesn't mean this is already consolidated ("assolits", as Mrs. Montblanc added in Catalan).

(Final interview to Mrs. Montblanc)

Chart 14. Direct and indirect evidence of the children's learning

- Quiet and productive class atmosphere.
- Majority participation in guided discussions (the number of right answers increased throughout the unit).
- Great variety and number of questions made.
- General progress in final drawings of the fish outer and inner body parts.
- Progress in knowledge inventories (from initial to final one).
- Correct remarks in the general discussion with the final knowledge inventory.
- Positive remarks in the final revision of question list on "What would we like to know about fish?"
- Positive participation in the guided elaboration of the concept map.
- Careful attention during: fish tank set up and maintenance, fish dissection, visit to the aquarium, visit to fish shops. Questions and remarks.
- Memory of what was observed when conducting subsequent activities: drawings, writing work, oral remarks.
- Positive behavior in individual, group and plenary work: respect, responsibility, organization, collaboration (there is progress according to the teacher).

Conclusions

Observing the school "The Three Bears", reflecting on it and on the work carried out by Mrs. Montblanc in that context, led us to establish or reassert several overriding ideas that we present below as our conclusions.

Seeing the school as an ecosystem

Teaching is a difficult and complex activity that involves taking care of many factors at the same time, so that it can be truly successful. Punctual isolated changes might not provoke the desired impact if the context of application is not sufficiently favorable. Therefore, and following the example of the school in question, it is important that the school authorities and teaching staff work together to see the school as a whole and to develop it as a sound stimulating "ecosystem" conceived to guarantee the maximum children learning. Areas, resources, organization, activities in and outside the classroom, must be valued based on their contribution to a more thorough education of the children, their coherence and complementary nature. An adequate and realist participation of the children's parents also needs to be included in this "ecological design" of the school (see similar considerations in Hopkins & Levin, 2000).

Democratizing the children's school life

Authoritarian schools or, on the contrary, laissez-faire ones, do not educate the children to live in democracy nor let them begin controlling their own learning process: They either walk blind trying to solve small imposed tasks day after day, or behave within the chaotic and erratic context of the permissive school. Little power restrains and generates indifference; the chaos and lack of organization leads to fragmentation and dispersion. The democratic school boosts metacognition, educates on civic-mindedness and stimulates the learner's active participation in his/her own learning process, facilitating the correction of deficiencies and reinforcing achievements. In "The Three Bears", striving for an organized and democratic atmosphere was an objective to be met every day.

Combining different types of activities, of varied length, complexity and degree of structure, including the children's research activities

We believe that it is necessary to make possible the development of research projects by the students within the context of the school, accompanying and complementing them with briefer and more structured tasks designed "from the outside" (such as demonstrations, paper-and-pencil reflective exercises, or brief laboratory experiments), together with activities of exploratory nature. More closed initiatives do not make possible the learning processes that are achieved with projects: the authentic expression of one's felt concerns, one's own planning, the organization in working groups, the monitoring of one's own work, the development of different research procedures, the communication of the research results. This didactical strategy therefore guarantees significant cognitive and affective achievements. Carefully combining this with briefer and more focused activities allows to achieve certain objectives that are considered important by the school, while the inclusion of other activities that are more open and unstructured than projects provides the students with new perspectives. The analyzed school has not reached this balance yet, for the focus on the development of projects has been frustrated by the difficulties to develop them and the highly inflexible and unpractical orientations with which the teaching staff of the school has been in contact.

Building up the material basis for adequate work

Improving the quality of schools, especially public schools, is not just a matter of money, but the latter is important if we think of the need to build up a material basis for work that would really make possible another way of being and learning at school. Class groups of 38 students, the lack of a library, textbooks as the only resource, financial difficulties hindering the realization of visits and excursions, narrow playgrounds, desks arranged in rows… all this creates a poor and monotonous atmosphere, in which a sustained high-quality teaching practice is not viable: These are environments that lead to simple routines of little formative value. This does not mean that equipping a school would guarantee an overnight boom of projects and creative activities, but once the foundations have been laid, it is possible to start constructing the building of high-quality school learning. The challenge is particularly enormous for poorer countries, which will have to give priority to investment in education and develop clever ideas that help them face the inevitable lower budget share per student. It is not realistic to believe in the success of new proposals if there are no new investments reaching a critical threshold. The school "The Three Bears" is an example of how it is possible to start developing well-equipped areas and environments that favor the children's education when there is an adequate financial support, yet not from the highest in the world.

References

Alberti, A. (1977). Introducción. In Ciari, B. *Modos de enseñar*, pp. 5-19. Barcelona: Avance. (Orig.: *I modi dell' insegnare*. Editori Riuniti. Roma).

Blumenfeld, P. C.; Marx, R. W.; Patrick, H.; Krajcik, J. y Soloway, E. (1997). Chapter 4: Teaching for Understanding. In Biddle, B. J.; Good, T. L. & Goodson, I. F., eds., *International Handbook of Teachers and Teaching*, pp. 819-878. Dordrecht / Boston / Londres: Kluwer.

Bransford, J. D.; Brown, A. L. & Cocking, R., eds. (2000). *How people learn. Brain, mind, experience, and school.* Third printing, april 2001. Washington, D. C.: National Academy of Sciences.

Carr, W. & Kemmis, S. (1988). *Teoría crítica de la enseñanza*. Barcelona: Martínez-Roca. (Orig.: *Becoming critical*. Falmer, Lewes, 1986).

Claxton, G. (1994). *Educar mentes curiosas. El reto de la ciencia en la escuela*. Col. Aprendizaje. Madrid: Visor. (Orig.: *Educating the Inquiring Mind*. Harvester-Wheatsheaf, London, 1991).

Claxton, G. (2001). *Aprender. El reto del aprendizaje continuo.* Barcelona: Paidós. (Orig.: *Wise Up.* Bloomsbury, London, 1999).

Damasio, A. R. (1994). *Descartes' Error*. New York: Grosset-Putnam.

Eisner, E. W. (1998). *El ojo ilustrado. Indagación cualitativa y mejora de la práctica educativa.* Barcelona / Buenos Aires / México: Paidós. (Orig.: *The enlightened eye. Qualitative inquiry and the enhancement of educational practice.* Prentice Hall, New York, 1990).

Erickson, F. (1998). Qualitative Research Methods for Science Education. In Fraser, B. J. & Tobin, K. G., eds., *International Handbook of Science Education,* pp. 1155-1173. Dordrecht / Boston / London: Kluwer.

Gallas, K. (1995). Talking their way into science. Hearing children's questions and theories, responding with curricula. New York: Teachers College.

Goodman, J. (2001). La educación democrática en la escuela. Sevilla: Publicaciones M.C.E.P. (Orig.: *Elementary schooling for critical democracy*. SUNY Press, Albany, 1992).

Guba, E. G. (1983). Criterios de credibilidad en la investigación naturalista. In Gimeno Sacristán, J. & Pérez Gómez, A. I., *La enseñanza: su teoría y su práctica,* pp. 148-165. Madrid: Akal. (Orig.: Criteria for assessing the trustworthiness of naturalistic inquiries. *ERIC/ECTJ Annual*, 29(2), 75-91, 1981).

Hatano, G. & Inagaki, K. (1997). Qualitative changes in intuitive biology. *European Journal of Psychology of Education.* XII (2): 111-130.

Hopkins, D. & Levin, B. (2000). Educational Reform and School Improvement. *NIRA Review.* 7 (3): 21-26. At: http://www.nira.go.jp/publ/review/2000summer/hopkins.pdf

Koch, J. & Burghardt, M. D. (2002). Design Technology in the Elementary School –A Study of Teacher Action Research. *Journal of Technology Education.* 13 (2). At: http://scholar.lib.vt.edu/journals/JTE/v13n2/koch.html

Lacueva, A. (2000a). *Ciencia y Tecnología en la escuela.* Caracas / Madrid: Laboratorio Educativo / Popular.

Lacueva, A. (2000b). Investigar para transformar: el paradigma crítico en la investigación educativa. *Revista de Pedagogía.* XXI (61): 145-167.

Lakoff, G. (1987). *Women, Fire and Dangerous Things. What categories reveal about the mind.* Chicago: The University of Chicago Press.

Lakoff, G. & Johnson, M. (1999). *Philosophy in the flesh. The embodied mind and its challenge to western thought.* New York: Basic.

Lawson, A. E. (1994). Uso de los ciclos de aprendizaje para la enseñanza de destrezas de razonamiento científico y de sistemas

conceptuales. *Enseñanza de las Ciencias*. 12 (2): 165-187.

Manning, M.; Manning, G. & Long, R. (2000) *Inmersión temática. El currículo basado en la indagación para los primeros años y años intermedios de la escuela elemental.* Barcelona: Gedisa. (Orig.: *Theme Immersion: Inquiry-Based Curriculum in Elementary and Middle Schools.* Portsmouth, NH., Heinemann, 1994).

Poddiákov, N. (1987). Sobre el problema del desarrollo del pensamiento en los preescolares. In *La psicología evolutiva y pedagógica en la URSS. Antología*, pp. 168-172. Moscú: Progreso. (Abridged version of text first published in Spanish as: *El pensamiento del preescolar.* Editorial Pedagógica. Moscú, 1977).

Ramos, J. (1999). Preguntar, debatir, indagar, compartir, cuestionar, reconsiderar, concluir… para aprender. *Investigación en la Escuela.* 38: 45-64.

Stake, R. E. (1998). *Investigación con estudio de casos*. Madrid: Morata. (Orig.: *The Art of Case-Study Research*. Sage. United States / London / New Delhi, 1995).

Stenhouse, L. (1991). Métodos de estudio de casos. In Husén, T. & Postlethwaite, T. N., eds., *Enciclopedia Internacional de la Educación. Volume 7*, pp. 3911-3916. Madrid: M.E.C. / Vicens Vives. (Orig.: *International Encyclopedia of Education. Research and Studies*. Pergamon, Oxford, 1987).

Notas

[1] Knowledge and Prior Study Inventory

T.N. [1] The English translation of the quotes and of the concept map (Illustration 1) presented here is based on the Spanish translation made from Catalan by the authors for the first publication of this article in Spanish.

T.N. [2]: The title, abstract and keywords of this article had been previously translated by the authors when the Spanish version was going to be published. They had to be maintained as they were for this version, determining the way some other parts of the text had to be translated throughout the article, as is the case of the names of the seven categories and of the didactical unit "Fishes".

APPENDIX

Plan of the didactical unit "Fishes"

Objectives

- Recognize and describe fish birth
- Recognize the fish typical shape
- Observe and compare fishes of different species
- Develop curiosity and interest for knowledge about fish habitats
- Develop attitudes of research and inquiry
- Develop the right way of referring to fish using the adequate vocabulary
- Use the magnifying glass correctly
- Be curious to know about fish

Conceptual contents

- Main features of fish life cycle (being born, grow, breed and die)
- Vertebrates' main characteristic
- Fish growing and development
- Movement and displacement
- Introduction to the fish tank
- Environmental factors and adaptation of fish to its environment

Procedural contents

- Direct and indirect observation of the fish outer features
- Direct observation of the fish habitats
- Oral and graphic description of the new knowledge
- Hypothesis formulation
- Consultation of books and other material
- Data gathering
- Usage of magnifying glass
- Classification of animals that live under the sea
- Memorization of the new vocabulary
- Setting up the fish tank

Attitudinal contents

- Collaboration in group activities
- Observation spirit
- Desire to know
- Responsibility in the use of materials and tools
- Interest in observation
- Efforts to improve verbal communication
- Interest in the good presentation of the work
- Respect for living beings

ABOUT THE AUTHORS / SOBRE LOS AUTORES

Aurora Lacueva (lacter@cantv.net): She is professor in the School of Education at the Central University of Venezuela. She conducts research in the fields of Natural Science Education and General Pedagogy. She has published, among others, the books *Ciencia y Tecnología en la Escuela* (Science and Technology at School) and *Más de 400 ideas para actividades y proyectos estudiantiles de investigación* (More than 400 ideas for student research activities and projects). Postal address: Apartado Postal N° 51510, Sabana Grande, Caracas 1050-A, Venezuela. Tel. and Fax: ++ (58-212) 6053000.

Francisco Imbernón Muñoz (fimbernon@ub.edu): He is professor of Teaching Methods and School Organization, specialized in teacher education. He has worked on initial and permanent teacher education at all school levels, from elementary to university, as well as on the preparation of professionals and teachers of different sectors. He has received several prizes for his work and has published different books. Contact address: Departamento de Didáctica y Organización Educativa de la Universidad de Barcelona. Paseo del Valle Hebrón, 171, edificio de Levante 2do piso. 08035, Barcelona (Spain).

Rosa Llobera (rllobera@d5.ub.es): She is professor of Experimental Science Education. She currently works on previous ideas detection and reasoning schemes, on the design of possible basically experimental strategies for the teaching-learning of chemical concepts by high-school and elementary students, as well as on didactical unit design. Contact address: Departamento de Didáctica de las Ciencias Experimentales y la Matemática, Universidad de Barcelona. Paseo del Valle Hebrón, 171, edificio de Levante, 1er. piso. 08035 Barcelona (Spain).

ARTICLE RECORD / FICHA DEL ARTÍCULO

Reference / Referencia	Lacueva, Aurora, Imbernón, Francisco y Llobera, Rosa (2004). *Fishes: a didactical unit in an uncommon school*. *Revista ELectrónica de Investigación y EValuación Educativa, v. 10*, n. 2. http://www.uv.es/RELIEVE/v10n2/RELIEVEv10n2_3eng.htm Consultado en (*poner fecha*).
Title / Título	Fishes: a didactical unit in an uncommon school. [*Los peces:* una unidad didáctica en una escuela "diferente"]
Authors / Autores	Aurora Lacueva, Francisco Imbernón y Rosa Llobera
Translator / Traductora	Ainoa Larrauri
Review / Revista	Revista ELectrónica de Investigación y EValuación Educativa (RELIEVE), *v. 10*, n. 2
ISSN	1134-4032
Publication date / Fecha de publicación	2004 (**Reception Date**: 2003 Dec 21; **Approval Date**: 2004 June 30; **Publication Date**: 2004 July 30)
Abstract / Resumen	*In this case study we describe and interpret a didactical experience centered on the theme "Fishes" and developed in a first-grade classroom of an innovative school. We systematically recorded the experience, collected documents, and interviewed the principal, the teacher and the students. Seven categories were used for the interpretation of data: learning connected to the real world, availability of sufficient resources, excessive narrowness of the theme, openness vs. structure in the didactical work, children as protagonists, a rich school life beyond the classroom, and the multi-faceted relation between school and home. The article outlines and discusses children's learning achievements.* En este estudio de casos se describe y se interpreta reflexivamente una experienciadidáctica centrada en el tema "Los Peces", y desarrollada en un primer grado deeducación primaria dentro de una escuela innovadora. Se llevó un registrosistemático de lo sucedido, se recopilaron documentos y se realizaronentrevistas. Para la interpretación de lo observado, se trabajó con sietecategorías que intentan destacar importantes características de la experiencia:un aprendizaje vinculado al mundo exterior,disponibilidad desuficientes recursos, la excesiva delimitación del tema en estudio, aperturafrente a estructura en el trabajo didáctico, niños y niñas protagonistas, unaescuela de rica vida más allá del aula, y la multifacética relaciónescuela-hogar. El artículo aporta consideraciones acerca de los aprendizajeslogrados por los estudiantes
Keywords Descriptores	*Educative innovation, science education, democratic education, didactics, elementary school education.* Innovación educativa, enseñanza de las ciencias naturales, educación democrática, didáctica, educación primaria
Institution / Institución	Universidad Central de Venezuela y Universidad de Barcelona (España)
Publication site / Dirección	http://www.uv.es/RELIEVE
Language / Idioma	Español & English version (Title, abstract and keywords in English and Spanish)

RELIEVE

Revista **EL**ectrónica de **I**nvestigación y **EV**aluación **E**ducativa

E-Journal of Educational Research, Assessment and Evaluation

[ISSN: 1134-4032]