



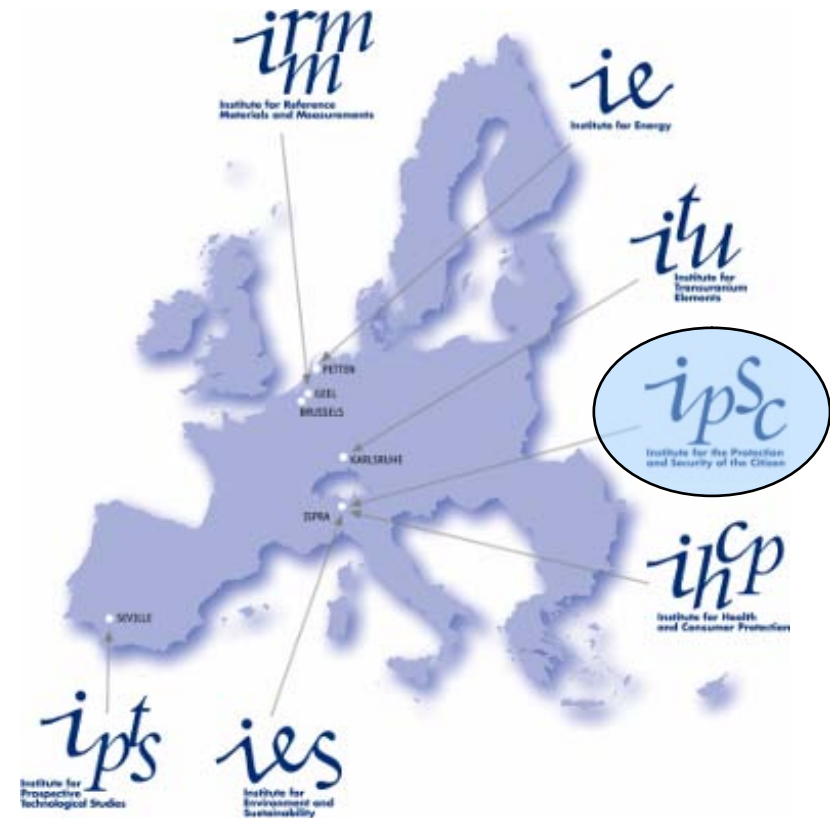
Conceptual Framework for Studying the Effects of ICT in Education

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CRELL at the Joint Research Centre

- CRELL is hosted by the Unit of Applied Statistics and Econometrics, JRC Ispra.
- As a Directorate General of the European Commission, the JRC provides scientific and technical support to Community policy-making.
- 7 Institutes in 5 Member States (total staff: 2,700).
- CRELL was established 2005 by Directorate General Education and Culture and the Joint Research Centre of the European Commission
- CRELL combines research in education, social sciences, economy, econometrics and statistics in an interdisciplinary approach
- 12 staff members



Emergence of European policy on Lifelong Learning

Lisbon European Council March 2000

Open method of coordination : Guidelines for the Member States

Indicators and benchmarks

Exchange of good practice

Peer reviews and mutual learning processes



Common objectives of education and training systems

European Quality Framework

Efficiency and Equity

Detailed Work programme of 2002

3 strategic objectives

13 detailed objectives

5 benchmarks (Reference Levels of Average Performance In EU Member States)

29 indicators for monitoring progress

Standing Group on Indicators and Benchmarks

(27 EU countries, 2 EEA countries, Commission, OECD, Cedefop, Eurydice, CRELL)

Progress Reports

Communication on a Coherent Framework of Indicators and Benchmarks (Feb. 2007)

Policy Areas

1. Improving equity in education and training;
2. Promoting efficiency in education and training;
3. Making lifelong learning a reality;
4. Key competencies among young people;
5. Modernising school education,
6. Modernising VET (the Copenhagen process);
7. Modernising higher education (the Bologna process);
8. Employability.

1. Objectives: Strategic and detailed objectives

1. Improving the quality and effectiveness of education and training systems in the EU
 1. Improving education and training for teachers and trainers
 2. Developing skills for the knowledge society
 3. Ensuring access to ICT for everyone
 4. Increasing recruitment to scientific and technical studies
 5. Making best use of resources
2. Facilitating the access of all to education and training systems
 6. Open learning environment
 7. Making learning more attractive
 8. Supporting active citizenship, equal opportunities and social cohesion
3. Opening up education and training systems to the wider world
 9. Strengthening the links with working life and research and society at large
 10. Developing the spirit of enterprise
 11. Improving foreign language learning
 12. Increasing mobility and exchange
 13. Strengthening the European co-operation

2. Benchmarks: 5 EU European Reference Levels of Average Performance to be reached by 2010

1. Reduce the share of 15 years old low achievers in reading (PISA, level 1) by 20% compared to 2000
2. No more than 10% of young people (aged 18-24) should be early school leavers*
3. At least 85% of young people (aged 22) should have completed at least upper secondary education
4. Increase the number of MST graduates by 15%
5. At least 12,5% of adults (aged 25-64) should participate in lifelong learning.

*Early school leavers: percentage of the population aged 18-24 with at most lower secondary education and not in further education or training.

Progress in the 5 benchmarks

Based on data 2000-2007

Benchmark already achieved:



Mathematics, science and technology graduates

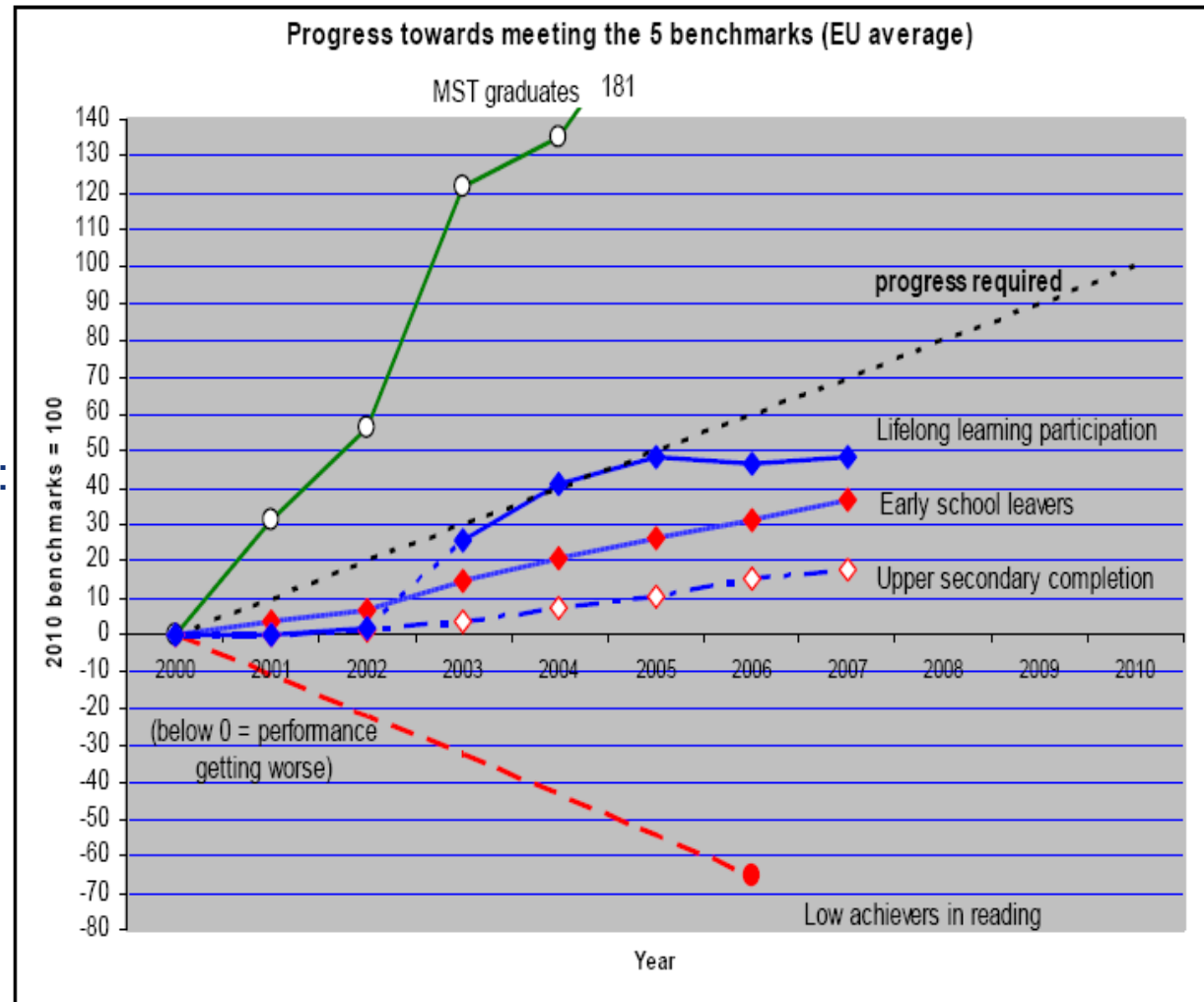
Constant, but not sufficient progress:

- Early school leavers
- Upper secondary attainment
- Lifelong learning participation

No progress yet:



Low achievers in PISA



3. Indicators: Coherent framework of indicators and benchmarks

16 core indicators

- | | |
|---|--|
| 1) Participation in pre-school education | 9) Upper secondary completion rates of young people |
| 2) Special needs education | 10) Professional development of teachers and trainers |
| 3) Early school leavers | 11) Higher education graduates |
| 4) Literacy in reading, mathematics and science | 12) Cross-national mobility of students in higher education |
| 5) Language skills | 13) Participation of adults in lifelong learning |
| 6) ICT skills | 14) Adults' skills |
| 7) Civic skills | 15) Educational attainment of the population |
| 8) Learning to learn skills | 16) Investment in education and training |
| | (+ Creativity and Innovation) |

Data sources



ESS	LFS	Participation
	UOE	Mobility, financing
	CVTS	Vocational education and training
	AES	Self reported adult skills
	SICTU	ICT



PISA survey	Maths, reading, science skills
PISA-Vet	Vocational education and training
TALIS survey	Teacher education (CRELL)
PIAAC survey	Adult skills
AHELO	Learning outcomes in Higher education



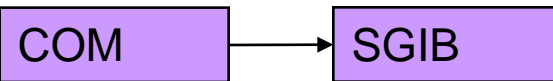
ICCS survey	Civic skills (CRELL)
ICILS	Computer and information literacy



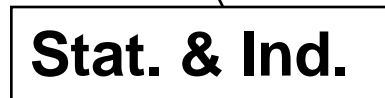
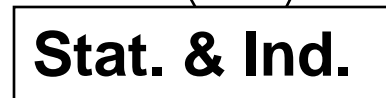
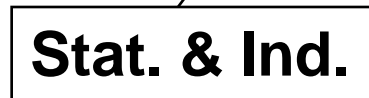
Language survey	Language skills (CRELL)
L2L survey	Learning to learn skills (CRELL)

Indicator development

Quantitative
analysis



Indicator
identification



Data producers



Role of ICT

- **STAFF WORKING PAPER:** « The use of ICT for innovation and lifelong learning for all. A report on progress » (November 2008)
- **ICT CLUSTER** of 18 Member States
- **2009 - The European Year on Creativity and Innovation** → Innovative learning through the use of ICT
- Ongoing **STUDIES** related to :
 - Learning 2.0
 - New learning communities through ICT
 - European-wide comparison of the impact of ICT on school education
 - Development of methodologies for ICT indicators
 - Study of the impact of TEchnology in Primary Schools (STEPS)

Need for regular studies on ICT impact

New technologies (e.g. ePortfolios)



Changing contextual conditions



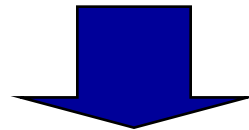
New teaching practices



New ways of learning



Increasing policy interest in understanding phenomena, effects and interrelations



NEED TO BE FREQUENTLY UPDATED ABOUT TRENDS AND ICT Impact

Situation

- Most studies do not provide a clear information about the real effects of ICT on learner and learning for policy-making
- Lack of comprehensive studies of the complex interactions between various types of ICT implementation and the effects of other factors such as institution-based interventions, socio-economic status and institutional expenditures
- No large-scale longitudinal studies of ICT's impact in education

“Need for a thorough, rigorous, and multifaceted approach to analysing the impact of ICT on education and students' learning”
(Cox & Marshall, 2007, also Kikis & Kolias 2005; Aviram & Talmi 2004 etc.)

JRC Research :

Influence of ICT on educational performance

Research questions

- What are the ICT-related factors that (positively or negatively) stimulate performance and outputs of education?
- What is the impact of digital media on personal development and learning?
- How can ICT contribute to flexible learning arrangements?
- What are the indicators for observing educational effects of ICT and how can it be measured at a comparative level across individuals, institutions and countries?

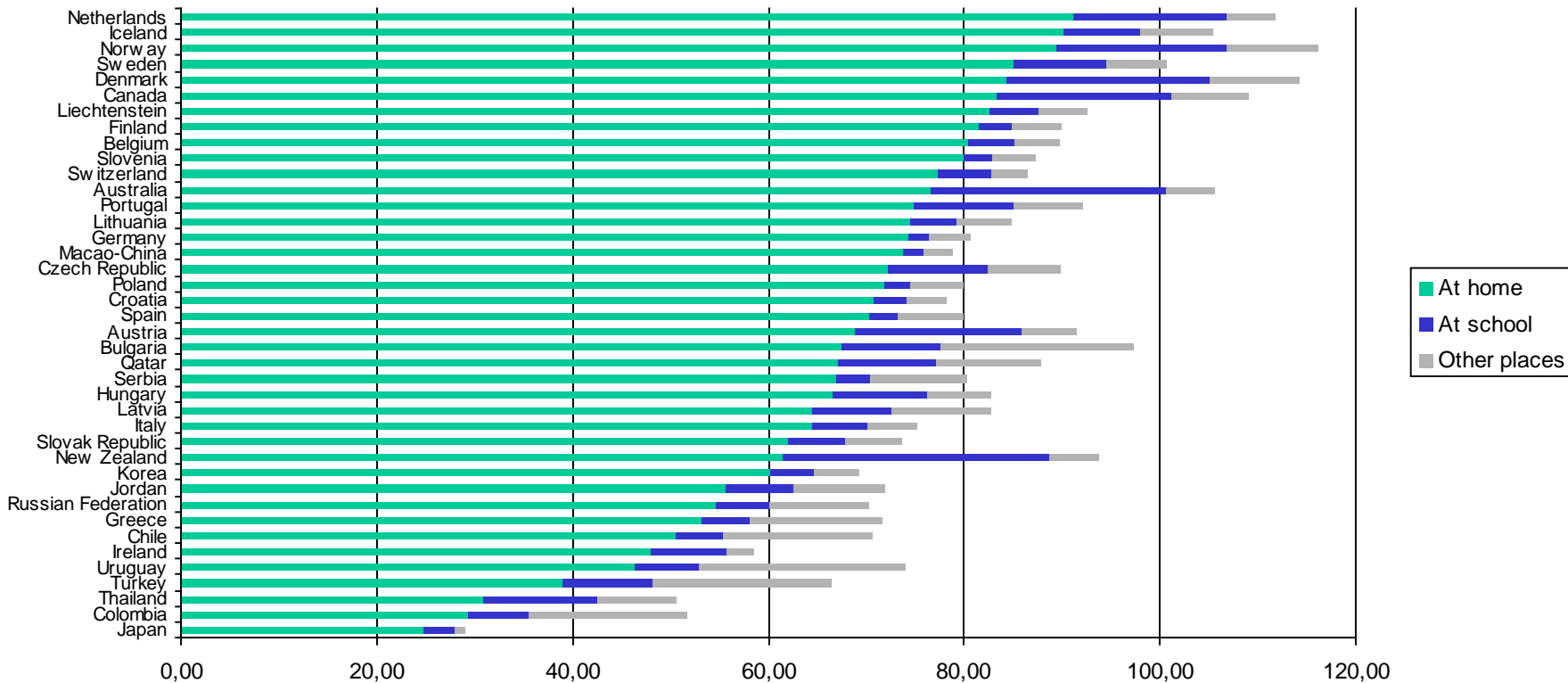
Questions posed to the Assessment of ICT effects

- ...what to assess
 - *What do we want to assess?*
 - *Why do we want to assess (purpose)?*
 - *What “can” we assess, what not?*
 - *Terminology*
- ...how to assess effects
 - *What do we have to look at when assessing the effects?*
 - *Is that what we assess that what we intended to assess?*
 - *What are the interrelations (e.g. to “innovation, creativity etc.”)*
- ...how to monitor effects?
 - *How can we ensure regular monitoring?*
 - *How can we monitor progress made?*
- ...how to come to comparable results?
 - *What data sources are available and what do we have to collect?*
 - *How can existing data feed existing indicators (e.g. on ICT skills) across countries?*
- ...how can we report data (e.g. visualisation)
- ...how to analyse data (analytical methodology)

What can we learn from surveys?

Example PISA: Availability and Use

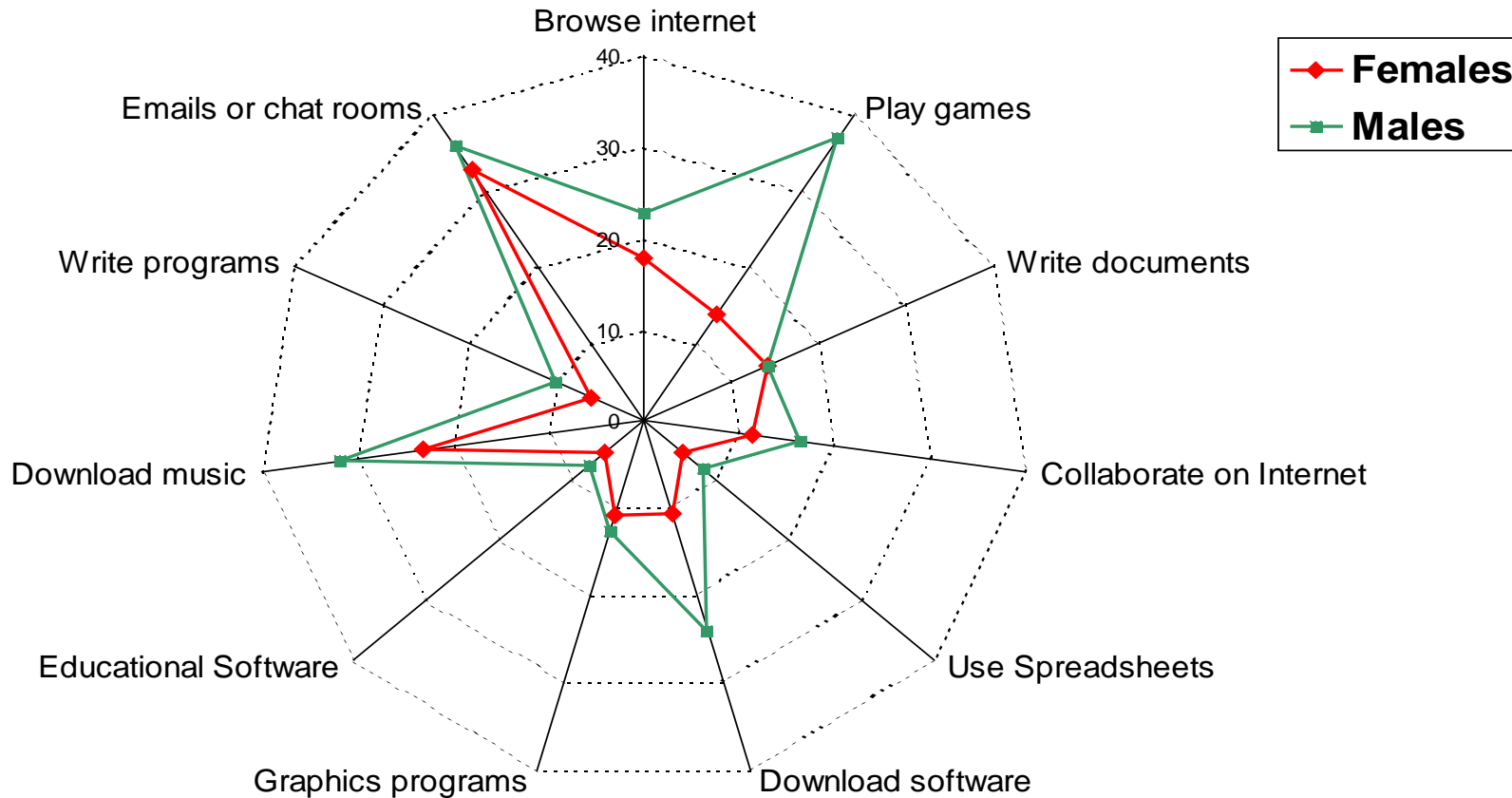
% of respondents that use a computers, everyday or almost everyday



What can we learn from surveys?

Example PISA: PROFILES and PRACTICES

Percentage of students that reported use of computers for the following “Almost everyday”

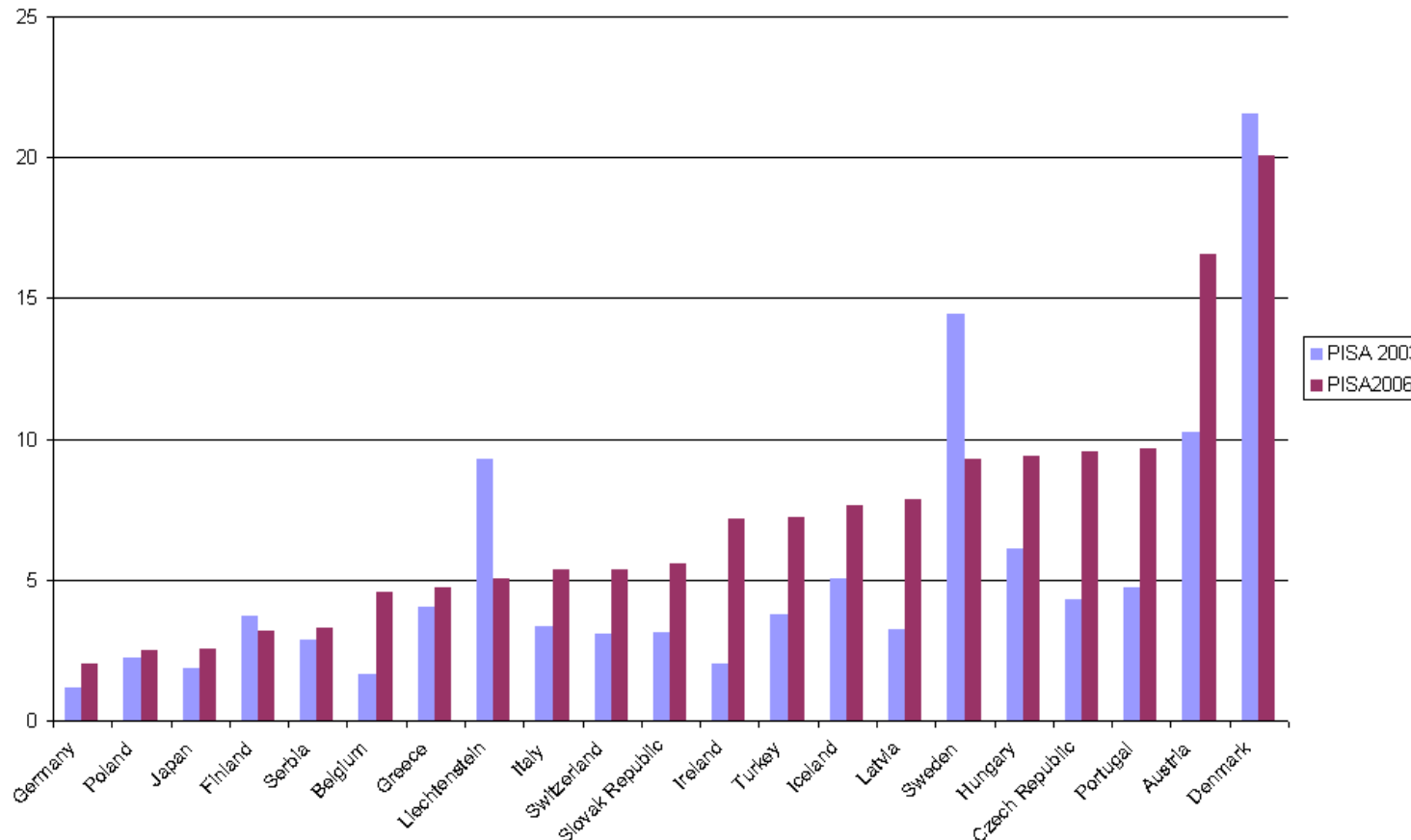


Source: PISA 2006, CRELL calculations

Series represent % of all the students that answered the questions in PISA 2006, weighted by Final Student weight

What can we learn from surveys?

Example PISA: TRENDS



Source: PISA 2006, CRELL calculations: Percentage of students that reported use of computers "Almost everyday" at school
Series represent % of all the students that answered the questions Q3b, PISA 2006 and Q4b in PISA 2003 weighted by Final Student weight

What can we learn from surveys?

Example EMPIRICA: Classroom Practices (subject areas)

Table 5-16: Percentage of teachers who have used a computer in class to present or demonstrate in the last 12 months by subject of teaching

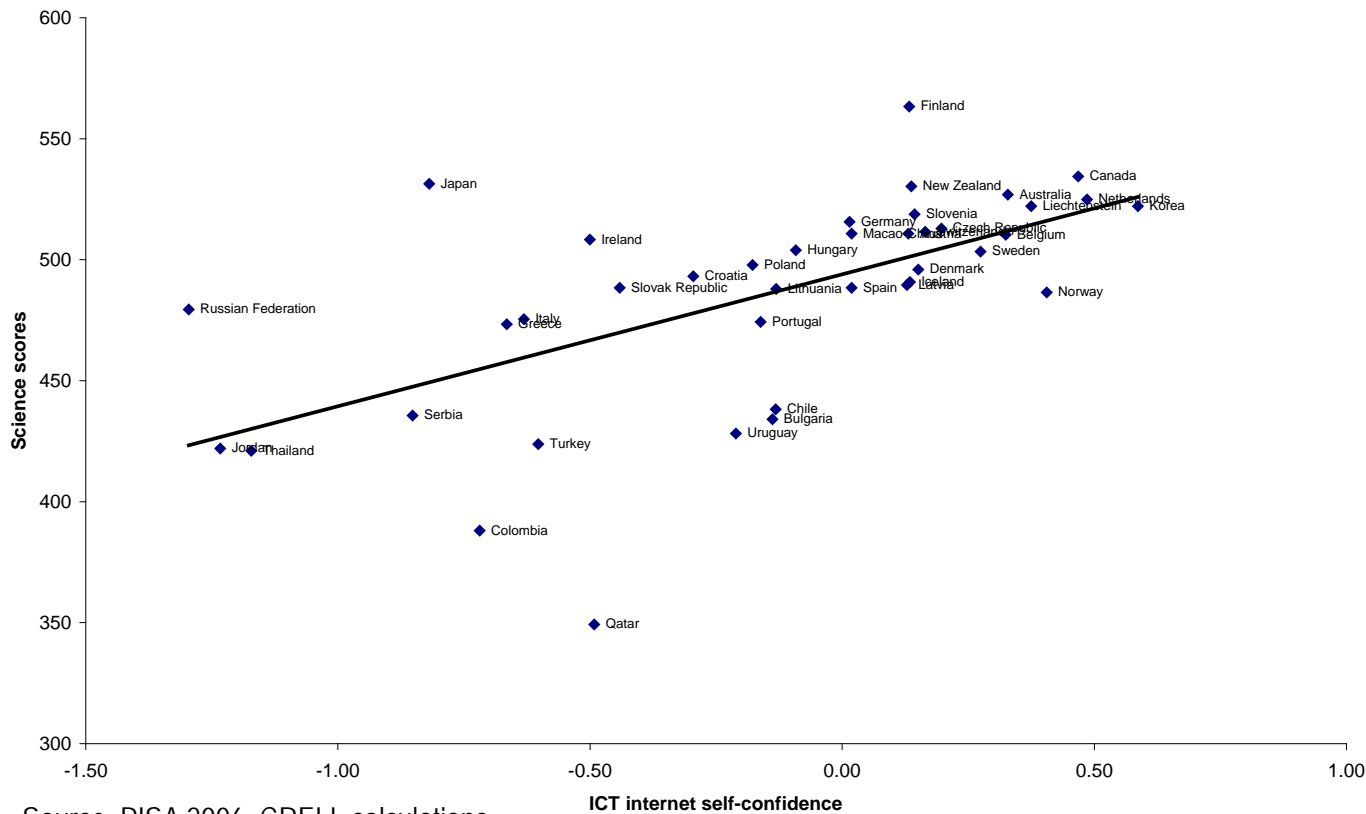
Country	Total	General primary education	Literature and languages	Humanities and social sciences	Science, mathematics, computer sciences	Physical and artistic/crafts education	Vocational education
BE	47.5	49.4	44.3	50.9	45.7	57.7	53.8
CZ	71.1	64.3	73.2	71.3	77.7	68.0	64.9
DK	55.4	51.1	47.3	65.6	58.3	63.2	68.0
DE	69.7	63.9	67.7	70.0	71.5	67.6	69.3
EE	51.1	49.7	52.3	59.3	63.0	33.8	43.1
EL	27.7	23.6	19.8	28.4	43.0	25.2	22.2
ES	61.7	61.9	60.6	55.1	68.7	52.9	75.8
FR	50.9	50.5	48.6	48.0	60.8	26.3	72.0
IE	58.3	61.6	54.8	53.1	55.7	44.7	69.1
IT	58.6	51.1	49.6	62.6	70.6	65.9	65.5
CY	68.4	75.1	70.8	78.3	77.7	54.9	56.8
LV	34.3	27.8	35.7	47.5	38.0	25.4	23.6
LT	55.5	37.9	57.2	67.3	69.4	38.8	50.8
LU	54.4	61.7	42.0	35.4	48.2	51.9	35.9
HU	41.0	21.3	34.7	42.6	52.5	25.4	51.0
MT	65.5	75.2	15.7	53.3	78.8	60.3	0.0
NL	74.6	75.1	74.0	65.1	82.6	61.6	75.1
AT	60.3	51.1	63.8	74.8	59.0	70.8	50.6
PL	54.5	51.0	47.8	60.3	64.6	33.6	54.9
PT	57.8	59.5	50.3	55.0	59.0	54.4	58.1
SI	62.9	64.7	56.1	65.5	74.4	44.2	74.3
SK	66.3	74.3	61.3	68.8	70.7	59.2	68.5
FI	64.7	70.6	54.4	47.1	49.7	53.8	63.1
SE	74.1	61.7	78.6	85.2	73.0	75.1	65.1
UK	89.5	92.2	74.1	92.7	90.9	85.7	87.4
IS	74.8	79.4	82.7	83.7	75.0	56.3	63.2
NO	68.9	73.2	66.3	75.7	70.4	62.3	76.5
EU25	63.4	64.9	58.7	66.8	69.8	60.1	66.1
EU25+2	63.5	65.0	58.9	66.9	69.8	60.2	66.2
EU15	65.2	66.1	60.3	68.5	71.0	65.6	68.6
NMS10	55.5	50.5	51.7	60.1	65.5	40.3	56.6

Base: All teachers in the respective breakdown category and country.
Question: q8
Wording: When you use computers and/or the internet in class, ... are the pupils equipped with computers and/or the internet?
Indicator: Percentage of teachers who have ever used a computer in class to present or demonstrate
Source: empirica; LearnInd 2006 (CTS)

xx.x%: based on at least 50 cases.
 xx.x%: based on at least 10 cases.
 xx.x%: based on less than 10 cases
 *): This value represents collapsed adjacent cells (due to sample sizes too small)

What can we learn from surveys?

Relationships



Source: PISA 2006, CRELL calculations

Series represent average country scores in the total Science scores (as reported in PISA 2006) and the ICT internet self-confidence scale (INTCONF weighted by final student weight)

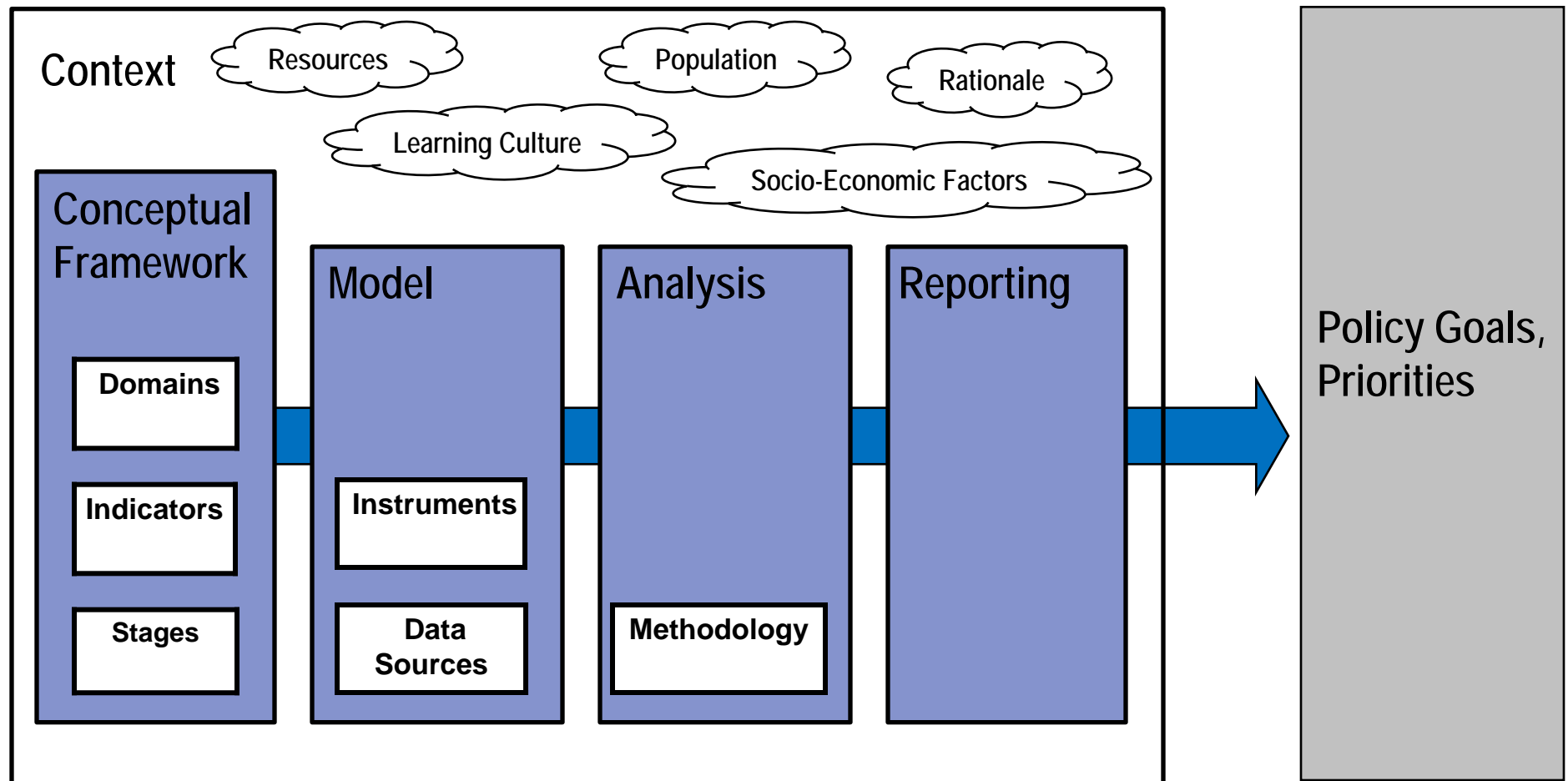
Limitations

- Skills are mainly assessed in terms of ICT literacy and attitudes, not by pedagogical (teaching/learning) practices and mental effects on learner and learning
- Little indications about actual instructional use of ICT and its effects
- If we want to learn about the impact of e-portfolios in education there is little we can conclude from existing studies.

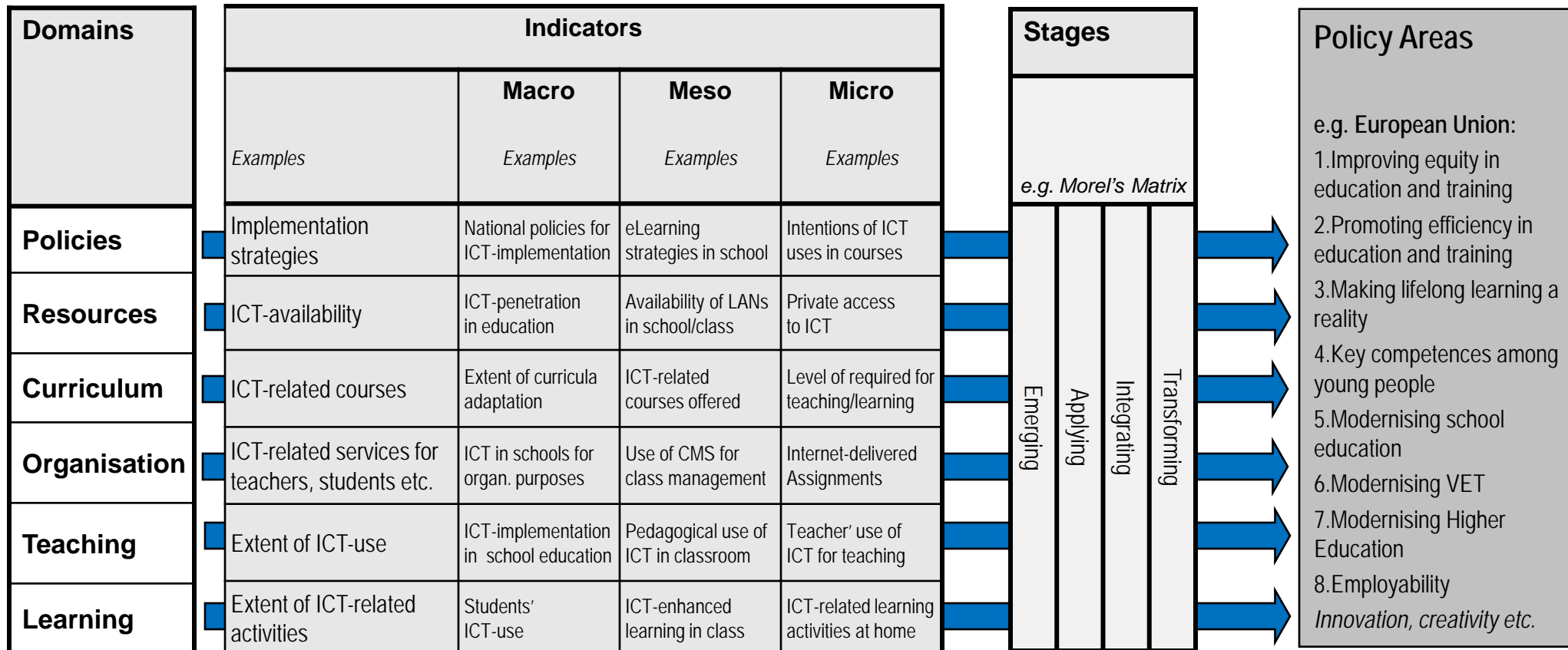
Challenges to be met

- Despite expected benefits for policy stakeholders at a general level current indicators and data do not provide sufficient information about ICT impact on learner and learning
- Studying ICT effects on learner and learning requires analysis at a more detailed and complex level.
- A systematic approach is needed distinguishing between perspectives, domains, indicators of ICT implementation which need to be matched to specific objectives

Monitoring ICT Effects in Education for Policy-making



Conceptual Framework for Studying ICT Effects



Stages: e.g. Morel's Matrix

Criteria/Phase	Emerging	Applying	Integrating	Transforming
Vision	Limited, pragmatic, dominated by interested individuals.	Driven by ICTs specialists.	Driven by subject specialists.	Entire learning community involved.
Learning pedagogy	Teacher centred.	Teacher centred. ICTs as separate subject.	Learner centred. Collaborative.	Critical thinking. Preferred learning styles, collaborative, experiential.
Development plan and policies	Accidental. Restrictive. No planned funding.	Limited. Centralized policies.	Individual subject plans for ICTs. Permissive policies.	ICTs is integral to overall school development plan (budget, professional development etc).
Facilities and resources	Stand-alone PCs for administration and in classrooms. Desktop applications, games.	Computer lab. Internet access.	Networked computer lab and/or classroom PCs. Range of peripherals. Range of subject- oriented content and software. Resource-rich learning centres.	Whole school learning and diverse learning environments. Web-based learning spaces, distance education, student self-management software.
Understanding of curriculum	ICTs literacy. Responsibility of individual teachers.	Use of software in discrete subjects (isolated).	Integrated. Resource-based learning, problem solving project methodology.	Virtual and real time contexts, modelling. Integrated curriculum delivery via the Web.
Professional development	Individual interest.	Training on ICT applications. Unplanned.	Subject-specific, evolving.	Integrated learning community. Innovative. Self-managed, personal vision and plan.
Community	Accidental.	Parental and community involvement.	Subject-based community, providing occasional assistance. Global and local networked communities.	Broad-based learning community involving families, business, industry, organizations, universities etc. School as a learning resource for the community.
Assessment	Responsibility of individual teacher. Didactic. Paper-and-pencil based.	Teacher-centred. Subject-focused.	Learner-centred. Subject-oriented. Integrated. Multiple media to demonstrate attainment.	Continuous, holistic, open-ended, project-based. Learning community involvement.

Analysis / Methodology: e.g. CIPP

	CONTEXT EVALUATION	INPUT EVALUATION	PROCESS EVALUATION	PRODUCT EVALUATION
OBJECTIVE	To define the <u>operating context</u> , to identify and assess <u>needs and opportunities</u> in the context, and to diagnose <u>problems underlying the needs and opportunities</u> .	To identify and assess <u>system capabilities, available input strategies</u> , and designs for implementing the strategies.	To identify or predict, in process, <u>defects in the procedural design or its implementation</u> , to provide information for the preprogrammed decisions, and to maintain a record of <u>procedural events and activities</u> .	To relate <u>outcome information to objectives</u> and to context, input, and process information.
METHOD	By describing the context; by comparing actual and intended inputs and outputs; by comparing probable and possible system performance; and by analyzing possible causes of discrepancies between actualities and intentions.	By describing and analyzing available human and material resources, solution strategies, and procedural designs for relevance, feasibility and economy in the course of action to be taken.	By monitoring the activity's potential procedural barriers and remaining alert to unanticipated ones, by obtaining specified information for programmed decisions, and describing the actual process.	By defining operationally and measuring criteria associated with the objectives, by comparing these measurements with predetermined standards or comparative bases, and by interpreting the outcomes in terms of recorded context, input and process information.
RELATION TO DECISION-MAKING IN THE CHANGE PROCESS	For deciding upon the <u>setting to be served</u> , the <u>goals</u> associated with meeting needs or using opportunities, and the <u>objectives</u> associated with solving problems, i.e., for <u>planning</u> needed changes.	For selecting <u>sources of support, solution strategies</u> , and procedural designs, i.e., for <u>structuring</u> change activities.	For <u>implementing and refining the program design and procedure</u> , i.e., for effecting process control.	For deciding to <u>continue, terminate, modify, or refocus</u> a change activity, and for linking the activity to other major phases of the change process, i.e., for recycling change activities.

Ongoing work

- Define set of indicators (type) and criteria during exploratory studies in selected areas
- Refinement