International GeoGebra Conference 2011
29-31 August 2011 – Hagenberg near Linz - Austria

GeoGebra and IWB: current practices and open problems

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The aim of mathematics education

- To foster the progressive construction of a personal heritage of mathematical knowledge, skills and attitudes which have to be meaningful, stable and fitted for the use in problematic situations both internal or external to the mathematics

“Mathematics for the citizen”

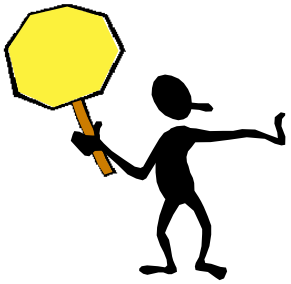
- Is the way researchers in Italy commonly refer to a body of knowledge and skills necessary for everyone in today’s society that are to be acquired sistematically and gradually at each of various stages of the whole period of school education

[UMI – Italian Mathematical Society]

The “Mathematics Laboratory” as a Renaissance Workshop…

- “We can imagine it as a Renaissance Workshop in which the apprentices learned by doing, seeing, imitating, communicating with each other”
- “A mathematics laboratory is not intended as opposed to a classroom, but rather as a methodology, based on various and structured activities, aimed to the construction of meanings of mathematical objects” [UMI]

- “In the laboratory activities, the construction of meanings is strictly bound, on one hand, to the use of tools, and on the other, to the interactions between people working together”



- “The meaning can not be only in the tool per se, nor can it be uniquely in the interaction of student and tool. It lies in the aims for which a tool is used, in the schemes of use of the tool itself”

Which can be the role of technologies?

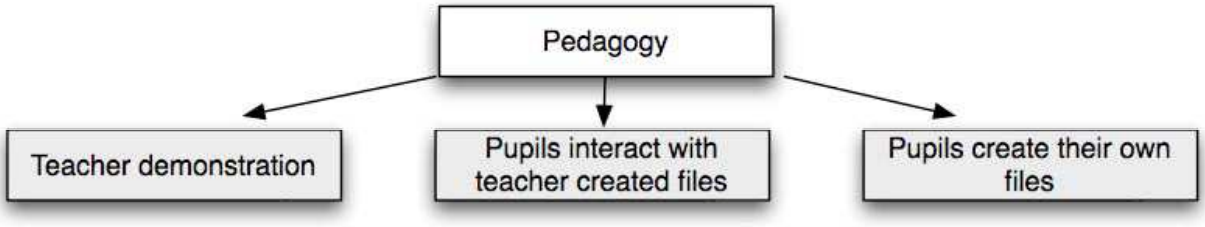
And the role of GeoGebra when used with an IWB?

The focus of the matter

- It can't be upon GeoGebra or IWBs or any other software or technology but…

- …it is has to be upon the construction of a personal heritage of mathematical knowledge, skills and attitudes which have to be meaningful, stable and fitted for the use in problematic situations

Possible roles of GeoGebra

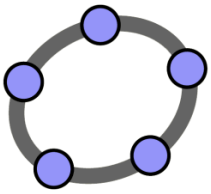


- Pedagogical framework of approach with GeoGebra by K. Jones, Z. Lavicza, M. Hohenwarter, A. Lu, M. Dawes, A. Parish and M. Borcherds

Possible roles of IWB

- Teacher presentation (no more interactive and effective than using a videoprojector)
- Pupils interact with pre-defined problems
- Pupils discuss open problems, creating, saving and retrieving their own files
- Pupils work “At the board, on the desk, in the head” (D. Miller)
- Pupils experience mathematics in the way professional mathematicians do (M. Dawes)
- …

Which can be the role of the teacher?



And the role of teacher educators?

The role of the teacher

- To exploit GeoGebra and the IWB to create meaningful learning environment
  - in which pupils could tackle with intriguing open problems
  - and…

GeoGebra

The role of the teacher

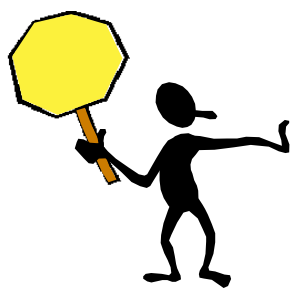
- To exploit GeoGebra and the IWB to create meaningful learning environment
  - in which pupils could tackle with intriguing open problems
  - and, acting as mathematicians, construct their personal heritage of mathematical knowledge, skills and attitudes fitted to be used in further problematic situations

The “instrumental orchestration”

- Teacher training should take in account the complexity of the integration at three levels:
  - a mathematical one (new environments require a new set of mathematical problems)
  - a technological one (to understand the constraints and the potential of artifacts)
  - a psychological one (to understand and manage the instrumentation process and their variability) [L. Trouche]

The needs of the teacher

- To become aware of the usefulness of GeoGebra and IWB as methodological tools to create new effective and meaningful learning environments



- To understand the importance of their own “adequate” preparation and updating to cope with technology-rich classrooms

Borrowing Hoyles's words:

In order for ICT to move from the periphery to centre stage in mathematics teaching and learning and for its potential for transforming mathematical practice for the benefit of all learners to be realised, teachers must be part of the transformative process

… [and, as educators, we should allow teachers] the time and space to take on the role of learner

[Plenary Lecture #3 - ICME 11]

The NCETM skills list of seven zones

- Classroom hardware
- Interactive whiteboards
- Strategies for lessons on laptops and netbooks, and lessons in the computer room
- Word processing for mathematics
- Spreadsheets for mathematics
- Internet resources and related issues
- Specialist software

Which can be the role of the GeoGebra Institutes?

The SPORE framework for PD (Miller)

- Skills (those technical skills required to use the full range of features + creativity)
- Pedagogy (the art and sience of taching and the development of a new pedagogy)
- Opportunity (skills and pedagogy provide the opportunity for interesting and creative uses)
- Reflection (the process to focus on aspects of the use, effects of the approach and impact on the teaching, pupils, their learnig and habit)
- Evolution (occurs as a result of the classroom experience and the constructive reflection)

A possible role of the educators within the GeoGebra Institutes:

- Let teachers experience by themselves the processes that come into play bringing GeoGebra and using an IWB in teaching learning situations:
  - the difficulties students can encounter and have to overcome
  - the cognitive processes they can put in action and the attainment they can achieve

- In this way teachers can tackle with:
  - the obstacles encountered and to be overcome
  - the cognitive and metacognitive processes carried out
  - the attainment that can be achieved
- They have the opportunity to reflect on changes occurring when using technologies and to become more skilful and self-confident when deciding to exploit the potentials of GeoGebra and IWBs in mathematics education

[Faggiano & Ronchi]

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Thanks for your attention!

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