European Schools

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MATHEMATICS SYLLABUS YEAR 4 to YEAR 7

Characteristics of the technological tool to be implemented

APPROVED BY THE JOINT TEACHING COMMITTEE ON THE 4th AND 5TH OF FEBRUARY 2010 IN BRUSSELS

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General Overview

This document is intended to describe the characteristics of the technological tool to be implemented in the context of the mathematics syllabus of the secondary classes 4 to 7 of the European Schools. The teacher will use this technology in the classroom and the students will use it at home or during the lessons, tests, exams and the baccalaureate.

Other scientific disciplines must also profit from the use of this technology.
To be selected for use in the European Schools, the technological tool must meet all the characteristics listed in this document.

1. Multi-platform Use

The technology must be available in two different versions:

1.1 As a software on a computer,

to be used by
- the teacher in a classroom equipped with a computer connected to a projector
- the pupils in an ICT room or at home

1.2 As a mobile unit (handheld)

to be used
- by the teacher in a standard classroom
- by the pupils during the lessons, the tests, the exams and the baccalaureate
- at home by the pupils who don't have access to a computer
- by the pupils in the study hall, in a science lab, in an economics class, etc.

The two modes of use should offer the same features and use identical commands with the same syntax.

2. Use, Storage and Exchange of Documents

The technology should be document-based supporting all different modules. The documents should be saved as regular files and be transferable between computers and mobile units as well.

Files must be compatible: the fact that a document was originally created on a computer or a mobile unit should be immaterial to its future use: it must be possible to continue to use it on any of these two platforms.

3. Modular design of the technological tool

The technology must support the interactive use of the following modules:

3.1 The Dynamic Geometry Module

It must at least allow:
- the construction of standard geometrical objects
- the modification of these objects
- the interactive manipulation of the objects
- the measuring of lengths, areas, angles, slope of a line, etc.
- the creation of animations of geometric shapes and the search for loci

3.2 The Interactive Graphics Module

This module should allow the study of functions and families of functions with one or more parameters, and also highlight their properties.

The technology should at least have the following tools:
- Automated and manual framing
- Search for critical points
- Simultaneous display of multiple graphs
- Use of one or more sliders to represent "parameters"
- Handling graphs interactively

3.3 Cohabitation of different types of geometric and graphics objects

It is necessary:
- to have an easy interaction between the two types of objects (geometric and / or graphics)
- to be able to represent different types of objects simultaneously in a single module

3.4 The Computer Algebra Module

This module must allow the user:
- to carry out all calculations described in the algebra and analysis syllabus: arithmetic, rational fractions, factorisation or development of factoring expressions, solving equations, calculation of derivatives, primitives, scalar product, vector product, determinants etc.
- to conduct counts (number of combinations, permutations,) as well as to use the laws of probability and the associated cumulative distributions (binomial, normal distribution, etc.)
- to solve a problem step by step, to allow students to focus on the learning of the algorithm for solving the problem, while eliminating the risk of calculation errors.

3.5 Interaction between the calculation module and the module of dynamic geometry

It must be possible to:
- define a geometric object using the values of variables defined in the calculation module
- conversely, to retrieve in the calculation module the values of some geometrical variables.

3.6 The Spreadsheet Module

Using a spreadsheet is very useful in several areas of mathematics, especially for the study of sequences and statistics.

The technological tool must have a spreadsheet module allowing:
- all conventional treatment, relative or absolute cell references, quick copying of a formula, conventional representations (bar graphs, histograms, pie charts circular), statistical calculations;
- Dynamic interaction with other modules;
- The making of formal calculations directly in the spreadsheet;
- compatibility to copy-paste data from another source

In addition to the spreadsheet, the technological support must have a specific educational tool allowing the user to:
- create and adjust a scatter plot by placing a movable line that can freely be moved
- directly obtain a linear regression
- work from data contained in the spreadsheet
- use all types of graphs

3.7 Text Editor Module

The technological tool must include a text editor module to:
- enter text including mathematical expressions and formulae, notations on the geometry and to assess the value without needing to open the calculation module
- create documents intended for assessing students' knowledge, to give instructions to students, etc

4. Special conditions concerning the use of technology during an exam/baccalaureate

To avoid fraud, the technological support must have a special "exam" mode in which only the resources of the standard calculator and specific documents for this examination will be available during the duration of the test.

This special mode does not require the removal (and therefore the potential loss) of data stored in the mobile unit before the examination starts. It is enough to deny access on a temporary basis and must be easy to implement.

5. Special conditions for use in science

5.1 Units and Constants

To better meet the needs of science teaching, the technological tool must allow direct use of physical constants and work on numbers with units.

5.2 Sensors

The mobile unit must have a port for connecting various sensors to store data from experiments directly into a spreadsheet; to analyze the data collected interactively using the different modules available. This use must be possible outside a science lab, in a standard classroom or during field trips.

6. Physical characteristics of the mobile unit

- It must be possible to update the software of the mobile to avoid the regular change of the mobile unit itself.

- When working on the mobile unit, the screen size should be sufficient to allow the manipulation of geometric objects, the study of graphs, displaying formulas.

- The mobile unit must have a colour display with a graphics resolution of 480 * 640 pixels or alternatively, a graphic resolution of at least 240 * 320 pixels with 16 grey levels.

- The mobile unit must have an alphabetical keyboard, a scientific keypad, a mouse port or another pointing device to replace the use of a mouse.
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- Communication between the mobile unit and any other device must be done via a USB cable or standard modes of wireless communication allowing a simple locking of the exchange of data during tests, examinations and the Baccalaureate.

7. Choice of a specific technological tool to implement in the context of the mathematics syllabus

The mathematics syllabuses are completely independent of the use of a specific technological support.

The characteristics of the technological tool have been described in detail in this document.

Based on this document, a group of experts whose members are maths coordinators at European Schools and which is chaired by the inspector responsible for mathematics will select the exact type of technological support to be implemented in the context of application programs.

This group of experts will regularly reconsider its decision on the basis of this document and on future technological developments.

The selected technology must ensure a successful life-span of the hardware of at least 4 years to avoid any change of the mobile unit during the full cycle of classes 4 to 7 of the secondary school of the European Schools.