Digital Technologies for Opening Education and Learning

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ASK - Advanced Digital Systems and Services for Education and Learning

- Founded **January 2000** / celebrating **15 Years**
- A **research** establishment that conducts interdisciplinary applied research in **Learning Technologies** and **Technology-Enhanced Learning**
- Research Outcome: **340 Publications** *(20 publications/year)*
- External funding **7,5M Euro** *(2000-2016)* through **43 R&D projects** *(500k Euro/year)*
- Employed **100+ People** *(Full/Part Contracts and Student Grants)*
- Hosted & Supervised: **15 PhD Students, 69 MSc Student, 70 UG Students** *(total 154 Students)*
- Currently linked with:
  - Department of Digital Systems, University of Piraeus, Greece, EU
  - Information Technology Institute, Center for Research and Technology – Hellas, Greece, EU
- Currently focus:
  - Educational Decision Support Systems based on analyzing Educational Data
  - Technology Supported Assessment based on Learning Analytics
  - Digital Tools and Systems to support (Open) Access to Personalized Learning Experiences for All
Overview

- Why Transformative Innovations in School Education need Digital Technologies?
- Key Technology-supported Educational Innovations
  - Opening Up Education to facilitate Personalized Learning
  - Connecting Learning inside/outside Physical Classrooms through the Digital Cloud
- Current Technical, Pedagogical and Organizational Challenges
  - Smart Integration of Physical Learning Spaces and the Digital Cloud
  - Profiling Digital Competences for Teachers, School Leaders and Schools: Towards a holistic approach on School Digital Competence: suggestions for further research in this area.
- Examples of European Initiatives towards Large-Scale Implementation of Technology-supported Educational Innovations
  - ODS – Open Discovery Space
  - ISE – Inspiring Science Education
Why Transformative Innovations in School Education need Digital Technologies ?
Digital Technologies:

- technology as an enabler for *transformations*
  - worthy to be used when it enables the provision of *learning experiences* that would not have been possible without the digital technologies
Digital Technologies as an enabler for *incremental* or *disruptive* transformations to the way that individuals, groups and organizations “learn” and the way to “assess” learning in the 21st Century

**Objectives**: From acquiring new “knowledge” to develop new and relevant “competences”

**Methods**: From “classroom” based teaching to “context-aware” personalized learning

**Assessment**: From “life-long” degrees and certifications to “on-demand” and “in-context” accreditation of qualifications
- **Solvable Challenges**
  - Integrating ICT in Teachers’ Education
  - Students Low Digital Competences

- **Difficult Challenges**
  - *Creating Authentic Learning Opportunities*
  - *Blending Formal and Informal Learning*

- **Wicked Challenges**
  - Supporting Complex Thinking and Communication
  - Students of Co-Designers of Learning

Fast Trends 1-2 Years
- Growing Ubiquity of Social Media
- Rethinking the Role of Teachers

Mid-range Trends 3-5 Years
- *Increase focus on Open Educational Resources*
- *Increase use of Hybrid Learning Design*

Long-term Trends 5 Years and more
- *Evolution of Online Learning*
- *Rise of Data-Driven Learning and Assessment*

“Opening Up Education”

A European Commission Policy Initiative
Opening Up Education - Aspects of Openness

- **Open Curriculum**: learners can mix educational resources, learning activities, and/or educational courses for different disciplines to meet their needs. This places learners in charge of their own learning and ensures that they will learn what they need to meet their personal desires and requirements.

- **Open Learning**: teachers, experts and/or peers can share new ideas and new understanding during the learning process. This provides learners with opportunities for self-determined and independent learning.

- **Open Assessment**: instead of formal evaluation of learning results, previously led by accredited education providers, assessment of what learners have learned can be carried out by their teachers, others and peers during the learning process via peer to peer or crowd-sourced assessment with on-demand accreditation for learners.

- **Open Platform**: cloud-based provision and the use of open standards make it easier for different platforms and services to exchange information and data.

Open Educational Resources (OERs)
OER Repositories Examples

- OER Commons, USA
- MERLOT, USA
- Learning Resource Exchange, EU
- Le@rning Federation, Australia
- Jorum, UK
OER or LOs Repositories

- web-based systems that
  - organize, classify, store and share OERs (or Learning Objects – LOs) and their associated metadata
- national – thematic
- include **limited explicit information** about the learning and educational context of use of their hosted OER
From OERs to Open Educational Practices (OEPs) and OEP Repositories

Move to...

Learning Object Repository

Learning Design Repository

Open LD #1

Open LD #N

LO #1

LO #2

LO #N
OEP Repositories

The Canadian LD Repository, Canada

LAMS Repository, Australia

iCOPER LD Repository, EU

OSR LD Repository

COSMOS Portal

COSMOS LD Repository, EU
Hierarchical Open Access Framework: 
Elements

Educational Content
Learning Objects
Educational Metadata (EM)
Learning Activities
Educational Courses
Education and/or Training Programmes
Hierarchical Open Access Framework: 

**Users’ Roles**

- **Educational Content**
- **Learning Objects**
- **Educational Metadata (EM)**
- **Learning Activities**
- **Educational Courses**
- **Education and/or Training Programmes**

**Hierarchical Elements**

- **Design and Develop**
  - Teacher / Educational Content Supplier
  - Teacher / Instructional Designer

- **Search / Select**
  - e-Learning Services Provider

- **Deliver**
  - Teacher / Learner

- **Participate**
  - Teacher / Learner
A Hierarchical Open Access to Education and Learning Framework: Overview

The ASK Learning Objects Metadata Authoring Toolkit 2.0 (ASK-LOM-AT 2.0)

- D. Sampson, P. Zervas and G. Chloros, "ASK-LOM-AT 2.0: A Web-Based Tool for Educational Metadata Authoring of Open Educational Resources", in Proc of the 3rd IEEE International Conference on Technology for Education (T4E 2011), Chennai, India, 14-16, July 2011
- D. Sampson, P. Zervas and S. Sotiriou, "Learning Object Repositories for Science Education: The OpenScienceResources Repository", in Proc. of the 11th IEEE International Conference on Advanced Learning Technologies (ICALT 2011), Athens, Georgia, USA, 6-8 July 2011 [BEST POSTER AWARD]

The ASK Learning Objects Metadata Application Profiling Toolkit (ASK-LOM-AP)

The ASK Learning Objects Social Tagging Toolkit (ASK-LOST 2.0)

The ASK Learning Design Toolkit (ASK-LDT)


The ASK Mobile Learning Design Player (ASK-Mobile-LD-Player) & The ASK Mobile SCORM Player

- D. Sampson and P. Zervas, "Enabling Interoperable Mobile Learning: Evaluation results from the use of the SMILE PDA Learning Design Player", in Proc. of the 5th International Workshop on Wireless, Mobile and Ubiquitous Technologies in Education (WMUTE 2008), Beijing, China, IEEE Computer Society, March 2008
From the Physical School Classroom to the Digital Cloud
On School Premises

School Portal/CMS

- Schools use their own technology infrastructure for hosting their portals/CMSs
- Schools portals/CMSs based on open source solutions or custom-based solutions (possibly with an extra cost)
On Digital Cloud
School Portal/CMS as SaaS

- Cloud infrastructures, which offer (a) hosting power, (b) computing power
- Each school can easily create its own portal/CMS – Software as a Service (Saas)
- No need for (a) programming skills and (b) cost for technology infrastructure procurement and maintenance
On School Premises
Teachers’ Communities

- They are not easily organized
- Best practices can not be easily communicated among their members
- Collective knowledge not easily stored and maintained
- Local coverage
- Limited opportunities for professional development
On Digital Cloud

Web-Based Teachers’ Communities

- Online collaboration tools such as Forums, Chats, Wikis, Virtual Worlds for retaining and advancing communities’ knowledge
- Share and reuse educational practices (Open LDs) and educational resources (OERs)
- Beyond local restrictions, wider participation
- More opportunities for professional development
On School Premises
Physical Laboratories

- Space and time constraints
- Limited type of experiments
- Accessibility issues
- High equipment procurement and maintenance costs
- Safety issues
On Digital Cloud

Online Laboratories (Virtual, Remote)

- Availability beyond time and space constraints
- Access to state-of-art experiments (high energy physics, remote telescopes)
- Provisions for people with physical disabilities
- No cost for equipment
- Simulate abnormal situations of experiments (virtual labs)
- Repeat experiments without constraints
Different Levels of Technology-Supported Educational Innovations

- **Level 1:** simple technological shift from local hosting to the cloud – practical added-value but not transformative
  
  \[\text{Infrastructure}\]

- **Level 2:** enhance classroom based activities with access to a wider set of resources/tools – incremental school based innovation
  
  \[\text{Resources – Teachers Competences}\]

- **Level 3:** orchestrate personalized learning experiences inside but mainly outside the school classroom – transformative innovation
  
  \[\text{Educational Policies and Organizational Changes}\]
Technical – Pedagogical – Organizational Challenges
Smart integration of *Physical Learning Spaces* and the *Digital Cloud*

- **connect**

<table>
<thead>
<tr>
<th>Within Classroom-based activities</th>
<th>Outside Classroom-based activities</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Within School</td>
</tr>
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<td></td>
<td>Outside School</td>
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  **via Cloud Technologies**

- **sharing**

<table>
<thead>
<tr>
<th>People</th>
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<td>Resources</td>
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<tr>
<td>Practices</td>
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<tr>
<td>Tools/Services</td>
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<tr>
<td>Interaction Data</td>
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Smart integration of

**Physical Learning Spaces and the Digital Cloud**

**Methods and Tools**

- **Orchestrate** Educational Activities (teaching – collaboration - scaffolding - feedback – assessment)
- **Collect** and **Analyze** Educationally Meaningful **Data** from all these activities
- **In a Smart Learning Environments** which integrate **Physical Learning Spaces** and the **Digital Cloud**
Technology-Supported Transformative Innovations for the 21st Century School Education: Teachers – School Leaders – Schools (not infrastructure)
Huge amounts of public funds have been invested all over the world on purchasing and installing technologies in schools – tremendous *investments in infrastructure*

However, limited investments have been planned and implemented in systematically developing, assessing and recognizing the essential digital competences for school teachers and leaders – limited *investments in human resources development*

This has led to *limited* educational *added-value* and the *lack* of transformative *impact* at school education ...
Although, the systematic development, assessment and recognition of appropriate *educationally meaningful digital competences* for both school *teachers* and *leaders* is recognized as a major element for the *up-take* of technology-supported and technology-enabled school innovations *at large scale*.

Still, both *Initial* and *Continuing* School Teachers and Leaders *Education* are predominately traditional both in terms of scope, methods and assessment in many parts of the World.
Furthermore, it is assumed

- that **all in-service teachers are able to** design and implement technology-supported and technology-enabled school innovations using a wide range of digital technologies for teaching and assessing their students within the national curricula with **limited additional professional development**

- that **all schools** share more or less the same level of **educationally relevant digital competences** ("e-Maturity") at organizational level to adopt technology-supported educational innovation, just because they have installed the same technological infrastructure
Profiling Digital Competences for
• Teachers
• School Leaders
• Schools
Teachers’ ICT Competence Profiles

- UNESCO ICT Competency Framework for Teachers (2011) [International] [http://tinyurl.com/ocaxgqk]
- International Society for Technology in Education (ISTE) Standards for Teachers (2008) [USA] [http://tinyurl.com/myft7rn]
- Technological Pedagogical Content Knowledge (TPACK) (2006) [tpack.org] [http://www.tpack.org/]
School Leaders’ ICT Competence Profiles

- Interstate School Leaders Licensure Consortium (ISLLC) Standards on Educational Leadership (2008) [USA]
  [http://tinyurl.com/q69cogt]

- International Society for Technology in Education (ISTE) Standards for Administrators (2009) [USA]
  [http://tinyurl.com/nmbcurv]
Schools’ ICT Competence Profiles (eMaturity)

- NAACE ICT-MARK (2014) [UK]
  [http://www.naace.co.uk/ictmark]
- eLearning RoadMap (2012) [Ireland]
  [http://tinyurl.com/naroatv]
- Australasian Council on Open Distance and e-Learning Benchmarks (2014)
  [http://tinyurl.com/oh3tvr]
- eLearning Maturity Model (2007) [New Zealand]
  [http://tinyurl.com/q6majjk]
Towards a holistic approach on School Digital Competence: suggestions for further research in this area
• Globally, **large-scale national initiatives** are being implemented towards promoting the level and quality of Information and Communication Technologies (ICT) use in school education.

• However, despite these efforts, the current level of **ICT uptake** at school level remains **low**.

• A wide range of factors have been identified as **barriers**, including lack of teachers' ICT Competences and lack of ICT infrastructure.

• Typically, these barriers are tackled separately without taking into consideration the ecosystemic nature of **schools as organizations**.

• We propose that a holistic approach on **School Digital Competence** based on combining both individual Teachers' and School Leaders’ ICT Competences and School’s e-Maturity is needed.
Research Challenge

- Educational Decision Support Systems at School Level
  - based on the unique profile of each school ecosystem
  - Supported by a cloud-based multi-stake platform that collects and analyses educational data at large scale.

- This approach moves forward the traditional perception of “one-size-fits-all” from a school level perspective, treating individual schools as unique educational organisation entities.
ASK: Advanced Digital Systems and Services for Education and Learning

- P. Zervas, S. Sergis, D. Sampson and S. Fyskilis, “Towards Competence-Based Learning Design Driven Remote and Virtual Labs Recommendations for Teachers”, *Technology, Knowledge and Learning*, Springer [Accepted for Publication]
Examples of two Large-Scale European projects funded by European Commission ICT Policy Support Programme (2012-2016)
A socially-powered and multilingual open learning infrastructure to boost the adoption of eLearning Resources;

involving 51 organizations with total budget of 15.8300.000€;

engaging 2.000 Schools and 10.000 Teachers (2012-2015)

http://www.opendiscoveryspace.eu/
## ODS - Open Discovery Space (2/7)

### European Schools:
- Can develop their **own School Portal on the Cloud and share their school resources (OERs and Lesson Plans/Educational Scenarios)**

### European Teachers:
- Can have access to a **wide number of OERs** from a network of web repositories
- Can have access to a number of **online teachers’ community tools** such as forums, wikis, and blogs
Advanced Digital Systems and Services for Education and Learning (ASK)

ODS - Open Discovery Space (3/7)

- **European Schools**
  - Can complete their ICT Competence Profiles (e-Maturity) based on eLearning RoadMap – Ireland and monitor their progress

- **European Teachers**
  - Can complete their ICT Competence Profiles based on UNESCO ICT Competency Framework for Teachers and monitor their progress
**European Schools:**

- Can **engage** their Teachers in **Online Training Activities** towards enhancing their Competences about using ICT in education.
Our related research: Recommender Systems for Education

- **Dynamic Elicitation of ICT Competence-based Teacher Profiles** based on their usage patterns (e.g., learning resource views, ratings, bookmarks) within Learning Object Repositories [1]

- **Personalised ICT Competence-based Learning Resource Recommendations to Teachers** based on their unique ICT-CP towards focused recommendation of appropriate Learning Resources [2]

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ODS - Open Discovery Space (6/7)

- **Added value / Anticipated Benefits of our research**
  - **Dynamic** elicitation of teachers’ ICT Competence Profiles based on their usage patterns within Learning Object Repositories (e.g., ODS)
    - More dense (*quantity*) automatically generated data (manual input of teachers’ ICT-CP not required)
    - More “credible” (*quality*) data (data are elicited from teachers’ actions, not self opinion – a common problem in literature)
  - **Personalized** learning resource recommendations for educational scenario design, based on the unique ICT competences of each teacher
    - More accurate recommendations than traditional methods
    - Based on identifying neighborhoods of teachers with similar levels of ICT Competences with inter- or intra-school communities.


ODS - Open Discovery Space (7/7)

- **Added value / Anticipated Benefits of our research**
  
  - Utilization of the elicited teacher ICT-CPs for designing School Teachers and Leaders **Decision Support Systems** for:
    
    o Recommendation of ICT Competence-wise appropriate Learning Resources to **Teachers** for their educational scenario design
    
    o Recommendation of targeted professional training to **Teachers** based on their identified ICT Competence shortcomings
    
    o Recommendation to **School Leaders** for recruiting suitable candidate teachers towards enhancing their overall **School Digital Competence**.

P. Zervas, S. Sergis, D. Sampson and S. Fyskilis, “Towards Competence-Based Learning Design Driven Remote and Virtual Labs Recommendations for Teachers”, *Technology, Knowledge and Learning*, Springer  [Accepted for Publication]
ISE - Inspiring Science Education (1/5)

Large Scale Experimentation Scenarios to Mainstream eLearning in Science, Mathematics and Technology in Primary and Secondary Schools;

involving 31 organizations with total budget of 9.800.000€;

engaging 5,000 Schools and 25,000 Teachers (2013-2016)

http://www.inspiringscience.eu/
ISE - Inspiring Science Education (2/5)

- Builds on top of the Open Discovery Space Technical Infrastructure
- Emphasizes on Science, Technology, Engineering and Mathematics (STEM) Education
- Adopts Inquiry-based Teaching (the 5E Model) to cultivate problem solving competence
- A widely accepted framework for assessing students’ problem solving competence is PISA 2012 Problem Solving Framework
- However, PISA 2012 problem solving competence assessment is *summative* and *disconnected from the school science teaching practice*. 
Ideally, we need “systems” for

(a) Students to receive immediate feedback during the process of developing their individual problem solving competence within the phases of the inquiry cycle, and

(b) Teachers to adapt their designed lesson plans and/or educational scenarios, so as to support their students in the process of developing their individual problem solving competences + teachers to receive concrete evidence about students’ performance on problem solving competence and clearly link them to their science teaching practices towards reflection and remedy.
ISE - Inspiring Science Education (4/5)

- European Schools:
  - Can engage their Teachers in designing lesson plans and educational scenarios that (a) follow the principles of inquiry learning enhanced with Problem Solving Assessment Questions following the PISA 2012 Problem Solving Assessment Framework and (b) deploy existing resources (from ODS) and tools (such as online labs or 3D Tools) and store them back on the ODS School Portals

ISE Authoring Tool
ISE - Inspiring Science Education (5/5)

- European Schools:
  - Can engage their Teachers in delivering previously designed lessons and educational scenarios for collection of students’ assessment data that can be compared with PISA 2012 reference data.
6-9 July 2015 Hualien, Taiwan

http://www.ask4research.info/icalt/2015/
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