

# Schools and the Digital Challenge

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# ICT in School: What research says

- ICT are a resource for improving teaching and learning processes
- ICT impact both on the learning of disciplinary subjects and on the acquisition of transversal cognitive competences

**BUT**

- Positive research results does not always repeat themselves when you scale system-wide
- Large-scale innovation can only take place if change affects the whole education system

# ICT in School:

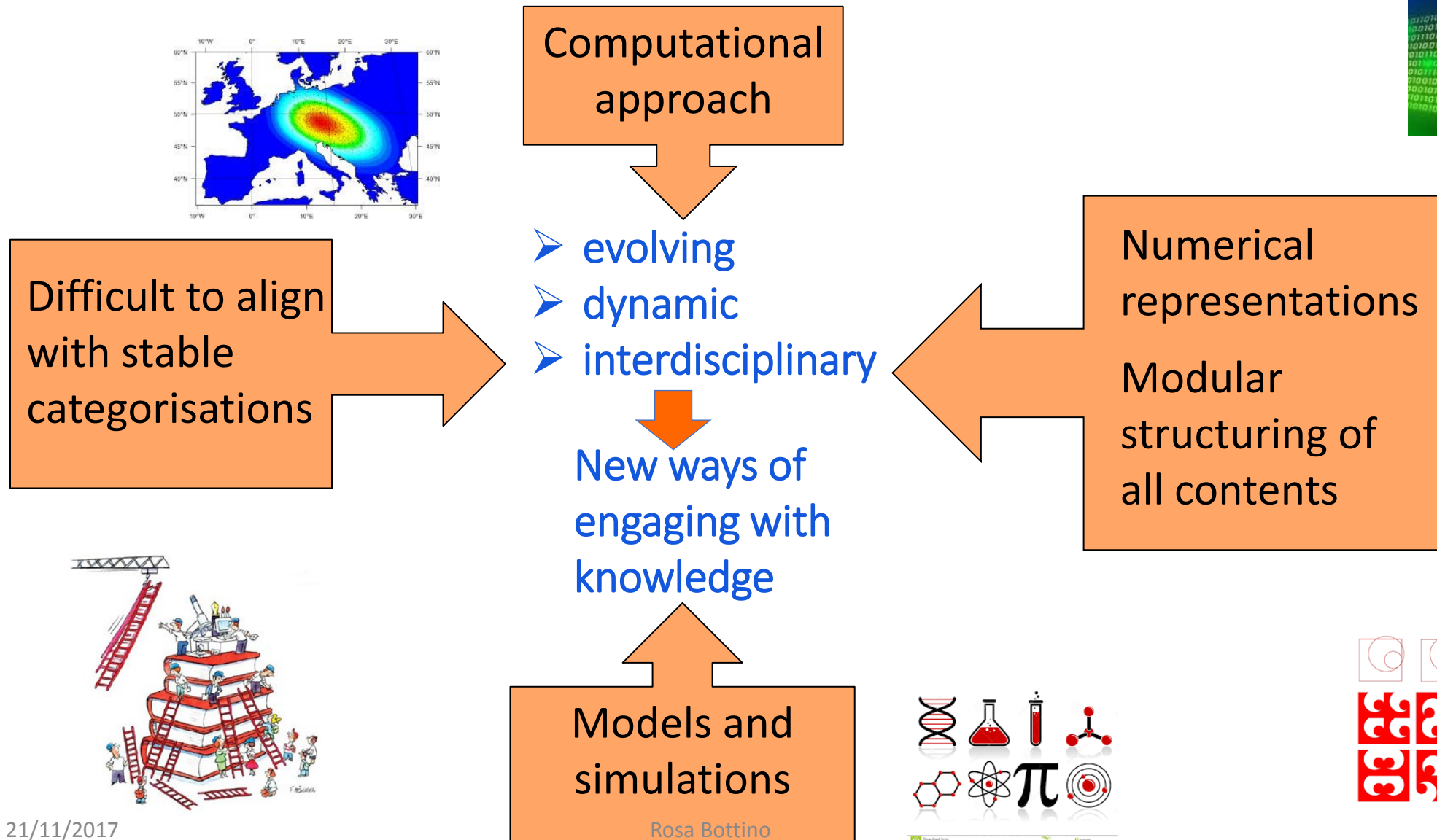
## What elements have emerged as crucial?

- ☐ Consider technological and pedagogical innovation as co-evolving
- ☐ Go beyond models based on knowledge transmission and on the traditional separation of subject areas
- ☐ Analyse new characteristics of knowledge and new skills
- ☐ See learning environments as open eco-systems
- ☐ Consider transferability and scalability issues

# evolution of technological and pedagogical innovation

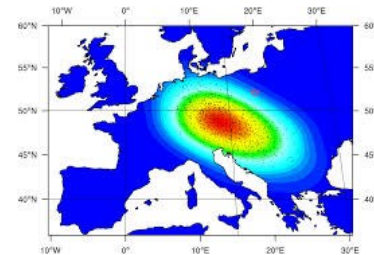
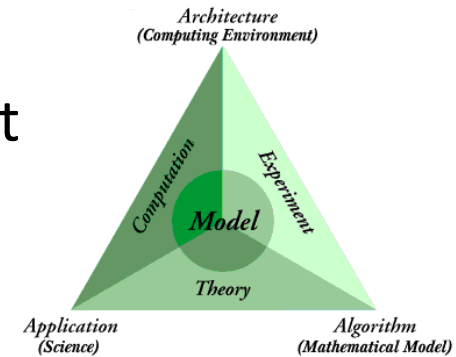
- **The introduction of technology** requires a transformation of the educational strategies and activities and of the learning environment as a whole
  - **Pedagogical innovation** requires an analysis of the potential offered by new technologies and how these can change the needs, the modalities and the content itself of the learning activities
- Integration of ICT in education should be approached with due consideration to the complexity of the underlying processes

# New characteristics of knowledge



# New characteristics of knowledge and new skills

- Computational modeling and numerical simulations change scientific disciplines and also humanistic and social ones
- This requires an epistemological analysis of disciplines and of what needs to be taught and learnt
- The concept of digital skill should be gradually expanded
- Becoming digital adults means dealing with organizations that use digital data, that make decisions based on digital data, that make them available on the web (also considering issues related to privacy, security, representation, etc.)



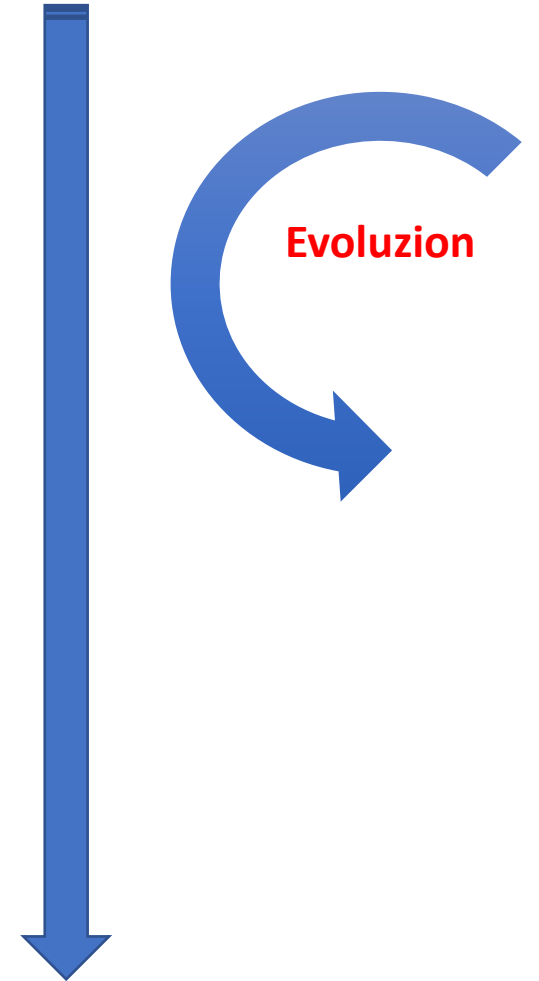
# New Skills

- Computer Science / Coding
- ITC Literacy
- Computational Thinking
- Technical/mathematical competencies to represent and reasoning with data (both symbolic and quatitative) and to integrate them in decision-making processes

*1970 – 1980*

*1990 - 2010*

*2010 - 2020*



# Computational Thinking



## Key concepts:

- Abstraction
- Algorithm
- Automation
- Decomposition
- Debugging
- Generalization



# Computational Thinking

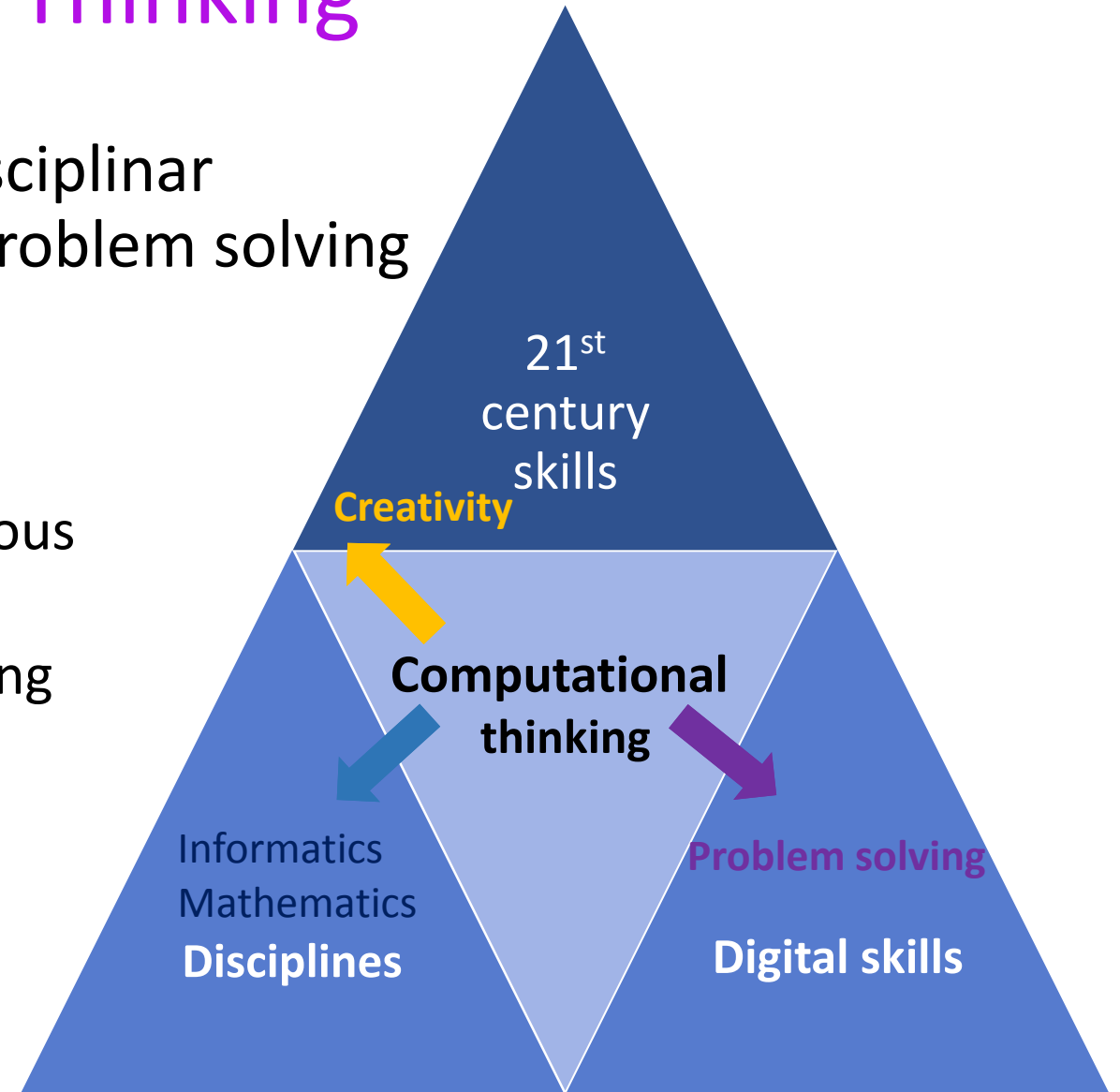
Computational thinking is linked to disciplinary competencies but allows to develop problem solving and creativity skills

- Needs to be learned in context
- Epistemological connections with the various disciplines must be studied
  - ✓ eg. Design of a video-game → modelling  
→ simulation in a given scientific field

## CompuThink study:

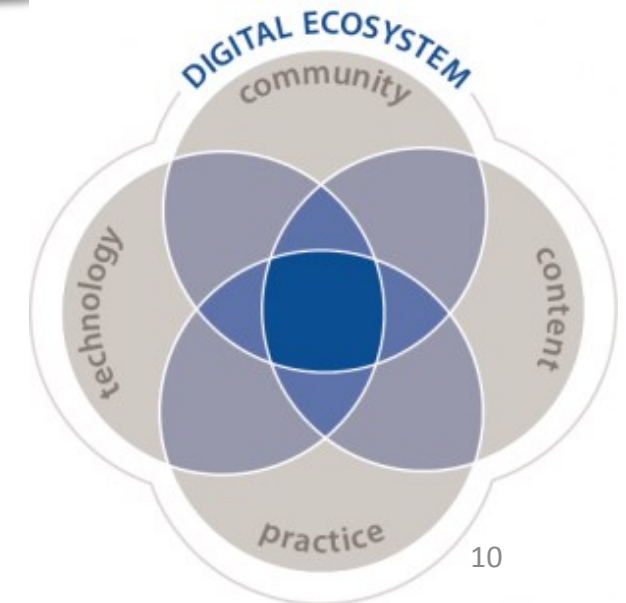
**overview** of Computational Thinking within the context of compulsory education

<https://ec.europa.eu/jrc/en/computational-thinking>



# Learning environments as open eco-systems

- Integration of different tools and platforms
- Interactions of different actors
- Changes in the physical environment (school classes)
- Integration between formal and informal learning
- Attention to physical and manipulative aspects not only to symbolic ones
- Attention to sustainability, inclusiveness, openness, ...



# Learning environments as open eco-system

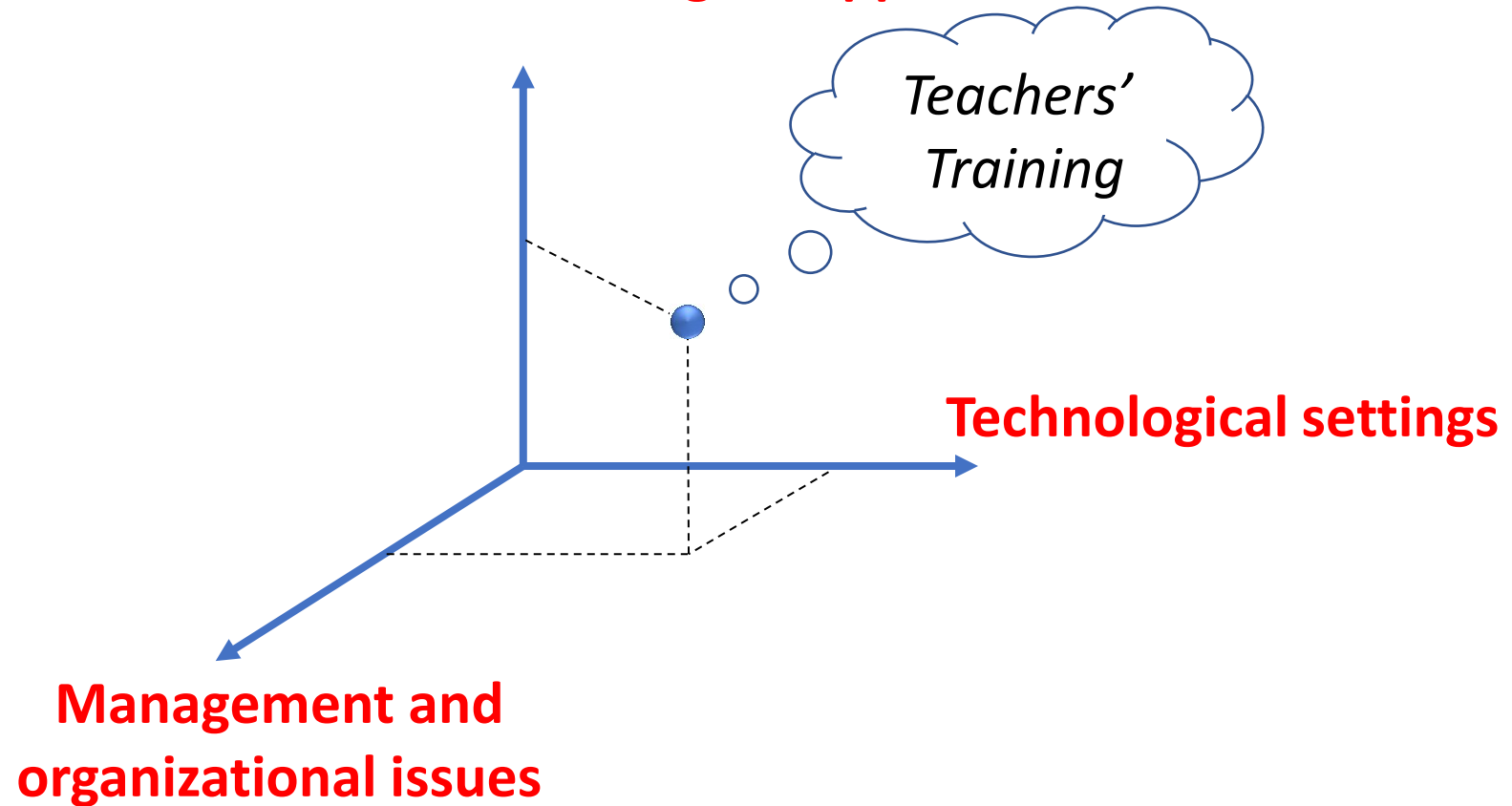
- Crucial role played by the web and its evolution:



- **Amplifier role of the web**: cognitive, collaborative, expressive, social aggregation, resources amplifier, opportunities amplifier, ecc.

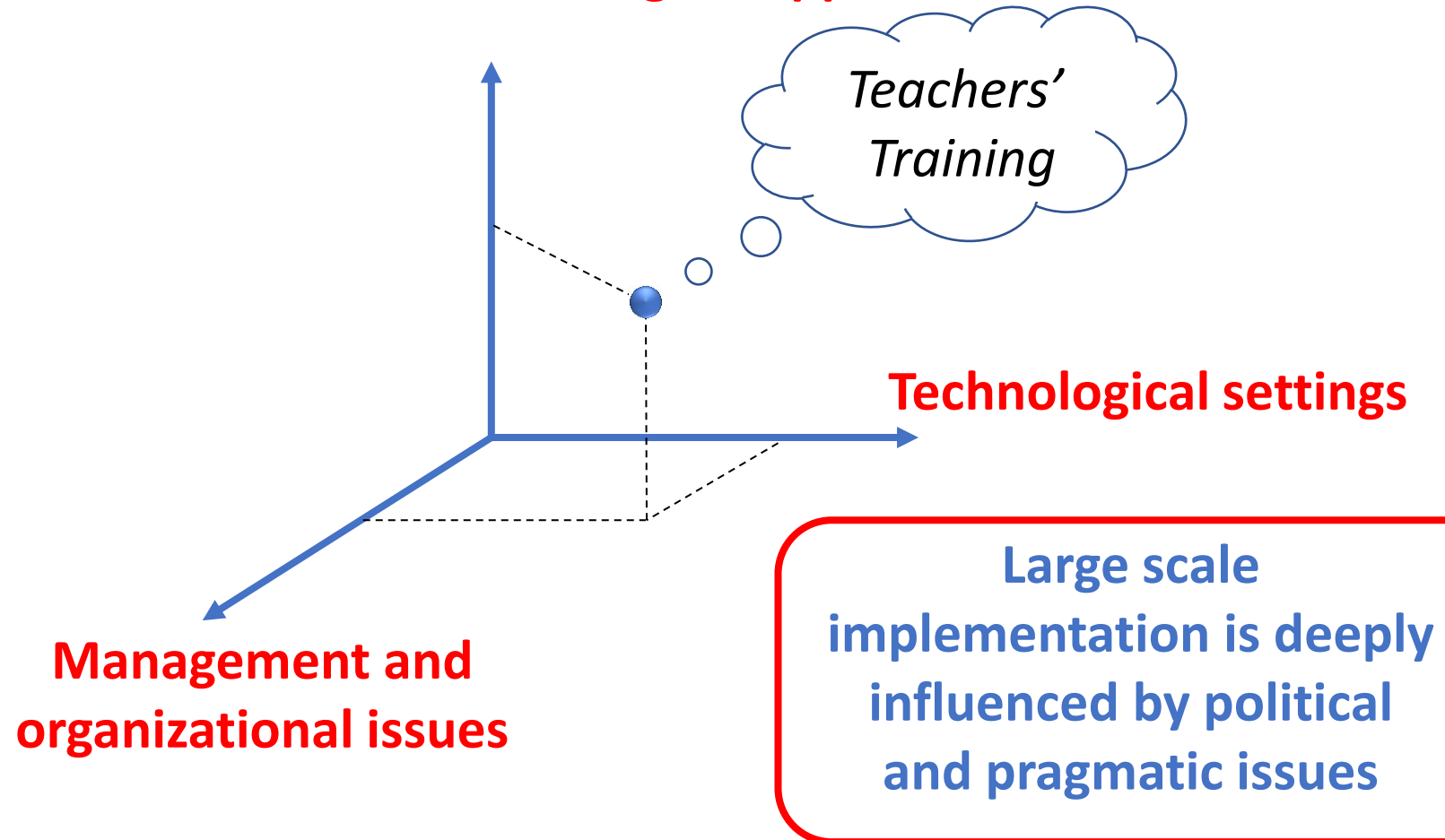
# Scalability & Transferability

Educational and methodological approaches



# Scalability & Transferability

## Educational and methodological approaches



## ICT in Schools: Policies (The case of Italy)

Year	Italian National Initiatives	Strategy
1985	National Plan for informatics	Professional development of maths teachers (introduction of computer science elements)
1997 - 2001	Plan to equip schools with technology and provide teachers with basic ICT skills	Schools were granted autonomy both in tech choices and training initiatives
2000	National program for teachers' training	ICT knowledge and its educational use
2007	ICT use into classroom activities	Different test-bed programmes with pilot schools but limited budget and scope

## Past Italian Initiatives: Outputs

- A significant number of schools were provided with a basic technological infrastructure
- A significant number of teachers was involved in ICT training activities

**BUT**

- The impact on teaching approaches and practice was limited
- Changes remain at the superficial level and did not bring about substantial innovation
- Even if good results are achieved locally they are rarely scaled up at system level

# Current Policy: Italian Plan for Digital Schools

- Launched in 2015
- Part of a major school reform
- 1.1 billion Euros:
  - ✓ digital infrastructure
  - ✓ Educational change and supporting measures
- To receive funds schools need to apply to open competitions submitting project proposals





# Italian Plan for Digital schools

**The Plan is articulated in 35 actions organized into five areas:**

- tools
- skills
- content
- staff training
- supporting measures (e.g. digital libraries, fab-labs, Stakeholder Club, etc.)

# Italian Plan for Digital schools

## Underpinning main ideas:

- ❑ Learning environments integrating technology should be:
  - **Sustainable**: “Bring your own device” indications; mobile labs; ...
  - **Collaborative**: space re-configuration; definition of innovative teaching and learning activities (e.g. flipped classrooms); ...
  - **Open**: reinforcement of the relationships between schools and external reality; “work-based” experiences; external labs; etc.
  
- ❑ Education systems need to be less self-referential, opening up to the world at large: the local community, enterprises, industries, etc.

# Italian Plan for Digital schools

## Main strategic features:

- ☐ The introduction of a “digital catalyst” and of a “digital team” in each school responsible for the implementation of the plan
- ☐ Investment for the creation of new physical places (labs, learning environments, libraries) for technological and methodological innovation
- ☐ Training plan targeting the entire school staff

# Italian Plan for Digital schools

## Problematic issues:

- ☐ The complexity of the implementation programme & the 'parallel' launching of the different actions
- ☐ The many professional and managerial responsibilities assigned to schools
- ☐ The insufficient support offered to schools for preparing proposals to apply to the different actions and during their implementation
- ☐ The fact that some of the actions proposed are optional activities not inserted in the curriculum (e.g. computational thinking, coding, ...)

# Italian Plan for Digital schools

## Problematic issues:

- ☐ The lack of a systemic approach among actions
- ☐ The lack of a comprehensive and systematic plan for the continuous training of teachers and school managers who implement digitalisation projects
- ☐ The necessity to reconsider curricula, evaluation, disciplinary contents, ...
- ☐ The lack of a systematic monitoring of the plan

# ICT and School:

## Critical reflections and indications

### ☐ To invest in training (in a long life learning approach)

- Teachers; school leaders; school staff

### ☐ To re-align with the other elements of the school system

- Evaluation, certification, curricula, disciplinary content

### ☐ To refer to an interconnected and collaborative approach

- From isolated technology use to a more integrated approach; sharing know-how and practices; developing digital resources that can be shared; focusing on whole schools rather than single classes

# ICT and Scool:

## Critical reflections and indications

### ☐ To offer support to schools, on a stable basis

- both in the design and implementation of innovative actions and approaches

### ☐ To strengthen the dialogue with research

- Enhancing and sustaining long-term dialogue in concrete fashion; documenting practice; improving communications; monitoring

# ICT and Scool: The role of research

- Educational research is the crucial link between educational reforms and the effects envisaged
- Only reforms that are based on sound educational research can lead to real and effective changes
- Educational research is not limited to narrow focus on empirical research and statistical results
- It should look behind the statistics and answer - through qualitative and quantitative methods – research questions on key processes in education



# ICT in School: What research can give

- Definition and evaluation of significant practices that integrate technology
- Prototypes
- Systematic and critical assessment of methodologies and theoretical assumptions
- Awareness of the complexity
- Progressive broaden the concept of digital competence and of traditional learning paradigms

# ICT and School: Conclusion

Education in many different countries has been at the forefront of policy experimentation



There has been ample opportunity for educational research to study system change and the differences that national contexts made

Educational research can provide those interdisciplinary and multidisciplinary approaches that are necessary to face complex problems



Educational research by its very nature brings together insights and methods from different disciplines applying them to education

# ICT and Scool: Conclusion

Educational research can make an essential contribution in the area of educational reform



Collaborations between research institutions and associations in different countries can have a crucial role in building teams that are able to draw on different models, methods and traditions to face the multifaced challenges facing school innovation

# The Institute for Educational Technology (ITD-CNR)



- One of the institutes of Italian **National Research Council of Italy (CNR)**
- It is the only public Italian institute entirely devoted to educational technology
- **Main research areas:**
  - E-inclusion
  - Informal and non-formal learning
  - Innovation in disciplinary learning
  - Innovation in professional training
  - New skills for the knowledge society



## Staff

25 researchers/technologists  
16 administrative and technical staff  
Around 13 research fellowships



**SCIENCE & TECHNOLOGY  
DIGITAL LIBRARIES**  
Educazione alla  
"digital scholarship"  
(CNR, Agenda digitale italiana)



**SMART ANGEL**  
Piattaforma cloud mobile  
a sostegno dell'autonomia  
dei disabili intellettivi  
(Aziende Liguri, POLO SI4LIFE)



**TRIS**  
Tecnologie di Rete  
e Inclusione Scolastica  
(Fondazione Telecom,  
MIUR)



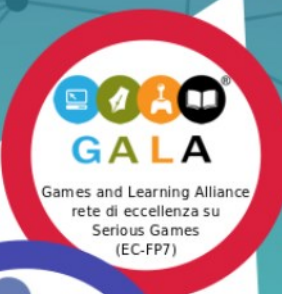
**WHAAM**  
Applicazioni web per il monitoraggio  
degli studenti con ADHD  
(EC-LLP)



**COMPUTHINK**  
Un'analisi di approcci educativi  
per lo sviluppo del pensiero  
computazionale  
(European Commission,  
European Schoolnet)



**ESSEDIQUADRO**  
Servizio Documentazione  
Software Didattico e altre  
risorse digitali  
per l'apprendimento  
(MIUR, INDIRE)



**AREA FORMAZIONE  
SCUOLA IN OSPEDALE**  
Formazione in rete  
per lo sviluppo professionale dei  
Docenti Ospedalieri  
e in Istruzione Domiciliare  
(MIUR, METID)



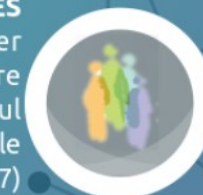
**MAGICAL**  
Imparare creando  
giochi in collaborazione  
(EC-LLP)



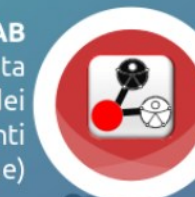
**SCINTILLA**  
Formazione a distanza e  
smartworking per l'inclusione  
lavorativa degli homebound  
(ISFORCOOP Liguria,  
Regione Liguria)



**INSPIRING SCIENCE**  
Educazione scientifica  
con le nuove tecnologie  
(EC-LLP)



**I-TREASURES**  
Nuove metodologie per  
preservare e diffondere  
la conoscenza sul  
patrimonio culturale  
intangibile (EC-FP7)



**SHAREHAB**  
Il social che aiuta  
la riabilitazione dei  
bambini ipovedenti  
(Istituto Chiossone)





CNR – Consiglio Nazionale Ricerche  
ITD – Istituto Tecnologie Didattiche



**Thank you for your attention!!!**



- Fondatore del primo istituto italiano di ricerca in Tecnologie Didattiche
- Progetti di ricerca e applicazione educativa in Italia e Europa
- Focus su temi di ricerca e sviluppo

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ITD Director

#### CONTATTI



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