What (else) should CS educators know? -Revisited

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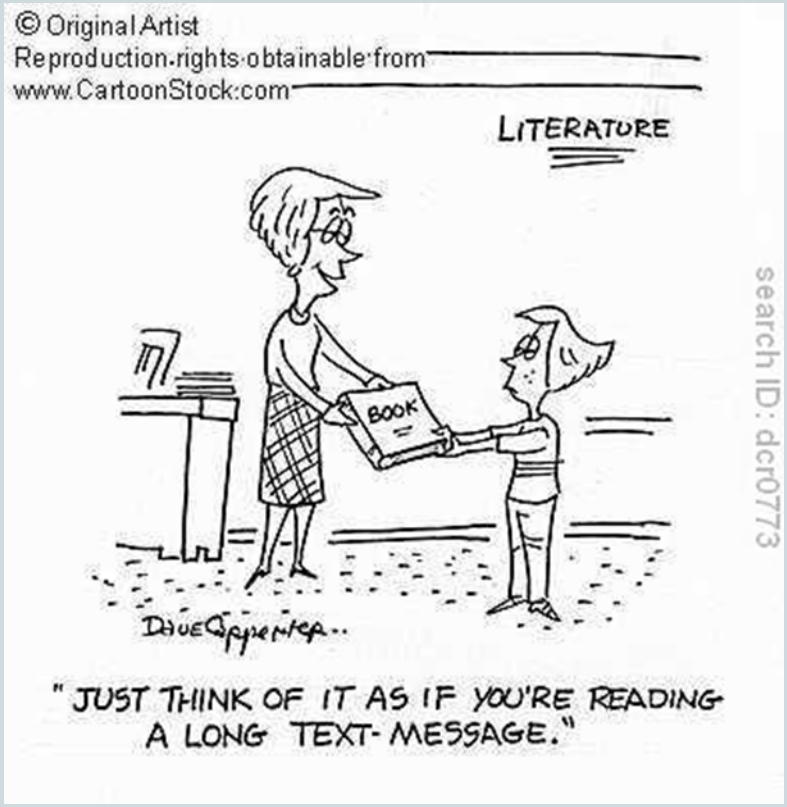
A Researcher's Apology

- Not a research paper;
- Why revisit a paper written 15 years ago?
  - Things have changed

Why revisit?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LITERATURE
BOOK
"JUST THINK OF IT AS IF YOU'RE READING A LONG TEXT-MESSAGE."
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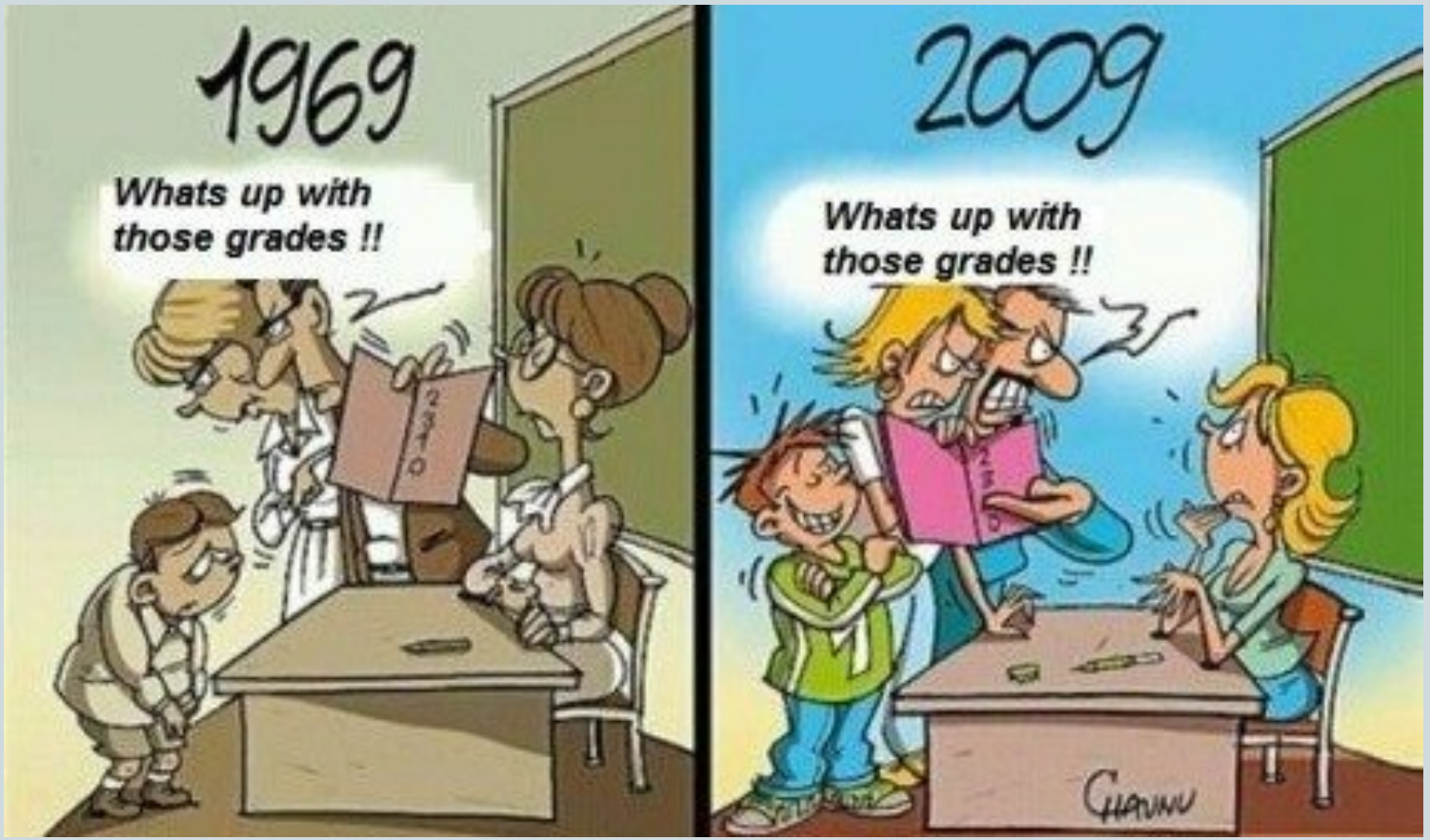
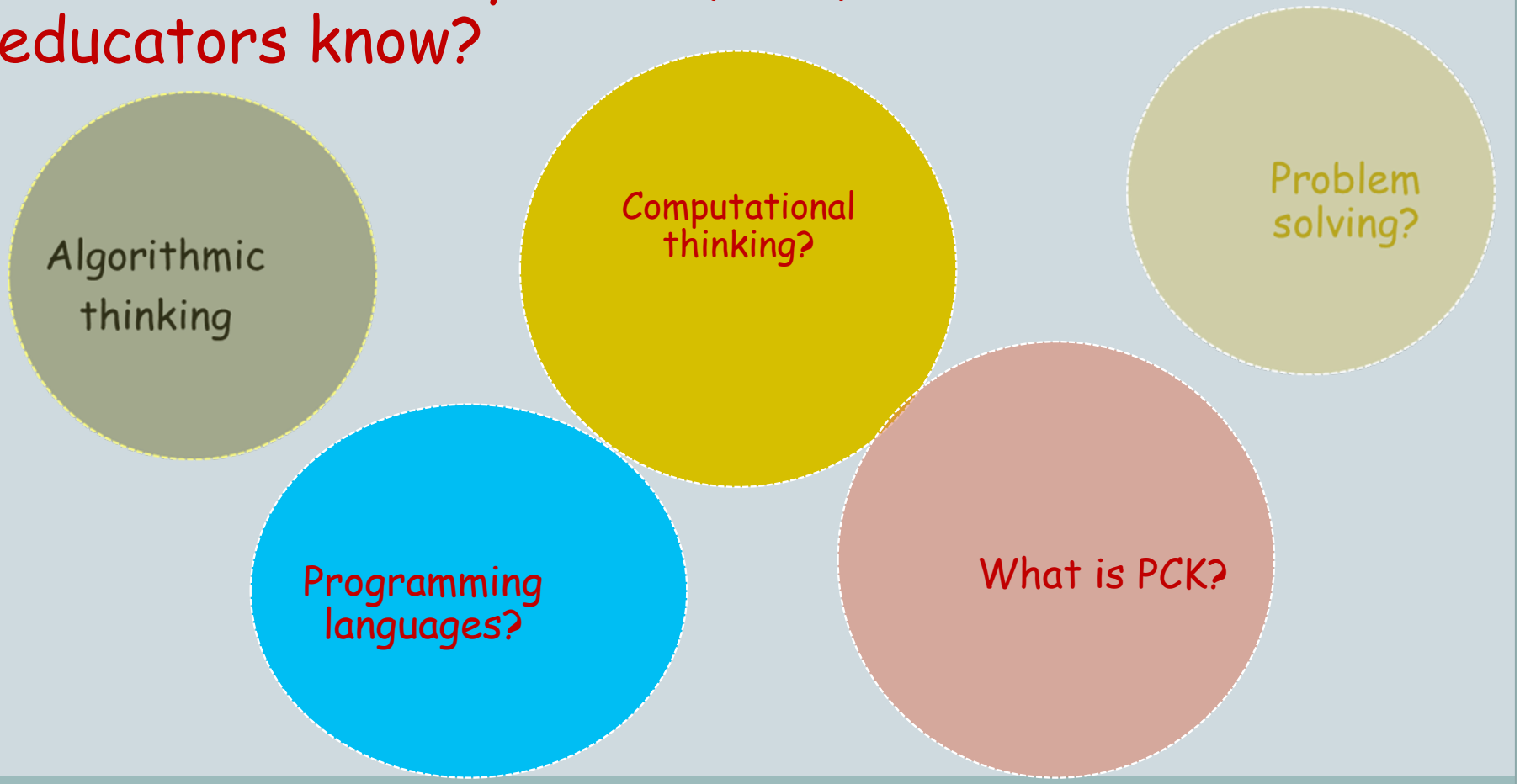
Why revisit?


1969
Whats up with those grades !!
2009
Whats up with those grades !!

Why revisit?

Do we know today what (else) should CS educators know?



However….

Most of the recommendations mentioned in the '98 paper still stand

with some adaptation.

End of apology…..

The background required:

Researchers

- Extensive knowledge in the field itself;
- Research skills and methodologies of the field.

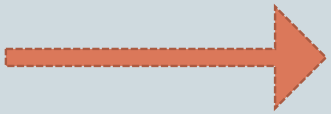
Educators

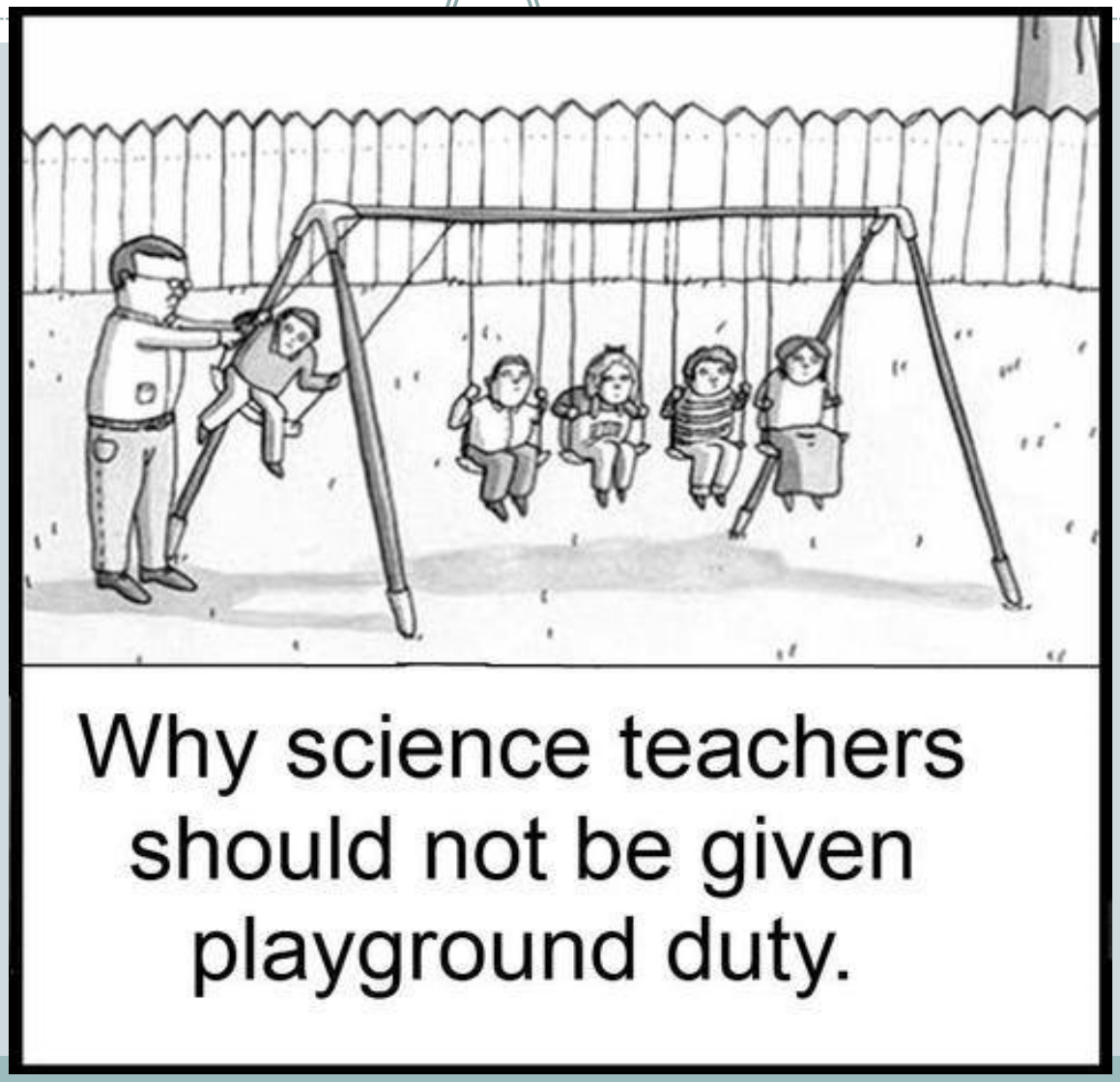
- Extensive knowledge in the field itself;
- The ability to convey this knowledge to others correctly and reliably;
- To provide perspective;
- To infuse students with interest, curiosity, and enthusiasm.

What makes CS teachers so special?

- What is the difference between CS teachers and other sciences?
- Why is it more difficult to become a CS educator?

We don't mean this…



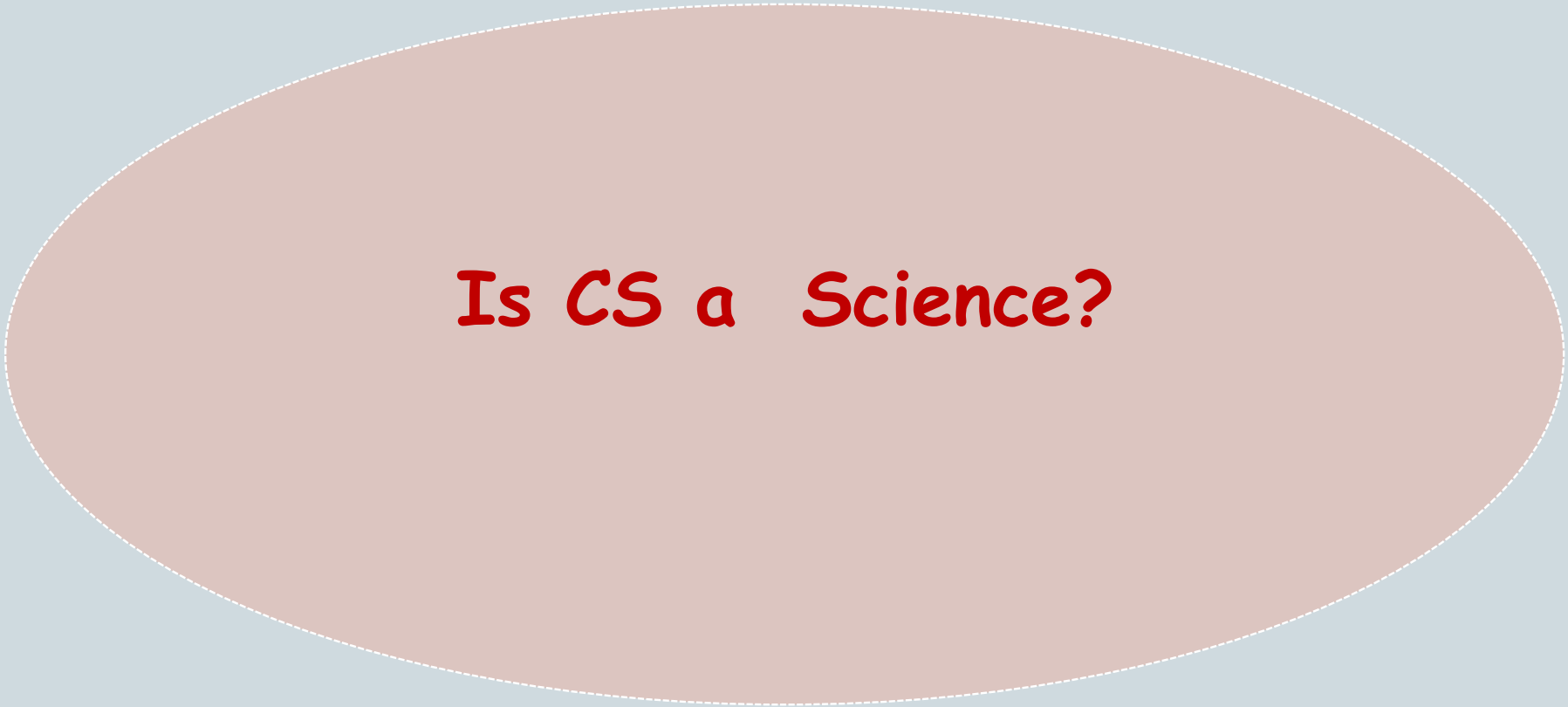

Why science teachers should not be given playground duty.

CS teachers face more challenges

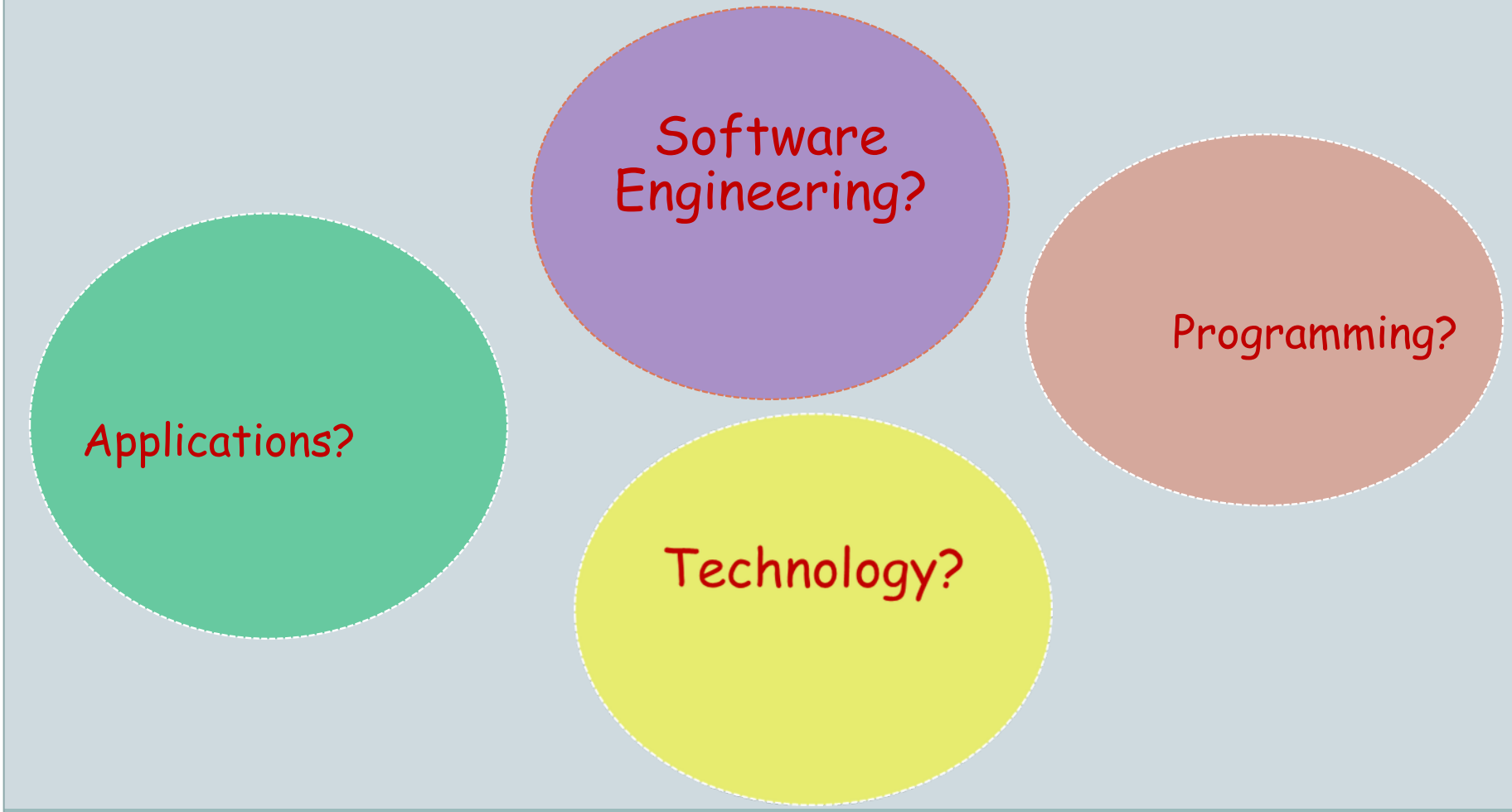
- Trouble in defining computer science;
- Continuously change or development of the field:
- Change of the technology;
- The "generation gap";
- In some countries isolation: the lack of a CS teachers community;
- The lack of professional literature;

The lack of PCK????

Trouble in defining computer science



What is Computer Science?



Still confusion

Among policy makers, parents, engineers, scientists…

My best friends:

Electrical engineer: if I can help with a technical problem with his Android;

Physicist:

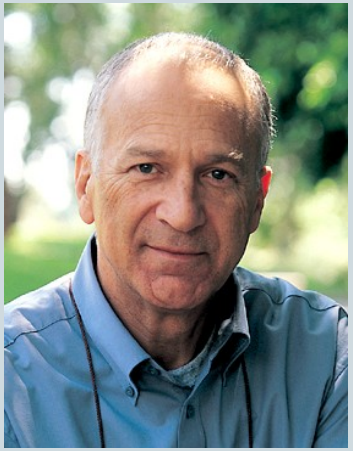
This is Math what you are teaching, problem solving….

What is Computer Science?

Peter Denning suggests CS is a mathematical discipline, a scientific discipline and an engineering discipline:

- *Mathematics*, the origins of Computer Science, provides reason and logic.
- *Science* provides the methodology for learning and refinement.
- *Engineering* provides the techniques for building hardware and software.

David Harel



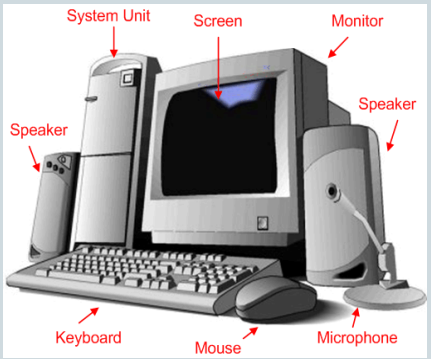
"The Spirit of Computing"

Three complexities:

- Computational complexity;
- Behavioral complexity;
- Cognitive complexity.

CSTA K-12 Standards

"Computer science (CS) is the study of computers and algorithmic processes, including their principles, their hardware and software designs, their applications, and their impact on society."



More Challenges

Continuously development of the field

- Change of programming paradigms/languages;
  - Procedural, OO, logical…..
- Emerging fields:
  - Cryptography;
  - Distributed computation;
  - Parallel computation;
  - "Cyber"

Continuously change of technology

The generation gap

Computer Science teachers have to face many challenges!
Much more than their colleagues.

We recommend exposing CS educators to the following:

Unique/special issues for CS educators

- History of CS: theory as well as the machines themselves;
- The name and nature of the discipline;
- The relationship of the field to other disciplines;
- Curricula and study programs on both the school and university levels;

Issues relevant also to other disciplines

- A variety of issues concerning problems in teaching theoretical and practical concepts;
- equity and gender issues;
- Methodological and pedagogical issues, including web-based and technology-based learning.

Also, skills to which teachers should be exposed:

- *self-study* of professional scientific literature;
- *scientific research skills;*
- *presentation skills ;*
- *skills required for preparing and delivering* a lesson.

How is it done in our CS teacher certification program?

In addition to a bachelor degree in computer science, two components: courses and practical training which is accompanied by a workshop.

Courses:

1. A seminar course (based on the '98 paper);

2. A method course.

The Seminar Course

To acquire:

- *self-study* of professional scientific literature;
- *scientific research skills;*

A reader of articles is provided, and students have to search for articles in the digital library, covering the subjects mentioned before.

To acquire

- *presentation skills ;*

Teacher students (in-service and pre-service) are required to present seminar papers;

Examples of Seminar papers:

Topic	Examples
The history of CS	The development of programming languages; of computers, of operating systems
CS curricula	The development of CS curricula in the school system, in colleges and universities in different countries; gender and equity issues in CS programs worldwide
CS teaching issues	The first programming language and its influence; problems in teaching the CS1 introductory course; problems in teaching programming; teaching different programming paradigms; difficulties in teaching recursion and ways to assist teaching and learning; challenges in teaching efficiency and how to prevent them; misconceptions in CS;
Methodology and pedagogy	Visual tools to assist teaching and learning; games and aids in teaching CS topics such as programming, data structures and algorithms, Turing machines and complexity; project based learning; lab-based teaching; internet based learning

The Method Course

Rewritten based on the

Hazzan, O., Lapidot, T. & Ragonis, N. 2011. *Guide to teaching computer science*. London: Springer-Verlag.

To acquire skills required for preparing and delivering a lesson.

Teacher students are required to prepare classes and deliver them to their pears and instructors.

Bottom Line

It is hard work

to become a computer science teacher!

Thank you☺