The Fibonacci Project

DISSEMINATING INQUIRY-BASED SCIENCE AND MATHEMATICS EDUCATION IN EUROPE

FIBONACCI NEWSLETTER
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Halfway trough the project

Fibonacci is starting a new school year, which will be rich in events, with especially the 5 training sessions on the common topics and the second European conference in Leicester in April 2012. Active twinning and tutoring between centres will help prepare the next phase of the project: the entry of 24 new players (TC3s).

This Newsletter focuses on Inquiry-Based Mathematics within Fibonacci, with insights into the role of the Scientific coordination for Mathematics (University of Bayreuth), the teaching of mathematics in early Childhood Education (University of Patras), the House of Maths in Vienna, the art of Inquiry and Discovery as part of an educational strategy (IMIBAS, Bulgaria), and Inquiry-based mathematics in secondary schools, with the case of Brussels.

We wish you all a successful 2011-2012 school year!

NEWSLETTER CREDITS

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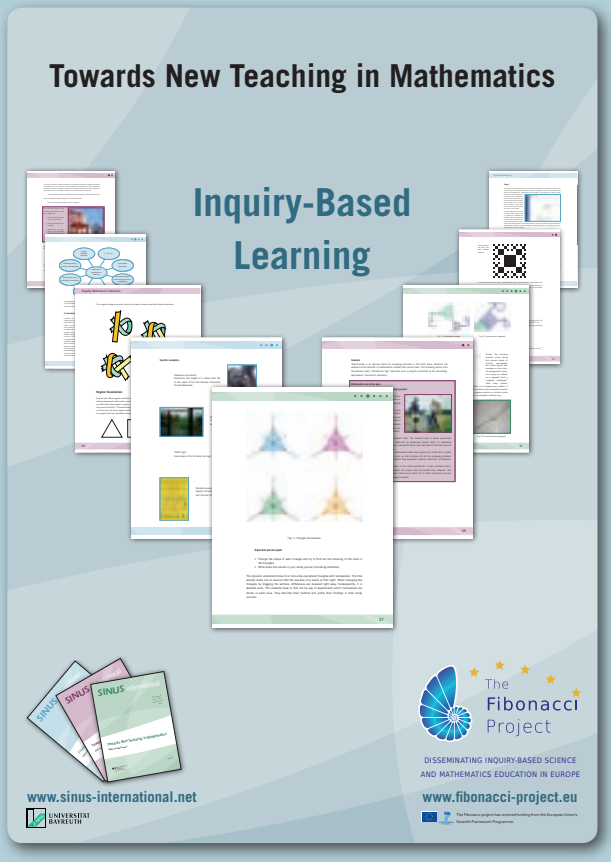
SEVENTH FRAMEWORK PROGRAMME

the involved teachers. Until now already 158 mathematics and science departments of schools have applied for participation, starting in September 2011. It will not be possible to participate as a single isolated teacher, for effectiveness and sustainability reasons. The Reference Centre, University of Bayreuth, will supervise the work; the coordination will be done by the State Institute for School Quality and Education (ISB) in Munich.

The kick-off meeting of the Bavarian tandems will take place from October 4-6, 2011, at the University in Bayreuth. Besides the organisational planning there will be several workshops about inquiry-based teaching and learning in mathematics and science. The science part will be supervised by Franz X. Bogner (University of Bayreuth). He is the European coordinator of the EU project Pathway which is also focused on inquiry-based methods and is specialized in science education. There is a long lasting fruitful cooperation between Peter Baptist, scientific mathematics coordinator of the Fibonacci project and Franz X. Bogner, as they have a shared responsibility as CEOs of the Centre of Mathematics and Science Education (Z-MNU).



Teaching mathematics at pre-school level: University of Patras

The University of Patras - (TC1) - (Laboratory of Science, Mathematics and ICT Education (LoSMICTE) of the Department of Educational Sciences and Early Childhood Education) is training future early-year teachers through theoretical and practical courses.

We have appreciated for a quite long time the valuable contribution that inquiry-based learning may have to the scientific literacy of young children. Working in the context of Fibonacci, during the academic year 2010-11 we established our 'teacher-network' and developed Teaching and Learning sequences in the context of IBSME in the sub-domains of physics, biology and mathematics.

The 30 members of the 'teacher-network' got familiar with our inquiry-based, natural sciences and mathematics didactic units, and were prepared to integrate them in their own practice through a series of seminars and workshops that we offered. Moreover, they were fully supported during the implementation phase in their classrooms.

Below, we present a general description of the mathematics didactic units that were developed by our colleague K. Zacharos and his post-graduate students.

Practices for measuring length and capacity in Early Childhood Education

The measurement of attributes – such as length and container capacity – constitutes an interesting aspect of mathematical training in early childhood education.

The goals of teaching measuring for the pupils in early childhood education are:

- ★ to understand the measurement process
- ★ to familiarise themselves with the practical uses of units of measurement
- ★ to build and use non-conventional measurement tools and
- ★ to make numbers correspond to quantities

The measurement process

The measurement process in early years can take, in general, two forms:

The first one requires *direct comparisons* of the magnitudes to be measured

For example:

- ★ two objects under comparison are equal in length when their ends correspond
- ★ to compare directly the capacity of two containers by asking children to use practices of 'filling' and 'emptying' the content from one container to the other one that is empty

In the second case, the measurement processes are indirect and require the mediation of suitable units or measurement tools.

The process

Teachers will have to try and highlight the major role of activities that are carried out within a playful structure

for the development of forms of mathematical thought. At the same time, the communicative framework is created by the teaching situation, a story that enables the transfer to an experimental atmosphere, as well as the development of the students' degree of autonomy.

Measurement of length

Length measurement is a typical case of linear measuring, which is offered as an introduction to measurement practices in preschool.

I. Direct comparisons

In the initial stages of acquiring skills in length measurement, children make direct comparisons. In this case two objects under comparison are equal in length when their ends correspond.

II. Indirect comparisons

Using units of length: In indirect comparisons the mediation of suitable units or measurement tools is required.

In this case we offer different kind of units (e.g. sticks, footprints, toothpicks, rope, etc) to compare objects in length. Children have to compare the arithmetical results and to decide about the suitable unit for the comparison (see Pictures). The teaching activities are set in the context of a story about a prince that has to save the princess who is prisoner in a castle. In the story the prince has to measure the distance across a river and build a bridge, the height of the window of the princess and so on.

Covering the length with sticks

Covering the length with footprints

Unit iteration on the length

Measurement of capacity

The concept: The term *capacity* is used to describe the ability of hollow objects to contain liquids or materials characterised by 'fluidity' (for example sand, rice, etc).

The teaching plan is set in the context of a farm and its animals and may include three phases:

I. Direct comparison

- ★ The children are asked to compare the capacity of two dissimilar containers.
- ★ The *aim* in this phase is to help children find and process the parameters that will allow the construction of the concept of capacity.

II. Indirect comparison

The *aim* here is to get children to use measurement units of capacity.

- ★ Children are asked to choose the largest between two or more unequal, full containers by using small cups as measurement units.
- ★ If we have to feed, for example, chickens, the following question could be posed: "How many chickens can we feed with each container?" "Is it possible to feed more chickens with one of those containers?"

III. Indirect comparison- The construction of a measurement tool

This phase of the teaching intervention aims at constructing a tool with which to measure capacity.

- ★ A cylindrical, oblong container and a felt-tip pen are presented.
- ★ According to the story with the chickens, the following question could be posed:
- ★ "How much should we fill this container with corn to feed two, three, four, ... seven chickens?"
- ★ In this case the children are called to construct and grade a measure instead of having to fill the container cup by cup each time (see picture).

Construction a measurement tool of capacity

Hands on! in the House of Maths (HdMa), Vienna

Maths becomes a real adventure for small and big scientists at the House of Maths (Haus der Mathematik, HdMa), located at the University of Education in Vienna, Austria (Pädagogische Hochschule Wien).

Touching is a must!

This slogan refers to the philosophy of hands-on activities: The touchable presentation of mathematical problems, which encourages students to find a new, discovery-driven and playful approach to maths. Special exhibits present maths as a touchable, versatile and understandable science.

Different learning environments provide a creative and active access to maths: There is a room showing the "History of Mathematics" and you also find a "Discovery-Area", which is full of hands-on exhibits and games. One of these is the exploration-table "Fibonacci sequence":

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, ...

Users can experience and discover the Fibonacci numbers in different contexts, e.g. by building a Fibonacci spiral or by modelling the rapid increase of an imaginary rabbit population with wooden coins. Solving Fibonacci's so-called "rabbit problem" may be difficult in its abstract, mathematical form but is much easier and more accessible when it is presented as a hands-on exhibit. The famous Fibonacci numbers are also hidden in nature: visitors can discover them hands-on in fir cones, sunflowers, a nautilus fossil and a cactus-plant.

The University of Education of Vienna seeks to best integration of the new ideas and options which the House of Maths offers into the education of future primary and lower-secondary teachers. Each semester, students get the opportunity to acquire more profound and practical knowledge concerning hands-on activities by attending the explainer-programme provided at the House of Maths. They will increase their skills by applying hands-on philosophy, didactics, maths and knowledge-transfer by presenting mathematical issues to groups of school-kids during their visit at the House of Maths.

see also:

<www.hausdermathematik.at>
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