PROYECTO de BUENAS PRÁCTICAS

"Give me a boat and I will move a Community"

Instituto Enseñanza Secundaria nº 1 – Jávea (Alicante)

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Assessment: Departament of *Didáctica de las Ciencias Experimentales* at the Universidad de Alicante

A.- DESCRIPTION

A.1. JUSTIFICATION

A.1.1 PROJECTS DEDICATED TO PROMOTE THE DEVELOPMENT OF A METHODOLOGY THROUGH INQUIRY

The ROCARD points out the lack of stimulus to science learning across Europe, in particular, the significant decline of Science students at both secondary education and at University, so it encourages all European countries to promote a taste for science learning from the earliest stages of education.
The Fibonacci Project, echoing the European proposal and following the ideas of great renowned researchers such as Dr. W. Harlen, P. Lena, D. Jasmin, among others, is born with the ambition to contribute to the dissemination of a methodology through inquiry in science and mathematics; strategy that has been considered successful considering the growing interest in learning science and mathematics. In this sense, FP6 Scienceduc projects and Pollen (www.pollen-europa.net) have successfully implemented the methodology of inquiry in 17 European cities. The SINUS-Transfer project (http. / / sinus-tranfer.eu) and the Austrian project IMST (http://imst.ac.at) have reached a large number of schools in their countries. These projects, along with others well-known, help to provide justification for the extension of the methodology IBSE (Inquiry based science and mathematic education) across Europe.

- The Fibonacci Project is based on three fundamental pillars:

a. Advocating an inquiry-based methodology that enables students to develop concepts that help the understanding of scientific aspects of the world around them through logical reasoning and critical about the evidence they have collected from their own surroundings.

b. Encouraging local and regional initiatives to help promote this innovation through use of resources from different actors, within and outside formal education and through the involvement of the local community in the same effort.

c. A network of IBSME strategy fostering that enables the dissemination of internationally recognized experiences. Reference Centers are responsible for fostering the twin centers.

- Fibonacci methodology aims at:

-Developing a culture of problem solving
-Working following a scientific methodology
-Learning from mistakes
-Ensuring a basic knowledge
-Experiencing in the environment using interdisciplinary methods
-Promoting the participation of girls and boys
-Promoting cooperation among students
-Promoting independent learning

A.1.2 UNIVERSITY OF ALICANTE PARTICIPATION AND THE CEFIRE BENIDORM-EXT. ONDARA AT THE FIBONACCI PROJECT

The department of "Experimental Science Teaching", Faculty of Education at the University of Alicante has analyzed in recent years the development of teaching and learning of science in elementary and secondary schools, and has found a decline in interest in scientific experimentation, as well as a growth of a learning of concepts based on memorizing, which is not fully understood even by teachers. From the 80, the department has been oriented to promoting science education following a methodology of inquiry in the early stages of primary and secondary education, by training future teachers in both the old and the current CAP master (teacher training course).

In 2009, the department applied to join the network of Universities of the Fibonacci Project (Disseminating Inquiry-based Science and Mathematics education in Europe) and was selected to be part of it, given its history and its close collaboration with the CEFIRE BENIDORM-EXT. ONDARA (a member of the department was part of the teacher center and made possible the approach to practising teachers). Within the network of universities that are part of the Project, the AU was linked with the reference center "University of Southern Denmark" and the twin center "Living Science" from Portugal.

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A.1.3 ACTIONS IN THE PROVINCE ORIENTED TO DISSEMINATION OF FIBONACCI METHODOLOGY

Once the project was approved, a briefing with the Department of Training and Innovation Department of Education was held, which was attended by the heads of those departments, Mr. José Barrachina and Peter Sigler, as well as the teacher/professor Dr. Joaquin Martinez Torregrosa and associate professor, coordinator of the project and the once teacher education counselor, Antonia Trompeta Carpintero.
From that meeting, the dissemination agreement through actions in the Marina Alta, Marina Baja, and Alicante city came out. Thus, during the school year 2010/2011, a 40-hour course was given at Les Rotes CEIP in Altea, which was dedicated to the study of the motion of the Earth and the Sun through inquiry for kindergarten, primary and the first cycle of secondary school levels; the study of the arrival of spring by observing given parameters (www.greenwave.eu) and a 30-hour follow-up IBSE activities seminar in Marina Alta and Marina Baja, with the collaboration of the CEFIRE BENIDORM-EXT. ONDARA. The Department of Science Teaching at the University of Southern Denmark, taught within the seminar a workshop on lesson-planning through inquiry:
"How could a seed successfully manage to root? - Designing a device that allows a seed to root as far away as possible from its mother tree.
"How could a boat set off as quickly as possible with a sail? - Designing a sail that allows the highest possible speed for a boat.

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The final agreements once the sessions were over and the assessment finished were the following:

- Shorter didactic units would be implemented, in order to make them more accessible for teachers.
- Programming of one of the two didactic units proposed by the Danish team, following an interdisciplinary proposal and with a plausible local community involvement.
- Preparing a seminar that would enable an individual assessment of the Fibonacci methodology, the implementation and assessing of a didactic unit; and/or the creation of new ones through investigation.
- Creation of a Spanish Fibonacci web-site in order to coordinate the actions among the involved agents and the insertion of IBSE resources.

A.2. PROPUESTA DE BUENA PRÁCTICA

A.2.1. GENERAL OBJECTIVES

La práctica que presentamos pretende:

- Promoting interdisciplinary methodologies in the study of an open problem.

- To promote unity of methodology between primary and secondary schools.

- Including work of all basic skills in the study of an open problem.

- Promote the teaching of science and mathematics through inquiry methodology.

-Approach schools to the local community by promoting formal and informal activities that facilitate the creation of a learning community

A.2.2. METHODOLOGY

The proposal involves the use of a methodology through inquiry - Inquiry based Education - which involves applying the following principles:

a. The key to learning is direct experience. The use of direct experience is key to the conceptual understanding of the world around the student.

b. Students must understand the problem on which they focuses their work. For students to feel involved in research, they need to understand the problems they face, and it should be meaningful to them.

c. “Doing” science requires teachers to teach their students a variety of skills. The teaching of observation, asking questions, drawing predictions, designing investigations, analyzing data, supporting their conclusions with evidence, is a requirement..

d. Learning science is not just performing on objects, but mainly reasoning, talking with others, writing on your own and with others. Students need to get their hands on the job but also to discuss, debate deeply with others and write about what they think.

e. The use of secondary resources reinforces and complements the direct experience. Students may not find everything they need to know by using the inquiry. It is necessary to use secondary resources to help explore and collect important information

f. “Doing” science is always a cooperative work. Scientific research is often collaborative. When students work together in small groups they are sharing ideas, debating, thinking about what they need to do and how to do it.

The teachers involved are committed to consider the following pedagogical implications:
- The organization of this kind should enable collaborative work. There must be an adequate space and materials, so they feel comfortable. This shall enable participation in all scientific work (acting, thinking, speaking and writing).

- The questions a teacher might pose are central to the inquiry. Questions should encourage a group of students to think and work in depth.

- Using the ideas and previous experiences of students. Students have ideas about the phenomenon that we present, some of these ideas are contradictory or incomplete. Teachers need to consider these ideas to adapt the activities accordingly.

- Conduct group discussions: Discussions between students help create opportunities to develop ideas. Listening, discussing ideas with each group, helps jumping into groupal conclusions.

- Guiding students in the delivery of the final work. Students must submit a final paper on the problem. They might need help because this task should include text, drawings, graphs, tables… They have to prepare a final presentation through use of ICT and through good oral preparation oriented to communicate their work.

And similarly, the teaching strategies to be used in the investigation shall be:

- Guiding students in designing their research. Learning to design an investigation is a fundamental part of the nature of science. The process often begins with a large group discussion to clarify the problem and determine the elements to consider. The next step is to determine how to witness the factors one at a time using the material available. In the case of observations rather than experimental, specify what students should observe, what data to collect.
- Helping students analyze the results and reach valid conclusions. Analyze results and reach valid conclusions is an essential part in the construction of meaningful knowledge. Students need help in presenting their findings at the end of the unit
- Comparing and contrasting with the established facts. Students investigate a phenomenon but are not discovering new laws of science, scientific knowledge is already established by scientists. However, they need to compare their results with the laws of science thet they will find in their text books, online or through discussions with local scientists.
- The formative assessment is done throughout the study process. It is a tool for teachers and students to carry out the work successfully. Summative assessment will take place at the end of the unit by presenting the work and through evaluation of test key ideas.

A.2.3. SPECIFICATIONS OF THE PROPOSAL

1ST PROPOSAL:

Interdisciplinary project: "*Give me a boat and I shall move a community"*

Participants:

- IES número 1 (Jávea),
- Collaborators: Ayuntamiento de Jávea (Concejalía de Cultura y Educación, Concejalía de deportes), Asociación de Embarcaciones Tradicionales, Cofradía de Pescadores, Club Náutico, Asociación CIRNE)

Descriptión of the Project:

The project proposes the development of a teaching unit through inquiry involving different disciplines together under a common axis dedicated to boats.

The teaching unit will contribute to the acquisition of basic skills outlined in our official curriculum of primary and secondary school.
It will enable the involvement of all local educational community, and / or county. It will also join Aabenraa local communities (fishing port of Southern Denmark) and the Lisbon port community.
It will bring the environment closer to the school, since the locations involved have a fishing port and many of their population have worked and are working at sea.

Skills and activities to be developed by teachers envolved:

The teachers involved will have to learn to be competent in the methodology of inquiry and the practical application of this methodology with students. All teachers will participate, no matter the subject they teach.

Participation in a seminar initiation inquiry methodology taught by the professors in the Department of Didactics of Experimental Sciences, University of Alicante and professors of the University of Southern Denmark, which have already implemented their experiences in their countries..

- 4-hour workshop aimed at preparing an interdisciplinary proposal on “Boats”. It will take place in the last week of October (between 24th, 25th and 26th October)

- **Participation in preparatory sessions**, coordination of activities proposed for students and continuous assessment. The estimated dedication of a fortnightly meeting in the first quarter of school in small groups. Coordination and ongoing evaluation will be conducted by faculty at the University of Alicante and the coordinators of the centers and / or subjects involved.
- **Participation in the final assessment session** of the Project and new proposals, with the Universidad de Alicante.

Skills and activities conducted by students:

a) Linguistic communication skill: Information search, use of debate, oral and written communication suitable for different contexts, literary and information-search reading skills.

Activities:

- Finding information about traditional boats used in the locality.
- Workshop on elaboration of ideas, hypotheses and conclusions.
- Workshop on Oral and written work using ICT.
- Comparison of traditional boats of the communities involved. Interviews with local sailors about changes in fishing gear, tools, types of boat, famous ships, functions, legends and stories.
- Taking data about key features of a boat.
- Situation radio communication.
- Communication by letter with students from other schools and countries.
- Reading stories of boats. Stories that connect communities.
- Reading biographies of great Spanish and European navigators.
- Reading current news occurred at sea: piracy, immigration in small boats

b) Mathematical skills: Apply problem solving strategies to everyday situations, select appropriate techniques to calculate, represent and interpret reality from the information available.

Activities:

- Workshop of proportion and measurement: statistical calculations, changing units, determination of areas and volumes, the study of proportions, and so on.
- Taking measures of a traditional sail boat. Calculations for building a scale model.

c) Digital skills: Searching for information, applied in different situations textual languages,

numeric, iconic, visual, graphic and sound.

Activities:

- Presenting virtual presentations, including iconography and music dedicated to the sea and ships.
- Search for specific information on ships and other issues.
- Communication and exchange of information through use of Internet with other students from other schools and / or countries involved.

d) Knowledge and interaction with the physical world skills: Analyzing physical phenomena to interpret reality, applying scientific and technical thinking, direct observations, understanding and identify questions and problems, draw conclusions and communicate, recognize the strengths and limits of research activity incorporate the application of scientific and technical concepts and basic scientific theories, to interpret the information to predict and make decisions, to perceive the needs of individuals, organizations and environment, make decisions about the physical world and the influence of the activity human.

Activities:

- Study of the winds of the bay of Javea, Altea, Alicante.
- Study of the need to use a compass. Taking measurements with the compass. Comparison of traditional and modern compasses.
- Orientation by compass and astronomical observation.
- Study of buoyancy.
- Study of the influence of wind on the speed of a sailboat.
- Research team: Given a hull of a boat, ask students to design the proper sails to achieve maximum speed.
- Study the utility of the "keel" in a boat.
- Analysis shipbuilding techniques and traditional sails.
- Study of characteristics of the local coastline.
- Study of European map of the countries where work is performed.

- Comparative analysis of the observations made on the coast 15 years ago by students in the town of Javea and current observation.
- Creation of a traditional scale boat which includes the use of a solar motor.
- Visit to port facilities and study of a fishing boat.
- Study the influence of wind on the speed of a sailboat.
- Sailing on the solar-powered catamaran that crosses the Mediterranean.

e) Artistic and cultural skills: Appreciation of aesthetic and cultural manifestations of the region and countries involved in the project.

Activities:

- Boat watch in the area and making sketches for group exhibition.
- Visit to cultural, educational and traditional facilities dedicated to sea and sailing to collect data on different cultural characteristics.

f) Learning to learn and personal autonomous initiative skills:

The above outlined activities are intended to contribute to the acquisition of these basic skills as they involve the application of strategies to achieve intended purpose, teamwork and reflection on action.

It is specifically intended that students learn to apply scientific methodology to a scientific-technological project involving the use of all phases of scientific inquiry "Fibonacci".

2nd Proposal: Study, implementaion and assessment of a IBSE didactic unit .

Participants:

- Teachers of primary and secondary schools in the province of Alicante that have expressed interest in implementing this methodology and that will be part of a seminar on "Fibonacci" coordinated by the CEFIRE BENIDORM: CEIP Les Rotes (Altea), CEIP San Roque (Polop), CEIP Muixara (La Nucia), CEIP Alfas del Pi,

CEIP Aneja (Alicante), CEIP Tossal (Alicante), CEIP Alfa y Omega (Denia), IES Callosa.

- Centre involved in education “Reasrach projects”: CEIP Trenc d’Alba (Jávea).

Description:

After receiving basic training in IBSE through a workshop created by the CEFIRE Alicante (same training as teachers of the first proposal), participants agree to implement one of the learning units are presented as examples of good practice in the pages devoted to projects Fibonacci, Pollen, Steam, Prisma, Indagala, Establish, among others.

B.- REQUIREMENT AND CONDITIONS FOR ITS IMPLEMENTATION

Basic skills training for teachers.
IBSME training methodology.
Support of local authorities.
Financial resources for procurement, depending on the unit that will be developed. The University of Alicante, a member of the network of Fibonacci, has a budget for attending training sessions, seminars and coordination of actions between European centers involved, but also for the purchase of materials for the workshops, but has no budget for teaching (classes and travel) and is therefore subject their involvement with the centers of the province to the creation of courses, seminars and workshops created from the centers of teachers. An extra budget calls for innovation or best practices would help in the work of spreading the proposal.

C.- SUCCESS EVIDENCES

C.1.- ASSESSMENT OF THE EXPERIENCE IMPLEMENTED IN *CEIP LES ROTES*

The evaluation of the course held in Les Rotes showed improvement in the provision of teachers themselves to science education and improvement of motivation in students themselves. Teachers their expressed interest in further training in this methodology, as well as a commitment to continue applying it in teaching units already created and

experienced or newly created.

C.2.- ASSESSMENT MADE BY EUROPEAN UNIVERSITIES

The different European universities involved in this project and others alike point out the improvement of student motivation in learning Science and Mathematics. The European Commission, aware of the improvement produced by students of both primary and secondary levels, and conscious of the need to be at an early age which influence students, has supported the project by including Fibonacci in the "Seventh FRAMEWORK PROGRAMME "

The European coordinators that prove the suitability of this change in methodology are:

- Science Coordination: La main à la pate (Academy of Sciences, National Institute for Pedagogical Research, École normale supérieure) France. JASMIN David.
- Coordination in Maths: University of Bayreuth. BAPTIST Peter.
- Scientific committee: University of Bristol – HARLEN, Wynne

  French Science Academy – LENA , Pierre

  King's College – DILLON, Justin

  Paris 7 University – ARTIGUE, Michèle

The network of centers working on the project consists of:

12 European universities that are centers of reference because they have considerable experience in the application of the methodology. Attached to them are twins who are 24 centers of the previous council, among which is the University of Alicante and 12 new centers to be included in the course 2011/2012. Their reports can be consulted on the project page Fibonacci:

www.fibonacci-project.eu

D.- ADAPTABILITY OF THE SUCCESS EXPERIENCE ONTO STUDENTS DIVERSITY

In the European seminar "Integrating inquiry across curricula" held at the University of Leicester in September 2011, there were different experiences focused on the adaptability of the methodology IBSME to student diversity. The experience presented by the group of professors from the University of Leicester showed practical ideas to support English language with science and mathematics students pair whose first language was English. Just as teachers of Luxembourg presented practical ideas for teaching science in German children who are not Germans, and finally presented the experience of Russian teachers should teach science in Estonian children whose mother tongue was Estonian.

The three cases are examples of an effort to teachers and / or students, the three cases are possible in our community and it takes a network of experiences that enable an improvement in teaching.

In the three experiences it was mentioned the help in science teaching that conveys the application of the new methodology, because it gives greater weight to the proceedings, and because the concept is understood along with the process. The language proficiency curriculum is enhanced by the use of scientific procedures clarifying the concept, although these students were reinforced with linguistic curricular sessions that made them overcome their language difficulties.

Regarding students with special educational needs, none have been referred, so that collection of data about it will be carried out.
As for the high attainer students, we do not have references.
In short, we consider as an initial hypothesis that students will benefit from this approach because it is an improvement in the initial motivation and increased the significance of the proposals.

E. DESCRIPTION AND ILLUSTRATION OF TEACHING MATERIALS THAT SUPPORT THE EXPERIENCE

The teaching materials that we propose have been developed by various sources:

1, Fibonacci Educational units - Examples in English, science or math, tested by different European schools in levels of infant, first, second and third cycle of primary school. They are available on: www.fibonacci-project.eu

The work units devoted to science the following contents:

1. Food: Where does bread come from? Ages 3 to 7 years
2. Our body moving. Ages 8 to 11 years.
3. Classification of living things. Ages 9 to 11 years.
4. Color composition of light. Ages 5 to 7 and ages 8 to 11 years
5. Decomposing of leaves. Ages 5 to 7 years.
6. All about stick insects. Ages 5 to 7 years
7. Levers. Ages 5 to 7 years.
8. Breathing, moving air. Ages 3 to 4 years
9. Making grape juice. Ages 4 to 5 years
10. Float or sink. Ages 5 to 7 years.
11. Let's find out about fruit. Ages 3 to 5 years.
12. The germination of a seed. Ages 3 to 5 years.
13. Hourglasses. Ages 3 to 4 years.
14. Time. Meteorology. Ages 5 to 7 years.

These units have been mostly translated by Teaching students in the specialty of English and made available to anyone who needs them. They are available in the virtual seminar material "" Developing a teaching unit through inquiry "CEFIRE BENIDORM the section of e-learning.

http://cefire.edu.gva.es/course/view.php?id=3354

2. Teaching units devoted to teaching the topic of "day and night" through investigation prepared by the University of Alicante. These three subunits dedicated to researching day

and night, day length, seasons and finding the relationship with the movement of the sun and earth. They are available at the seminar indicated in the previous section.

3. Pollen project lesson plans, in "La main à la pâte". They are units of a project previous to Fibonacci, devoted to primary levels, mostly in high stages of primary school with application to junior high.
They are available in Spanish at:

http://lamap.inrp.fr/international/

4. Proposals from the Universidad de los Andes for Science by inquiry, for kindergarten and primary levels that can be found in:

http://www.indagala.org

5. Proposal to investigate the air, dedicated to the second stage of childhood or lower primary school performed in a Valencian Community and coordinated by the team at the University of Alicante. It is available in Castilian and Catalan languages on:
http://rua.ua.es/dspace/handle/10045/8340

6. Proposals for junior high English. Are available on page:

“European Science and Technology in Action. http://www.establis-fp7.eu/resources

7. Proposals from other European projects are included in the project page Scientix
http://www.scientix.eu

8. Proposals from Universidad de Alicante: www.rua.ua.es