



# Working for a Leap in the General Perception of Computing

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Conclusions

# Computer Science is misperceived



www.kangourou.it

Too few people really know what computer science is.

Negative effects:

- Computer science students tend to have inadequate motivations and preparation.
- The society cannot fully exploit the benefits of the revolution brought by the invention of the computer
  - World Economic Forum Global Information Technology Report 2007-08  
<http://www.insead.edu/v1/gitr/wef/main/home.cfm>
    - In network readiness, Italy is 42<sup>nd</sup> of 127 countries, almost last among Western Europe countries,
    - although it is 27<sup>th</sup> in number of PC's per inhabitant and 22<sup>nd</sup> in percentage of Internet users

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What is the role of computers in computer science?

*“Computer science is no more about **computers** than astronomy is about telescopes.” [Dijkstra, 1986]*

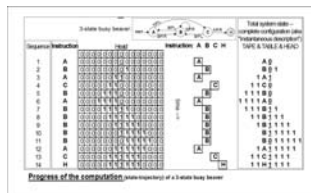
*“The term **computer science** is as descriptive as the etymology of the word geometry” [Abelson, 1987]*

The answer is: computer science is not (or not only) the science of computers, but rather the science of computing; for this reason the name **Informatics** is preferred in Europe.



Informatics is a multi-faceted discipline seen in three radically different ways when taught in school:

- 1 as a science, with its own peculiar approach to problem solving



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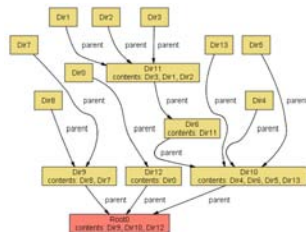
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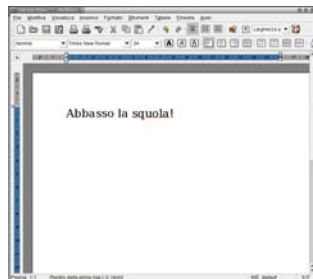
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- 2 as a technology, producing hardware and software tools





Informatics is a multi-faceted discipline seen in three radically different ways when taught in school:

- 1 as a science, with its own peculiar approach to problem solving
- 2 as a technology, producing hardware and software tools
- 3 as an instrument, to work on problems arising in all contexts



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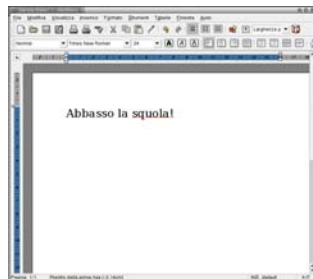
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The general public has a reductive perception of informatics as the mere ability to master a set of applications!

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# What can be done?





A cultural battle is due:



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To clearly distinguish informatics from fluency in ICT:

- forge a new name: **Applimatics**
  - fluency in ICT is important (see the success of ECDL) but it does not necessarily imply a computing mind setting
- introduce school children to informatics as a science



Informatics is a very formative discipline, involving:

- abstraction
- algorithmic thinking
- structured problem solving
- computation with constraints on the resources (time and space)
- ... (+ 22?, see B. Meyer)



Directions from the Italian Department of Education:

- Informatics as a trans-disciplinary cultural tool
- Use of information and communication technology tools to process data, texts, and images
- Knowledge of the main components of a computer and their functions

The scientific acceptance is absent

Schools often lack the resources (hardware, software, human competence) to adequately implement even these directions



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Our proposal: **a game-contest to introduce children (and teachers) to computing**

# The Kangourou of mathematics



[www.kangourou.it](http://www.kangourou.it)

- The Kangourou of Mathematics is a yearly held **game-contest** created in France in 1991 by André Deledicq on the model of the 1978 Australian Mathematics Competition.
- An international association, **Kangourou sans frontires**, was founded in France in 1995, whose aim is to promote the **spreading of a basic mathematical culture** by all means.
- In conjunction with the contest, Kangourou is engaged in the production and distribution of **pleasant publications** for the dissemination of mathematics to the general public.
- The game-contest is financed with the participation fees (this year € 2.5 on average per participant).

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- Italy joined in 1996. Since 1999 the game in Italy is organized in collaboration with the Department of Mathematics of the Università degli studi di Milano.
- The 2008 edition saw the participation of over 5 millions primary and secondary school pupils (47,000 in Italy).

# The Kangourou of mathematics



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The Kangourou has received many awards for its contribution to the promotion of mathematics among young people.

- In comparison with contests such as the “Olympics of Mathematics”, it is characterized by a **promotive approach** rather than the selection of excellence.
- The **fun** of the children is a priority.
- The contest is the opportunity for distributing pleasant documentation to **pupils** and **teachers**.
- During the finals, seminars on the teaching of mathematics are organized for the accompanying teachers.
- The success of the competition for mathematics suggested to extend the Kangourou to English: in 2008 it had 11,500 participants.

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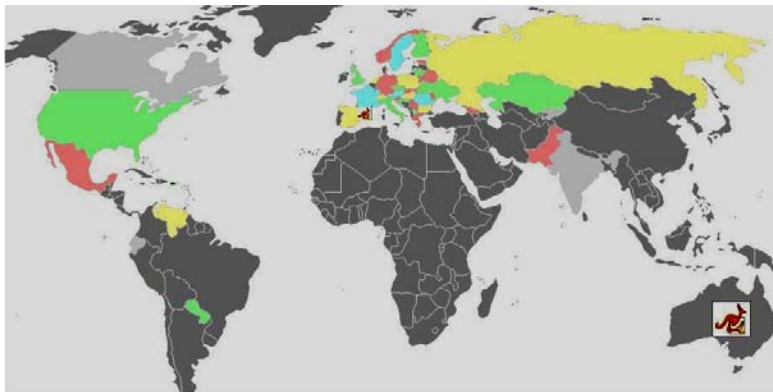
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# The Kangourou of mathematics



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The Kangourou of mathematics in the world (41 countries).



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# The Kangourou of mathematics



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Every year 150 professors choose the 144 questions for the next year among the 1,500 new problems proposed.



(Berlin, October 15 – 19, 2008)

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# The Kangourou of Informatics



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Why not extend the Kangourou to informatics too?

*"I think that it's extraordinarily important that we in computer science keep fun in computing. When it started out, it was an awful lot of fun." [Alan J. Perlis]*

The only experience is in Romania: since 2005, very technical questions mixed with mathematics (for secondary school pupils)

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The problems to be faced:

- it should promote mainly the **scientific acceptance** of informatics, but be distinguished from mathematics and logic
- the **level of competence** to be assumed
- the **teachers to be addressed** (mathematics, technical subjects / technology, humanities)
- the role of the **computer**

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# A preliminary test



- A test questionnaire was distributed to a group of teachers and their pupils in order to tune our proposal to the actual school context.
- Six classes (two per grade) from the same school participated
- A multiple choice questionnaire with 14 problems involving different aspects of informatics
- Relatively complex problems
- Neither pupils nor teachers had been prepared in any way
- The teachers were very skeptical about the ability of their pupils to solve the proposed problems



The problems involved the following aspects of informatics:

- Syntax
- Grammars
- Simulation of algorithms
- Analysis of finite state automata
- Composition of primitives into an algorithm
- Jargon
- Information coding
- Security issues



# A preliminary test



## Outcomes:

- the percentage of correct answers (around 25%) didn't vary significantly with respect to the classes, showing no significant difference in informatics skills
- pupils, especially the younger ones, didn't use all the available time
- the older pupils seem to rely a little less on intuition
- possibly with some preparation, or at least indication not to rely so much on intuition, the percentage of correct answers would increase
- most of the pupils reported they had fun in solving the problems



- Promoters:
  - Kangourou Italia
  - Università degli Studi di Milano, *Dip. di Scienze dell'Informazione e Dip. di Informatica e Comunicazione*
  - Università di Genova
  - AICA
  - Ministero della Pubblica Istruzione
- Sponsors
  - Epson
  - Mirabilandia
  - Assoit
  - DDM
  - Inca

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- A **team** (4 pupils) contest
- For the **first classes of secondary school** (grades 6–8)
- **Two phases**: a preliminary in the schools followed by a national final for the best 25 teams (max 1 per school)
- Multiple choice and interactive questions for the preliminary with the use of an ad hoc software
- Open questions and the use of tools for the final.



## Our assumptions

- No specific technical knowledge (programming languages, other formalisms for the representation of algorithms)
- Some ability to recognize the most common jargon terms (bit, password, ...) and knowledge of their high level definitions
- Logical, problem solving, and information coding abilities, stemming from their mathematical background



## Santa Claus

Santa Claus has prepared a few gift parcels having different colors: red, yellow, blue, and he has put them in two stores, mixing colors. Now he needs to know how many red parcels he has stored. He has got some elves who do the work for him, but each elf only knows how to perform one operation and moreover Santa can choose only three of the following elves. Which elf will Santa NOT choose?

- Arvo moves blue parcels from a store to the other.
- Bjork moves red parcels from a store to the other.
- Ceula moves parcels from a store to the other but he is color-blind.
- Dino counts the parcels in a store.



## Password

Philip needs to choose a password to protect his e-mail. Which of the following passwords ensures greater security?

- 1 Philip1995, by adding his birth year.
- 2 Ph111p, changing a few letters into numbers.
- 3 PhiLiP, using some capital letters.
- 4 Philipemail, to remember what the password is for.
- 5 TpitfIto!, the initials of the sentence "This password is the first I thought of!".



- The general perception of the utility of informatics as a mere set of computing tools is very reductive with respect to the true conceptual contribution of the revolution brought by informatics and has negative effects
- The Kangourou could be a way to introduce children through play to the principles of informatics, now pervading all sciences.
- The differences in preparation and experience of teachers and pupils require an effort in the preparation of an effective and attractive proposal.



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Kangourou Italy web site: <http://www.kangourou.it>

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