14-16 June, 2011, Sofia, Bulgaria

UNESCO International Workshop

RE-DESIGNING

INSTITUTIONAL POLICIES AND PRACTICES

TO ENHANCE THE **Q**UALITY OF **E**DUCATION THROUGH

INNOVATIVE USE OF **D**IGITAL TECHNOLOGIES

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PREFACE

The present book contains the Proceedings of the UNESCO International Workshop *QED: Re-Designing Institutional Policies and Practices, to Enhance the **Q**uality of **E**ducation through Innovative Use of **D**igital Technologies*, held in Sofia, Bulgaria on 14-16 June 2010. It is the forerunner of the UNESCO activities at the State University of Library Studies and Information Technologies (SULSIT). The QED is the natural continuation of EDUsummIT 2011: *Building a Global Community of Policy-Makers, Educators, and Researchers to Move Education into the Digital Age.*

The QED workshop was an action taken by UNESCO's Teaching Policy and Development Section, co-orgnized with the SULSIT, Sofia, Bulgaria, together with The Bulgarian Academy of Sciences, The Bulgarian Ministry of Education, Youth and Science and the Bulgarian National Commission for UNESCO. It has been successfully implemented and has achieved multi-direction positive results and impact. Useful ideas and practices have been discussed, which will continue to be built up and used in the future including the following ones:

- to re-establish the Children in the Information Age Initiative and Conference with the support of UNESCO, IFIP, and other international organizations
- to establish forums and communities of practice for cross-stakeholder ICT in Education communication
- to develop and establish a repository of open ICT in Education best practices (SULSIT) and to develop and launch an initiative for multi-lingual and multi-cultural communication and exchange of best practices in ICT in Education.

Although presented in a condensed form here the contributions reflect the main ideas conveyed by their authors at the QED workshop and will hopefully serve as an inspirational source for further work towards advancing education into the digital age.

Evgenia Sendova
Eugenia Kovatcheva

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Stoyan Denchev, University of Library Studies and Information Technologies
Evgenia Sendova, Bulgarian Academy of Sciences
Mariana Patru, Program Specialist in ICTs, UNESCO

UNESCO 2011

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I. BACKGROUND

International Workshop *QED: Re-designing Institutional Policies and Practices to Enhance the Quality of Education through Innovative Use of Digital Technologies* (14-16 June 2011, Sofia, Bulgaria) was an action taken by UNESCO's Teaching Policy and Development Section, co-orgnized with the State University of Library Studies and Information Technologies (SULSIT), Sofia, Bulgaria, together with The Bulgarian Academy of Sciences, The Bulgarian Ministry of Education, Youth and Science and the Bulgarian National Commission for UNESCO.

The QED was also as a follow-up to EDUsummIT 2011.

The workshop had the following objectives:

- to identify innovative institutional policies that define 21st century education systems and support new roles for teachers;
- to propose model strategies for addressing the needs of all learners by mainstreaming 21st century pedagogies and technologies - such as collaborative, cross-disciplinary and inquiry-based learning projects - into curricula and teacher professional development courses;
- to put forward exemplary national policies and initiatives that will help advance the public education system into the 21st century;
- to develop recommendations on knowledge-sharing, collaboration and networking at regional/global level to drive forward ICT-enabled educational reform in the digital age.

The workshop included more than 80 attendees - policy makers, researchers, professionals, teachers, educators and ICT specialists. In addition - a local satellite ICT teachers' workshop with about 40 participants was hold on 13 June in the SULSIT.

Workshop participants:

- 14 foreign experts from Germany, Hungary, Italy, Japan, FYROM, the Netherland, Russian Federation, Spain, USA;
- 25 - Bulgarian researchers, university lecturers, ICT specialists and policy makers;
- 40 teachers and educators.

II. FEATURES OF THE WORKSHOP

High-Level Participation and Eminent Keynote Speakers

Eight word recognized specialists,representing wide geographical coverage were invited by SULSIT based on nominations by UNESCO's Teaching Policy and Development Section, and the Bulgarian National Commission for UNESCO to give lectures on present problems and actual issues, innovative projects, best practices, history in the field of Quality of Education and Innovative Use of Digital Technologies around the world: Mariana Patru (UNESCO), Paul Resta (University of Texas at Austin, USA), Joke Voogt (University of Twente, The Netherlands), Evgueni Khvilon (UNESCO Chair in Innovative and Information Technologies in Higher Professional Education, Moscow, Russian Federation), Marta Turcsanyi-Szabo (ELTE University, Hungary), Stephan Pascall (Former Member of DG INFSO, European Commission), Plamen Nedkov (IT STAR, Central, Eastern and Southern Europe), Emma Kiselova (UNESCO Chair in e-Learning, Universitat Oberta de Catalunya, Spain). The workshop was open by representatives of the Bulgarian Ministry of Education, Youth and Science, the Ministry of Culture and the UNESCO Bulgarian Commission. The workshop participants were higher-level officials, policy-makers, experts and educators from different countries - Germany, Italy, Hungary, The Netherlands, USA, and Japan.

Invited Experts

There were 19 invited speakers from universities, academia, research institutions and schools as follows:

- **SULSIT, Sofia, Bulgaria** - Stoyan Denchev, Roumen Nikolov, Ivanka Yankova;
- **Sofia University, Bulgaria** - Krassen Stefanov, Eliza Stefanova, Nikolina Nikolova, Eugenia Kovatcheva;
- **Bulgarian Academy of Sciences** - Blagovest Sendov, Petar Kenderov, Evgenia Sendova, Radoslav Pavlov;
- **ITSOS *Marie Curie*, Milan, Italy** - Pierfranco Ravotto;
- **Shizuoka University, Japan** – Kamen Kanev;
- **The University of the West Indies, Trinidad and Tobago** Alexander Nikov;
- **Sofia schools** - Ekaterina Pavlova, Ludmila Karamanoleva, Steliana Kokinova;
- **NGO, *Zaedno v chas* (*Teach for Bulgaria*)** Evgenia Peeva, Rebecca Helmer.

Program with a Package of Events

The workshop program was structured so as to include in addition to the keynote lecture sessions the following activities:

- a special international symposium *From "Children in the Information Age" to "Children in the Knowledge Society"* (Session in memory of Ivan Stanchev)
- a teacher session: *THE 21ST CENTURY PEDAGOGY: The Inquiry-based Learning in Action: Good practices of Fibonacci teachers*
- a social event – visiting the Boyana Church - world heritage under the UNESCO protection, and the National History Museum.
- Organizing formal ceremony in SULSIT: Certificate hand-delivery to teachers having demonstrated long-term good practices; Sign of Honour of SULSIT giving to Mariana Patru, Johanna Vooght and Evgueni Khvilon.

In-depth Exchange of Expertise and Interaction

There were two panel discussions specially set for *Policies, Strategies, and Practices in ICT Enhanced Education* and *Policy Making to Advance Education to Digital Age* respectively on 14 and 16 of June.

On 15 of June there were two sessions on *Innovative Educational Practices* as well as a session on *Open Educational Recourses and Cultural Heritage*.

Popularization, Visibility

Throughout the whole period of the project implementation, the Communication Strategy was carried out, which had its visual, verbal, eventful and contextual dimensions.

Visual aspect

In accordance with the requirements of the UNESCO, its visual identification was observed together with recognizing the unique project vision.

Basic PR tools:

- QED Workshop Logo;
- The QED brochure;
- Posters;
- The QED web-site*: http://qed.unibit.bg* proved to be a very important source for promoting the ideas of the event, thus becoming a promising platform for the project future development. It is announced on the SULSIT web-site, the Bulgarian National Commission for UNESCO web site; the Fibonacci Project site,

and the Italian electronic newspaper Bricks *http://bricks.maieutiche.economia.unitn.it/.*

The QED Workshop Photo archive

is being maintained, tracing back the complete realization of the project activities, and documenting its successful development.

Verbal aspect

The the event has been reflected in various media sources with announces, reports, interviews. A 'QED Media Coverage' archive is being maintained.

Press Release

spread on 10 June 2011, 12 June 2011, 13 June 2011.

QED Media Coverage' Archive - Twelve electronic Media published the Press Release for the event.

- 10.06.2011. KROSS Agency. In-coming events.
- UNESCO International Workshop QED: Re-designing Institutional Policies and Practices to Enhance the Quality of Teaching through Innovative Use of Digital Technologies
- 10.06.2011. SvejoNet. *http://svejo.net/1160667*-mezhdunaroden-yunesko-seminar-v-sofiya-za-inovativno-prilozhenie-na-digitalnite-tehnologii-v-obrazovanieto
- 12.06.2011. Cultural News Info.kulturni-novini.info http*://www.novini-te.com/bg-1/Международен-ЮНЕСКО-семинар-в-София*
- 12.06.2011. News Den BG. *http://news.den.bg/home/arts/Международен-ЮНЕСКО-семинар-в-Софи*
- 13.06.2011. Klassa.bg. *http://www.klassa.bg/news/Read/article/171838_*
- 13.06.2011. БГНЕС *http://www.bgnes.com*
- *14.06.2011. http://www.competencemap.bg/language/bg/ftp/.../bulletin-14-06-2011-pr.pdf*
- 14.06.2011 Novinite za Vas *http://novinite.za-vas.com/date/2011/06/12/*
- 14.06.2011 Knigomreza *http://knigomrezha.wordpress.com/2011/04/10/*
- 14.06.2011. News Svetni me *http://news.svetni.me/see/VWnb-*
- 14.06.2011. PrehodBG *http://prehodbg.com/aggregator/balgariya/2010/03/25/photo/*

- 14.06.2011 Vesti.bg

Contextual Aspect

Informing about and popularizing the aims and the impact of the QED Workshop amongst other forms of current activities of SULSIT, UNESCO's Teaching Policy and Development Section, The Bulgarian Academy of Sciences, The Bulgarian Ministry of Education, Youth and Science and the Bulgarian National Commission for UNESCO such as: conferences, seminars, exhibitions, celebrations and others.

III. CLOSING WITH RECOMMENDATIONS FROM THE PARTICIPANTS

The common and unanimous evaluation of the project team, the project beneficiaries and partners is that the International Workshop QED: *Re-designing Institutional Policies and Practices to Enhance the Quality of Education through Innovative Use of Digital Technologies* (14-16 June 2011, Sofia, Bulgaria) has been successfully implemented and has achieved multi-direction positive results and impact. Useful experience has been gathered, which will continue to be built up and used in the future.

Towards Knowledge Societies (KS)

The vision of the QED International Workshop towards knowledge societies is in full harmony with the UNESCO World Report published in 2005 which offers an intellectual, strategic and ethical vision on KS:

- Education and access to knowledge
- Quality education for all
- Knowledge sharing as a development imperative
- Innovative approaches to e-learning

Open and Distance Learning - a major strategy for expanding access, raising quality and ensuring cost-effectiveness

Idea #1: Building shared vision for policy makers

A pre-assembled kit has to be built in support of a shared vision of the policy makers:

- The kit contains examples of successful policy models and implementation plans for teaching and learning with ICT in the 21st century.
- The kit could be accompanied with examples from a database.

Idea #2: Database of promising practices for teachers

A database with promising practices for learning with ICT in the 21st century should be developed with the following features:

- Basic function: to start the conversation of teaching and learning in the 21st century at school / teacher education level
- Illustrating the implementation of 21st century skills at different age levels
- Illustrating how technologies can be used to support 21st century learning
- Simple but convincing examples

- When possible with small video clips
- National database (because of language issues)
- National databases linked to a global database (maintained and hosted by UNESCO)
- Feeds into communities of teachers in specific settings
- Adding other experts to the communities of teachers
- Accompanied with a toolkit for how to work with teachers

Idea #3: Portraits of 21st century learners

Aim:

- to understand better how young adults (school leaders) and possibly also at other age levels) experience the need for 21st century competencies and the role of formal/informal learning in acquiring these competencies

Why: to inform policy and practice

What:

- a group of young adults (secondary school leavers) is selected; they are followed for a period of time
- they reflect on what competencies they need for the 21st century
- how, where and when they learn (or not) these competencies (formal/informal learning)
- discuss this with their peers, with teachers/ school leaders and employers.
- through social media (and every now and then) face to face;

How:

- the project runs for a specific period of time (one year?)
- committed countries have their own group of (21?) young adults
- they meet internationally through social media (and one or twice face to face) under the auspices of UNESCO

Some questions raised

- What would you suggest to the policy-makers?
- How can they support innovative teachers?
- How can they help their development?
- How could the respect to them increase?

The vision for the teacher's role

- The educational role may be taken partly by the IT, but not the

upbringing
- The democratic society has to define clearly its principles for the upbringing of children.
- A drastic change of the social status of the teachers is needed.
- The teachers:
  - should be owners of the concept of 21st century learning – need to be involved in the policy debate
  - should understand ICT as well as integrate content, pedagogy and technology
  - are afraid that if using pedagogy of the 21st century they would lose control over the learning process of the students

Eight core teacher policy goals

Transforming Education with ICT

Recommendations in five key areas:
- Learning
- Assessment
- Teaching
- Infrastructure
- Productivity

Competency based education
- knowledge, skills and attitudes should be part of teaching
- it is necessary to promote their application (not only acquisition)

Proposals for Actions

- To re-establish the "Children in the Information Age" Initiative and Conference with the support of UNESCO, IFIP, other international organizations, governments, etc.
- To organize an international workshop aiming at defining the conceptual framework of the "Children in the Information Age" Initiative, 3rd September, Burgas, Bulgaria (associated to the International Conference "Software, Services and Semantic Technologies (S3T)" (1-3 September) and International Conference Library and Cultural Management and ICT (3-4 September).
- To set-up and moderate an online forum for discussion of the QED experts and building a QED community of experts (SULSIT);
- To develop and establish a repository of open ICT in Education best practices (SULSIT);
- To establish a system of QED annual awards, e.g. "100 best ICT in

Education practices", "100 leading experts", "100 best ICT in Education publications". To establish a Commission for Nominations and Selection;

- To establish forums and communities of practice for cross-stakeholder ICT in Education communication, including "Children in the Information Age" Conference;
- To develop and launch an initiative for multi-lingual and multi-cultural communication and exchange of best practices in ICT in Education;
- To support development of software tools and services supporting multi-lingual and multi-cultural communication and exchange of best practices in ICT in Education;
- To develop and launch a multilingual Open Educational Archive of the Network of UNESCO Chairs on ICT in Education;
- To develop and launch a multilingual Open Courseware of the Network of UNESCO Chairs on ICT in Education;
- To develop and launch a digital repository of UNESCO Cultural Heritage and initiatives to embed this content into education;
- To establish set of actions for support Science, Math and Engineering education and competence development by using ICT.

ANNEXES

ANNEX 1: SCHEDULE

TUESDAY, June 14

Inter Expo-center, 147 Tzarigradsko shosse

09:00 – 10:00	**Registration**
10:00 – 10:30	**OPENING SESSION** *Chair person: Stoyan Denchev* Ministry of Culture Ministry of Education, Youth and Science UNESCO Bulgarian Commission
10:30-11:00:	Keynote: **Mariana Patru –** *Information and Communication Technologies in Teacher Education: A Priority Area of UNESCO*
11:00-11:30	Keynote: **Blagovest Sendov** - *Upbringing in the Digital Age*
	11:30 - 12:00 coffee break
	Chair person: Roumen Nikolov, Evgueni Khvilon
12:00-12:30	key note **Paul Resta -** *Redefining Teacher Education for Digital Age Learners*
12:30-13:00	keynote **Stoyan Denchev** *Typical Aspects of Information Technologies Training in Universities*
	13:00 – 14:00 lunch
14:00 -15:30	**Panel Discussion:** **POLICIES , STRATEGIES, AND PRACTICES IN ICT ENHANCED EDUCATION** *Chair person: Evgueni Khvilon* Joke Voogt Emma Kiselova Turcsanyi-Szabo Marta Plamen Nedkov Peter Kenderov, Evgenia Sendova
	15:30 - 16:00 coffee break

16:00 - 17:30 PARALLEL SESSIONS

Panel Discussion: From *Children in the Information Age* to	**Teacher session:** **THE 21ST CENTURY PEDAGOGY**

Children in the Knowledge Society (Session in memory of Ivan Stanchev) *Chair person: Blagovest Sendov*	*Chair person: Toni Chehlarova* **The Inquiry-based Learning in Action:** Good practices of *Fibonacci* teachers

19:00 Dinner

WEDNESDAY, June 15

Inter Expo-center, 147 Tzarigradsko shosse

09:00 -11:00	**INNOVATIVE EDUCATIONAL PRACTICES** *Chair person: Roumen Nikolov*
09:00-09:30	Keynote: **Stephan Pascall** *The EU Digital Agenda a Leap Towards Better Education*
09:30-10:00	Keynote: **Joke Voogt** *Education in the21st century: What to Expect from Teachers*
10:00-10:20	Evgenia Peeva, Rebecca Helmer *Setting up Incoming Teachers for Success in the Classroom*
10:20-10:40	Pierfranco Ravotto *Competence Based Education with Web 2.0*
10:40-11:00	Kamen Kanev *Tangible ICT-based Learning Environments for Enhanced Quality Education*

11:00 - 11:20 coffee break

11:20 – 13:00	**INNOVATIVE EDUCATIONAL PRACTICES** *Chair person: Evgenia Sendova*
11:20 – 11:50	**Peter Baptist -** *Towards New Teaching in Mathematics*
11:50 – 12:20	**Roumen Nikolov** - *Bridge between EDUsummIT and QED*
12:20 – 12:40	Eliza Stefanova, Nikolina Nikolova, Eugenia Kovatcheva *I*Teach – an innovative teaching methodology*
12:40 – 12:50	Ludmila Karamanoleva, Ekaterina Pavlova et al – *Architecture at school*
12:50 – 13:00	Steliana Kokinova *A Jump in the Unknown* or *Why does the Fortune Favor the Bold*

13:00 – 14:00 Lunch

14:00 - 15:30	**OPEN EDUCATIONAL RECOURCES AND CULTURAL HERITAGE** *Chair person: Evgenia Sendova*
14:00 – 14:20	Radoslav Pavlov *Learning Applications on top of Digital Libraries for Cultural Heritage*
14:20 – 14:40	Valeria Fol, Oleg Konstantinov, Eugenia Kovatcheva - *Discover the Thracians*
14:40 – 15:00	Ivanka Yankova – *The Libraries – Partners in Education*
15:00 – 15:20	Krassen Stefanov - *Using Digital Libraries in the Teacher Education*

16:00 – 18:00 Boyana church or *the National History Museum*

THURSDAY, June 16

State University of Library Studies and Information Technology, 119 Tzarigradsko shosse, 4 floor

09:00 -10:30	**Panel Discussion:** **POLICY MAKING TO ADVANCE EDUCATION TO DIGITAL AGE** *Panel moderator: Mariana Patru*
10:30 – 11:30	**Alexander Nikov** - *Learner-oriented design of ICT based learning environments. Usability, personalization and emotive design of ICT-based learning environments for enhancing the education quality.*
11:00 – 12:00	**Workshop highlights and recommendations** *Chair persons: Roumen Nikolov, Evgueni Khvilon*

ANNEX 2: LIST OF THE PARTICIPANTS

List of the Keynote Speakers & Specially Invited Guests

Name	Institution
1. Alexander Nikov	The University of the West Indies, USA
2. Betty Collis	University of Twente, The Netherlands
3. Blagovest Sendov	Bulgarian Academy of Sciences (BAS)
4. Boris Borisov	SULSIT, Bulgaria
5. Ekaterina Pavlova	teacher, Bulgaria
6. Elena Varbanova	Technical University, Sofia, Bulgaria
7. Eliza Stefanova	Sofia University, Bulgaria
8. Emma Kiselova	UNESCO Chair in e-Learning, Universitat Oberta de Catalunya, Spain
9. Eugenia Kovatcheva	Sofia University, Bulgaria
10. Evgenia Peeva	Teach for Bulgaria, Bulgaria
11. Evgenia Sendova	Institute of Mathematics and Informatics, BAS, Bulgaria
12. Evgueni Khvilon	UNESCO Chair in Innovative and Information Technologies in Higher Professional Education, Moscow, Russian Federation
13. Irena Peteva	SULSIT, Bulgaria
14. Ivanka Yankova	SULSIT, Bulgaria
15. Jef Moonen	University of Twente, The Netherlands
16. Joke Voogt	University of Twente, The Netherlands
17. Kamen Kanev	Aizu University, Japan
18. Krassen Stefanov	Sofia University, Bulgaria
19. Ludmila Karamanoleva	teacher, Bulgaria
20. Mariana Patru	Division of Higher Education, UNESCO
21. Marta Turcsanyi-Szabo	ELTE University, Hungary
22. Nikolina Nikolova	Sofia University, Bulgaria

Name	Institution
23.Oleg Konstantinov	Sofia University, Bulgaria
24.Paul Resta	University of Texas at Austin, USA
25.Petar Kenderov	Institute of Mathematics and Informatics, BAS, Bulgaria
26.Peter Baptist	University of Bayreuth, Germany
27.Pierfranco Ravotto	ITSOS "Marie Curie", Milan, Italy
28.Plamen Nedkov	IT STAR, Central, Eastern and Southern Europe, Italy
29.Radoslav Pavlov	Institute of Mathematics and Informatics, BAS, Bulgaria
30.Rebecca Helmer	Teach For All, USA
31.Roumen Nikolov	SULSIT, Bulgaria
32.Roumiana Peytcheva	Sofia University, Bulgaria
33.Stefan Dodunekov	Institute of Mathematics and Informatics, BAS, Bulgaria
34.Stephan Pascall	Advisor at European Commission
35.Stoyan Denchev	SULSIT, Bulgaria
36.Tania Todorova	SULSIT, Bulgaria
37.Toni Chehlarova	Institute of Mathematics and Informatics, BAS, Bulgaria

List of the QED and the *Fibonacci* Workshop Participants

Name	Institution
1. Albena Vassileva	Institute of Mathematics and Informatics, BAS, Bulgaria
2. Anelia Revalska	18th General High School, Sofia, Bulgaria
3. Angel Gushev	High School of Science and Mathematics, Veliko Tarnovo, Bulgaria
4. Ani Tsoneva	Vocational School of Tourism, Pleven, Bulgaria
5. Antoaneta Sharkova	General High School “Vasil Levski”, Dimitrovgrad, Bulgaria

Name	Institution
6. Antoaneta Stoimenova	Elementary School "St. Kliment Ohridski" , Bulgaria
7. Boriana Nakova	132nd General High School, Sofia, Bulgaria
8. Daniela Petrova	German High School, Sofia, Bulgaria
9. Dessislava Dimkova	Institute of Mathematics and Informatics, BAS, Bulgaria
10. Emmilian Kadiyski	Teach for Bulgaria, Bulgaria
11. Georgi Diankov	Teach For Bulgaria, Bulgaria
12. Georgi Dimkov	Institute of Mathematics and Informatics, BAS, Bulgaria
13. Ivanka Mirleva	General High School "Ekzarh Antim I", Kazanlak, Bulgaria
14. Ivaylo Nenkov	Teach for Bulgaria, Bulgaria
15. Jasmina Markoska	Skopje, FYROM
16. Jordanka Gorcheva	Institute of Mathematics and Informatics, BAS, Bulgaria
17. Katerina Marcheva	*"St.* Kliment Ohridski*"* Secondary Foreign Language School, Blagoevgrad, Bulgaria
18. Katia Chalakova	High School of Science and Mathematics, Dimitrovgrad, Bulgaria
19. Konstantin Delchev	Sofia University, Bulgaria
20. Kremlina Cherkezova	34th Elementary School, Sofia, Bulgaria
21. Maya Sokolarska	General High School "V. Levski", Roman, Bulgaria
22. Maria Brauchle	South-West University, Blagoevgrad
23. Maria Sendova	Teach for Bulgaria, Bulgaria
24. Metodi Glavce	Skopje, FYROM
25. Nadka Sheinkova	National High School of Humanities, Blagoevgrad, Bulgaria
26. Neli Hristozova	6th Elementary School, Stara Zagora, Bulgaria
27. Nikolina Georgieva	119th General High School, Sofia, Bulgaria

Name	Institution
28.Pavel Boytchev	Faculty of Mathematics and Informatics, Sofia, Bulgaria
29.Petia Eftimova	Bulgaria
30.Petkana Aleksandrova	General High School “Ekzarh Antim I”, Kazanlak, Bulgaria
31.Rumen Kunchev	6th Elementary School, Stara Zagora, Bulgaria
32.Raina Georgieva	General High School “Tsar Simeon Veliki”, Vidin, Bulgaria
33.Silvia Milanova	Teach For Bulgaria, Bulgaria
34.Slavica Grkovska	Skopje, FYROM
35.Stefka Aneva	Plovdiv University, Bulgaria
36.Steliana Atanasova	119th General High School, Sofia, Bulgaria
37.Steliana Kokinova	First English High School, Sofia, Bulgaria
38.Svetlana Ilionova	119th General High School, Sofia, Bulgaria
39.Todorka Terziyska	Plovdiv University, Bulgaria
40.Vania Krusteva	General High School “Tsar Simeon Veliki”, Vidin, Bulgaria
41.Vera Tsveova	32nd General High School, Sofia, Bulgaria
42.Yordanka Elenkova	Regional Inspectorate of Education, Montana, Bulgaria
43.Yulia Micheva	Blagoevgrad, Bulgaria
44.Zdravka Hadjiivanova	Vocational School of Economics, Blagoevgrad, Bulgaria
45.Zenafer Bajmak	Skopje, FYROM

ANNEX 3: SUPPORTING DOCUMENTS

Agenda

OPENING SESSION

Chair person: Stoyan Denchev

Ministry of Culture
Ministry of Education, Youth and Science
UNESCO Bulgarian Commission

Keynote: **Mariana Patru –** *Information and Communication Technologies in Teacher Education: A Priority Area of UNESCO*

Keynote: **Blagovest Sendov** - *Upbringing in the Digital Age*

Chair person: Roumen Nikolov, Evgueni Khvilon

Keynote: **Paul Resta -** *Redefining Teacher Education for Digital Age Learners*

Keynote: **Stoyan Denchev**
Typical aspects of Information Technologies Training in Universities

Panel Discussion:
POLICIES , STRATEGIES, AND PRACTICES IN ICT ENHANCED EDUCATION

Chair person: Evgueni Khvilon

Joke Voogt
Emma Kiselova
Turcsanyi-Szabo Marta
Plamen Nedkov
Peter Kenderov, Evgenia Sendova

Panel Discussion:
From *Children in the Information Age* to *Children in the Knowledge Society*
(Session in memory of Ivan Stanchev)
Chair person: Blagovest Sendov

Teacher session:
THE 21ST CENTURY PEDAGOGY

Chair person: Toni Chehlarova

The Inquiry-based Learning in Action:
Good practices of *Fibonacci* teachers

INNOVATIVE EDUCATIONAL PRACTICES

Chair person: Roumen Nikolov

Keynote: **Stephan Pascall**
The EU Digital Agenda a Leap Towards Better Education

Keynote: **Joke Voogt**
Education in the21st century: What to Expect from Teachers

Evgenia Peeva, Rebecca Helmer
Setting up Incoming Teachers for Success in the Classroom

Pierfranco Ravotto - *Competence Based Education with Web 2.0*

Kamen Kanev
Tangible ICT-based Learning Environments for Enhanced Quality Education

INNOVATIVE EDUCATIONAL PRACTICES
Chair person: Evgenia Sendova

Peter Baptist - *Towards New Teaching in Mathematics*

Roumen Nikolov - *Bridge between EDUsummIT and QED*

Eliza Stefanova, Nikolina Nikolova, Eugenia Kovatcheva
*I*Teach – an innovative teaching methodology*

Ludmila Karamanoleva, Ekaterina Pavlova et al – *Architecture at school*

Steliana Kokinova
A Jump in the Unknown or *Why does the Fortune Favor the Bold*

OPEN EDUCATIONAL RECOURCES AND CULTURAL HERITAGE
Chair person: Evgenia Sendova

Radoslav Pavlov
Learning Applications on top of Digital Libraries for Cultural Heritage

Valeria Fol, Oleg Konstantinov, Eugenia Kovatcheva - *Discover the Thracians*

Ivanka Yankova – *The Libraries – Partners in Education*

Krassen Stefanov - *Using Digital Libraries in the Teacher Education*

Panel Discussion:
POLICY MAKING TO ADVANCE EDUCATION TO DIGITAL AGE
Panel moderator: Mariana Patru

Alexander Nikov - *Learner-oriented design of ICT based learning environments. Usability, personalization and emotive design of ICT-based learning environments for enhancing the education quality.*

Workshop highlights and recommendations
Chair persons: Roumen Nikolov, Evgueni Khvilon

Information and Communication Technologies in Teacher Education: A Priority Area of Unesco

Mariana Patru

Teacher Policy and Development Section
Division for Planning and Development of Education Systems
UNESCO HQ Paris

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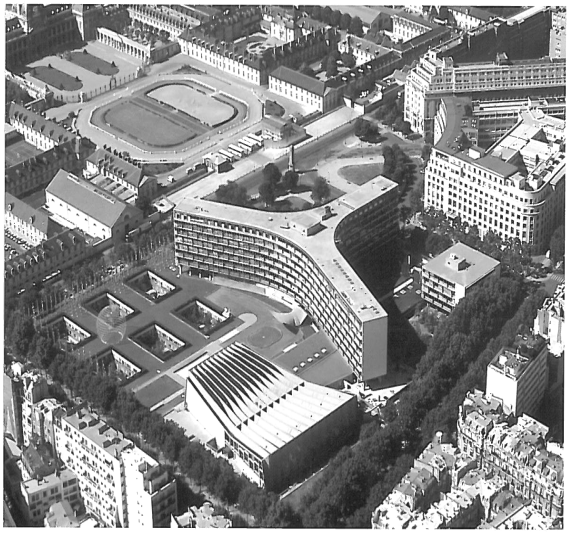
Preamble

However difficult, governments must protect education budgets and invest in what makes education work - creating stimulating learning environments, providing incentives for quality teaching, reaching out to the vulnerable and adapting curricula and pedagogies to a fast-changing world. The better the learning outcomes, the more attractive education becomes.

Address by Irina Bokova, Director General of UNESCO, to the Education World Forum, 11 January 2011, London

UNESCO Its Five Functions Laboratory of ideas



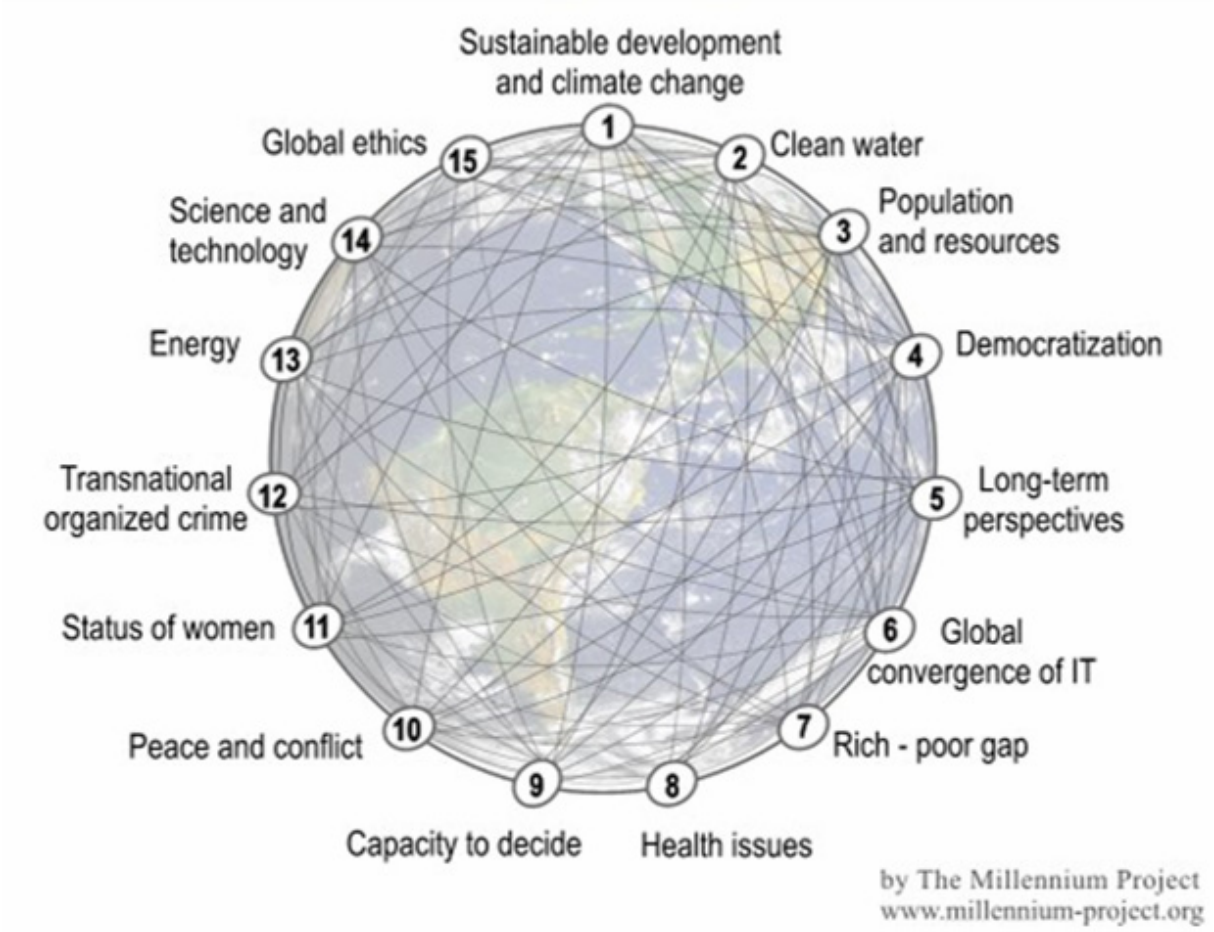
- Standard-setter
- Clearing house
- Capacity builder
- Catalyst for international co-operation

How Does UNESCO Work?

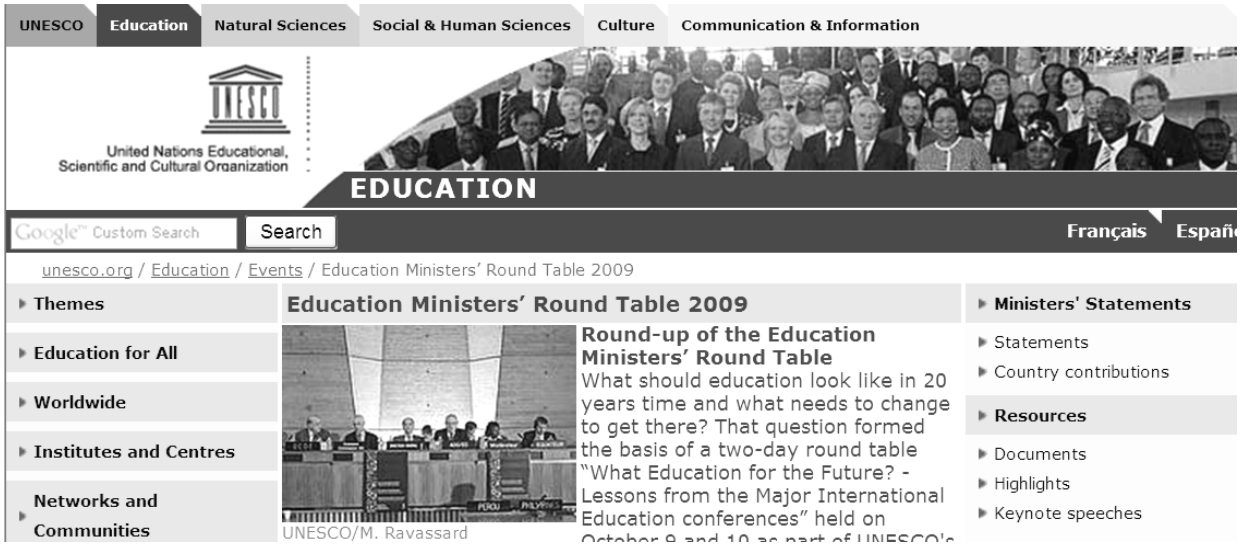
- Analysis of trends, challenges, needs and results through coordination and partnership
- Implementation of activities in cooperation with national authorities at policy- and decision-making level, intergovernmental organizations, non-governmental organizations, the private sector
- ICT in education:
  - IGOs: OECD, The World Bank, The European Commission, The Commonwealth of Learning, International Telecommunications Union
  - NGOs: International Federation for Information Processing (IFIP); Society for Information Technology and Teacher Education (SITE);

European Association of Distance Teaching Universities (EADTU); European Distance and E-learning Network (EDEN); International Council for Open and Distance Learning (ICDE); etc.

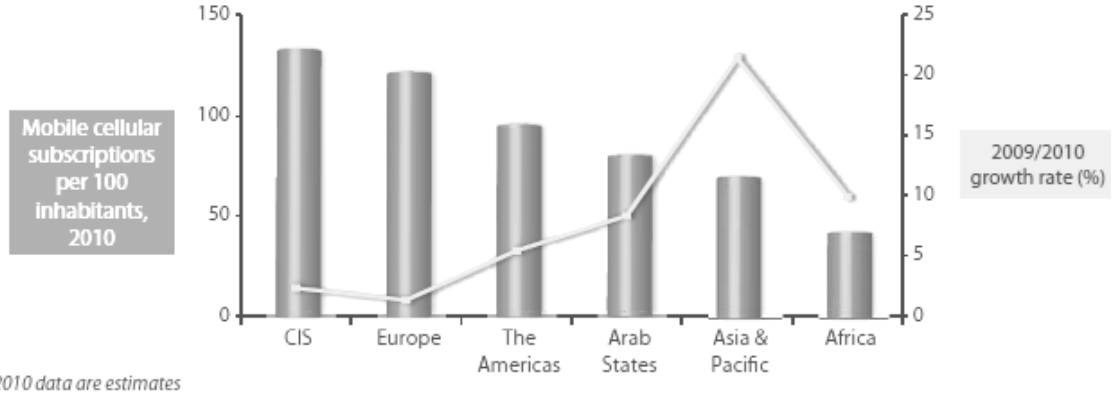
Fifteen Global Challenges for Humanity: The Key Issues of the Early 21st Century



Regular Consultations with Ministers of Education



Exponential Growth of Mobile Technology (ITU: ICT Indicators for 2010)



Note: 2010 data are estimates
Source: ITU World Telecommunication/ICT Indicators database

Emerging Technologies: Key Trends over the Next 5 Years

Within the next twelve months

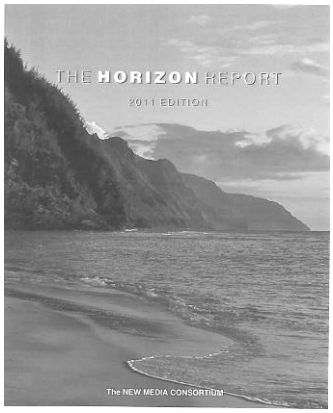
- Electronic books
- Mobiles

Two to three years

- Augmented reality
- Game-based learning

Four to five years

- Gesture-based computing
- Learning analytics



http://net.educause.edu/ir/library/pdf/HR2011.pdf

The World Bank Teacher Policies around the World (TPAW): 8 core teacher policy goals

- Setting clear expectations for teachers
- Attracting the best into teaching
- Preparing teachers with useful training and experience
- Matching teachers' skills with students' needs
- Leading teachers with strong principals
- Monitoring teaching and

learning
- Supporting teachers to improve instruction
- Motivating teachers to perform

OECD: Improving Policies for Developing a High Quality Teaching Profession

Teachers Move Up on the Policy Agenda: TALIS 2008 and 2013
- How well are teachers prepared today to face the diverse challenges in schools?
- How efficiently do appraisal and feedback incite good teaching and support teachers' development needs?
- How can policy makers ensure that resources invested in teachers' professional development will have a positive impact on teachers' work?

COL: Harnessing ODL to Recruit and Train Millions of Teachers
- Teacher education and ODL - two domains of research and practice crucial to national development and global sustainability in the early 21st century and beyond
- Exemplars of innovative technologies and equally innovative applications of those technologies in teacher education in developing and developed countries are provided

US: Transforming Education with ICT

Recommendations in five key areas:

- Learning
- Assessment
- Teaching
- Infrastructure
- Productivity

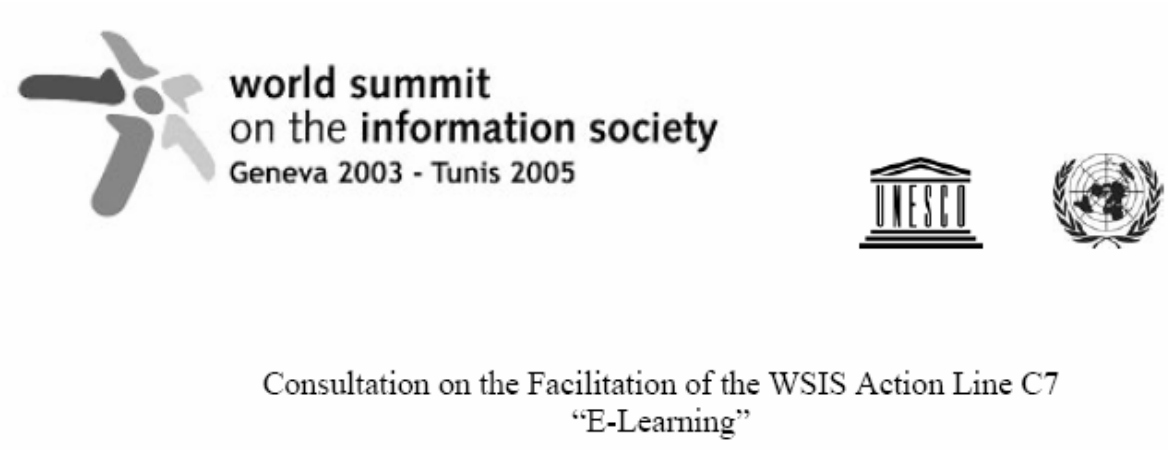
The ICT Revolution - A revolution which has triggered:

- a redefinition of the roles for academics (such as coaches, mentors, partners rather than content experts only)
- a new business model for universities faced with competitive forces (e.g. partnerships with other content providers - publishers and media companies - in the textbook market)
- the convergence of various communication devices at an affordable cost (m-learning)
- openness, sharing, participation and collaboration at an unprecedented scale (open source, open content, open educational resources)

Towards Knowledge Societies (KS)

UNESCO World Report, 2005 offers:

- an **intellectual, strategic and ethical vision on KS**
- **Education and access to knowledge**
- **Quality education for all**
- **Knowledge sharing** as a development imperative
- Innovative approaches to **e-learning**



- Enhancing capacities for e-learning in education
- Communication and learning tools
- E-learning policies and strategies

- Digital content within learning and education
- Legal and Institutional frameworks
- Research and development in e-learning

2009 World Conference on Higher Education: What Role for ICT?

A few key messages in this regard:

- Member States should support the fuller integration of ICTs to meet increasing demands for **quality higher education in a lifelong learning perspective**
- the application of ICT to teaching and learning has great potential **to increase access, quality and success**
- the accelerated velocity of technology change has created pressing challenges that higher education, governments and industry must address together
- **increasing attention to teacher training**: empowering teachers ("digital immigrants") to harness the potential of ICT to provide learners with the knowledge and skills they need in the 21st century
- in spite of the progress made, ICT are still unfairly distributed worldwide - need for more international solidarity to close the digital and knowledge divides

Will ICTs Make the Traditional University Obsolete?

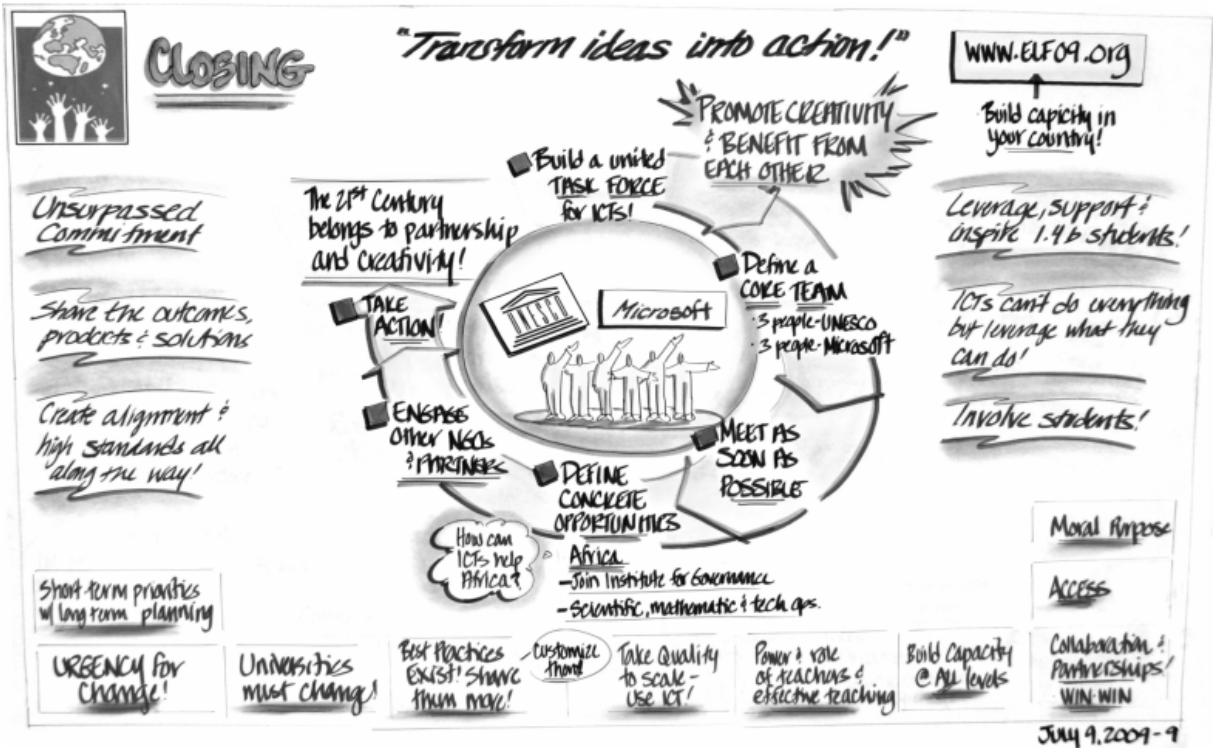
- The conventional system alone cannot meet the challenges. We must ask the questions:
  - Will present-day universities become the dinosaurs of tomorrow?
  - Will there be profound changes in learning content?
  - What is the role of students and staff?
  - How will we ensure quality and sustainability on the Internet?
- Several innovations, such as open educational resources, mobile devices, social software and virtual mobility will radically change the landscape of global learning and expand the global learning community.

UNESCO ICT Competency - Framework for Teachers
(developed in partnership with Intel, Microsoft, Cisco, ISTE, Virginia Tech)

- Strong global need to impart ICT skills to teachers
- No universally recognized certification for ICT skills for teachers and no framework to update teacher training programs
- To enhance teachers' professional development so as to advance their skills in pedagogy, collaboration and school innovation using ICT
- Three booklets: policy framework; competency standards modules;

implementation guidelines (translated into over 12 languages)

2009 Education Leaders Forum: "Universities Must Change!"
(organized by UNESCO and Microsoft)



Open and Distance Learning: A Viable Alternative to Conventional Education

- ODL - a major strategy for expanding access, raising quality and ensuring cost-effectiveness
- For governments –
  - the main potential is to increase the capacity and cost-effectiveness of education and training systems
  - to reach target groups with limited access to conventional education and training
  - to support and enhance the quality and relevance of existing educational structures
- For the student/learner
  - ODL means increased access and flexibility as well as the combination of work and education
  - also a more learner-centred approach, enrichment, higher quality and new ways of interaction
- For employers -
  - ODL offers high quality and usually cost-effective professional development in the workplace
  - allows upgrading of skills, increased productivity and development

of a new learning culture (in addition, it means sharing of costs, of training time, and increased portability of training)

A Framework for Successful Implementation of ICT Use in Teacher Education

- Seven chapters which provide resources to make policy makers better apply ICT to teacher education programs
- Implementing successful integration of ICT in teacher education – key to fundamental wide-ranging reform

Open Educational Resources for Teachers

One Laptop per Child (OLPC): "Connecting the Unconnected"

An MIT Media Lab project:

- a low-cost, low-powered full-featured computer
- designed to dramatically enhance children's primary and secondary education worldwide
- 1 GB of memory; 4 GB of flash memory
- has wireless broadband

UNITWIN / UNESCO Chairs Program

I. Definition and Background

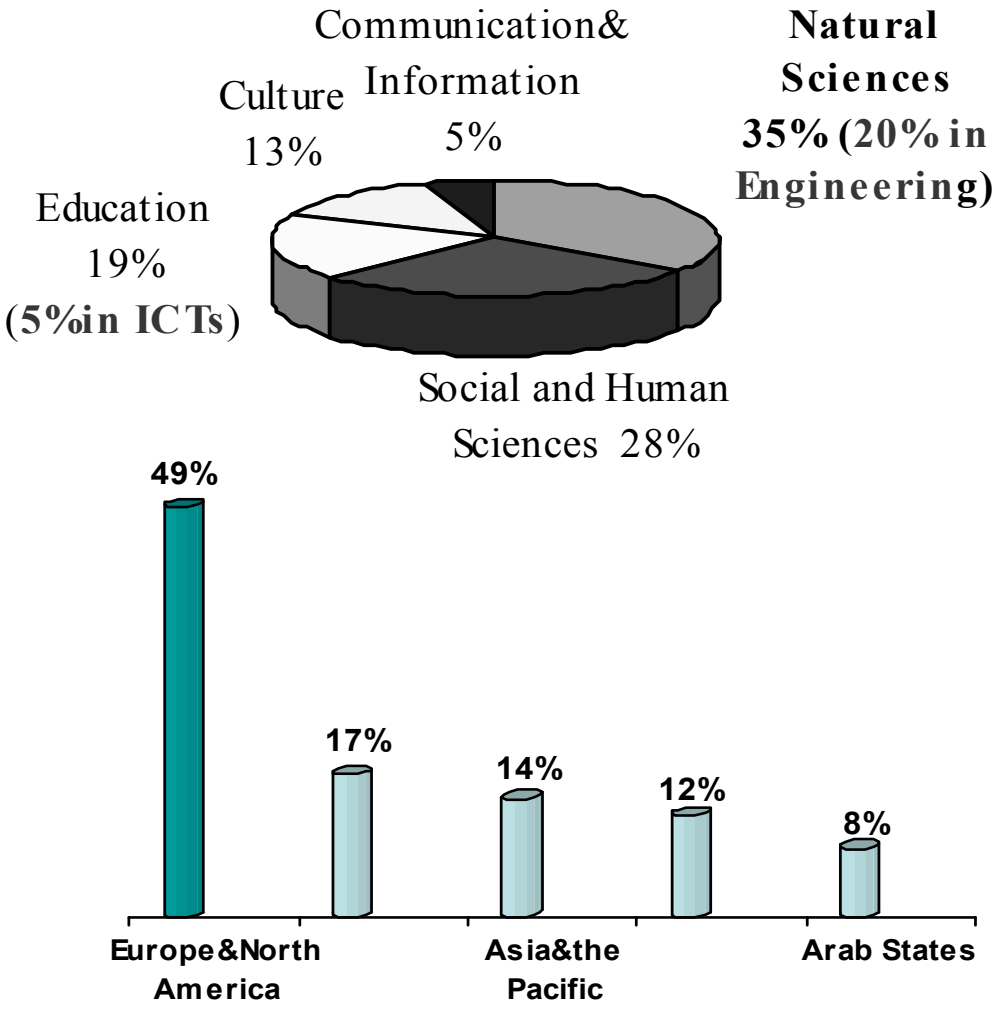
- UNITWIN is the abbreviation for the University Twinning and Networking.
- The UNITWIN/UNESCO Chairs Program, established in 1992, is conceived as a way to advance research, training and program development in higher education by building university networks and encouraging inter-university cooperation through transfer of knowledge

across borders.

Disciplinary and Geographic Breakdown

II. UNITWIN in figures (as of 21.04.2010)

- 659 UNESCO Chairs
- 65 UNITWIN Networks
- 770 Higher Education Institutions
- 127 Member States



Best Practices in and with ICT in Education

- **UNESCO King Hamad Bin Isa Al Khalifa Prize for the Use of ICT** (set up in 2005; donation made by the Kingdom of Bahrain)
- US$50,000 divided equally to 2 prizewinners; rewards innovative and creative use of ICT to enhance teaching,

learning and overall educational performance

Prizewinners:

- 2006: KERIS (Korea); Kemi-Tornio Polytechnic (Finland)
- 2007: Claroline Consortium (Belgium), Curriki (USA)
- 2008: Shanghai TV University (China); Dr Hoda Baraka (Egypt)
- 2009: Alexei Semenov (Russian Federation); Jordan Education Initiative
- 2010: NIACE (UK); Fundación Infocentro (Venezuela)

If a country is to be corruption free and become a nation of beautiful minds, I strongly feel there are three key societal members who can make a difference. They are the Father, the Mother and the Teacher.

Address to the Nation on the Eve of Independence Day, 2006
Dr. A.P.J. Abdul Kalam,
President of India, 2002-2007

Upbringing in the Digital Age

Blagovest Sendov

Bulgarian Academy of Sciences

It is nice to see again a UNESCO event in Bulgaria, devoted to the problems of education in the information society. It is time to reset this cooperation. The UNESCO – Bulgarian initiative "Children in an Information Age", which started 27 years ago, is almost forgotten, due to the political changes, but the ideas are still alive and important.

For the last 15 years, my activity was not directly connected with teaching, but the problems of education and upbringing have always bothered me. The comments, I am going to make, are not a result of a special research or a new pedagogical experiment. They are observations, based on (stemming from) our big educational project, which started 32 years ago and lasted 13 years (see [1]), and my involvement for many years in discussing the impact of computers on society (see [2]).

Education and upbringing

The relation between education and upbringing is not very well defined. In a broader sense, *upbringing* may be considered as part of education. On the other hand, the methods and the goals of upbringing are different from these of education. A person with a very good upbringing might mot be very well educated. The quality of the upbringing depends on the characteristics of the society to which the person belongs. The measures for the quality of education are more universal.

There is no universal standard for upbringing. You may find a lot of writings for religious upbringing (Catholic, Eastern orthodox, Protestant, Muslim and others). There is extended literature for socialist and communist upbringing.

One of many definitions of upbringing is: helping someone grows up to be an accepted member of the community.

It is accepted, that:

- upbringing is given during the formative years of the child,
- the characteristics of the upbringing are strongly related to the type of society.

In these two points, education is different from upbringing. First, education is not limited only in the formative years of the child. We are talking for *life long education*. Second, education and especially, science education is universal and in general do not differ in different types of societies. Moreover, the religious upbringing sometimes clashes with science education. Examples along these

lines may be quoted also from the past communist era in East Europe.

It is interesting that publications, especially the ones devoted to upbringing, are always connected with some type of doctrine, religious, ideological, military or other. The goal of upbringing is to produce a person acceptable for the respective society.

The purpose of my intervention is to pose the question:
Do we care about upbringing in the digital age?
It is marvelous that there are so many activities and projects for education in the digital age. My feeling is that upbringing in the digital age is considered to be a part of educational activities of the teachers and the influence of the parents.

The democratic society in the digital age has its specific characteristics. We have to define clearly these characteristics to be able to determine the respective principles for the upbringing of the children.

Information ecology
To give an example for a specific direction of upbringing in the digital age, let us consider the information pollution. When the world entered the industrial age in the beginning of the last century, the society was not sensitive to pollution. The chimneys producing tons of dust were a symbol of progress. A person with a good upbringing today will keep the environment clean. The information pollution is much more quick and universal. We need a very effective upbringing in the information ecology.

The problems of the Information ecology are not only problems of upbringing and education. The digital age is only in the beginning of its development and the information pollution is not considered seriously enough.

The social status of the teachers

It is evident that the role of the teachers in education and upbringing is the most important one. Hence, the quality of education and upbringing of the future active citizens of our society depends directly on the quality of the teachers. If a society is striving to optimize its development, social status of the teachers in this society has to be very high and go up. In fact, this status is going down. A clerk in the financial business receives a salary several times bigger than a teacher's. The financial bosses earn hundred times more than a teacher.

What is the explanation of this phenomenon? I will offer you one possible explanation.

The accumulation of new knowledge and rapid development of the human

society is becoming dangerous for nature. There are many man-maid ecological catastrophes based on new scientific discoveries. To defend itself, nature has to slow down this process. The most effective way is to diminish the quality of education. This is realized by the degradation of the social status of the teachers and consecutively of their quality. The future generation will not be so well educated and not so dangerous for nature.

I am very interested to hear other explanations, which do not involve the wisdom of nature, but rather the internal forces of society. Such explanations will definitely motivate evolutionary or revolutionary changes of society.

The role of the teachers in education may be taken in part by the information technology. But the role of the teachers in upbringing the new generation is unique and is not to be delegated to any technology. Moreover, the authority of the teacher is much more important in the upbringing then in teaching. A teacher with low social status is handicapped in upbringing the young students.

If nothing is changed, we have to expect catastrophe in upbringing in the future. One example is the behavior of the public during the football matches.

What has to be done?

This is a very difficult and fundamental question. The principle that in the democratic society, only the family and the church are responsible for the upbringing of the children is not working well. The upbringing by the church is very effective. This is the motivation to bring the religious education in the school. But there exist different religions in a democratic society. So the solution is usually not to allow religious education in schools.

There seems to be a silent understanding that a democratic government has no strict obligations and responsibilities for the upbringing of the children. In agreement with this policy is the low social status of the teachers. But this policy is dangerous in the long run.

The democratic society in the digital age has to define clearly its principles for the upbringing of children. The fulfillment of these principles has to be a responsibility of the governments, local and national. An ultimate condition for the success is a drastic change of the social status of the teachers. Such a change is a very difficult problem, and UNESCO has to be engaged in searching for a solution.

References

[1] Sendov, Bl. 1986. Education for an information age. Impact of science on society (Paris UNESCO), no. 146, p. 193 – 201.
[2] Sendov, Bl. 1997. Towards global wisdom in the era of digitalization and communication. Prospects, vol. XXVII, no. 3, p. 415 – 426.

Redefining Teacher Education for Digital Age Learners

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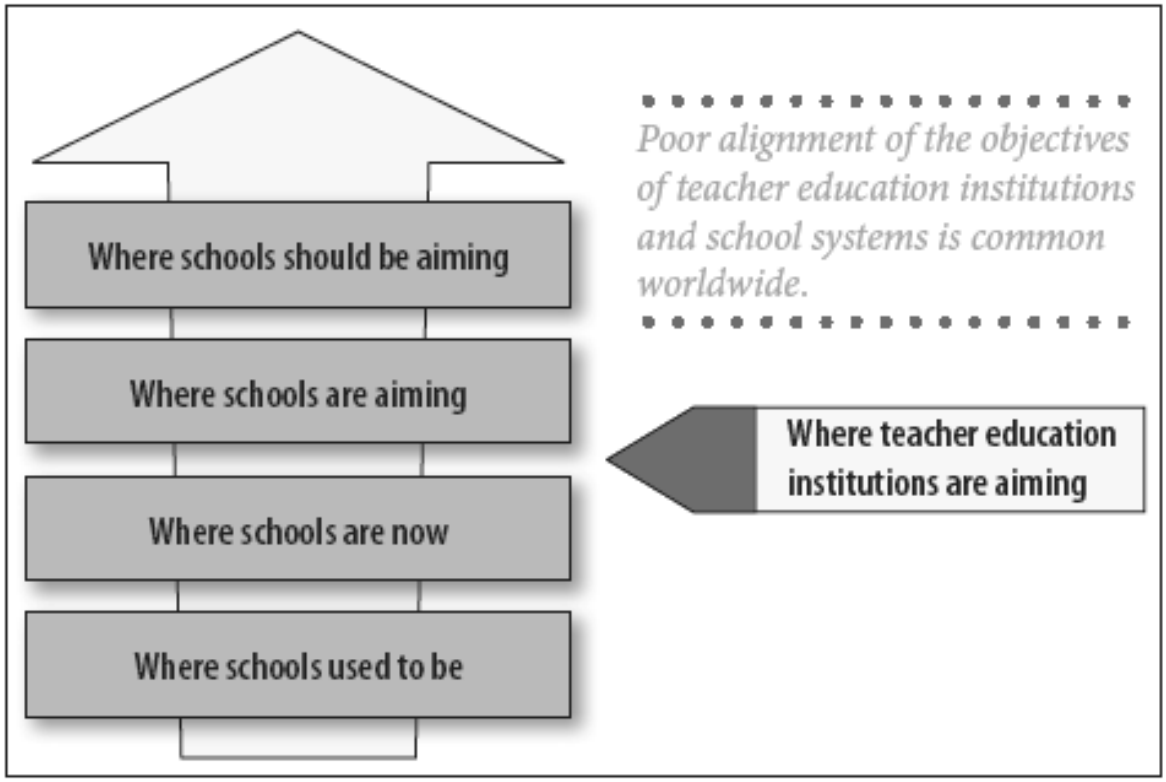
There is wide recognition that teacher education must change to meet the needs of 21st Century learners.

Challenges to change:

- Multiple constituencies influence teacher education
- Lack of a shared vision of change

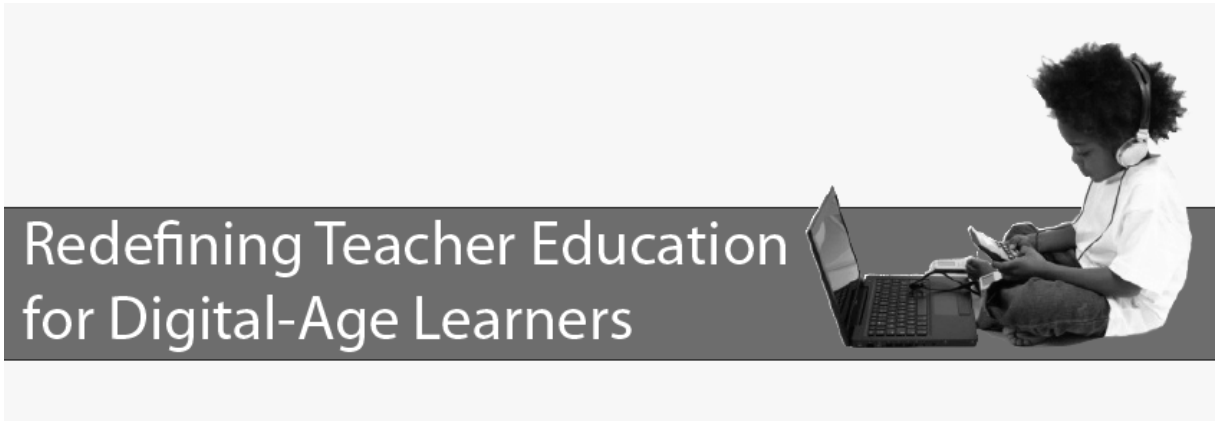


http://www.redefineteachered.org

Participants:

- State and federal legislatures
- State educational agencies and certification boards
- National and regional accreditation associations
- Educational professional associations
- Teacher unions
- Teacher education institutions
- Universities

- Schools
- Federal government
- Technology industry



A Call to Action

The Summary Report of the Invitational Summit on Redefining Teacher Education for Digital-Age Learners

Goals of Summit

- Identify characteristics of a 21st century educator
- Define the critical elements of an educator preparation program that produces such an educator
- Identify the institutional, state, and national policy structures that support the creation of these programs
- Develop a national coalition to reinvent teacher education for digital-age learners

21st Century Teacher Characteristics

- Facilitate and inspire student learning and creativity so that all students achieve in the global society
- Be global educators
- Work with their student to create new learning opportunities
- Enable students to maximize the potential of their formal and informal learning experiences
- Use the full range of digital-age learning tools to improve student engagement and achievement
- Use student data to support student learning and program improvement

- Ne life-long learners

Redefining the Teacher Education Framework

- Model strategies for addressing the needs of all learners
- Prepare educators to interpret and utilize data to customize instruction
- Be responsive to changes in the global society
- Prepare teachers for career-long professional growth

Model and advocate 21st century teaching practices in teacher preparation curriculum and instruction

Prepare teachers to work as effective members of learning teams

Prepare teachers to teach in blended and online learning environments

- Growth of virtual high Schools and cyber charter schools
- Requirements for Online course

Extend curriculum and teacher role to include both formal and informal learning

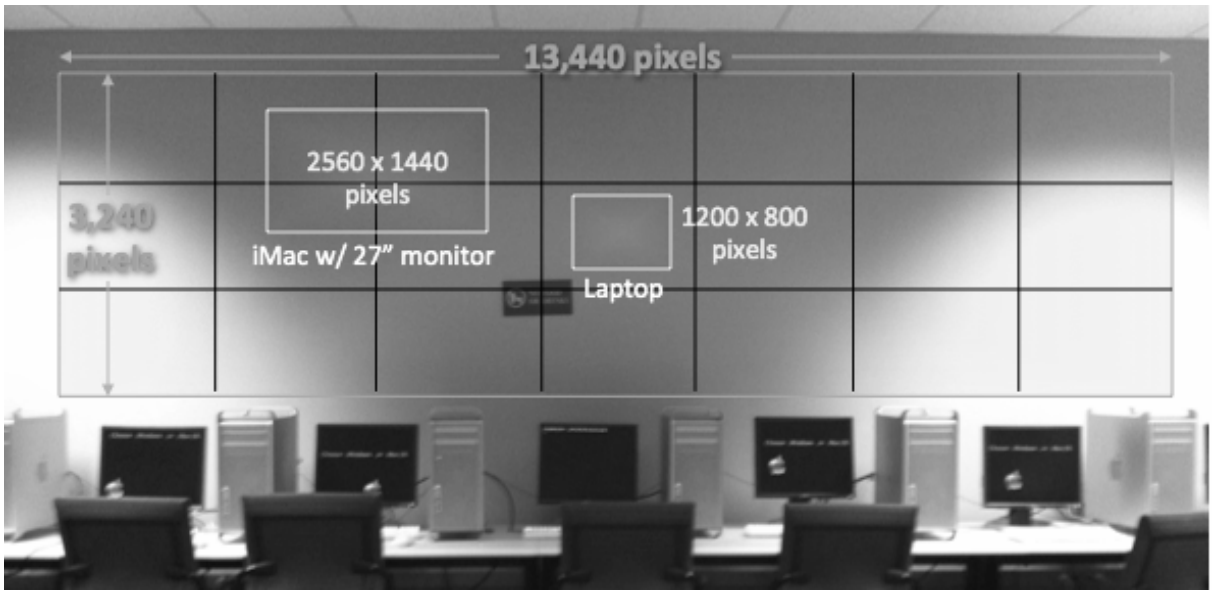
Be a university-wide endeavor - The UTeach Program

Use simulations to prepare teachers to deal with difficult situations

Importance of visualizing massive amounts of educational data

University of Texas at Austin Visualization Laboratory

UT Learning Technology Center Education Visualization and Learning Analytics Lab



The transformation of teacher education will require changes in policy structures at the institutional, state and national Level

Institutional Policies to Transform Teacher Education

- Faculty Development
- Faculty Engagement in Clinical Practice
- Competency-Based Teacher Education Programs

State Level Policies

- Develop state shared vision
- State educator certification policies must support:
  - new roles for educators
  - new ways of staffing schools

National Level Policies

- Create a national coalition to reinvent teacher education
- Build a National Educator Competency Development Hub
- U.S.ED should support research to improve online educator professional development

Impact of Summit

- State initiatives: New Hampshire, Wisconsin, California and Texas
- National Council for Accreditation of Teacher Education
- Australia Summit on Educator Development
- National Coalition to Reinvent Teacher Education

Typical Aspects of Information Technologies Training in Universities

Stoyan Denchev

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A lot of people, including specialists in the field of informatics use the term "information technologies" only as a synonym of technologies, based on the use of computers. Although this is not wrong, one should not forget that the activities associated with the selection, collection and evaluation of information, its efficient processing, storage and dissemination have been performed long before the advent of computers, especially personal ones.

At the current stage of its development, information technologies constitute a sound basis for participatory motivation: on the one hand - of the social aspect of the processes for managing the access to information, and on the other – of the commercial, market development of electronics and the supporting industries related to it.

And yet what is information technology?

Definition: The term *information technologies* stands for integrated sets of scientific, technological and engineering activities, specialized equipment and specific management techniques that are used in the creation, processing, storage, dissemination and consumption of information.

Generally speaking, information technologies incorporate two main aspects: social and technical.

From a social standpoint, information and communication technologies have made and promise to make it even greater the qualitative change in the mass communication systems. The change in public communications provides a direct impact on the quantitative and qualitative part of the employment of the workforce. This, in turn, has a substantial effect on all socio-economic processes.

From a technical standpoint, information and communication technologies lead mainly to relevant, qualitative change of means and methods for handling information. Here attention is paid to the widespread computerization and the creation of conditions for conducting a maximum communicability in all spheres of socio-economic life.

Considered in both aspects, the purpose of the current development of information technologies should be such that they can be of benefit to every individual and for society as a whole.

Information technologies have two main lines of development:

- Creation and development of products (devices, systems) and concepts (ideas, procedures, etc.), and
- Applications.

At this stage of development of socio-economic relations, information technologies (where the computer is a main component) are widely used in all fields of human activity.

The issue of implementing information techniques and technologies in education has several relatively independent aspects; among them special place is rendered to exploring the options for using information techniques and technologies as a training tool and for increasing the effectiveness of the teaching process and their inclusion in it, as well as studying them as a component of general and special training.

Naturally, the problems of computerized education, as a reflection of the Scientific and Technical Revolution (STR) in education, found impact in almost all parts of our planet. These problems and the resulting tasks attracted the attention of the relevant international and national, governmental and non-governmental organizations. Firstly, we should note IFIP – the International Federation for Information Processing.

Immediately after its establishment, IFIP set up the so called Technical Committee on Education TC3. The goals that this committee had to achieve were the following:

- to analyze contemporary technological and social trends and identify the new needs and areas for teaching activity in the sphere of information processing;
- to draw up recommendations for elaborating syllabi in informatics, etc.

Technical Committee TC3 of IFIP has already successfully held several international conferences on information technology issues and on worldwide computer training in particular.

Secondly, we will point out the International Commission on Mathematical Instruction ICMI. This commission was created as part of the International Mathematical Union. During the fifth international congress on mathematical education ICMI 5, one of the main topics was the issue of computer in education and more particularly "Mathematics and the computer". ICMI has published a special document entitled "The impact of computers and

informatics on mathematics and its teaching". This document has been circulated for discussion and it sets many issues of concern to present day teachers in primary, secondary and higher educational institutions about the connection that has to be made between computerization and training, particularly training in mathematics and informatics.

Active work on the issues of computer training is carried out by UNESCO as well, by means of a special program in informatics.

Training in information technologies is one of the main fields in the work of ACM (Association for Computing Machinery). For more than 40 years this international association develops and offers comprehensive, practically tested programs for teaching at different levels of educational structures (mainly bachelor and master programs).

After summarizing the recommendations of all organizations that deal with the problems of training in information technologies, it can be concluded that their proposals are reduced to developing specific curricula in the following areas:

- Computer Science;
- Computer Engineering;
- Information Systems;
- Software Engineering;
- Human – Computer Interaction;
- Associate Degree Programs;
- Software Ergonomics;
- Informing Science.

Global experience in the field of application of informatics /and computers in particular/ in training can be differentiated into three distinct phases, the so-called entering waves. During the first wave the computer makes its way into the school as a teaching aid, like the projector, the tape recorder, etc. As a technical tool the computer is particularly useful: it gives an opportunity to illustrate many things, lectures become more interesting and exciting.

During the second wave the impact of the computer is mainly on the content of the training, while in the first wave, the impact is mainly on the method and system of teaching. Typical for this second wave is the system reassessment of the objectives and content of individual school subjects in the presence of powerful information transformers.

The third wave is represented by massive Web-based distance learning.

Systematic research on the possibilities of the use of ICT in school practice began in the mid 70's. The most extensive studies were conducted in Great Britain, the Netherlands, the USA, France, Japan, Germany and the former

Soviet Union. Historically computer-based training has developed as follows:

1. At the end of the 60's and the beginning of the 70's USA, Canada and the former USSR began research and related practical work for the deployment of large computer complexes (one or a few large ECMs, equipped with telecommunication facilities) in the educational system. These studies are mainly oriented to the needs of the universities.
2. In 1966 in Palo Alto /Stanford University/, California – USA computers started to be used for the needs of primary schools. It was there that for the first time a classroom was equipped with terminals and experimental lessons teaching grammar and maths games were conducted.
3. In 1974 in England, by decision of the Government, a national program for developing computer /based on micro computers/ training /NDPCAL/ was introduced. In the framework of this program a lot of special projects are funded.
4. The creation of specialized software systems and technical support for the education of children by using computers was launched. In his book "Mindstorms - children, computers and powerful ideas", The Harvester Press Ltd. (1980), S. Papert discusses for the first time the issues concerning the use of children-oriented programming language LOGO.
5. After 1980 in almost all regions of the world work began concentrated on the problems of education in information technologies (with an emphasis on the higher education sphere). And just like in the beginning, highly developed industrial countries set the pace.

From the analysis of the historical review the purpose and the resulting problems associated with the introduction of ICT in education are easy to define. It becomes evident that the existing problems that arise and are solved when considering information technologies a means of training and an object of study, have mostly innovative nature.

Here are some examples of the national policy on the problems of computer training in several Western countries:

GREAT BRITAIN - in the historical review we have focused on the creation of the NDPCAL national program. Later on the other, more ambitious program of the English Government: Microelectronic Education Program (MEP) also received funding. In the framework of this program, England, Wales and Northern Ireland are divided into 14 regions and there is a regional centre of computer training for all levels of education in each of these areas.

SCOTLAND - this country also has its own program for computer-based training /SMDP/. In many respects Scotland’s program for computer training duplicates those of the UK.

FRANCE – this is one of the countries where work on the problems of information technologies in universities is most intense at present. French schools use mainly French computers, such as Logabax and Micral.

GERMANY - three major programs for computer based training were funded. They are called *Datenverarbejtungs-programm der Bundesregierung 1, 2, 3*. Greatest success in implementing these programs has been achieved in Bavaria. Last but not least, Germany pays special attention to the effective computer training for teachers. With regard to this, far back in 1986 the federal government adopted a special program whose aims were every school to train at least 3 /three/ teachers in basic computer education and all higher educational institutions to establish a Department of Informatics and/or Information Technologies.

DENMARK - in 1972 the so called Johnsen Committee, supported by the Danish Ministry of Development issued a report that recommended and provided guidelines for the application of computers in the teaching process. Practical work on the implementation of similar projects started in 1975. At this stage 79% of the primary, 93% of the secondary and 100% of the universities in Denmark are equipped with computers.

USA - centralized researches on the introduction of computers in the academic activities are not carried out; instead hundreds of different projects in this area have been created and implemented. Actually, at this stage all university structures and almost all secondary schools are equipped with computers of the newest generation. Researches were conducted in the USA and they have made it possible to differentiate three main areas of deployment of advanced computer technology in the educational system of the country:

- studying informatics in all its aspects;
- using computers as an additional training aid;
- using computers as a means of programmed instruction, replacing the teacher.

Most often in American universities you can find computers such as APPLE /about 50% of all computers / PET and TRS. Recently (2005), IBM computers have started to invade American high schools. Their share is now about 50%, with a tendency to reach 75% by 2008.

Researches and developments in the area of implementation of information equipment and technologies in schools are conducted in Eastern Europe as well.

The educational reform in Russia is aimed at further improving the quality of training, at bringing it in line with the conditions and requirements of modern

scientific and technical revolution (STR). At this stage the use of computers in Russian universities is definitely of more theoretical, research nature, while the massive invasion of this technique is still a question of the future. We should not forget the fact that the former USSR was one of the pioneers in the implementation of large and mini computing systems in higher education institutions.

Great success in information technologies training has been achieved in HUNGARY. Presently more than 15000 computers are installed in about 800 schools in the country and are actively used in the teaching process. All universities are 100% supplied with modern computer equipment and technology.

BULGARIA has some experience in solving the problems, especially in studying the basic, initial elements of programming and computing. About 68% of secondary schools and 27% of primary schools had equipped, so called computer classes. By 1995 most of the computers used in schools were made in Bulgaria: PRAVEC microcomputers. At present 87% of these computers are replaced with modern ones such as IBM. In the last 3-4 years, due to the affordability of acquiring modern mid-range computers for personal use, a 'transfer' of part of the computer training from educational structures to people's homes is observed.

After recording the huge slowdown in the deployment rate of modern information and communication equipment and technologies in the educational system of our country, urgent and emergency measures have been undertaken in last year to make up for the lost. By Decision of the Government the realization of a project, meeting the needs for modern computers and communication equipment and technologies was initiated at all levels of the Bulgarian educational system. The Bulgarian National Virtual University was launched and it develops successfully. Thus, Bulgaria is trying to become an integral part of the *E-EUROPE* project of the EU.

INFORMATION TECHNOLOGIES training in Bulgarian universities is differentiated mainly in two basic directions depending on the type of these institutions.

In engineering and technical universities priority is given to syllabi, grouped around the mathematical foundations of informatics, computer engineering and technologies, communication technologies, software engineering, software ergonomics and associated syllabi.

In humanities universities the focus is on advanced mathematical training, computer and information sciences, information systems, organization of the

interaction and communication problems "human-computer", software engineering and information management.

Compulsory total credit hours in studied subjects during the four year training period necessary for obtaining Bachelor's degree is no less than 2800 hours and they are acquired accordingly:

- compulsary subjects - 1700 hours including 150 hours of specializing practice;
- optional subjects - 700 hours including 100 hours self-study;
- facultative subjects - 420 hours.

Compulsory total credit hours in all subjects studied over the two / three / semester period of training for obtaining Master's degree is no less than 730 hours and they are acquired respectively:

- compulsory subjects - 300 hours;
- optional subjects - 180 hours;
- facultative subjects - 60 hours;
- individual work - 40 hours;
- preparation and thesis defense - 150 hours.

Training in Bulgarian universities of information technologies in their different varieties and interpretations is performed on an average European level. It complies with the established basic concepts and the latest trends of development in science and technology. University teachers have the necessary scientific, professional and language skills. The quality of students is very good. Almost as a rule, when applying for a wide variety of university majors, student applicants in the information technologies field form the highest acceptance grades.

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Competency, Innovation – Aiming for Sustainability

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Abstract. The presentation aims to show how ELTE University tries to develop competencies in digital literacy and modern teaching/learning methodologies directly among the teaching staff and student teachers as well as indirectly within public education in order to inject innovation there. Several of our courses provide permanent information flow of innovative nature and a newly established mentoring network presumes sustainability of updates for in-service and practicing teachers.

Keywords: Web 2.0, teacher education, competencies, innovation, sustainability, mentor, network

1 Introduction

The 21st century is dedicated to bring up a knowledge-based society in which required competencies strive to follow the extremely fast development of tools that are needed for enhanced work and Life Long Learning. But, the structure of teacher education is not suitable to handle the extent of changes going on in our daily lives influencing the next generation of learners. Thus, there needs to be a sustainable flow of innovation continuously shaping public education in order to bring up a generation that can stand up to requirements within the future workforce.

Besides, science and computer engineering related jobs are endangered by the decrease in number of students entering related studies worldwide, not to mention those wanting to become teachers, especially in our countries! We need to maintain interest in computer studies by making sure that the next generation not only becomes a user of computers as an autonomous learner and as a tool for performing job related functions, but also understand their own learning processes, get acquainted with tools that can help them become better learners and teachers as well as understand how *'things work within the system'*.

2 Teacher Education Program at ELTE

One of the courses (taught by the author – Head of T@T lab [1]) *"Educational Technologies"* attempts not just to teach about learning technologies and their adaptation within the learning processes, but also to lead students to become active members in knowledge building within a larger learning community, adding their own values to enrich the outcomes and be able to communicate through different disciplines.

Requirements differ, depending on the particular program the future teacher is participating in, the choice of topic depends on the specific interest of the student, the type of course work depends of the preferred learning style of the students and thus each student contributes to the knowledge building of the course outcomes (Fig. 1).

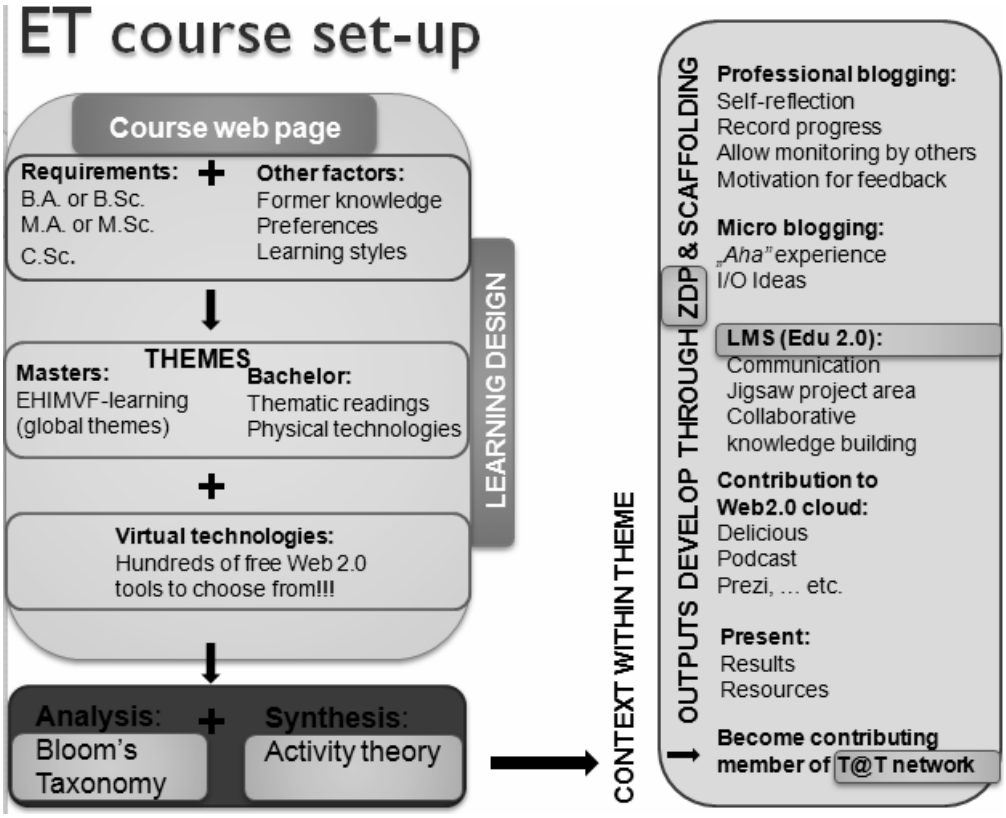

Fig. 1. *Course design of Educational Technology*

In doing so, they must be able to choose from activities that are engaging, have adequate motivation to learn themselves, understand well the process and depth of learning and how suitable environments can be built for the learners, what role the teacher has in this environment, and how he/she can continuously build and renew his/her own PLN. Thus students have to be aware how they can adapt learning theories in practice, facilitate the development of skills in several areas (thinking, working, tools, and society responsibilities), and be aware how innovation could be attained throughout their teaching practice by acquiring the necessary knowledge, skills, attitudes, values and ethics (Fig. 2.).

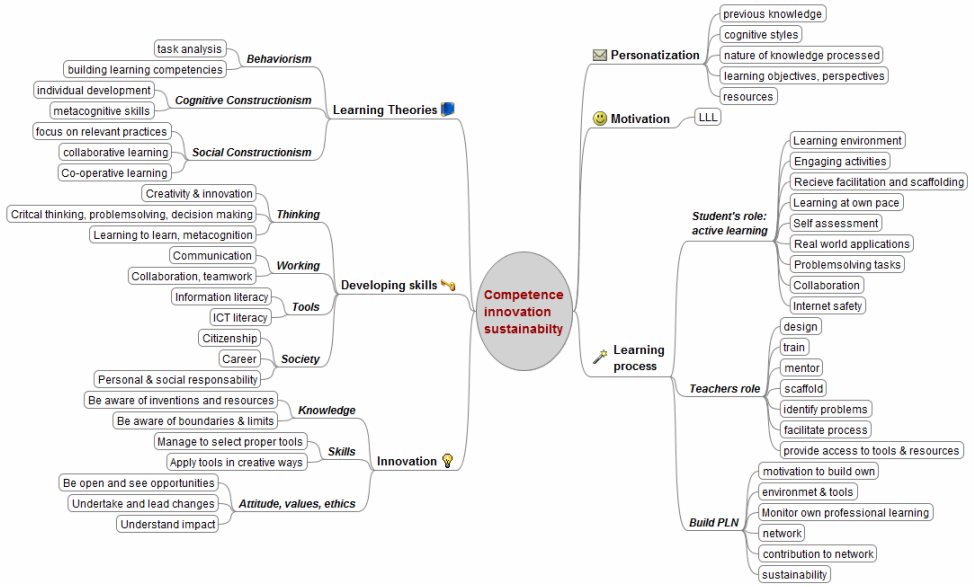

Fig. 2. *Mindmap of aim's in teacher training, mirrored in course structure and in activities*

3 T@T Mentoring Network

The T@T (indicating Technology Enhanced Learning in Hungraian) mentoring network has just been set up to provide help and guidance for future teachers, practicing teachers and those starting to adapt to new tools and methodologies within the whole range of the education system. Putting the learners in the middle of the process and orienting them into learning possibilities that develop their own needs, raise required competencies, become autonomous learner of knowledge on demand and keep their motivation alert to accommodate changes. A Web 2.0 supported Ning community portal lies at the heart of the network that provides connectivity (Fig. 3).

Collaboration was established between faculties doing research together on topics concerning innovation in learning and the network invites other universities and educational institutes as well as industry in relation to emerging tools for learning to join the network and take part in the dissemination of innovation in order to maintain sustainability. All Faculties have developed and constantly update their innovative recourses and aim to share them throughout the full spectrum of teacher education with other teaching staff at university as well as reach out to help fresh teachers entering their profession at school and effecting practicing teachers in service. Yearly conferences are being held and a new Journal was issued on Educational Technology by ELTE University Faculty of Education and Psychology [2].

Members of the T@T Mentoring Network (future teachers, practicing teachers, teacher trainers, researchers, stake holders, etc.) can keep up with their normal every day use of Web 2.0 technologies (Tweet, Blog, share bookmarks on Delicious, …etc.), they just have to make sure that they also use the tag

"TeThalo" if they wish to share the item with the mentoring network. All items tagged as such and within the agreed Web 2.0 inventory would be aggregated into the Netvibes pages and enrich the resources of the community, resulting in a sustainable flow of innovative ideas. The mentoring portal is open to all future teachers, practicing teachers, researchers and developers who have registered giving their credentials (LinkedIn, FaceBook, or institutional web page) to take active part in this win-win relationship.

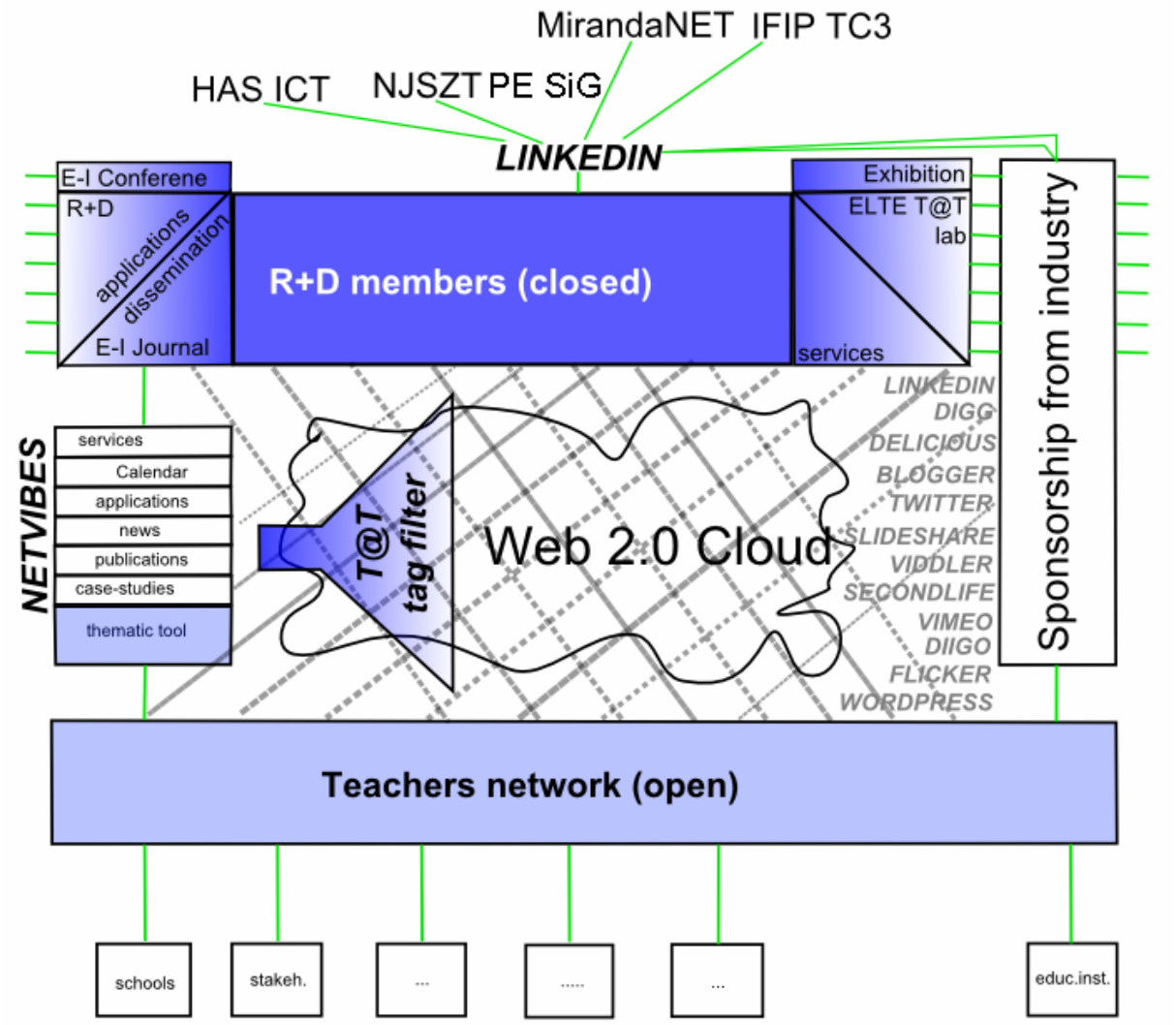

Fig. 3. *Structure T@T network [3], link: http://tet-halo.ning.com/.*

The democratic inclusion of all related ideas is monitored and negotiated between the teacher trainers, researchers, developers forum within LinkedIn *http://www.linkedin.com/*, that also share the portfolios of academic partners, which provides backgrounds in establishing new projects both locally and internationally as well as publish research findings in local and international circles. The structure of the T@T Mentoring Network [3] (Fig.4.).is very similar to the structure of the IFIP Education Network [4] (Fig.4.) (both administered by the author), allowing local teachers (after having adequate confidence with

language) to swim over to international grounds.

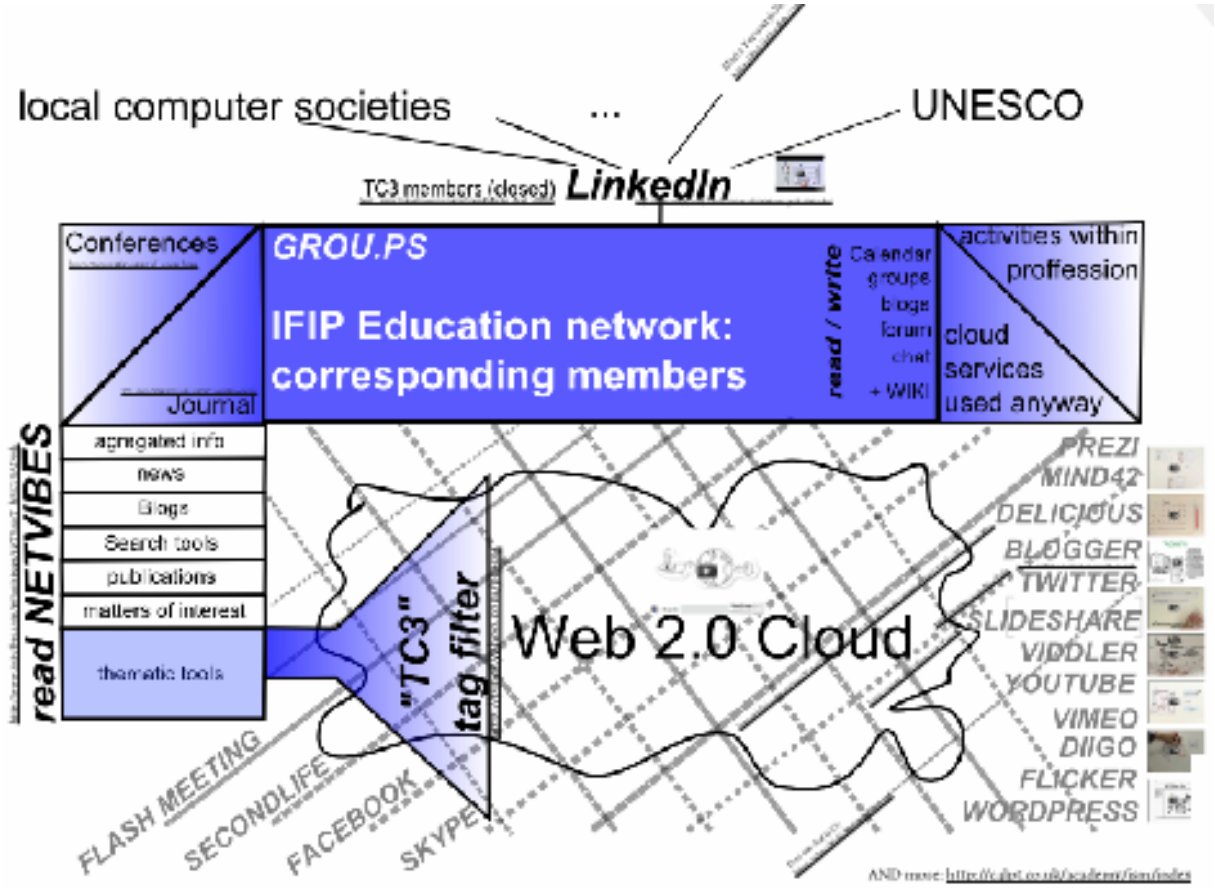

Fig. 4. *Structure of IFIP Education network [4], link: http://ifip-education.ning.com/*

8 Conclusion

Although at an early stage, we have experiences of good practices, a critical mass of continuously increasing younger generation of educators and our good will to make this project succeed and flourish for the benefit of the next generation.

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Panel on Policies, Strategies and Practices in ICT Enhanced Education

Education and ICT Skills for the Information Society:
The IT STAR and CEN WS on ICT Skills Experience

Plamen Nedkov

Chief Executive of IT STAR, Member of CEN's WS-ICT Skills Steering Committee

IT STAR

www.itstar.eu was established in 2001. It is a professional association in the ICT field in Central, Eastern and Southern Europe with a mission to assist and promote the activities of its members and to encourage and facilitate regional and international cooperation on IS matters. Its members[1] are leading professional informatics societies from 3 *old* and 9 *new* EU members, as well as from 3 candidates for EU membership, which bring valuable national and international experience on Information Society issues – IS indicators and readiness, policies, strategies and other – as they relate to the Region, within a European and Global context. The Association facilitates partnership by providing a professional forum with its conferences, publications, statements and other activities to national and international stakeholders from academia, government, industry and civil society.

The CEN Workshop on ICT Skills

http://www.cen.eu/cen/Sectors/Sectors/ISSS/Activity/Pages/WSICT-SKILLS.aspx is a specialized working body of CEN, the European Standardization Committee, which provides a platform for the development of European Standards and other technical specifications.

It contributes to the long-term e-Skills Agenda of the European Commission, in close interaction with DG *Enterprise and Industry*: It brings together representatives of industry, academia and IT associations to address such issues as professionalism, e-Skills shortages and other related issues to competitiveness, growth, innovation, employment and social cohesion. Its main activity is the development and publication of CEN Workshop Agreements (CWAs[2]), consensually achieved specifications in an open environment of consultations, often used in fast evolving technologies and new markets. 11 CWAs were approved so far and currently 2 CWA drafts are posted at for public

[1] See http://starbus.org/download/memsoc.pdf

[2] See http://www.cen.eu/cen/Sectors/Sectors/ISSS/CEN%20Workshop%20Agreements/Pages/ICT-Skills.aspx for all CWAs produced

review.

The two organizations are actively contributing to each other's initiatives -- speakers at IT STAR events, contributions to CEN WS/ICT activities and other. IT STAR's scope covers a wide array of Information Society issues[3]. For the purposes of this panel discussion we will focus on the experience of both organizations in the area of Education and e-Skills.

The notion of the **Information Society** (IS) is unclear for a good part of the population and, indeed, there is no simple definition. Several definitions[4] and descriptions of the IS as post-industrial society have been considered, among them the reference provided by Wikipedia, which sees IS as *a society in which the creation, distribution, diffusion, use, integration and manipulation of information is a significant economic, political, and cultural activity* and further points out that the Knowledge Economy is its economic counterpart and that its markers are *technological, economic, occupational, spatial, cultural, or some combination of all of these*.

The IT STAR debate on strategies and policies concludes that all IT STAR countries have the principal strategy and policy documents, supported by laws and regulations covering various aspects related to education, e-governance, industry, commerce and other, though their quality and their ability to adapt to the rapidly changing circumstances is often questionable. Many elements are of a theoretical nature and remain ambiguous.

Governments in the region have a responsibility to provide clear visions and to seek multi-stakeholder partnerships on IS strategies and policies, to ensure better coordination between ministries and governmental agencies and within the sectors on matters related to the IS. It is essential to have strong collaboration between government, academia, the business/application communities and civil society in extending available products and services by combining and utilizing the respective strengths and resources of all stakeholders.

An important IS related responsibility is to reduce digital illiteracy so as to include, or keep, the active population in the labor market and to assist the social inclusion of vulnerable population groups.

In assessing IS development, technological and macro-economic indicators

[3] For a more extensive overview check http://www.itstar.eu and "Current State of Informatics in Central, Eastern and Southern Europe: The IT STAR Experience" – P. Nedkov (with contributions from B. Domolki, G. Occhini and N. Schlamberger) in UPGRADE Vol X issue No. 4., August 2009 – www.upgrade-cepis.org

[4] The Slovenian Society INFORMATIKA (SSI) has proposed a definition. If SSI's definition is adopted as a measuring stick, most countries in the region would not qualify as information societies. See Niko Schlamberger, *Strategy of Development of the Information Society in the Republic of Slovenia*, in National Information Society Experiences, ISBN88-901620-2-3, © IT STAR 2009

should be matched with other *softe* socially oriented indicators reflecting cultural tradition and workforce specifics. A study[5] made available at the 3rd IT STAR WS in Godollo argues that *frog-leaping* cannot be achieved by simply introducing more e-services and technology, that social environments have their own rationale, accelerators and breaks and the effect of transferring technological solutions from one country to another will be different depending on the social environment. A one-sided approach might lead to inadequate policies followed by questionable measures and investments.

Education and e-Skills

Education and e-Skills are critical for IS developments as ICT is a ubiquitous enabling technology that permeates all spheres of human activity. The digital literacy paradigm both empowers and sets higher standards for Education and the related stakeholders. E-Skills in Education, as in other spheres, should be aligned with web 2.0 approaches and social networking applications, which transform traditional top-down organizational schemes into dynamic structures based on free open exchange.

A series of IT STAR conferences[6] have debated the topic of Education and e-Skills for IS:

The overall EU workforce specification is such that there is serious shortfall of ICT practitioners[7] and a scarcity of required e-Skills for the new digital scenario. According to national and international research[8] this fact hampers EU competitiveness vis-à-vis other world regions, with serious economic and social implications.

In Europe's Strategy for the Digital Economy by 2020[9] a number of planned actions relating to e-skills are included, among them *digital skills and competences as a priority area, developing tools to recognize e-competences and proposing EU-wide indicators of digital competences, promoting stronger participation of women in ICT, developing online consumer education tool on*

[5] See Cene Bavec, *Stimulus for the Use of Public Services in the European Union,* in National Information Society Experiences, ISBN88-901620-2-3, © IT STAR 2009

[6] See www.itstar.eu and specifically the WS and publications sites referring to R&D in ICT in Central, Eastern and Southern Europe, Bratislava, 2006, Universities and the ICT Industry, Genzano di Roma, 2007, National Information Society Experiences, Godollo, 2008, ICT Skills, Education and Certification, Rome, 2009, Electronic Business, Zagreb, 2010

[7] According to the Digital Agenda, Europe risks a shortage of 700,000 IT jobs by 2015.

[8] See Fulvia Sala – *The cost of Ignorance in Information Society: An Italian Multi-annual Research Program,* in IT STAR Newsletter, Vol.7, no. 2, Summer 2009 – http://nl.starbus.org and Bruno Lamborghini's Opening Address in Proceedings of the 4th IT STAR Workshop on ICT Skills, Education and Certification: the Multi-Stakeholder Partnership ISBN 88901620-5-8, © IT STAR

[9] See http://ec.europa.eu/information_society/digital-agenda/index_en.htm; The IT STAR Newsletter has initiated a series of articles on aspects of the digital agenda as they relate to the EU member states in our region.

new media technologies and other. The Strategy calls on *Member states to promote long-term e-Skills and digital literacy policies and to mainstream eLearning in national policies.*

There is a need of uniformity with regard to e-Skills terminology: 3 broad areas of e-Skills – ICT practitioner skills, ICT end-user skills and e-Business skills – are defined. While the first two are sufficiently outlined, e-Business skills (sometimes referred to as e-Leadership) remain to be better described. An attempt in this direction was made during the recent IT STAR conference in Zagreb, Croatia[10].

In the ICT end-user area the most familiar certification in the IT STAR Region is **ECDL – The European Computer Driving Licence**[11]: It is an international standard in end-user computer skills with its core version comprising of 7 modules – concepts of ICT, using the computer and managing files, word processing, spreadsheets, databases, presentations, Internet. From the 11 million ECDL/ICDL skill cards issued internationally, two thirds are issued in Europe.

Regard the ICT practitioner skills, the Industry recognition of ICT certifications is of special value. In this respect, the CEN WS on ICT-Skills, supported by DG "Enterprise and Industry" launched some years ago the development of the **European e-Competence Framework (e-CF)[12],** a benchmark from the ICT business employers' perspective consisting of ICT practitioner and manager competences structured as needed and applied on the workplace, and intended to assist transparency and mobility in the EU labor market. The e-CF assists **ICT practitioners and managers** with guidelines for their competence development. It is useful to the education and training sector as a tool for planning and design of ICT related curricula and programs, to HR specialists for planning competence requirements, and to policy-makers and market researchers in providing reference for ICT skills and competences in a long-term perspective.

The e-CF is structured in 4 Dimensions:

Dimension 1 includes the 5 e-Competence areas, derived from the ICT business processes PLAN - BUILD - RUN - ENABLE – MANAGE

Dimension 2 presents a set of reference e-Competences for each area, with a generic description for each competence. 36 competences are identified.

[10] See Denise Leahy and Dudley Dolan, *The Skills Challenge for e-Business* in Electronic Business, Proceedings of the 5th IT STAR WS, ISBN9788890540615, © IT STAR 2011

[11] http://www.ecdl.com

[12] See ICT Skills, Education and Certification – ISBN88-901620-5-8, © IT STAR 2010

Dimension 3 matches European reference level specifications on e-Competence levels e-1 to e-5, which are related to EQF levels 3-8.

Dimension 4 offers examples of knowledge and skills related to the e-Competences, which are indicated as optional framework components for inspiration. They are not intended to be exhaustive.

e-CF's terminology is in conformity with the EQF - *Competence*: A demonstrated ability to apply knowledge, skills and attitudes for achieving observable results; *Knowledge*: represents the "set of know-what" (e.g. programming languages, design tools,…) and can be described by operational descriptions; *Skill*: Ability to carry out managerial or technical tasks. Skills are components of competences and specify some core abilities, which form a competence; *Attitude*: cognitive and relational capacity (e.g. analysis, synthesis, flexibility, pragmatism,…).

The e-CF serves as a *translation* and alignment platform for other international and national programs and models such as EUCIP, the SFIA models (*Skills Framework for the Information Age*), AITTS (*Arbeitsprozessorientierte IT-Weiterbildung*), Nomenclature 2005 CIGREF (*Club Informatique des Grandes Entreprises Françaises*), the Career-Space profiles and other schemes.

EUCIP – The European Certification of Informatics Professionals[13]

EUCIP is a professional certification and competency development scheme, identifying 22 professional profiles and aimed at informatics professionals and practitioners. It assists the integration of new programs and tools for certification of professional competences into university computer science courses and sets its overall goals as follows:

- Define an industry independent-driven vocational structure and standards for the informatics profession
- Establish a sustainable European services network for informatics competence development
- Contribute to closing the ICT professional skills gap in Europe
- Offer a vehicle for life-long learning and competency enhancement for the ICT profession

ECDL and EUCIP are CEPIS[14] sponsored schemes supported by IT STAR's member societies and promoted in the region along with e-CF, as a reference framework of primary importance in the EU.

Many IT STAR members see ICT skills and English as essential elements of the

[13] http://www.eucip.com
[14] http://www.cepis.org

soft skills portfolio for professional development and argue that there needs to be defined levels of certification such as the ECDL for all first year students.

A negative tendency in the 90's and the early 2000's was the slow decline of the educational system in most of Eastern Europe. A main factor was under-financing but despite the problems, education in the region remains high in the mindset of the population and the performance results in various international competitions (i.e. International Olympiad in Informatics.[15]) demonstrate competitiveness. A worrying trend however is that students increasingly prefer social sciences to technical disciplines.

Eastern Europe experiences a need for stronger collaboration between informatics departments and business/application communities. There is also the need of strong engagement in multi-stakeholder partnership projects as the combination of governmental regulation and support, academic knowledge and business motivation positively influences the emergence of new products and services and increased competitiveness.

The relationship between Academia and industry is complex - Universities need research to maintain a high level of academic excellence, to remain a key player in basic and high-end science and to receive additional funding from industry; Industry relies on new academic recruitment by attracting and selecting talented students but also through joint research with universities in areas in which their own R&D units need further competence. In this partnership there are conflicting interests due to the essence of the 2 sectors - often Industry requires immediate solutions while academia supports the notion of the broader and more abstract horizons of the discipline.

The Tripartite relationship *Academia-Government-Industry* calls for the following considerations:

The ICT industry is a sphere of rapid technological change, which makes existing knowledge quickly obsolete. While innovation today is mainly produced outside academia, universities give high-value contributions by way of strong partnership schemes. A great challenge for European universities is to cultivate the spirit of innovativeness by regarding the process of education not simply as an individual endeavor of the students but rather an environment of group work, establishing trust and open exchange of ideas.

The demand for continuous life-long learning and e-learning

[15] More on this in IT STAR Newsletter Vol.5, no.3, Autumn 2007 and in particular, article by Petar S. Kenderov, *Bulgaria – Birthplace of International Competitions in Informatics for School Students*

Short summary related to Eastern Europe

Governments, academia, industry and civil society need to be well equipped to monitor, manage and participate in IS processes and the most valuable resource is a well-educated and well-motivated population, sustained by a robust system of education and research.

There is need to concentrate on developing content in national languages, on actively supporting the study of technical disciplines, and on investing in ICT skills. In the process, EU funds and various kinds of financial support can be exploited, which is important, as any activity and change of orientation requires substantial financing. The issues that need to be compensated for are the recession, unclear policies and demographic problems. Revisions of national IS strategies would be most advisable, to be followed by realistic action plans with mandatory elements such as timeframes, finances, entities in charge, and deliverables.

Most of the IT STAR countries share a common ancestry, face similar ICT issues and are on comparable levels of IS development. Therefore, the opportunity for contacts to establish project oriented *pools* and other forms of regional and international cooperation is important and beneficial.

Towards Enhancing the Inquiry Based Mathematics Education

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Abstract. The paper presents the implementation of the Inquiry based mathematics education in Bulgaria in the frames of the Fibonacci and the InnoMathEd European projects. The first impressions of the project activities with teachers and students as well as some lessons learned are shared.
Keywords: IBME, Fibonacci, InnoMathEd, teacher training, dynamic geometry software, Elica 3D applications

1 Introduction

The idea of Lifelong learning (although not quite new) is in the core of recent educational projects worldwide. Its importance is due to the extreme dynamics of the information/knowledge/creativity society. To build continuously knowledge throughout one's life is not just a skill but a crucial competency for the future citizens. To keep up with the knowledge dynamics in a specific field, experts should acquire skills such as:

- conducting their own explorations
- searching and identifying relevant information
- applying creatively their findings
- presenting the results in a way convincing for others.

Such ICT-enhanced skills are gradually becoming part of what is expected from the university graduates but they should be cultivated much earlier - at a school setting. An educational strategy towards this goal is based on the inquiry approach to learning.

2 Inquiry based mathematics education

The phrase Inquiry Based Education (IBE) is used to describe a process in which the students (under the guidance of a teacher) are "creating" or "discovering" the knowledge themselves by conducting experiments, by asking relevant questions, by searching for answers in the existing information resources, by formulating and investigating conjectures, by discussing with peers.

While this approach has been natural for the natural sciences it is relatively new in the context of the mathe-matics education and has been promoted in Bulgaria mainly since 1984 within the experimental schools of the Research

Group on Education [1-5].

The recent developments in Bulgaria in the field of IBE are closely related to two European Projects - InnoMathEd (Innovations in Mathematics Education on European Level) [6] and Fibonacci (Disseminating inquiry-based science and mathematics education in Europe) [7].

3 Activities within the InnoMathEd and the Fibonacci projects in Bulgaria

The Inquiry Based Mathematics Education (IBME) in the frames of these two projects has been promoted in Bulgaria at two levels - nationally and locally, in major regional centers [8].

3.1 Seminars and workshops promoting a new role for the teachers

At national level the promotion instruments were workshops, seminars and special sections of the national conferences organized by the Union of Bulgarian Mathematicians. At local level IBME was promoted and supported by multiple training and presentation sessions organized in twelve Bulgarian regions with the help of the Local Boards. Altogether more than 500 teachers have been exposed to such events.

Fig. 1 Teachers in the role of students - "Hands on" and "hands with" geometric constructions

The specifics of the teachers training courses was the variety of the audience - in their endeavor to embrace a critical mass of teachers able to implement the inquiry-based learning by means of dynamic computer environments, the regional experts and school principals would often form groups of teachers

from the primary and secondary school, teachers in mathematics, informatics, ICT and sometimes even in science, arts, and history.

This was a serious challenge for the teacher educators. They had to introduce for a couple of days relatively new dynamic software (GeoGebra, Geonext, Elica applications for 3D explorations) in the context of didactic scenarios specially developed by the Bulgarian Fibonacci team in harmony with the curriculum (but not limited to it) and to demonstrate the inquiry-based teaching/learning process.

In order to grasp better the specifics of the IBE the teachers were encouraged to enter the role of their students and to explore the dynamic software environments on their own (Fig. 1). Thus, even teachers with relatively modest technical skills could gain self-confidence and showed promising results.

Furthermore, they could experience the profit of working in teams integrating people with different level of technical skills, various interests and expertise still sharing the same enthusiasm of creating an exploratory spirit in their class settings.

The variety of the audience stimulated the lecturers to reveal a broad spectrum of the potential of the dynamic software - from typical geometry constructions, to modeling of rotational objects and tessellation in the style of Escher (Fig.2-3).

In addition to the teacher education courses the first phase of the Fibonacci project embraced the following activities:

- follow-up visits to check the progress of the teachers with using dynamic computer environments
- development and providing an open access to more than 50 dynamic scenarios appropriate for imple-menting IBME in 1-12 grades [10]
- launching a competition among teachers for developing mathematics modules based on dynamic software
- stimulating the submission of articles in the Mathematics and Informatics Journal (published by the Bulgarian Ministry of Education, Youth and Science)
- development of the first issues of a series of dynamic textbooks for the junior high school [11]
- organizing a bi-weekly Fibonacci Seminar on the premises of IMI-BAS
- stimulating the work of mathematically gifted high-school students on research projects

Fig.2 Modelling rotational solids by means of Elica 3D applications

Fig.3 Visual modeling in the style of Escher tessellations by means of GeoGebra

3.2 Follow-up events - teachers projects presentations and field visits

Follow up workshops and the seminars were organized to check the progress of the teachers in acquiring the skills necessary to implement dynamic computer environments in a class setting. At these events the teachers presented and defended projects developed individually or in a team on a topic currently taught by them (Fig. 4).

The first impressions of the Fibonacci team are that the prevailing part of the teachers were still seeing the dynamic software as a means for visualization of mathematical facts rather than for organizing experiments and explorations, for discovering patterns, for making conjectures. But feeling comfortable with the use of dynamic software is an important (even though a small) step towards making the inquiry-based approach a natural component of the learning process.

The next step (still a challenge for us as promoters of the inquiry-based learning) is to encourage teachers to apply the full potential of the dynamic mathematics software in support of that style in class.

To this goal we organize open meetings/seminars twice a month discussing

various strategies of supporting teachers in their efforts. The proposed strategies include maintaining a forum on the Project using various platforms for sharing the best IBME practices of teachers, visiting the Fibonacci project schools, updating and en-riching the repository of dynamic learning environments, writing and translating electronic textbooks facilitating the disseminations of the Fibonacci project ideas.

The experience the University of Bayreuth (our Fibonacci Reference Center) in Increasing Efficiency in Mathematics and Science Education (the SINUS project) on the whole territory of Bavaria has been extremely valuable - leading experts of German Fibonacci team have visited Bulgaria, met with teachers and delivered talks at conferences and articles in proceedings and journals, parts of [9] are being translated (to be published).

Field visits in Project partner cities (Augsburg and Bayreuth) were very fruitful for the Bulgarian researchers and teachers. Problems and projects demonstrated by the hosting partners inspired the development of new dynamic scenarios (e.g. Patterns with poliominoes in a table with numbers).The multiple discussions on the local education system and teachers' professional development, national educational standards and curricula, available didactical tools and materials were later shared at the bi-monthly Fibonacci seminar at IMI. Putting the effertos and achievements of the Bulgarian fibonacci teachers in an international setting contributes to their self-confidence and pride of belonging to the European community of innovative educators.

Fig.4 Teachers presenting and defending their projects in front of the Fibonacci team and other colleagues

The visits of the Fibonacci project evaluators and consultants and their on-going support in following the professional development of the teachers have been also crucial for the next steps - identifying 40 "Fibonacci-teachers" (Fibonacci Project teachers) to act as cascade teachers in tier respective schools.

The support for these teachers and the joint work with them is the major task now for the Fibonacci team in Bulgaria and the seminar organized jointly with QED [12] demonstrated that these teachers are capable and willing to help other teachers in applying the IBME approach.

3.3 Development of resources

The potential of the computer learning environments for supporting a new type of relationship among teachers and students (as members of a research team in which the teacher acts as a discovery-guide) is very important. The participants in the inquiry-based learning process are expected to observe a specific phenomenon, to formulate a conjecture based on these observations, to check and verify this conjecture experimentally. Such a style enables the students (and their teachers alike) to experience the flavour of the real mathematics as a field of new discoveries. Even if they happen to re-discover America, they would enjoy the process of sailing to it, and would enhance their creative thinking. They would learn to try and compare various strategies for attacking a problem and would understand that in mathematics the road to a goal is often more important than the goal itself. Which method to apply, how to apply it, which parts to neglect are aspects not covered by any method, thus mathemat-ics should be experienced not just as a science but as art as well!

The experiment allows the students to decide what is invariant or crucial in a specific construction, what could be neglected, rejected or modified. Furthermore, they could formulate their own problems by implementing similar ideas in a context interesting for themselves. Last but not least, they could become co-authors of the toolkit of a specific dynamic computer environment by enriching it with tools constructed by themselves.

While developing the dynamic resources in support of the IBME our Fibonacci team tried to interweave all these ideas - a challenging task in view of the relatively conservative mathematics curriculum and methods of evaluation. But the task was worth attacking since based on previous experience we knew that the learning process could be made enjoyable and natural for the students if they were provided with appropriate dynamic environments functioning as mathematical laboratories.

Let us formulate in a nut shell the basic principles behind the development of

resources (1-12 grade) published as dynamic scenarios on the Bulgarian Fibonacci site [10]. These resources have been carefully designed to provide opportunities for

- the teachers to work as research partners of their students
- the students to find their own learning paths according to their interests and potential
- for all users to build the knowledge in a cross-disciplinary context (especially integrating mathematics with IT, natural science and art).

Here are some examples of dynamic scenarios based on explorations by means of GeoGebra (Fig. 5- 8).

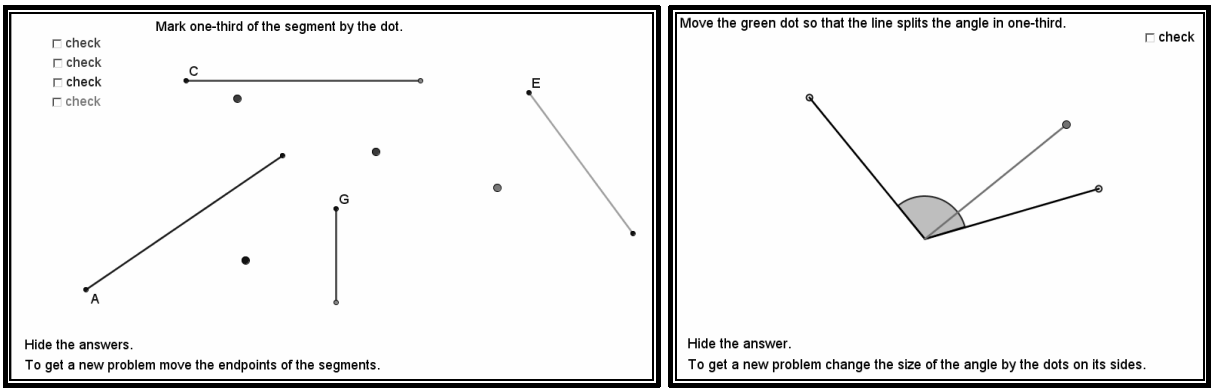

Fig.5 Enhancing students' eye-meter - modules for young students (2-3 grade) intended to develop their evaluation skills with regard to fractions of segments and angles

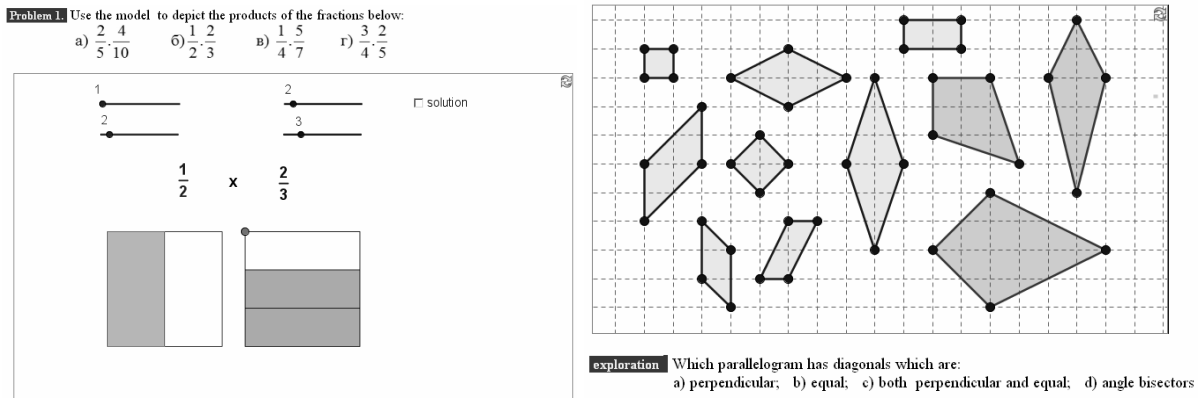

Fig.6 Modules for deepening students' (5-6 grade) understanding of operations with fractions and geometric objects

The resources developed by the Fibonacci team are being evaluated by the teachers by testing them in a class setting. The feedback of the teachers is then reflected by the authors thus making the resources *dynamic* in multiple aspects. Furthermore, the teachers modify the team resources or create themselves modules fitting their current pedagogical tasks. After evaluating teachers' development we publish them on the Project site under the heading Learning Environments Contributed by Teacher.

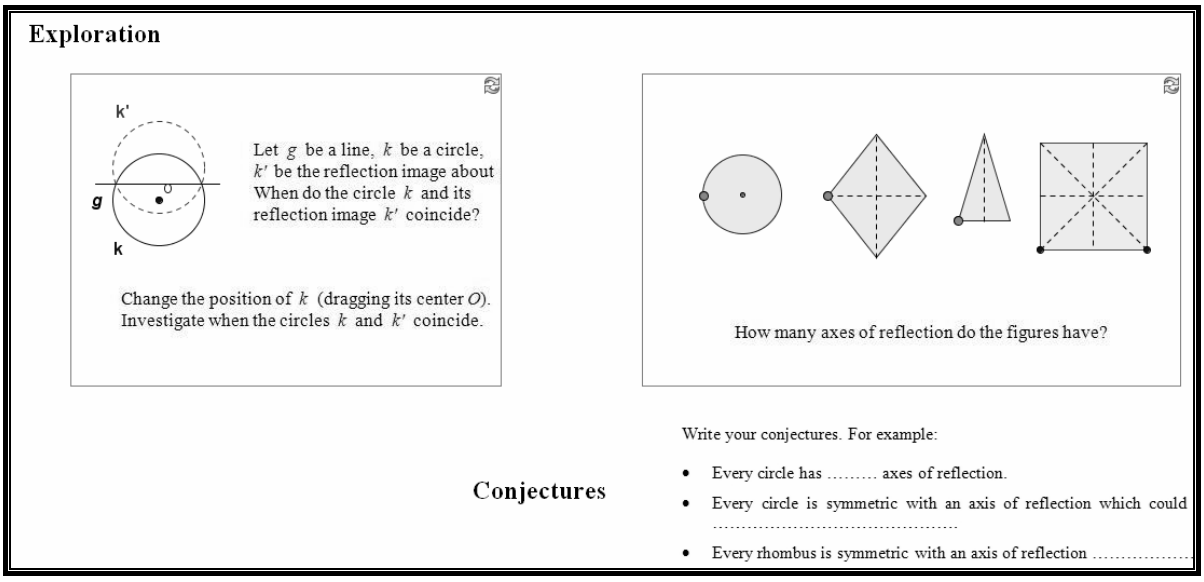

Fig.7 Exploring the properties of geometric transformations (modules for 8th grade)

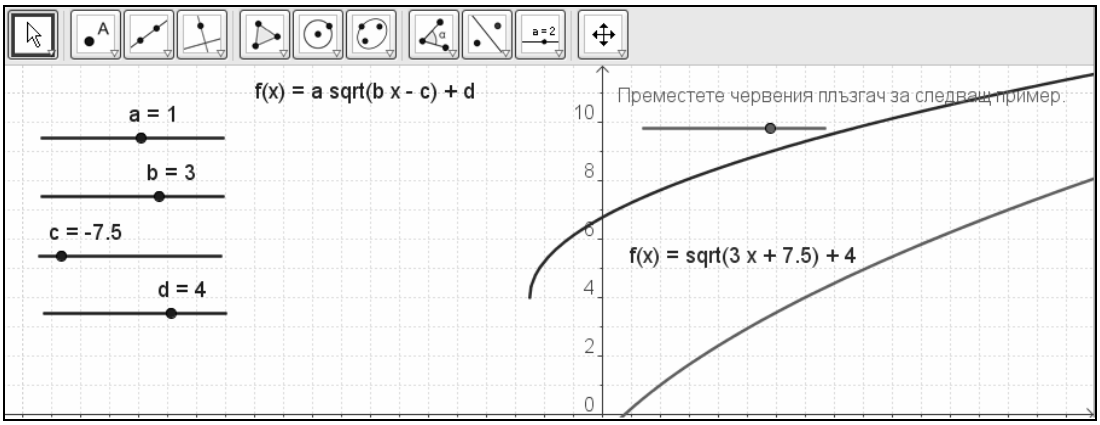

Fig.8 Games with graphs of functions (8-12 grade) -
the goal is to make the blue graph fit the red by means of the sliders

Another important initiative of the Fibonacci team is to encourage the teachers involved in the project to report their good practices in implementing the IBME on the pages of the Mathematics and InformaticsJjournal. The journal is meant for teachers and students of all ages thus disseminating the Fibonacci project ideas on a relatively large scale

So far the teacher materials published on the Fibonacci project site and in the Mathematics and Informatics Journal deal with graphs of functions, solving equations containing absolute values, extreme points of functions, systems of inequalities, systems of equations, systems of trigonometric inequalities, operations on fractions.

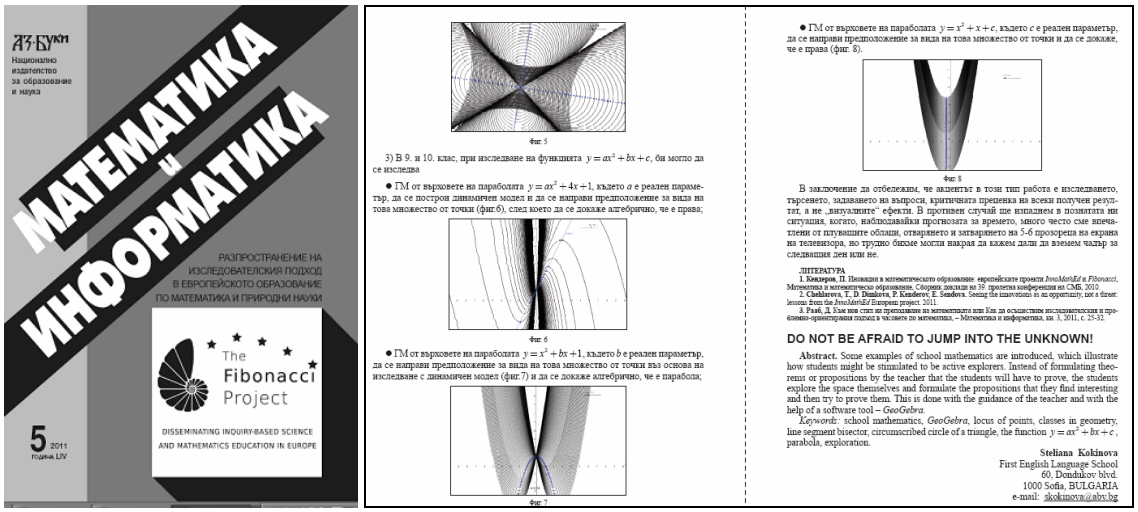

Fig.9 Don't be afraid to jump in the unknown - an article by a Fibonacci teacher

3.5 Current dissemination of the project ideas, resources, outputs

Although the scale of the Fibonacci project dissemination is relatively large in terms of number of schools and teachers, it is extremely importnat to raise the awareness of the general public about the impact of the IBME on the students' motivation for learning. With this in mind the Bulgarian Fibonacci team has been involved in a number of social events dedicated to the attractive side of mathematics - interviews with local radio- and TV stations, creating flims with the participation of teachers and students practicing the inquiry based approach, delivering presentations at international fora. The European Reserachers' Night (an event, having become already a tradition) turned out to be especially contegious with its "Dynamic mathematics". This was the title of a section at the premices of the Bulgarian Academy of Sciences where our Fibonacci team organised a quiz of puzzles (based on dynamic software) and an Escherisation contest (creating tesselations in the style of Escher) (Fig. 10).

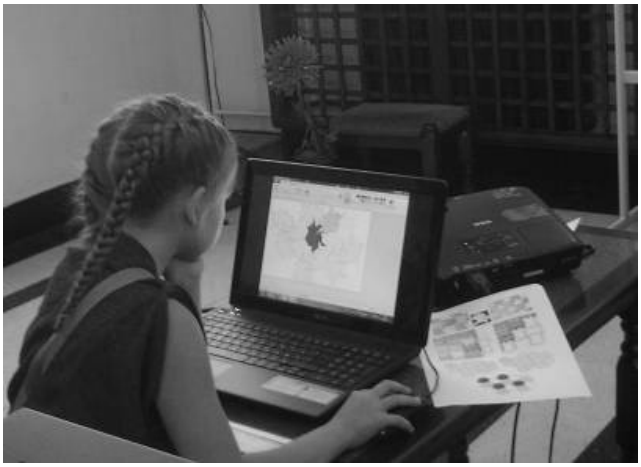

Fig.10 Raising the awareness of the general public about the real nature of mathematics The Researchers' Night

The event was attended by children and adults, joining in teams to "take the gauntlet" thrown dawn by the or-ganizers. Not only the random visitors, even colleagues expressed their sincere surprise that mathematics could be made so attractive and enjoyable for young people.

It is our strong belief that the talent is a resource which, unlike the ores, could vanish if not discovered early enough…Thus encouraging the research potential of mathematically gifted high school students is a special branch of the IBME which has good roots established by the mathematical community in Bulgaria. Below we describe an initiative in this direction launched 11 years ago.

4 A Representative Model of IBME for High-School students

To put the students with special interests in mathematics, informatics and information technologies (IT) in more realistic research situation, the High School Institute in Mathematics and Informatics (HSSI) was founded by the Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences, the Union of Bulgarian Mathematicians, St. Cyril and St. Methodius International Foundation, and Evrika Foundation in year 2000 in response to the decision of UNESCO to declare that year as "World Year of Mathematics". [13]. This institute inherited the good traditions of an earlier movement of the technically creative youth in Bulgaria and an international research program held at MIT (USA) - the Research Science Institute (RSI) [14]. The name "Institute" reflects the endeavor to have an organization that functions like a research organization and according to the principles of scientific life [15]. The infrastructure of the HSSI has been adapted to the specifics of the local conditions - its activities are focused on projects in mathematics, informatics and information technologies [16-19]. The mission of HSSI is to identify students who have potential in doing research in these fields and take care of their development as future scientists.

The participants in HSSI are high school students between 8th and 12th grade, usually aged 15 to 18, mainly from specialized Science and Mathematics Secondary Schools in the country. Every participant in HSSI works individually (or in a team) on a freely chosen topic in mathematics, informatics and/or IT under the guidance of a teacher or another specialist. A written presentation of the project is sent to HSSI. All papers are refereed by specialists and the reviews are given to the authors. Papers involving creativity elements are given special credit. The best projects are accepted for a presentation in the conference sessions of HSSI.

During one school year HSSI organizes three events - two conference sessions and a research summer school.

The High School Students' Conference is usually attended by more than 200 students, teachers, researchers in mathematics and informatics, parents, journalists. The conference is held in two streams - mathematics and informatics/IT. The authors present their work in front of a Jury of specialists in the field and in the presence of the general audience. The jury can ask the students various questions at the end of their presentations so as to check the level of their understanding and creativity. The projects in informatics and IT are additionally run on computers to be judged by a specialist from technical point of view before being presented to the audience and the jury. Parallel to these two streams is a poster session. Based on the merits of the paper and the style of presentation, the Jury judges the works and selects the best ones. Their authors receive Certificates for Excellence; all other participants are given Diplomas for participation in the event, which is already a high recognition.

The authors of the best projects in the High School Students' Conference are invited (at the expenses of HSSI) to take part in an Interview for selecting two Bulgarian participants in RSI and to participate in the School Section of the Annual Conference of the Union of the Bulgarian Mathematicians. The School Section is an independent event - it could be attended by students who present their research for a first time. The process of reviewing and selecting papers for the School Section is the same as above. The authors of the best projects from this section are invited to participate in the Research Summer School (also at the expenses of HSSI).

The three-week Research Summer School takes place in July-August in two locations - at the sea coast and in the mountains. During the first two weeks, lectures and practical courses in mathematics and informatics are delivered by eminent specialists from universities, academic institutions and software companies including Fibonacci team lecturers (Fig. 11). The main goal of the training is to extend the students' knowledge in topics related to their interests

and to offer new problems which become the core of short-term projects.

The third week is devoted to a High School Students Workshop, where the participants report on their short-term project's results and exchange ideas for further studies. The presentations are in front of specialists whose role is to advise the students in finding the right topics and problems to be studied, to recommend methods and tools to be used to achieve high quality results.

To help teachers improve their mentoring skills a High School Teachers Workshop is organized during the third week of the Research Summer School. Participants are the research advisors of the students projects, presented at the events of HSSI during the school year.

Fig.11 The lecture on inversion by a member of the Fibonacci team provides food for new research projects

Several high-school students from the High School Institute of Mathematics and Informatics were specially invited to participate in the workshop with presentations of their projects demonstrating the potential of the dynamic software for attacking open problems and formulating their own ones.

Since year 2000 the HSSI selects the Bulgarian representatives for RSI. The interviewers include researchers from IMI and other research institutions, representatives from St. Cyril and St. Methodius International Foundation and most importantly - RSI alumni. The questions aim at checking the fluency of the candidates in English, their general and professional culture, talents in other fields (sports, music, etc.), and social skills. Even from the questions of their peers the candidates realize that to participate in RSI is not only a great honor but a challenge and a responsibility to pass to the rest what they have learned. The selection process is difficult - two RSI participants and two alternates are chosen among about 20 excellent candidates based on their overall performance - their work on the projects, their presentations, achievements in mathematics and informatics events, and the interview.

Fig.12 Discussing important scientific issues at the MIT canteen - a breakfast with professors in mathematics and a dinner with a Nobel laureate in chemistry

The most important result of HSSI is the specific knowledge and skills acquired by the students of HSSI and RSI. In order to work successfully on a given project the students in these institutes learn additional material, often going far beyond the obligatory syllabus and curriculum. They understand much deeper what they learn and are able to apply their knowledge to solving open problems and to formulating new problems worth investigation. This is what happens in real research. The opportunity to present results to peers makes the similarity with science even stronger. In fact, the RSI and the HSSI students get a rather real picture of what science is and acquire practical habits in doing research. They demonstrate the potential of the inquiry based learning by "discovering" the knowledge themselves, by searching the existing classical literature and Internet resources, by combining in an original way known facts and, not rarely, by obtaining new results about the studied topic. The mentors do not provide the knowledge in terms of direct instruction. They help the students develop the necessary research skills (analytical thinking, formulation of conjectures, experimental verification of the conjectures etc.) and guide the overall process of work.

5 Conclusions

The impact of the activities within the InnoMathEd and the Fibonacci European projects on both teachers and students makes us optimists. We strongly believe that the continuous professional development of the teachers (especially when officially recognised) will lead to a new attitude towards mathematics teaching, towards learning throughout one's life and towards the role of mathematics in everyday life.

Furthermore, developing and disseminating inquiry-based education as a major transversal competence will contribute to the building of a knowledge/ creativity society. When provided with the right learning environment the students will feel better motivated and encouraged to construct their knowledge by experimenting, asking questions, conjecturing, providing arguments and, finally, by discovering for themselves the studied (and possibly new) facts as well as the interconnections between them. In short they will be

supported to act like researchers and problem-solvers, and apply these competencies in the course of a lifetime. This will help them not only to keep in pace with the development of a specific field of their professional realization but to demonstrate crucial competencies in a wider spectrum of life.

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The EU Digital Agenda: A Leap Towards Better Education

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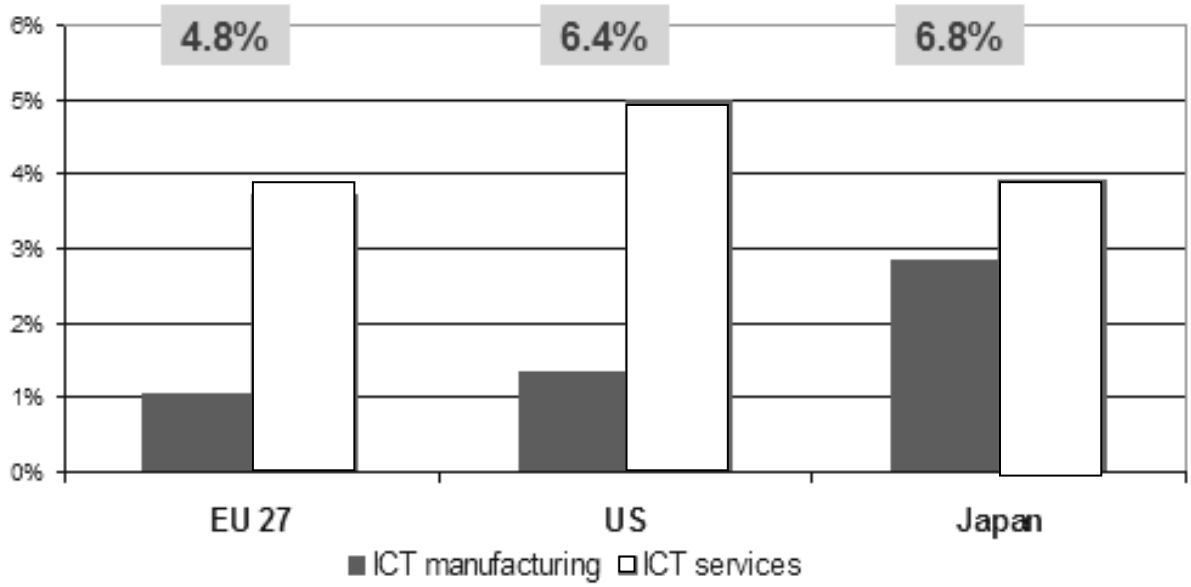
europlan | Working together for the information society in Europe

Why ICT matters?

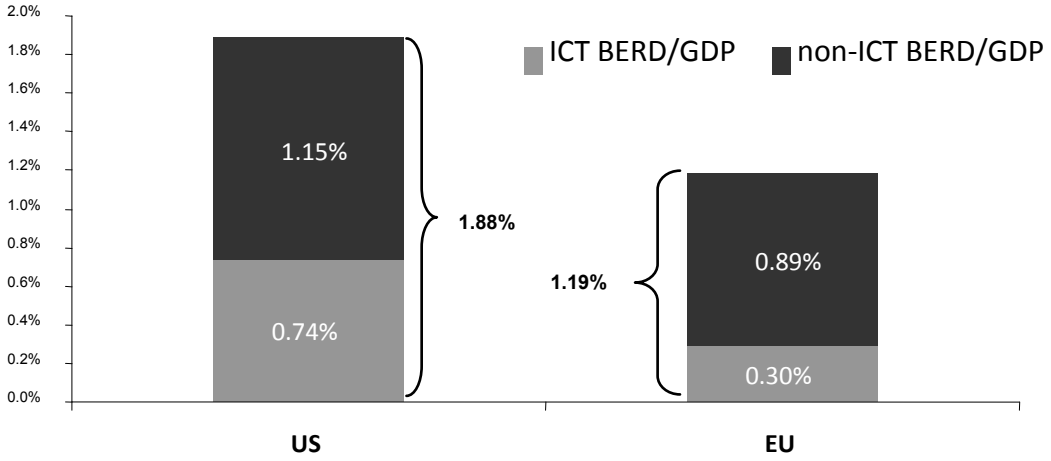
The ICT sector represents 4.8% of the EU economy	ICT manufactureing (1% of the GDP) alone generates 25% of total business R&D	The ICT sector and investment in ICT are responsible for 50% of productivity grouwth
ICT sector value added as a % of GDP	ICT contribution to labour productivity grouwth	Share of ICT in business R&D expenditure

Share of the ICT sector in the EU, the USA and Japan



Investment in Digital Economy is key to future prosperity

Business R&D spending in the USA and in the EU



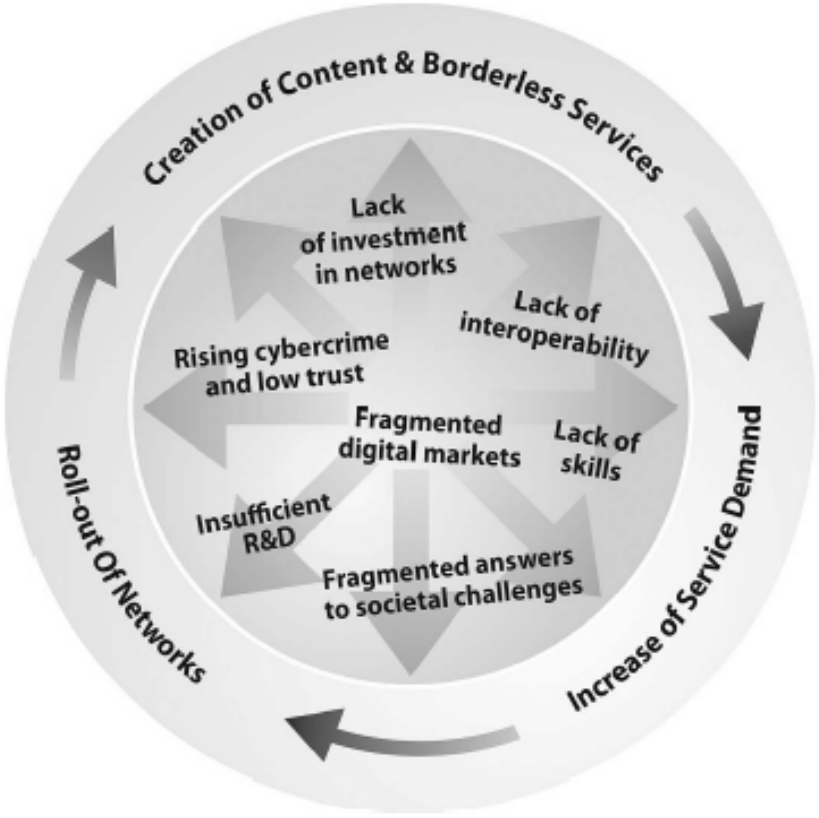
Source: IPTS-JRC

Contribution of ICT and non-ICT sectors to total BERD intensity (% of GDP, 2007)

Europe 2020

- is the EU's growth strategy for the coming decade, with priorities for a smart, sustainable and inclusive economy
- sets out objectives on employment, innovation, education, social inclusion and climate/energy

The seven challenges identified in the Digital Agenda for Europe



Digital Agenda for Europe

- One of seven lead initiatives of the Europe 2020 strategy
- Aim:
  - overcoming the crisis
  - preparation for the challenges of the century
- Function:
  - work plan for the European Commission
  - cross-portofolio approach

DAE priority area for Research and Innovation

The priorities are:

- To reach the overall 3% R&D headline target in Europe 2020 public investment EU Member States will have to **double annual public spending on ICT R&D from €5.5 billion to €11 billion** (including EU Programs)
- To leverage private spending from €35 billion to €70 billion for example by stimulating pre-commercial procurement, public private partnerships
- To develop 'light and fast' ways for SMEs and young researchers to access EU funding for ICT research
- To inject more focus and **pooling of efforts in research funding.**
- To emphasize research efforts at the service of society by targeting issues such as ageing population or environmental crisis

Framework Program 7 (2007-2013)

- Budget of over € 50 billion
- “European added value”
- Main strategic objectives;
  - Strengthen scientific and technological base of European industry
  - Encourage its international competitiveness, while promoting research that supports EU policies

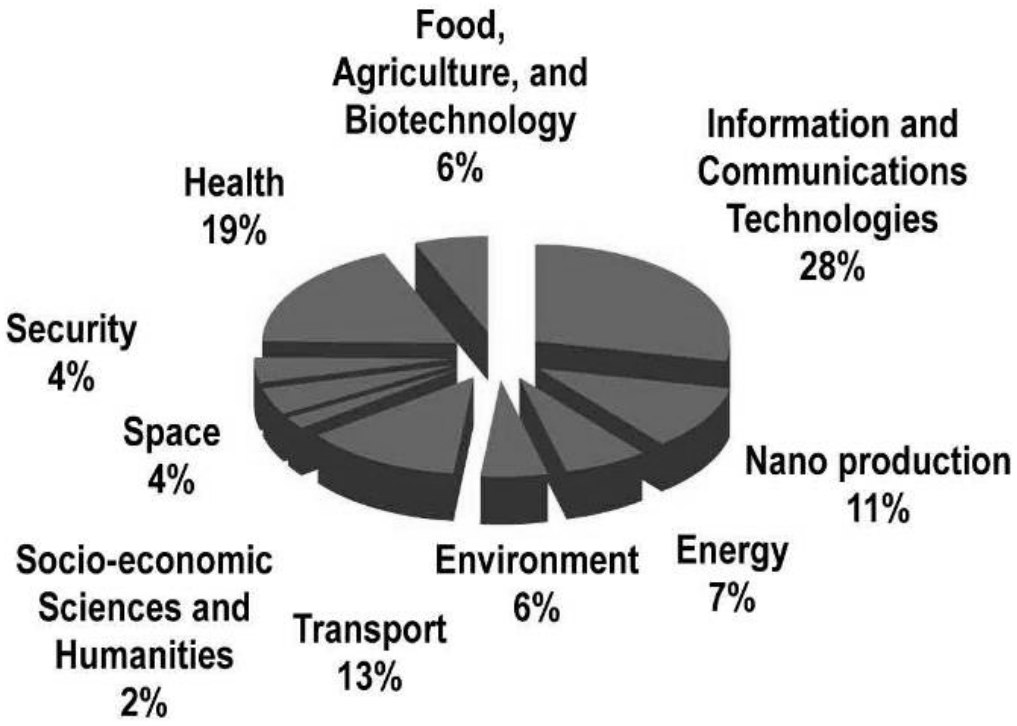
FP7 Cooperation Program (€32.4 billion) - The ICT thematic area is the largest in the Cooperation Program with a budget of € 9,1 billion

ICT Theme

Initiatives for strategic research in priority areas of ICT can be funded via the Information Society policy priority of FP7 by a total of up to EUR 1.8 billion

Objectives

- Reinforce basic ICT technologies and infrastructures - seize new opportunities in emerging fields, build on existing strengths, help share risks and build partnerships
- Reinforce ICT contributions to major socio-economic challenges - health and ageing, lower-carbon economy, sustainable manufacturing and services, learning and cultural resources
- Support to international cooperation
- Strengthen cooperation in an enlarged Europe
- Support to pre-commercial procurement



Challenges ICT Work Program (2011-12)

- Challenge 1 - Pervasive and Trusted Network and Service Infrastructures
- Challenge 2 - Cognitive Systems and Robotics
- Challenge 3 - Alternative Paths to Components and Systems
- Challenge 4 - Technologies for Digital Content and Languages
- Challenge 5 - ICT for Health, Ageing Well, Inclusion and Governance
- Challenge 6 - ICT for low carbon economy
- Challenge 7 - ICT for the Enterprise and Manufacturing
- Challenge 8 - ICT for Learning and Access to Cultural Resources
  - Addresses the need for flexible and efficient access to information and knowledge for educational and training purposes

- Aims to stimulate progress in the development of applications for use in education
- Target Outcomes
  - Technology Enhanced Learning systems with the capability of human tutors
  - Educationals tools for : science, technology and maths
  - Advanced solutions for fast and flexible deployment of learning opportunities at the workplace
  - Computerised tools fostering creativity in learning processes
- Technology-enhanced learning
  - Advances in learning through ICT
  - Systems endowed with the capabilities of human tutors
  - Educational technologies for science, technology and maths
  - Solutions for deployment of learning opportunities at the workplace
  - Computational tools fostering creativity in learning processes

Deadline: 17/01/2012

Conclusion

- ICT is a significant contributor to the GDP both as an enabler and as an industrial sector
- Europe 2020 strategy shows the way for a smart,sustainable and inclusive Europe
- The Digital Agenda for Europe identifies the key challenges to be solved so that Europe will exit the current financial crisis
- FP7 in general and the ICT Theme in particular make a major contribution towards the success oif the Digital Agenda for Europe
- Learning technologies are key to a more efficient and productive Europe
- Learning technologies is one of the major areas funded by the ICT Theme

Education in the 21st Century: What to Expect from Teachers

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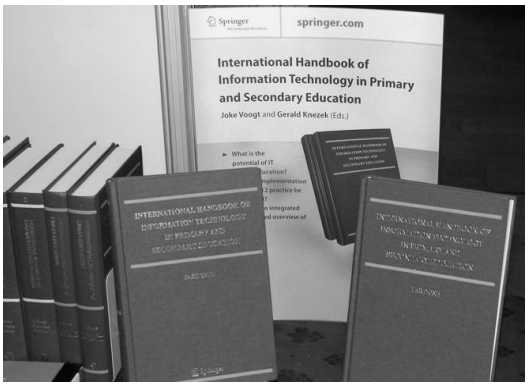
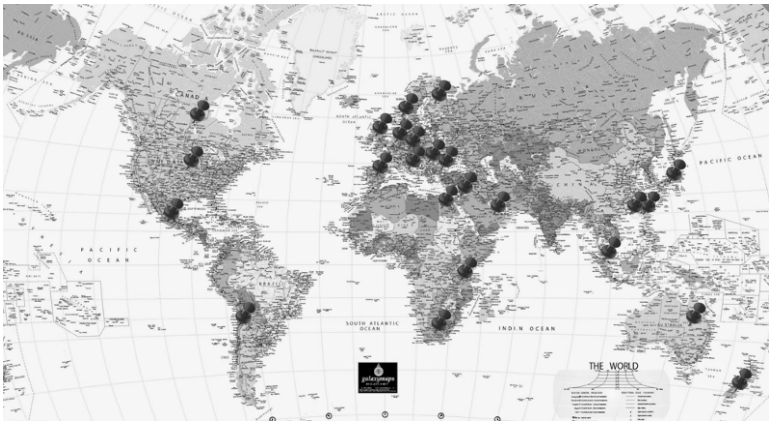
International Handbook of Information Technology in Primary & Secondary Education

(Voogt & Knezek, 2008) - Synthesis of research on ICT in education from a broad international perspective



Start – UNESCO, Paris, 2006



What research has demonstrated

- ICT can enhance teaching and learning
- Under which conditions ICT works (at system, school and teacher level)

but

- ICT scarcely finds its way in teaching and learning practice

International Summit of 70 scholars, leadership and policy makers to go beyond the findings of the Handbook

Call to action edusummit 2009

- To better understand student technology experiences in informal learning environments, in order to inform learning in formal settings
- To develop new assessments designed to measure outcomes from technology enriched learning experiences
- To develop and use distributed leadership models for technology use in schools and teacher education programs
- To develop and use models for teacher learning on technology use in schools and classrooms at the pre- and in-service levels
- To develop ideas on international opportunities relating to new and emerging technologies in order to address the needs of developing countries and promote global social awareness and responsibilities
- To develop and disseminate a list of essential conditions that need to be in place to ensure benefit from technology investments
- To actively study both research on and development of ICT applications in classrooms
- To use findings presented in the Handbook to inform research, policy and leadership for ICT in schools
- To develop mechanisms for sharing and distributing research, promising policies and practices on ICT in education

- To nurture an international community of ICT scholars, policy makers and leaders who continually build upon our knowledge base to inform policy and practice.
- To disseminate and discuss the recommendation in this Call to Action to other national and international ICT initiatives.

Building a Global Community of Policy-Makers, Educators & Researchers to Move Education into the Digital Age

Themes based on the Call to Action

- Restructuring Educational Systems
- Student Technology Experiences
- **Teacher Professional Development**
  To develop and use models for teacher learning on technology use in schools and classrooms at the pre- and in-service levels
- Global Awareness
- Assessment
- **21st Century Learning**
  To establish a clear view on the role of ICT in 21st century learning and its implications for formal and informal learning
- Barriers/Essential Conditions
- Research on IT in Education

Teaching and Learning in the Knowledge Society

'What do students need to learn: 21st century skills

'Skills' encompass: To know, to do and to value Broad consensus on what 21st century 'skills' are, but local reconceptualization is needed

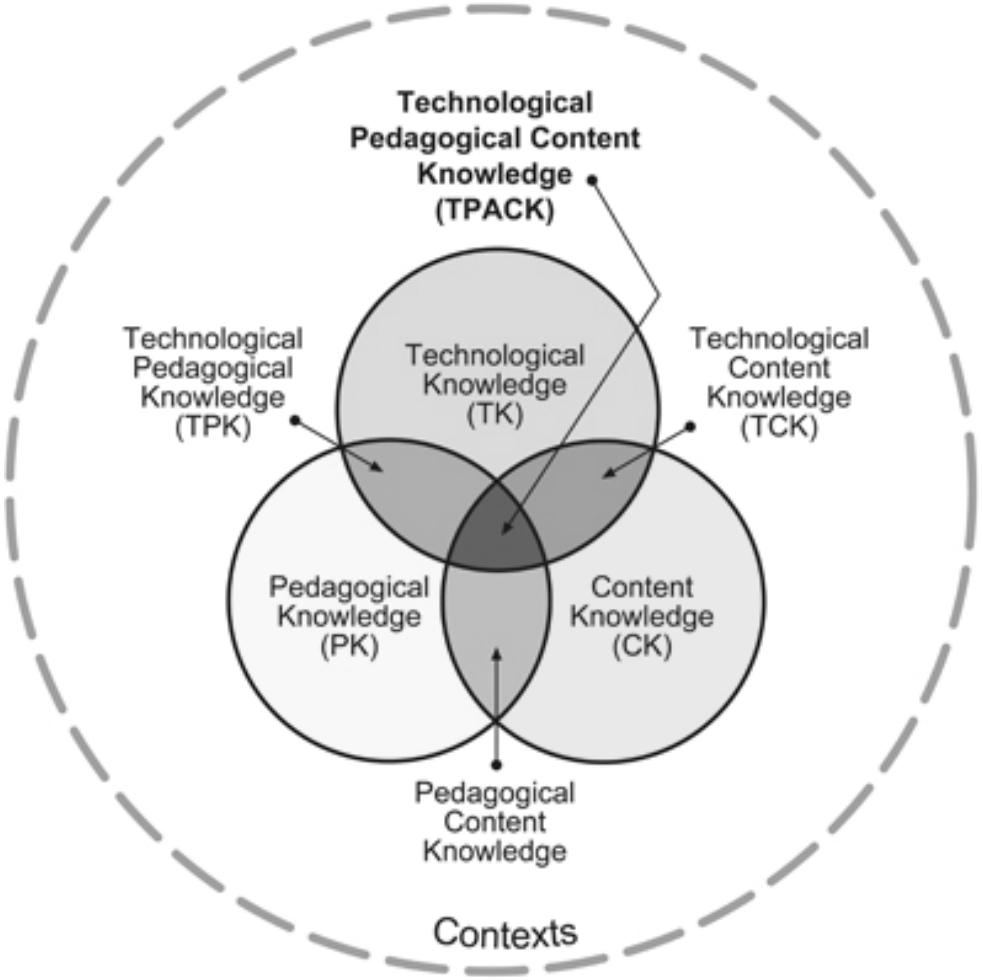
How do teachers need to teach? - Towards a pedagogy for the 21st century

Aspect	Less ('traditional pedagogy')	More ('emerging pedagogy' for the knowledge society)
Active	Little variation in activities	Much variation in activities
Collaborative	Individual	Working in teams
Creative	Reproductive learning	Productive learning
Integrative	No link between theory and practice	Integrating theory and practice
Evaluative	Summative	Diagnostic

Technological Pedagogical Content Knowledge

Koehler & Mishra (2006):

- The integration of ICT in education benefits from a careful alignment between content, pedagogy and the affordances of the technology
- Teachers who want to integrate technology need to be competent in all three domains



Competencies are not enough!

Christensen & Knezek, 2008

- Enhancing an educator's Will (Attitude), Skill (Competencies), and Access to technology tools will in turn lead to higher stages of classroom technology integration.
- Access and Skill is necessary to develop low levels of technology integration;
- But positive Attitudes ('will') is necessary to make creative use of technology

Riel &Becker, 2008; Drent & Meelissen, 2008; Voogt, 2010

- Teachers who use ICT innovatively are more professionally engaged (Voogt, 2010), are entrepreneurs (Drent & Meelissen, 2008) or 'teacher leaders' (Riel & Becker, 2008)

Some preliminary conclusions from the EDUsummIT

- Teachers (and learners) need to be owners of the concept of 21st century learning
- Lack of understanding of ICT prevents teachers to better prepare students for their future
- Teachers need to understand how to integrate content, pedagogy a and technology
- Teachers are afraid they loose control over the learning process that takes place 'inside' students

Preliminary Recommendations

- Document a shared vision for education and the role of ICT & PD which engages all stakeholders to encourage ownership
- Allocation of funding for Teacher Professional Development as a part of any new ICT initiative
- A career-long PD continuum to prepare for emerging roles and practices of teachers is needed

WWW.EDUSUMMIT.NL

Training New Teachers Effectively

Evgenia Peeva, Rebecca Helmer
Teach For Bulgaria / Teach For All

The key focus of Teach For All network organizations is the recruitment, selection, training, and support of talented individuals who will be effective teachers in the classroom for two years and effective leaders across all sectors ongoing. The training provided by network programs to their teachers focuses on increasing their effectiveness and helping them to develop into transformational teachers who have a life-changing impact on students. In this article, we will present an overview of the main components of the training and support process and the key principles that drive our approach.

Introduction to Teach For All and Teach For Bulgaria

*TEACH FOR ALL (**www.teachforall.org**)*

Teach For All is a network of independent organizations committed to improving the quality of education across the globe to ensure that all children have access to a quality education. There are currently programs in 19 different countries across 5 continents that are a part of the network.

Each program in our network has a similar mission and a similar approach to recruiting and selecting teachers, training and supporting them, and working with their alumni to effect even greater change.

Teach For All seeks to accelerate the impact of these local enterprises by helping them to overcome the challenges they face and by creating an effective network where best practices and lessons learned can be shared across programs.

The oldest of the 19 programs in the network are Teach For America and Teach First. Teach For America, founded in 1990, currently has over 8,200 teachers teaching in urban and rural schools across the United States, and there are over 20,000 alumni of the program working across all sectors to address educational need. Teach First, founded in the U.K. in 2002, has over 900 participants teaching in 6 different regions in the U.K.. They also have more than 1,000 Ambassadors, over 40% of whom are already in school leadership roles. These programs have already had very strong results. As just a few examples:

- The University of Manchester's Maximum Impact Evaluation showed that schools that employed Teach First teachers saw statistically significant improvement in test scores of students. (See the full study at: *http://www.teachforall.org/articles/max_impact.pdf*)

- A study of 42 teacher training programs in the state of Tennessee in the United States, showed that Teach For America was the top teacher training program in terms of the value-add that teachers bring to student achievement in their classrooms. Teach For America teachers, despite being new teachers, outperformed veteran teachers in certain subject areas. (See the full study at: *http://www.tn.gov/thec/Divisions/fttt/report_card_teacher_train/report_card.html*)

We are starting to see similarly successful results across the network. The success of these programs is dependent upon selecting the right people and then training and supporting them appropriately. In this article we will focus on the latter: How do you train new teachers to be effective? What kind of support do new teachers need in order to be successful?

*ZAEDNO V CHAS (Teach For Bulgaria) (**www.zaednovchas.bg**)*

Zaedno V Chas (or Teach For Bulgaria) is a non-profit organization dedicated to ensuring that all children in Bulgaria receive a quality education. We recruit and select highly-talented, motivated, Bulgarian young people from all academic majors, who were not originally planning to become teachers. We place them for two years in high-needs, Bulgarian classrooms where they teach full-time and have a transformative impact on the lives of their students. This experience, in turn, transforms the teachers and gives them insight into what it will take to effect the needed educational change in our country. After the two years, they will continue to impact education from across all sectors, in whichever career path they plan to pursue.

A large part of our work is the training and support of these new teachers to ensure that they develop professionally and have the desired impact on students. We've drawn many of our training principles and techniques from the Teach For All network, and this article will seek to explain the lessons we have learned from across the globe.

TRANSFORMATIONAL TEACHING

New teachers can accomplish results with students that greatly exceed our expectations and fundamentally change students' life opportunities.

Justin was a Teach For America teacher who taught sixth-grade science. When he started teaching, many of his students were over 2 years behind academically. Despite this challenge, he decided to set a high bar for student learning and to require his students to learn not only the standards for sixth grade science, but also some 7th and 8th grade and high school standards. He

set a goal that students would score 80% or higher on a final exam that tested all of these standards. Justin developed a system to track student learning and motivate students to achieve, and he called the parents of each of his students to explain his goals and the system. After careful planning and hard work, at the end of the year, the average grade on the final exam (which tested a lot of high school level material), was 81%. He won an award from his school as Teacher of the Year.[2]

Tarun, Aditya, and Anita were three Teach For India teachers who taught students age 6-11. When they started to work with their students, many of the students could barely speak or understand English and were lacking confidence. Some were late to lessons or absent from school. They set the big goal for their students that by the end of the year, they would be able to perform *The Lion King* musical in English. The students were inspired by the goal and worked hard to improve their reading, writing and speaking ability. . . and it worked! At the end of the year, they performed the musical to an audience of over 1,000. The principal and the parents noted their improved fluency in English as well as their increased confidence.[3]

Across the Teach For All network, there are increasing numbers of first and second year teachers achieving similarly impressive results for their students. In order to support and enable teachers to achieve such levels of success with their students, the programs must build training and support programs that effectively prepare their teachers to have these results.

Overview of Training and Support Processes Across the Network

Programs in the network have a similar approach to training and supporting their teachers.

Pre-Institute Work

First, after the participants are selected, they engage in pre-institute work. The purpose of pre-institute work is to:

- introduce participants to the overall program, its mission, and its approach;
- ground them in a framework for excellent teaching;
- provide them with examples of excellent teaching and role models;
- foster a sense of commitment to the program and the mission as well as a bond between teachers;
- begin a reflective process about the connections between teachers' actions and student learning.

While it varies from program to program, the pre-work is usually

predominantly distance learning. Participants will read texts and watch videos online and answer reflective questions. They also visit classrooms locally and reflect on what they see.

Institute

Each program provides intensive summer training for its teachers. Institute is designed to:

- provide teachers with the foundational skills, knowledge and attitudes they need as beginning teachers;
- offer teachers the opportunity for authentic practice;
- provide teachers with tools they need to be successful during the school year;
- build a strong sense of culture and shared purpose among the teachers.

Across the network, the length of institute varies from 4-8 weeks. The schedule is intensive (often at least 12 hours per day) and offers teachers the opportunity to attend lectures, but also to practice teaching – either with students or their peers - and engage in reflective conversations about their teaching practice. Technology is leveraged throughout the institute to track student learning, record teachers to allow them to see their own practice, provide tools and resources to teachers for the creation of their lesson plans and other products, and provide video examples of other teachers for discussion. Staff members review lesson plans from the teachers, observe the teachers and engage in data-based reflection on their practice, and model effective practice for the teachers.

Ongoing Support

Programs in the network know that while pre-work and summer institute can provide strong foundations for beginning teachers, they are not enough. Teachers need to have support throughout the two years to help them to be successful. The purpose of ongoing support is to:

- empower teachers to reflect on their own practice;
- provide teachers with tools and examples to help improve their performance;
- create a strong culture and sense of responsibility among the cohort of teachers.

Teachers are assigned a coordinator, who observes them in their classroom and helps them to engage in self-reflection about their results. The coordinator also provides tools and resources for development. Teachers often have an in-school mentor who helps them to integrate into the school community. They

have an online platform where they can engage with other teachers in their cohort to share lesson plans, ask questions, and collaborate. In some programs, they might also have a professional mentor from a non-school organization (e.g. business, non-government or a government organization) who gives them professional and leadership advice and demonstrates certain critical leadership skills relevant to teaching and other professional fields. The teachers come together at regular intervals for professional development sessions which target areas where the majority of teachers need support.

Foundational Principles for Training And Supporting New Teachers

A few key principles undergird the approach to training and support in the network:

1) A Focus on Students

New teachers will struggle with many skills, and it can often feel overwhelming to know where to focus on their own development. One key way network programs address this is that the key driver of all training and development is student learning. Teachers are taught early on that they are fully accountable for the success of their students; while many factors can contribute to a students' level of success in school, the teacher has the greatest influence over students' outcomes.[1] The expectation is that teachers will focus on what is within their control and will overcome all obstacles to ensure that all of their students are successful. This allows the teachers to focus on improving their practice in the areas that will have the greatest impact on student learning.

Having student learning as a focus drives a few key actions within the program:

- Teachers are not evaluated by a checklist of actions observed during the lesson. Rather, the teacher is given feedback based on how motivated the students were and by how many of the students mastered the desired skill during the lesson. So, during a classroom observation, we ask the question "What have the students learned and why?" rather than asking "What did the teacher do?"
- Teachers are trained early to evaluate student learning and adjust their practice based on what they see (see additional details below in the data-driven reflection section)
- Trainings for teachers focus on helping them build their capacity to set goals for students, analyze student progress against those results, and modify their own practice as a result of the impact their actions have on student learning. This is the core of this approach.

2) A Clear, Guiding Vision of Excellence in Teaching

New teachers often struggle to understand exactly what effective teaching is, and effective training programs de-mystify what good teaching looks like and break down the components of effective practice that lead to student learning. Across the network, each program has taken on defining what excellent teaching looks like in their context by looking at the nature of educational need in their country and seeking examples of teachers who have successfully addressed that need.

Programs have also looked internationally for the models that are most successful with the highest-need student populations in their country, and many programs have adapted Teach For America's Teaching As Leadership framework to their own context. The Teaching As Leadership model was developed by observing thousands of teachers in the Teach For America program and pulling out the key actions that differentiated the teachers who had excellent results with their students from those who had average results with students.

Teach For America discovered that effective teachers do the same things as effective leaders in any context. They:

- Set big goals
- Motivate others to work hard to achieve those goals
- Plan purposefully
- Execute Effectively
- Work relentlessly
- Continuously increase their effectiveness.

Teach For America's training is built around these pillars, and a matrix has been developed to help teachers to evaluate their strengths and areas for improvement and to take the necessary steps to improve. They provide video examples of what it looks like to perform each of the skills at different levels, so that teachers can self-diagnose their strengths and areas for growth. This approach has been successfully adapted to diverse contexts such as Peru, India and Bulgaria. For more information about the Teaching As Leadership framework, you can go to the website: www.teachingasleadership.org.

Whether it's the Teaching As Leadership framework or another framework, it is helpful for teachers to be able to see a guiding vision for what excellence looks like in the classroom so that they know what to aspire to. That framework can help guide decisions about what to do during the training and can help the teachers to evaluate their own practice.

3) Backwards Planning

Many execution challenges in the classroom are linked with planning, so teachers need targeted support and training that is focused on planning.

A key element to the teacher training that helps new teachers focus on what is most critical is the theory of backwards planning. New teachers often ask the question "What will I do during class?" instead of asking the question, "What will my students accomplish during class?" Backwards planning asks teachers to first set the goal or learning objective they want to reach at the end of a year, unit (several weeks of teaching linked by a theme), or lesson and then plan from there how to most effectively and efficiently arrive at that goal.

Through templates, modeling, and explicit instruction, the institute helps teachers to plan more purposefully, ensuring each action they take is driving toward the desired results with students.

At the summer institute, teachers are asked to deliver lessons, either to students at a summer school or camp, or to their peers. Coordinators review the teachers' lesson plans and give them feedback. Prior to the beginning of the year, they help teachers to develop a year-long plan and a detailed plan for their first unit. These plans guide their work for the rest of the year and help them make sure that they will arrive at their vision for students by the end of the year. Throughout the year, coordinators and mentors provide support on planning, particularly to teachers who are struggling.

4) Data-Driven Reflection and Commitment to Continuous Improvement

New teachers need support in understanding and reflecting on their strengths and weaknesses and taking action to improve. They also need to feel a sense of urgency about developing for the sake of their students. Throughout the entire training and support cycle, we focus on building skills and habits among the teachers of continuous data-based reflection and active improvement. Teachers are trained from the start on how to build effective assessments for students that are aligned with objectives. They receive training on how to track student achievement and are given tools and trackers to support this practice. They are encouraged to collect daily formative data that will allow them to know whether the students have mastered the objective they've taught. They also collect and track summative data. Time is actively built into the institute for guided reflection, where teachers look at student results and think about trends in the data. They examine the links between the actions they took as teachers and student results, and they create plans for their development as teachers that will lead them to be able to address the gaps that they are seeing with their students. Throughout the institute, the coordinator guides the reflection process, but the aspiration is that, over time, the teacher will

become skilled in self-reflection and will be able to independently diagnose trends in student learning and their links to teacher actions and take the appropriate steps to address them. Teachers are continually asking the questions "What did my students learn today?" "Which of my students learned which skills?" "What did I do as a teacher that contributed to or hindered my students' learning?" "Why did I do that?" "What steps can I take to improve?"

5) Practical Focus and Opportunities for Practice

The quickest way to accelerate the learning curve for new teachers is to allow them to have experience teaching as early as possible. Practice teaching allows teachers to take concepts that would otherwise seem abstract or theoretical and to apply them instantly. It also helps teachers to feel more drive to learn the material quickly as they need to use it in class tomorrow.

In many summer institutes across the network, teachers begin teaching (in a heavily supported environment) after only 5 days of training. In order to prepare them for this, the approach to training and support needs to be focused on the most essential, practical skills they need. Instructors need to think to themselves, "What will this teacher need to know or be able to do in order to start teaching tomorrow?" All workshops for teachers at the institute then need to be focused on building actual tools the teachers will need for teaching. So, rather than teaching only the theory of lesson planning, teachers need to create lesson plans during a workshop. Instead of learning about learning modalities only in theory, teachers need to incorporate them into their thinking about an upcoming lesson.

This practical focus allows teachers to more quickly grasp the basics of teaching and to be better prepared to lead a classroom in the fall. It also allows the program to have a more authentic way of checking whether teachers have truly mastered a skill, rather than testing only theoretical knowledge.

6) Importance of Community

New teachers often feel isolated in their school environment. They frequently struggle in their classroom, and they do not know who they can turn to for help. Building a community among teachers allows teachers to feel like a part of a greater team and to have a peer group with whom they can collaborate.

Programs in the network go to great lengths to build a sense of community and shared purpose among teachers. They leverage intranet technology to create a website where teachers can share ideas, stories, and lesson planning tools. They bring the teachers together regularly for team-building and skill-building. Teachers work in small teams at the institute and also participate in small

group workshops throughout the year. Most importantly, programs build a shared mission and set of values for the community of teachers and regularly discuss both and how they affect their work.

In addition, coordinators and mentors play a big role in building a sense of community. Coordinators work with a small group of teachers to observe their instruction and give them feedback. Mentors and coordinators offer examples and resources from their own classrooms to help the teachers improve. They answer questions the teachers have, provide emotional support, and help teachers feel integrated within the school community.

Building a sense of community can improve teachers' overall practice. It can also help improve new teacher satisfaction and retention in the classroom.

7) Varied teaching techniques and tools

In order for the training to be as robust and effective as possible, it must take advantage of varied techniques and approaches to communicating information effectively. First, new teachers need role models. Seeing examples of excellent teachers and working with staff members who themselves were excellent teachers, helps teachers to have a clearer vision for what they want to achieve. When these role models are also the instructors who lead the training sessions, the instructors have the opportunity to model good practice in their own approach to leading a lesson, and teachers can see and absorb what excellent teaching looks like in action.

Second, while each classroom is unique, there are similarities across different classroom contexts. New teachers already have many things to think about and do; there is no need for them to re-invent the wheel when resources already exist. Programs in the network provide a number of support tools to their teachers – templates for planning, samples of lesson plans, classroom management plans, videos of teaching techniques, handouts for lessons, trackers, and more. This way, teachers need to do the work of customizing the tools for their own classroom context, but do not need to build the tools from scratch.

Finally, technology also plays a big role in training new teachers. Online and Excel tools allow teachers to track the progress of their students' learning. Online communities allow teachers to exchange ideas and resources and help them feel connected across various schools and several locations. Video technology allows coordinators to capture footage of new teachers in their classrooms and play them back for the teachers as a learning tool. Video clips of excellent teachers also provide examples for discussion and practice. Teachers can also leverage technology in their own classrooms to help students

to learn more quickly.

Whether we use role models, support tools, technology, or other techniques in building a teacher training program, we must consider the needs of teachers and the most effective and efficient ways to meet those needs.

Conclusion

While the approach to teacher training across the network is unique, many of the underlying principles and approaches could be applied across a variety of new teacher training programs. We have already seen that this approach to training and support can be successful in over 15 countries. Across most contexts, having a clear, driving focus on student learning and a culture of continuous improvement leads new teachers to be able to learn quickly and prioritize the right development for themselves. Support in planning and regular feedback help the teachers to develop quickly, and programs leverage the right tools, technologies, and techniques to prepare teachers to be successful. When trained and supported effectively, new teachers can be highly effective, even in their first years of teaching.

Recommended Reading

- Classroom Assessment Minute by Minute, Day by Day, by Siobhan Leahy, Christine Lyone, Marnie Thompson and Dylan William.
- What Makes a Great Teacher, by Amanda Ripley (http://www.theatlantic.com/magazine/archive/2010/01/what-makes-a-great-teacher/7841/)
- Teaching As Leadership, by Steven Farr and http://www.teachingasleadership.org/
- Driven by Data: A Practical Guide to Improve Instruction, by Paul Bambrick-Santoyo
- A Chance to Make History, by Wendy Kopp
- Teach Like A Champion, by Doug Lemov

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1 – http://educationnext.org/valuing-teachers/

2 - http://teachingasleadership.org/sites/default/files/Profiles/Yan_Justin_MS_Science.pdf

3 - http://www.teachforall.org/newsletter/may2011/network_feature.html

Competency-Based Education with Web 2.0

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Introduction

The European Commission, training experts and national/local authorities have been insisting for long on two educational themes: competency- based education and the use of ICT to support education and training.

These two themes have generally been treated in a distinct way. And if we join them: can we promote a competence-based learning through the use of ICT?

In this paper I will try to provide an affirmative answer to such a question, also on the basis of the experience done in Sloop2desc, a project funded under the EU Lifelong Learning Program. Firstly I will treat the two issues separately, and then I will give evidence that joining them together is not a mere a sum, but a synergistic effect.

Competence-based education

School and universities are invited, from many subjects, to shift the emphasis away from the *content* of teaching and from training paths to the *learning outcomes* achieved, which can be used in the study, in the world of work and in any other social context, from single subjects to competences, are they key competences or professional ones.

But what do we mean by competences? Everyone is familiar with the European Qualification Framework, EQF, [1], while the European e-Competences Framework, e-CF [2] which applies the EQF model to ICT competences is less known for now. These two documents substantially provide the same definition of competence.

From EQF we read:

Competence *means the proven ability to use* ***knowledge, skills*** *and* ***personal, social and/or methodological abilities****, in work or study situations and in professional and personal development.*

Form this we can derive that the components of the competence are as follows:

- Knowledge defined as *the outcome of the assimilation of information through learning. Knowledge is constituted by a set of facts, principles, theories and practices related to a field of work or study*.

- Skill defined as *the ability to apply knowledge and use know-how to complete tasks and solve problems*.
- Personal, social and/or methodological abilities.

But competence is not a simple summation of them: it is the proven ability to use them in a context!

From e-CF we read:

***Competence** is a demonstrated ability to apply **knowledge, skills and attitudes** to achieving observable results.*

Also in this case the single components are listed and described:

- ***Knowledge** represents the "set of know-what" (e.g. programming languages, design tools...) and can be described by operational descriptions.*
- ***Skill** is defined as the ability to carry out managerial or technical tasks.*
- ***Attitude** means … the cognitive and relational capacity (e.g. analysis capacity, synthesis capacity, flexibility, pragmatism,...).*
- (In e-CF the term *attitude* replaces *personal, social and/or methodological abilities*. The Users' guide specifies: *It is close to the concepts of manner and demeanour, it is the French "savoir être"*.).

e-CF also contains the following concepts: *If skills and knowledge are the components, attitudes are the **glue**, which keeps them together.*

What information can we draw for school and university? Essentially the following two main concepts:

- all three components - knowledge, skills and attitudes (I use this more synthetic term, but I consider it, at least in the first approximation, equivalent to "personal, social and/or methodological abilities") - must be taken into account;
- it's not enough to ensure the acquisition of knowledge and skills, or the possession of attitudes; it's necessary to promote their application in situations to get observable results.

As far as **knowledge** is concerned**,** schools and universities have already done a huge amount of work.

With regard to the concept of **skills** the situation is varied. Technical schools have always promoted them; other schools and also universities have often considered them as a spin-off effect, almost automatic, of knowledge or as something to be left to the work context.

Knowledge and skills are indeed intertwined, but if skills can generally originate from knowledge, it is also true that "doing" can stimulate the acquisition of

knowledge.

In addition, the acquisition of skills is more likely to be self-checked by the student with a positive effect on her/his involvement in the achievement of learning goals and on her/his motivation to learn.

The matter of **attitudes** is more complex. The risk is to consider them a personal characteristic, something determined by genes and/or social conditions, something on which the primary school may take action, while university and perhaps even the secondary school can't intervene any longer being them already acquired (or not acquired) at that time. So the *glue*, that holds together knowledge and skills and which is an essential component of competence, is often left out of the training, or, anyway, there is not a conscious, explicit and "organized" intervention.

Finally how to put students into *context* already during the training? How to encourage them to produce **observable results**? Non-formal experiences, generally of two types, already exist, they are work placements and project work. By definition the former type occurs in the context of work with its dynamics and its products, while the projects focus on results to be achieved, individually or in groups, and generally goes beyond the mere disciplinary scope.

What suggestions can be given to promote a competence-based teaching? In my opinion the following ones may help:

- clearly define the competences to be achieved as a basis of the educational contract with students,
- precisely define the knowledge and skills on which those competences are based and provide "objective" evaluation tests,
- make the necessary attitudes explicit and help students self-evaluate and improve in respect to them,
- propose collaborative project activities suitable to make students consolidate and reinforce knowledge and skills, and in which they could measure and develop their attitudes (personal, social, methodological abilities),
- organize experiences to be carried out outside school/university where, again, they could measure and enhance knowledge, skills and attitudes.

ICT (and the web 2.0) as a learning environment

A mature technology changes people's habits and it becomes part of the *natural* environment in which they live. The idea of *travelling* was certainly different before the train, the car and the plane. For us today, unlike most of the generations of homo sapiens who have "travelled" before us, it goes

without saying that travelling implies the choice among such means; nowadays a long journey on foot may represent a news, hence the reputation of the Camino de Compostela.

The idea of *writing*, depending on the era, has recalled the wax tablet on which to engrave with a stylus, the papyrus, a quill pen and ink, paper and pen, the keyboard of a computer, and now for someone still a table, the iPad screen. Technology is considered as such when it innovates, after that it becomes part of the environment.

ICT and mobile devices are, by now, the natural environment to communicate, to search for and transmit information, to plan, store and share documents, photos and videos. They are the environment in which we work, the one in which young people grow up, play and communicate to each other. The school can‘t remain apart, must learn how to teach *in the* digital technology.

I say *teaching in the technology* not as opposed to teaching *the* technology or teaching *with technology*, but to show it as part of the environment in which teaching and learning intertwine: an environment that is made of natural classrooms and *virtual* ones, of slate whiteboard and interactive whiteboard, and LIM, desks, chairs and e-learning platforms, books and eBooks, pens and notebooks, podcasts, videos, forums, chat, audio and video conferencing, mobile phones, smart phones, net books.

It’s an environment where students and teachers can access a wide variety of tools

- to develop resources: word processing, spreadsheet, presentation and programs to draw, for digital recording, photographing, filming, to build simulations ,
- to produce resources collaboratively: GoogleDoc, wiki, MindMap, ...,
- to share resources: YouTube, Slideshare, ...,
- to communicate to one another synchronously and asynchronously: Skype, messenger, forum, e-mail, SMS, blogs, ...,
- to search for information: Google or other search engines and the entire Internet.

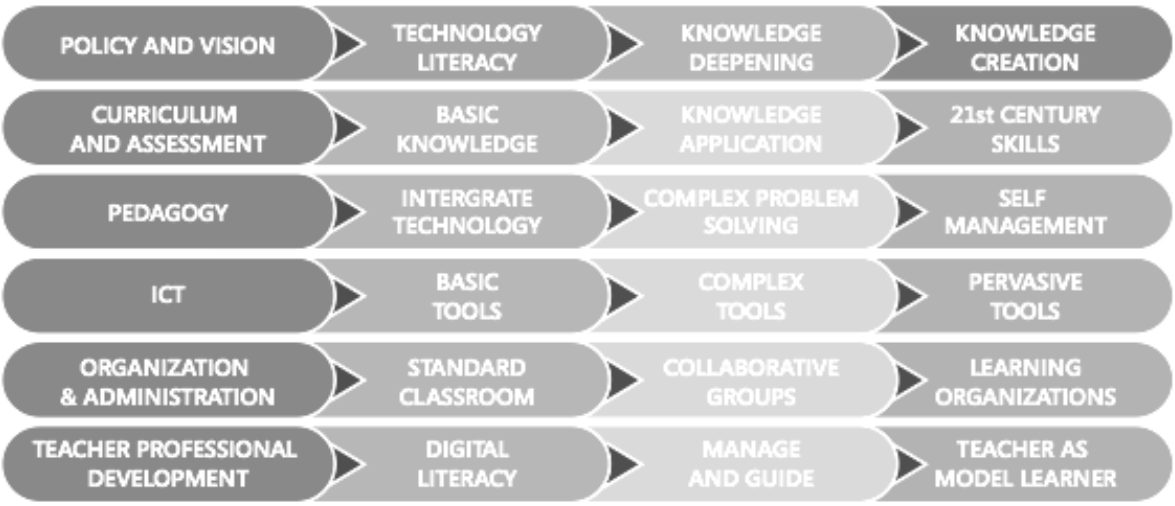
In such an environment the student will probably learn in the same complex and varied way, as women and men have ever learned: by trial and error, by imitation, by hints, memorizing, thinking and questioning, by intuition, discussion, ... gradually including new elements in their cognitive matrix and, more occasionally, restructuring it.

Rather the teachers have to play their role in a different way different from the past: the environment of the nineteenth and twentieth-century class was

limited geographically (the classroom), temporally (the period of the lesson, usually marked by the bell) and as for the instruments (chalk and blackboard, a map, pen, notebook, square and compass) and content (the textbook).

The learning environment is now unlimited. Mobile devices and the Internet allow you to be in touch anywhere, anytime. The available tools are, as stated above, many and varied. All the resources on the Internet are accessible to anyone and in 2008 - according to a calculation made by researchers at the University of San Diego (California) – were about 9,570,000,000,000,000,000,000 byte, almost 10 yottabyte (10,000 billion terabytes, where a terabyte equals 1,000 gigabytes and can contain more than 3,000 copies of the Encyclopaedia Britannica)! An huge heap of both high quality and real junk, full of potential, but also a possible cause of confusion.

In a conference under the auspices of UNESCO, like this one, I cannot but recall in this regard, as UNESCO *has set* - in the *UNESCO ICT Competency Standards for Teachers* - the competences required for teachers to act in such an environment.



Before closing this point, I would like to highlight a feature of the new environment for communication, work and learning, the one known as Web 2.0 and which has been revived by the open source and open content movement.

There is a philosophy - and practice -, which underlies many of these tools: the participation of users in the production of content, collaboration, knowledge sharing, collective intelligence, and community building.

Such a philosophy and related activities are already wide spreading in the community of teachers, but they can and must impact also on a different relationship between students and learning content: students not only as beneficiaries but also as producers of content.

The Sloop2desc project and its achievement

Sloop2desc is a TOI, Transfer of Innovation, project, funded by LLP Leonardo da Vinci program, 2009. The Promoter is the ITD-CNR in Palermo. The partnership includes Italian partners, AICA is one, Irish, Romanians and Slovenians. The previous project SLOOP, *Sharing Learning Objects in an Open Perspective*, specifically aimed at the development of a community of teachers interested in integrating online and face-to-face education and producing and sharing open educational resources; namely to freely use, modify and distribute them. Addressed, therefore, the question of the use of ICT as a learning environment.

By developing an online course for teachers - how to use the Internet in teaching and how to produce open digital resources for online teaching - the project has researched how to develop teachers' competences, especially the ones that are described by the UNESCO document. It focused on how to develop such competences through e-learning. The SLOOP course has not only been designed for the acquisition of knowledge - as many other online courses -, but also of skills, attitudes and competences.

This is the innovative model taken up and developed by Sloop2desc (where *2desc* stands for *TO develop European skills and competences*), which has made the issue of competence-based learning explicit in its courses.

The following table shows the breakdown of the course.

Modules		**Length**	**Units**	**Learning outcomes**
1	Using MOODLE as a trainee and as a teacher	3 weeks	Using Moodle as trainee	1. use Moodle as a trainee: • how to register oneself, fill in one's own profile, insert one's own photo • how to exchange messages with other registered trainees; • how to enrol on a course and monitor one's own activities; • how to take part in a forum;
			Using Moodle as trainer	2. perform tutoring activities (as a teacher not as an editor): • how to monitor trainees' or groups of trainees' activities; 3. create or modify a course (as a teacher/editor): • how to add resources to a course: label, link, text page, web page, folder; • how to insert activities in a course: forum, online task, lesson, quiz, hot potatoes quiz, SCORMs, wiki, register;

				• how to insert an embed code in a label or in a web page to reproduce resources existing in other sites such as Slide Share, YouTube, Scribd, ...; 4. create a course: • how to open ex-novo a new course or starting from a pre-existing course; • how to assign and modify roles.
2	Being an online tutor and using web 2.0 tools	3 weeks	The online tutor	1. To indicate the main characteristics of the role of the online tutor
			To create, organize and share resources on the Net	2. To search and organize knowledge sources through the web 2.0 tools: • list of references on the Web, • social bookmarking (Delicious, ...);
			E-cooperation	3. to cooperate online in synchronous and asynchronous way, through Web tools such as: • Skype, • Forum; 4. To use tools for collaborative knowledge production, such as: • Googledoc • wiki; 5. to promote role playing and simulations.
3	Using and developing open educational resources for an eLearning environment	3 weeks	Sharing and reusability philosophy	1. provide definitions of “open educational resources” or “open learning objects”; 2. describe the several Creative Commons licences;
			Web 2.0 tools for sharing	3. share resources in web 2.0 environments (such as Slide Share, YouTube, Scribd, …) tagging them to make search easier;
			The SCORM model and tools for the production of SCORM compliant LOs	4. describe the SCORM model; 5. describe the IEEE LOM metadata system; 6. develop a SCORM by using software like eXeLearning
			Sloop repository	7. search for educational resources within a repository
4	European Qualification Framework (EQF), e-Competence	2 weeks	EQF	1. describe the aim of '*European Qualification Framework for Lifelong Learning* - EQF – and its level-based structure;
			e-CF	2. describe the structure of European e-Competence Framework, e-CF;

	Framework (e-CF) and EUCIP standard		EUCIP	3. describe the EUCIP model of informatics competences and professional profiles; 4. list EUCIP certifications and related certification procedures; 5. identify, within the EUCIP Syllabus, the competence core units required for a specific professional profile; 6. use the Eucip self-assessment tool to outline one's own proximity profile; 7. analyse one's own or other's out coming profile in order to identify what training needs are needed to achieve a specific professional profile.
5	Collaborative development of educational resources based on EUCIP standard	6 weeks	Development of OERs on the Eucip syllabus	1. plan open educational resources; 2. develop open educational resources using a wide range of tools; 3. make the educational resources open providing them with a suitable licence, source accessibility, instructions how to use or modify them. 4. cooperate in planning and developing a course on Moodle.

It is worth clarifying that the online learning model we adopted is the virtual classroom in the Moodle environment:

- the participants are organized into classes (30-40 people with two tutors), each of them in their own *course*,
- activities are scheduled so that the students carry out activities at the same time,
- a strong interaction is required between the students and between students and tutors (in forums and using e- mails, chat, videoconferences) sometimes as debates and exchanges of ideas, some other times as cooperation in carrying out activities (also using tools such as wikis, googledoc, mindmap, ...).

The course expects the acquisition of a set of **knowledge**, for example, concerning the CreativeCommons licenses, the European documents on key competences, EQF, e-CF, the EUCIP syllabus, ... To provide such knowledge either links to existing presentations and to the original documents have been included or slides with audio, or videos or SCORM objects have been developed.

To consolidate this knowledge, activities like *reading, listening,...* have been accompanied by a request to discuss it in forums starting from inputs provided by the tutors. For example: *What CreativeCommons license do you think is more suitable for teaching materials?*

The Sloop2desc course intends to promote several **skills**, for example how to use Moodle and tools for the production of learning resources - Exelearning,

SlideShare, ... – and for communication and collaboration - Skype, Wiki, GoogleDoc, ... - or for sharing (yet SlideShare, freeLOms,).

To promote the acquisition of these skills the course proposes

- existing, or ad hoc developed tutorials, often in the form of videos on YouTube (or Vimeo) or SlideShare presentations,
- work proposals, sometimes individual, sometimes in groups. So, for example, as for the use of Moodle a *trial course* has been created where participants could practice including resources and activities.

All the modules have a discussion forum and, therefore, the discussions among peers and between peers and tutors - is one of the main features of the course. In Modules 2 and 3 collaborative activities are planned. Collaborative activity in Module 2 is essentially functional to learn how to use tools like Skype, GoogleDoc and the wiki. In Module 5 collaborative work aims at the production of resources to be used with students.

Discussions and collaborative activities help develop a set of attitudes related to exchanges of ideas, acceptance of different points of view, and assumption of responsibility and, where appropriate, leadership.

Finally the course has aimed at the production, by participants, of learning resources for their students, resources to be used in an eLearning and competence-based learning context. So the participants have been provided with a context where they had to work together to produce observable results, applying and developing knowledge, skills and attitudes.

Conclusion

The Sloop2desc project is about to finish but the evaluation activities have not been completed yet. The project results will be presented in September 2011 in a booklet and in final seminars in the partners' countries.

Anyway, we can already anticipate that most of the participants have greatly appreciated the course; in many cases the participants have already started to transfer what they have learned and experienced to their classes.

And from this we will be able to get a sound feedback on the Sloop2desc model.

Integrating online with face-to-face learning and using digital technology as a learning environment is not only a way to speak the same language of our students, digital natives, but also a way to make teaching and learning more flexible and personalized, to make students *acting* rather than *acted upon*, involving them in activities that produce observable results.

Tangible ICT-Based Learning Environments for Enhanced Quality Education

Kamen Kanev

Shizuoka University Hamamatsu, Japan

Steps of employed jigsaw activity

- Each group member receives a different piece of the information.
- Students change groups and form topic groups (experts) in order to master the material.
- Students return to their original group and share the information with the others.
- Each student prepares an assignment or completes a part of a group project. This is aimed at demonstrating each person's synthesis of information possessed by the group.

Computer-assisted learning in collaborative environments

Institutionally-based education, including that using Computer Supported Collaborative Learning (CSCL), has difficulty into accounting for variations in:

- class sizes,
- teaching styles and objectives,
- learner preferences,
- cultural practices, and
- administrative constraints.

A collaborative teaching system should be easily modified by teachers:

- to suit required teaching constraints and objectives,
- to take into account diverse types of activities,
- to support group management of students learning with the system, and
- to allow incorporating the use of computers into the curriculum of communicative group tasks.

A digitally-enhanced environment for collaborative learning

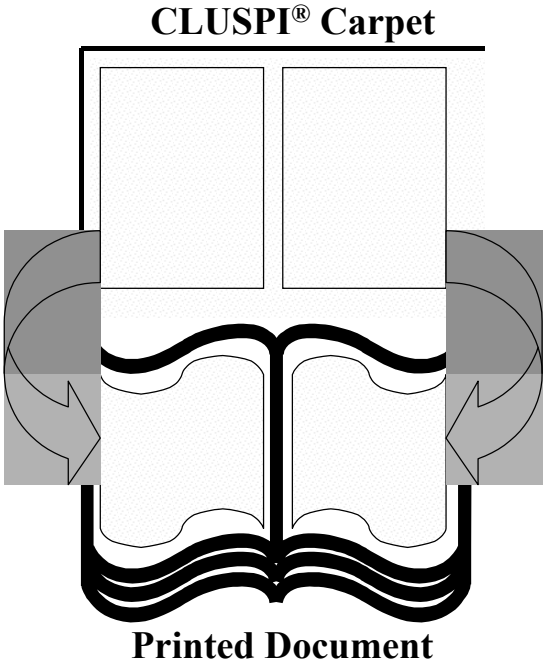
We have developed a teaching method that uses **digitally-enhanced paper materials** and Cluster Pattern Interface **(CLUSPI) readers** to provide :

- a flexible organizational structure,
- additional learning content,
- multi-dimensional learning activities, and
- reasons for students to discuss the content with each other.

In order to fulfill the requirements of our teaching method, we needed a technology that would blend with the principle support medium (i.e. paper).

Relaxation of the rigid structures associated with traditional barcodes is possible through graphical object and cluster-based surface encoding methods. CLUSPI® for example, is a cluster pattern-based encoding scheme that has been specifically designed to blend seamlessly with printed document content.

A digitally-enhanced environment for collaborative learning



Imagine the CLUSPI® carpet as a large transparent sheet. Then cut a piece that fits to your document size and paste it over a printed page. The transparency carries the CLUSPI® code, but does not obscure the underlying page content.

CLUSPI® code can also be directly embedded in the document and printed together with the document content.

In contrast to other methods, CLUSPI® uses **groups, or clusters, of graphical objects** for the digital-encoding of data, while individual graphical objects do not necessarily carry direct digital information.

The notion of cluster here is not bound to any explicit property, such as distance or color or shape and **can be redefined to meet specific application requirements**.

The CLUSPI® encoding scheme allows for different types of digitally-encoded information to be easily and efficiently embedded in **multiple layers** of clustered graphical objects. Consequentially the carpet encoding appears to be:

- quite regular,
- with no special margins or blocks,
- no markers that stand out, and
- the ink covered area is only a small percentage of the total area.

The Dynamic Group Environment for Collaborative Learning (DGE/CL)

The main goals of the CLUSPI®-enhanced dynamic group environment are:

- to provide reading assistance on the basis of individual need,
- to help students to understand content, genre and text features, and
- to provide a dynamic group environment which engages students in a reading activity.

Content database and content management

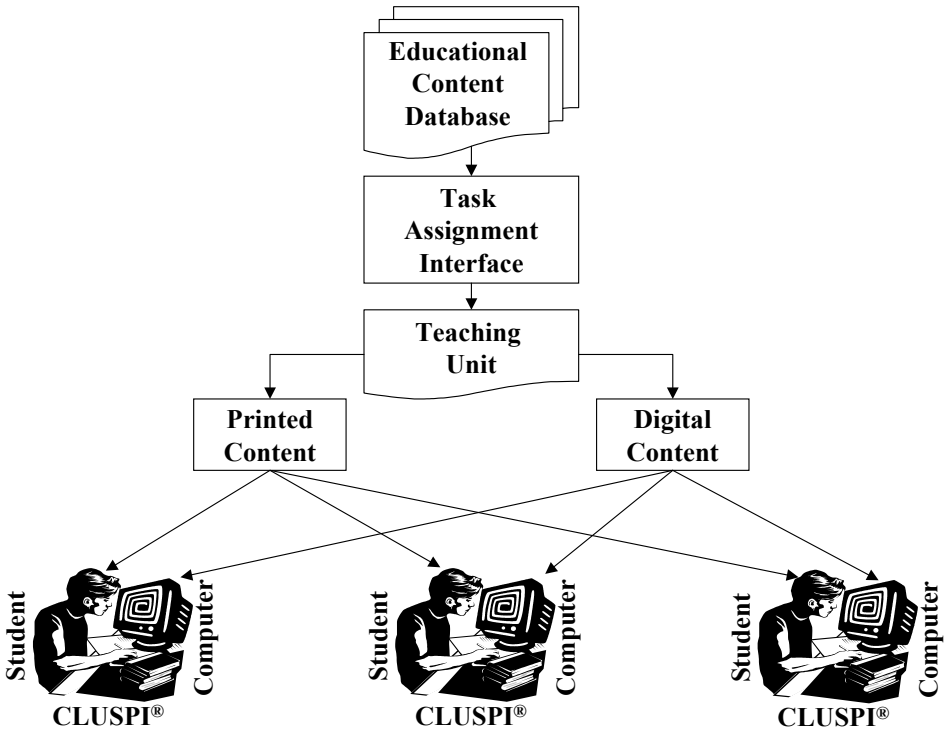
Encouraging group activities, through multiple view representations of information entities:

- Different teachers would naturally use different wording and different supporting materials when introducing a new notion.
- If every student would initially have access to only one of the many aspects or views of the new notion, embarking on the path to deeper understanding naturally leads to the exchange of information with other students and working in groups.

DGE/CL

Content management

A structural diagram of the Dynamic Group Environment for Collaborative Learning (DGE/CL)



Task assignment interface

Available teacher controls and functionality:

- to set the parameters for the activity,
- to assign the appropriate content variables,
- to choose a learning objective of the task assignment, and
- to determine the content and activities, which will be available at each stage of the task.

Partitioning capabilities for different types of activities:

- **Teacher-determined** – this feature would be used if teachers wanted students to remain always with the same group members.
- **Content-determined** –to complete a component of the task, students randomly interact amongst class members to find the information required to complete the task.
- **Student-determined** – pre-defined groups are either not necessary, or can be self-assigned by the students.

The CLUSPI® device sharing requirements depend on the group partitioning choice.

- **Teacher-determined** - individual CLUSPI® devices could be distributed to each group in advance.
- **Content-dependent and student-dependent** - predetermined assignment of CLUSPI® devices is not possible.

We have combined a CLUSPI® device and an RFID reader in a single handheld unit that allows dynamic device allocation, based on immediate user identification.

Combined CLUSPI®/RFID unit

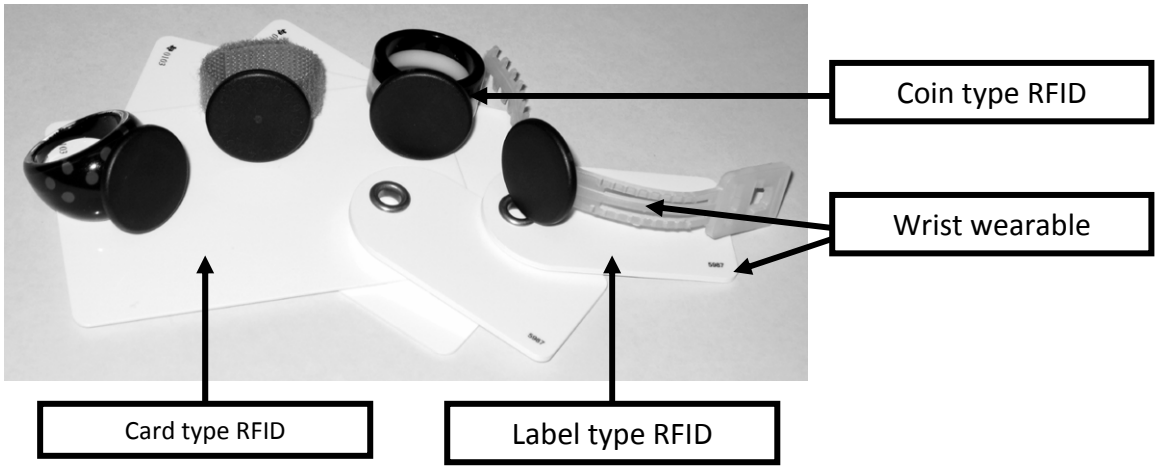
The combined CLUSPI®/RFID handheld unit, can be used for pointing and clicking on digitally enhanced printed materials as shown on the right.

The CLUSPI® print-based interface

From a user perspective, the combined unit functions as a standard CLUSPI® device, so no additional training is required.

To activate the CLUSPI® device, a pre-registered RFID tag has to be brought within the sensing range of the RFID reader.

Users properly wearing their tags would not even notice the new, immediate user identification functionality.



RFID tags with different sizes and shapes

From a system perspective, the RFID reader and the CLUSPI® device are seen as two independent components with their own interfaces and operating software.

Software functionality steps:

- Determine the presence of a valid RFID
- Establish an appropriate user context
- Enable the CLUSPI® reader accordingly

Conclusions and future work

- Considered collaborative learning in a dynamic group environment mainly from organizational and teacher perspective.
- Need a thorough study of the learner's view of the system and particularly the CLUSPI® based interactions from the user perspective.
- Planning an in-depth exploration of the CLUSPI® based direct point-and-click functionality and its potential in other areas.

Towards New Teaching in Mathematics: How to teach mathematics according to the Fibonacci-philosophy?

Peter Baptist,

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First we have to realize, there is not a single way of successful mathematics teaching. But we know for sure if learning is to be successful students must get the chance to go individual ways in their learning process.

There are certain basic guiding principles that ought to be characteristic for our teaching:

- Less focus on passing factual knowledge to students, more focus on independent problem solving.
- Less focus on mere computing and manipulating formulas, more focus on understanding.
- Not only focus on acquiring particular math skills and results, but also focus on the necessary learning processes and strategies.

The implementation of these guiding principles leads to an *experimental access* to mathematics. If there is actually a formula or a rule then it is at the end of the learning process, not at the beginning.

We introduce mathematics in the context of carefully chosen problems. In the process of trying to solve such problems the students develop mathematics. We follow the American mathematician Paul Halmos (1916 – 2006) who demands: *Don't preach facts, stimulate acts.* That means: The teacher is not an entertainer, the student is not only a consumer. We do not present ready to consume mathematics. Teachers must help students to understand the concepts of mathematics, not just the mechanics of how to solve a certain problem.

Stimulating acts means to encourage students to develop their own informal methods for doing mathematics. We ask them

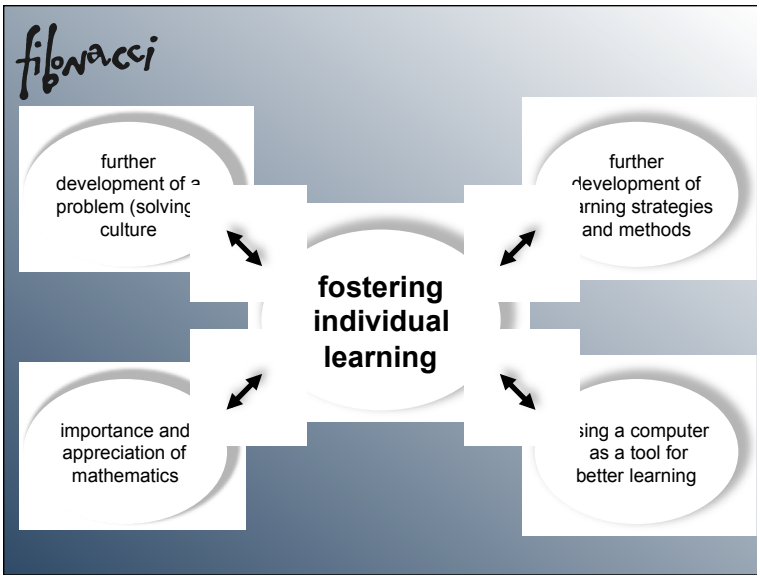
- to explore,
- to observe,
- to discover,
- to assume,
- to explain,

- to prove.

This sequence of activities exactly describes what we understand by *Experimental Mathematics*. The first five items are typical for science teaching as well. The distinctive feature of mathematics is the last item: In mathematics we have to prove our discoveries and conjectures and after that the results are valid for ever.

Strictly speaking our goal of mathematics education for the 21st century was already written down in the 19th century by Wilhelm von Humboldt (1767 – 1835): "The student is mature, if he or she has learnt so much that he or she is able to learn independently."

Even about 200 years old this message is still very topical. Big ideas never loose their relevance. To support this aim we have to continue the further development of a problem-based culture and of learning strategies and methods. We have to encourage teachers to use the computer as a tool for better learning and we have to stress the importance of mathematics for our daily life and for our future.



It has already been stated that successful instruction has an individual face that is primarily that of the individual instructors. Ideas and materials provide inspiration, but implementation always has a personal touch. To improve classrom instruction we first have to change the way we deal with content, i.e. we need innovations in the classroom. Access to the *Fibonacci philosophy* is best achieved through conscious consideration of one's own teaching. Here certain central themes can serve as a means of orientation. These themes take five different aspects of teaching into consideration:

- Teaching style
- Work with problems/tasks

- Technical contents
- Type of achievement testing
- The role of mathematics teachers.

Reflection based on these central themes also makes sense for education degree students and probationary teachers. Although first-time instructors usually have only very limited teaching experience (if any), these central themes clearly point to crucial areas for subsequent instructional activity (for a detailed explanation cf. SINUS international, Towards New Teaching in Mathematics, Part I).

A first step is taken by reconsidering one's own instruction on the basis of the central themes indicated. Thus the foundation is laid for a change in teaching. What remains then is for implementation to take place in accordance with the slogan cited from Paul Halmos: "Don't preach facts, stimulate acts."

Literature

Baptist, Peter, Carsten Miller and Dagmar Raab (eds.), 2011, SINUS international, Towards New Teaching in Mathematics, Part I, II, III, Bayreuth

Bridge between EDUSUMMIT and QED

Joke Voogt[1], Roumen Nikolov[2]

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International Summit on ICT in Education, EDUsummIT 2011, 8-10 June, Paris

Building a Global Community of Policy-Makers,
Educators and Researchers to Move Education in the Digital Age

Goals

- to continue the discussion going on under the EDUsummIT initiative;
- to bring some regional issues and aspects (Central and Eastern Europe, South-East Europe)
- to produce a policy report (conceptual papers, recommendations, best practices, actions, cooperation frameworks);

Thematic Working Groups (TWG)

TWG 1: Restructuring educational systems to move into the digital age;

Niki Davis (New Zealand), Birgit Eickelmann (Germany), Mariana Patru (UNESCO), Renate Schulz-Zander (Germany) & Peter Dzvimbo (South Africa)

TWG2 Student technology experiences;

Gerald Knezek (USA), Rhonda Christensen (USA), Kwok Wing Lai (New Zealand)

TWG 3: Teacher professional development;

Peter Albion (Australia), Don Knezek (USA) & Edem Adubra (UNESCO)

TWG 4: Global Awareness

Paul Resta (USA)

TWG 5: Assessment

Mary Webb (UK), David Gibson (USA)

TWG 6: 21st century learning

Joke Voogt (the Netherlands), Chris Dede (USA).Ola Erstad (Norway)

TWG 7: Barriers to successful implementation of technology integration in educational settings

Michael Searson (USA), Roumen Nikolov (Bulgaria), Therese Leferriere (Canada)

TWG 8: Researching IT in Education

Margaret J. Cox (UK) & Takashi Sakamoto (Japan)

TWG 7: Barriers to successful implementation of technology integration in educational settings

Essential Conditions/Barriers (ISTE 2009)

- **Shared Vision.** Proactive leadership in developing a shared vision for educational technology among all education stakeholders including teachers and support staff, school and district administrators, teacher educators, students, parents, and the community
- **Empowered Leaders.** Stakeholders at every level empowered to be leaders in effecting change.
- **Implementation Planning.** A systemic plan aligned with a shared vision for school effectiveness and student learning through the infusion of information and communication technologies (ICT) and digital learning resources
- **Consistent and Adequate Funding.** Ongoing funding to support technology infrastructure, personnel, digital resources, and staff development
- **Equitable Access.** Robust and reliable access to current and emerging technologies and digital resources, with connectivity for all students, teachers, staff, and school leaders
- **Skilled Personnel.** Educators, support staff, and other leaders skilled in the selection and effective use of appropriate ICT resources
- **Ongoing Professional Learning.** Technology-related professional learning plans and opportunities with dedicated time to practice and share ideas
- **Technical Support.** Consistent and reliable assistance for maintaining, renewing, and using ICT and digital learning resources
- **Curriculum Framework.** Content standards and related digital curriculum resources that are aligned with and support digital-age learning and work

- **Student-Centered Learning.** Planning, teaching, and assessment center around the needs and abilities of students
- **Assessment and Evaluation.** Continuous assessment, both of learning and for learning, and evaluation of the use of ICT and digital resources
- **Engaged Communities.** Partnerships and collaboration within communities to support and fund the use of ICT and digital learning resources
- **Support Policies.** Policies, financial plans, accountability measures, and incentive structures to support the use of ICT and other digital resources for learning and in district school operations
- **Supportive External Context.** Policies and initiatives at the national, regional, and local levels to support schools and teacher preparation programs in the effective implementation of technology for achieving curriculum and learning technology (ICT) standards.
- **Conditions that do not support full integration** of technology could be considered barriers to optimal learning conditions.
  - For example, in situations where stakeholders do not have a shared vision for educational technology (one of ISTE's essential conditionals listed above), this lack of vision would serve as a barrier to effective implementation of ICT
- **Multi-stakeholders partnership and ownership scaffolding**
  - Include ALL stakeholders (policy makers, international organizations, universities, industry, teachers, students, researchers, etc)
  - International/regional/national/local/organization level
  - Web 2.0 model
  - Social networking and social engineering
  - Leadership (priorities, conditions)
- **Shared Vision** - In order to achieve sustainable successful outcomes, a shared vision has to be a belief that technology is beneficial, as defined by different communities of users or practice and educational models, and to be embraced with an open mind by all involved.
- **Policy** - It is critical to have a policy on introduction of technology in education;
- **Raise the level of conviction and belief** in the importance of technology with the decision and policy makers (a school board, a district, nation wide country level, regional level, international level);
- This can be done through **leveraging world organizations** like UNESCO, OECD, World Bank, EC, and others to create the awareness and somehow create the pressure on the various countries to follow suit.
- **Teachers are the main change agents** - teachers as the main elements

to improve the teaching and learning and to introduce 21st century skills. However, in order to do that, there has to be strong **capacity building** programs for teachers to do that;

- **21st century skills have to be embedded and integrated into the curricula**, this will somehow, lead teachers to use more of the technology in the teaching process.

In order to achieve sustainable successful outcomes, a shared vision has to be a belief that technology is beneficial, as defined by different communities of users or practice and educational models, and to be embraced with an **open mind** by all involved.

- Barrier: Educators who are reluctant to use digital technologies
  - Action: 21st century skills for teachers –teacher educators, pre- & in-service teachers
- Barrier: Inadequate engagement by key stakeholders and CoPs in policy and strategy
  - Action: Involve technology users, especially learners in key policy and strategy decisions
- Barrier: authoritarian and dogmatic approaches to knowledge transfer
  - Action: Engage educators in activities that include the evaluation of a variety of positions on the web
- Barrier: Teachers being afraid they loose control over the learning process that takes place 'inside' students
  - Action: teacher education that provides opportunities for teachers to experience more open approaches supported by the ICT use
- Barrier: lack of understanding of ICT benefits to better prepare students for their future
  - Action: clear, consistent articulation of shared vision
- Barrier: lack of support for teachers (teacher educators, teachers, teacher candidates)
  - Action: online professional learning communities (teacher educators, etc...)
- Barrier: slow production of adaptive materials
  - Action: confront producers with demand, design new business models

Stakeholders

- Learners
- Teacher
- teacher educator/teacher candidate
- Universities

- policy makers,
- parents,
- communities,
- municipalities,
- NGOs
- SMEs (open-source software, venture capitalists) or other industries.
- Learners have to always be involved.

As regards practice, and especially teachers, teacher educators and teacher candidates, identified **barriers** are the following ones:

- disagreement in values, theoretical models, practices;
- teachers being afraid they will loose control over the learning process;
- loose authoritarian and dogmatic approaches to knowledge transfer, and
- low investment of the industy into developing the skills of the 21st century workforce.

- Therefore, a needed condition for ICT integration would be to help teacher's understanding and develop their capability to engage actively and collaboratively with learners so that the learning process continually enhances the shared curriculum goals.
- This could be accomplished by focusing teacher education and training on the learning outcomes when using ICT so that teachers gain confidence in a dialogue-based learning process within learning communities.
- The deployment of technology to support onsite/online programs for teachers and students would incorporate processes such as coaching, modeling, and the building of online professional learning communities (teacher educators, in-service and pre-service teachers).
- However, it is important to examine the use of technology in the curriculum to prevent overstimulation and under-stimulation of the learner so that learning can take place.
- Moreover, in many contexts, by focusing on 21st Century skills, such programs would elevate the status of teachers and teacher profession (another condition to be met).

Specific actions for helping policy makers and experts at different levels to understand the benefits of technology in learning and the importance of involving key stakeholders, including learners, in policy, strategy and implementation :

- conduct of top level conferences and opportunities for informing

decision makers by key stakeholders, particularly learners ;

- creation of communities of practice focusing on particular issues to bring together decision makers and stakeholders;
- involvement of powerful international backers and agencies (e.g., UNESCO) to support the shared activity;
- proactive engagement of users of learning technologies with producers of learning materials and software content to have the needs of learners and teachers met as well as developers' aspirations; and
- to bring together a range of funders with users so they could understand each other's better and develop user-led materials.

I*Teach – An Innovative Methodology

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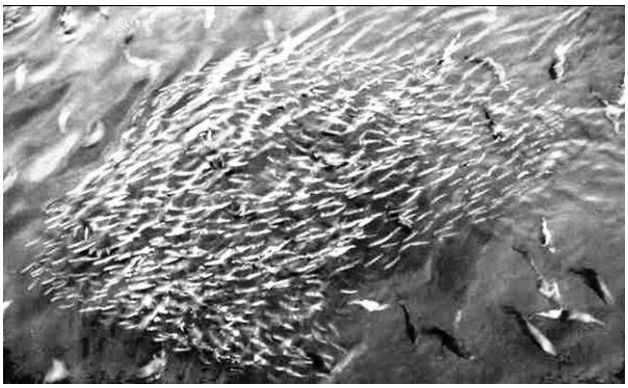
Give a man a fish and you feed him for a day.
Teach a man to fish and you feed him for a lifetime…
Chinese proverb

I'm pointing at the moon,and you're looking at my finger
the Zen koan

Our original interpretation was inspired by the Chinese proverb about the fishing and the Zen koan: I'm pointing at the moon, and you're looking at my finger (the moon been replaced by the sun this time) and we were trying to express the current situation with the teacher education – we, the teachers' educators are talking about what we expect to see one day, and the teachers are interested in what they are going to do on Monday.

What are metaphors for education?

Like a *school of fish*



For students:

To choose your own path to the goal

To take his own challenge

For teacher: To be ready to give help at any time but not without asking

Visual interpretation as a bike -
Art, ecological, modern, going ahead

Innovative Teacher (I*Teach)

Identifying and building up ICT-enhanced skills the synergy between soft skills and ICT skills

- searching and selecting information
- presenting information
- working on a project
- working in a team

i.e. Discovering ICT tools, Learning How to Use ICT Tools and Understanding How and When to Use ICT Tools

I*Teach characteristics

The learning process: driven by students' interests

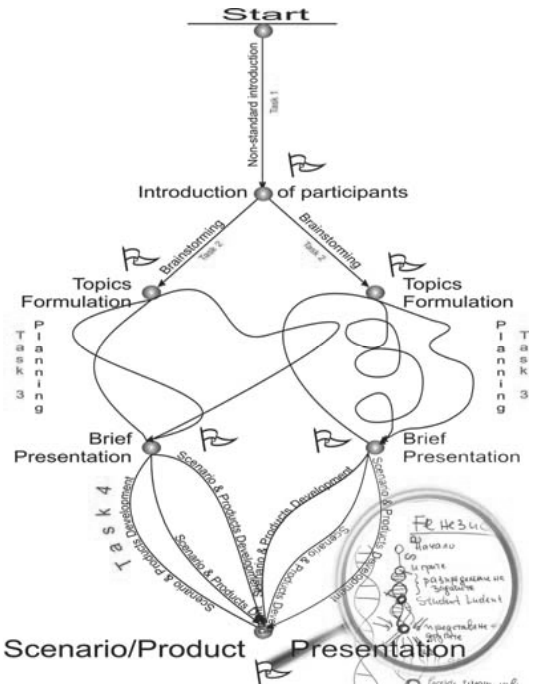
The students:

- motivated to participate actively in the process of **learning by challenge**
- **work in a team on a project**, whose goals they formulate themselves

The teacher:

- guides the students
- through *the road* with *milestones* of intermediate objectives to *the goal*
- by interweaving pedagogical and content related goals with building of ICT-enhanced skills

The results: including *product* on the table



The I*Teach scenario

According to the project framework I*Teach scenario represents a composition of *tasks* (implemented by active learning methods) leading to an educational *goal* by covering intermediate objectives (*milestones*).

The road to the goal is a metaphor behind a specific educational scenario with *milestones* of intermediate objectives.

Teaching teachers

I*Teach at meta level

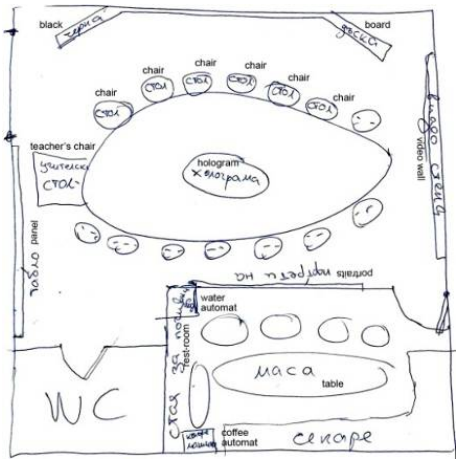
*When I*Teach means I*Learn*

Come to our place

Several meta-courses keeping the upper template on different main topics uncovered the teachers' creativity and hidden talents

…. and more

Meeting in Ten Years - *School-of-the-Future* – the student research - the contemporary information and communication technologies *enlarge the classroom in time and space* thus providing new opportunities for the project-based learning



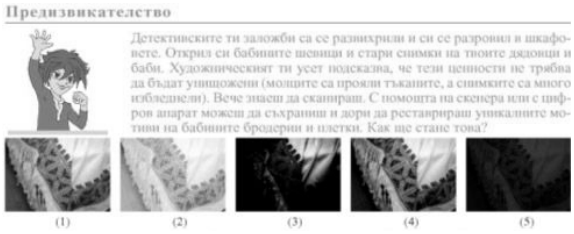
… and in the school

Op Art or Art of Object-oriented Programming

Goinng closer and closer to the school we had a chance to approbate our ideas with real student on different ages

A set of IT textbooks in the style of “hard fun”

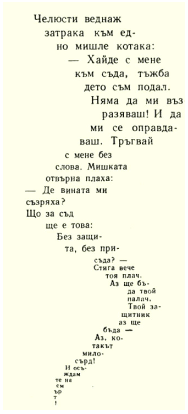
The specifics of the textbooks



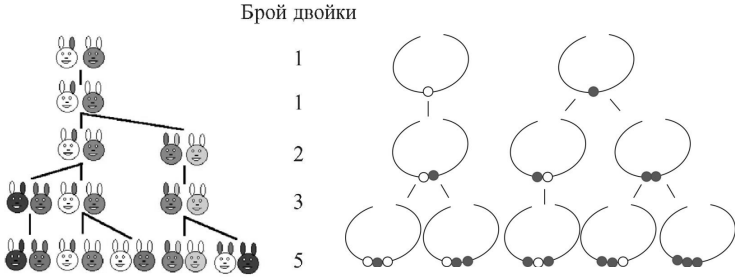
- Language
- Structure
  - A short introduction
  - The new notions
  - The challenge
  - Creative tasks
  - Amusing stories
- The paths
- The spirit

Some examples of interdisciplinary scenarios

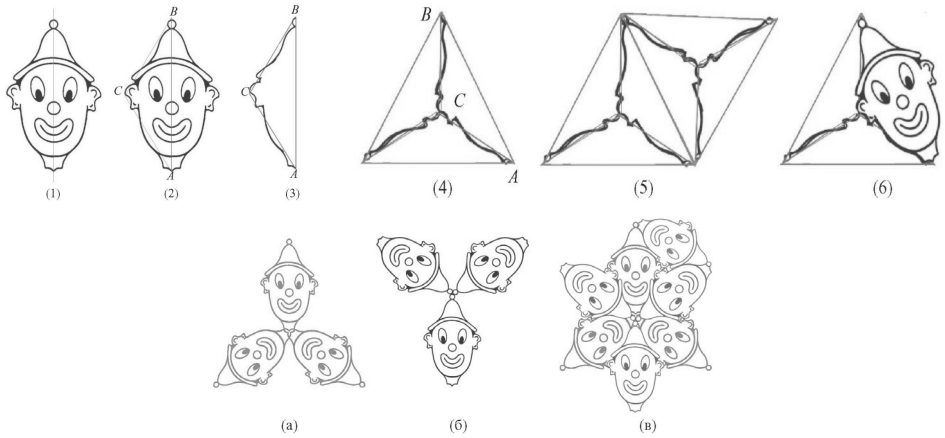
Visual poetry and acrostics



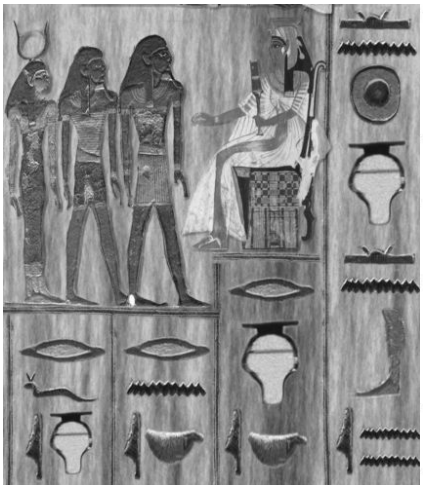
The rabbits, necklaces and Fibonacci



Visual Modeling in the style of Escher



The grand finale - The challenge of restoring ancient vessels and identify its application

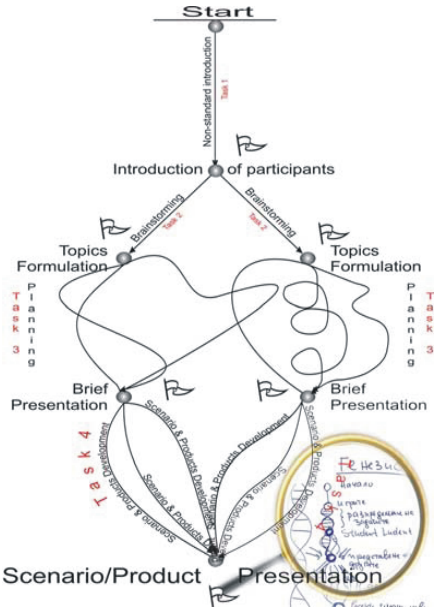


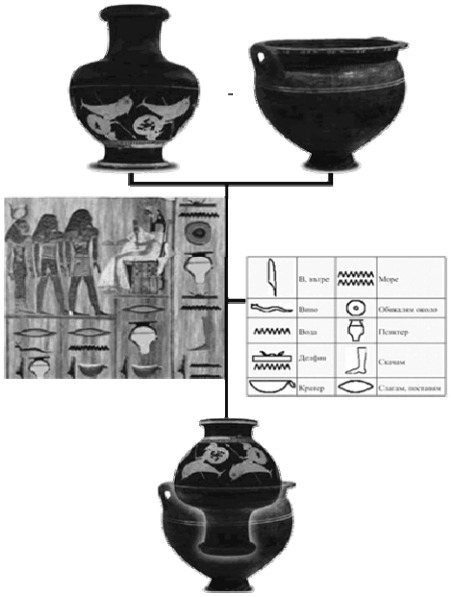
	В, вътре		Море
	Вино		Обикалям около
	Вода		Псиктер
	Делфин		Скачам
	Кратер		Слагам, поставям

Факс с превод на йероглифите

The coded message and a fax with the translation

The road map of final challenge could be present





Back to the metaphors

Scenario

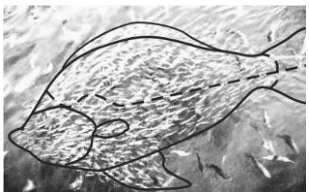
- composition of tasks
- leading to educational goal
- covering intermediate objectives (milestones)

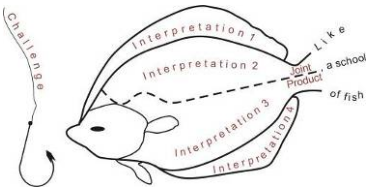
Metaphor

- a path (the process)
- leading to the peak
- traced by landmarks

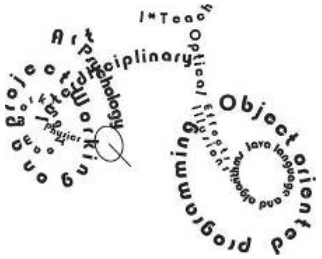
The collective intelligence

After each training we analyzed the process and prepared a roadmap of the it using the initial metaphor





I*Teach: driving the education to creativity and innovations



Architecture at School

Ludmila Karamanoleva, Ekaterina Pavlova et al

The Goal

The topic chosen being:

Main styles (orders) of early Greek architecture to stimulate students to formulate and solve problems tuned to their interests

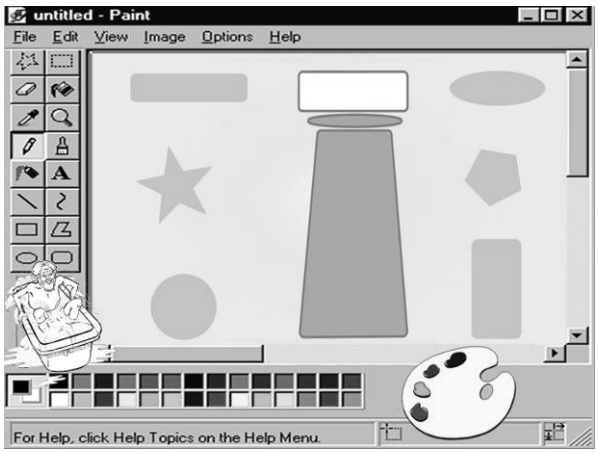
The Content

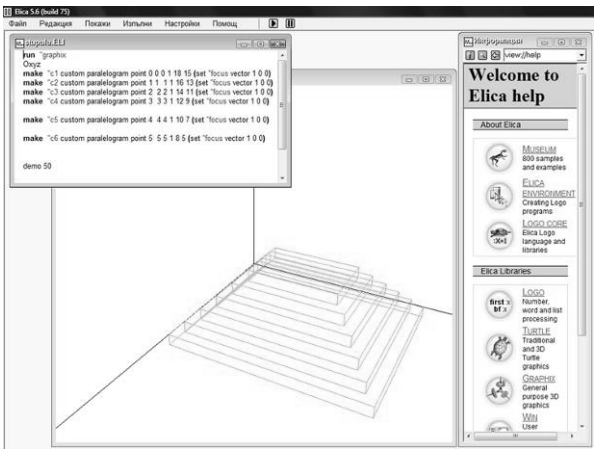
- cognitive (Sapiens): Ancient Greece, architecture, coulmns;
- challenging (Ludens): „The Eureca club"
- constructing (Faber)

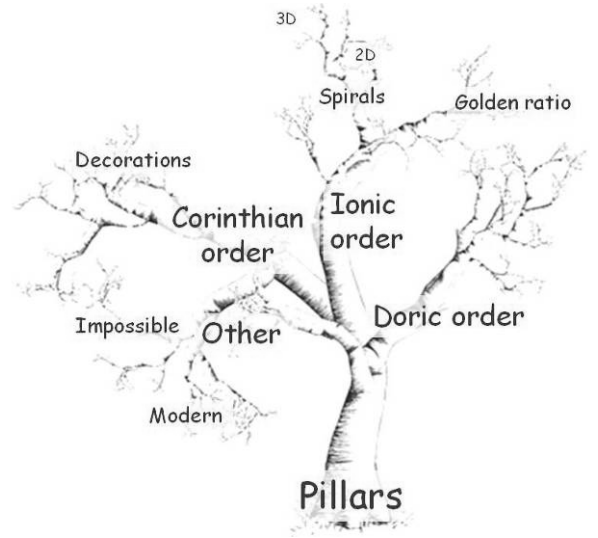
Style: neolapidary

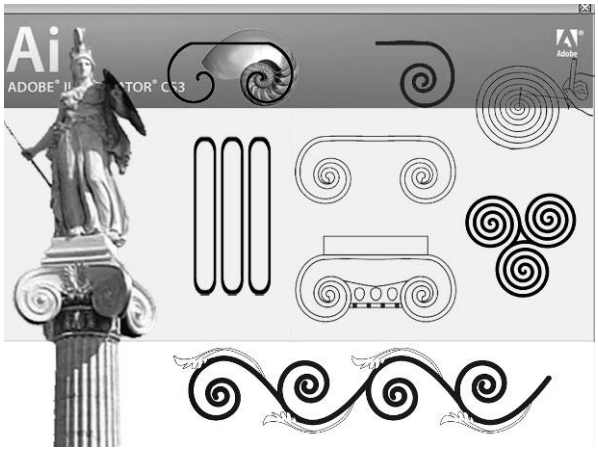
Ideas for Today and Tomorrow

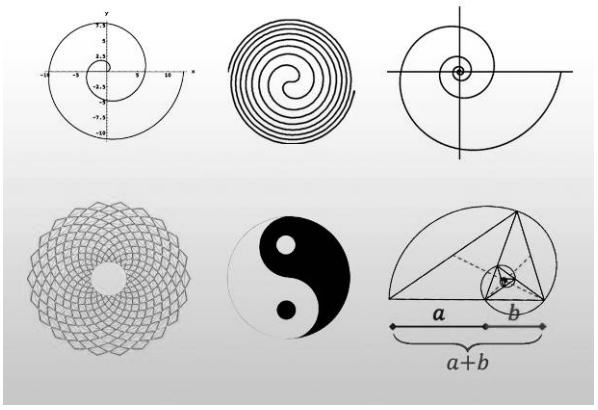
Modeling in A Class Setting

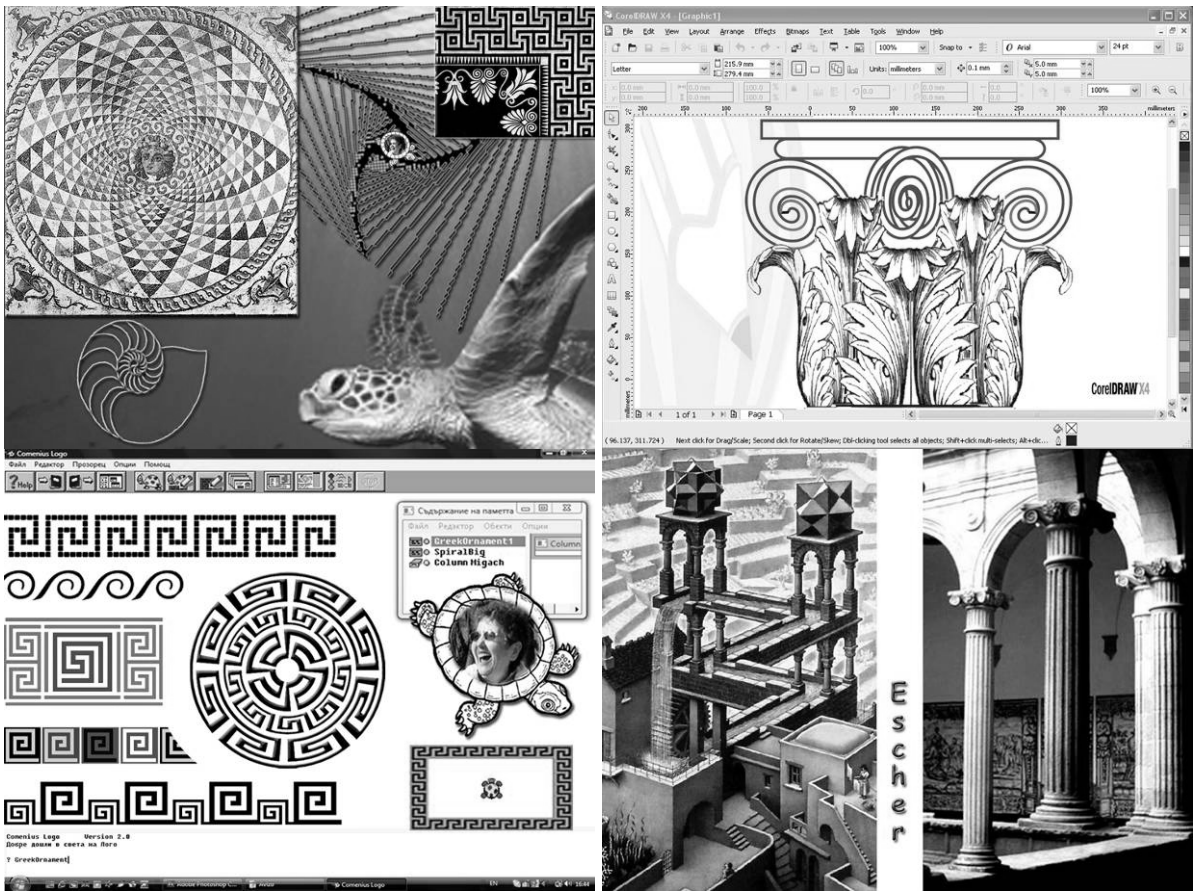











CorelDRAW X4
Escher

Educational Applications on Top of Digital Libraries for Cultural Heritage

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radko@cc.bas.bg, dessi@cc.bas.bg

SINUS project

Research Project "**Semantic Technologies for Web Services and Technology Enhanced Learning**" (No. D-002-189)

Financial support: National Science Fund of Bulgaria

Partners:

- Bugarian Academy of Science – two institutes:
  - Institute of Mathematics and Informatics
  - Institute of Information and Communication Technologies
- Active Solutions Ltd - Software Company

Duration: 3 years (2009 - June 2012)

Objectives:

To develop an environment for extending, binding and using heterogeneous multimedia digital libraries, accessible as web services. Extensions of the DL in the following directions:

- Enrichment of the built-in domain knowledge, through /additional/ ontological models and extended search functionality;
- Enrichment of search results visualization – explicitly controlled and content-based sorting of found objects, explicitly controlled and content-based display of additional descriptive (metadata based) information.

Development of specialized e-learning facilities, allowing learning-by-authoring of specific learning materials by intensive use of multimedia digital libraries.

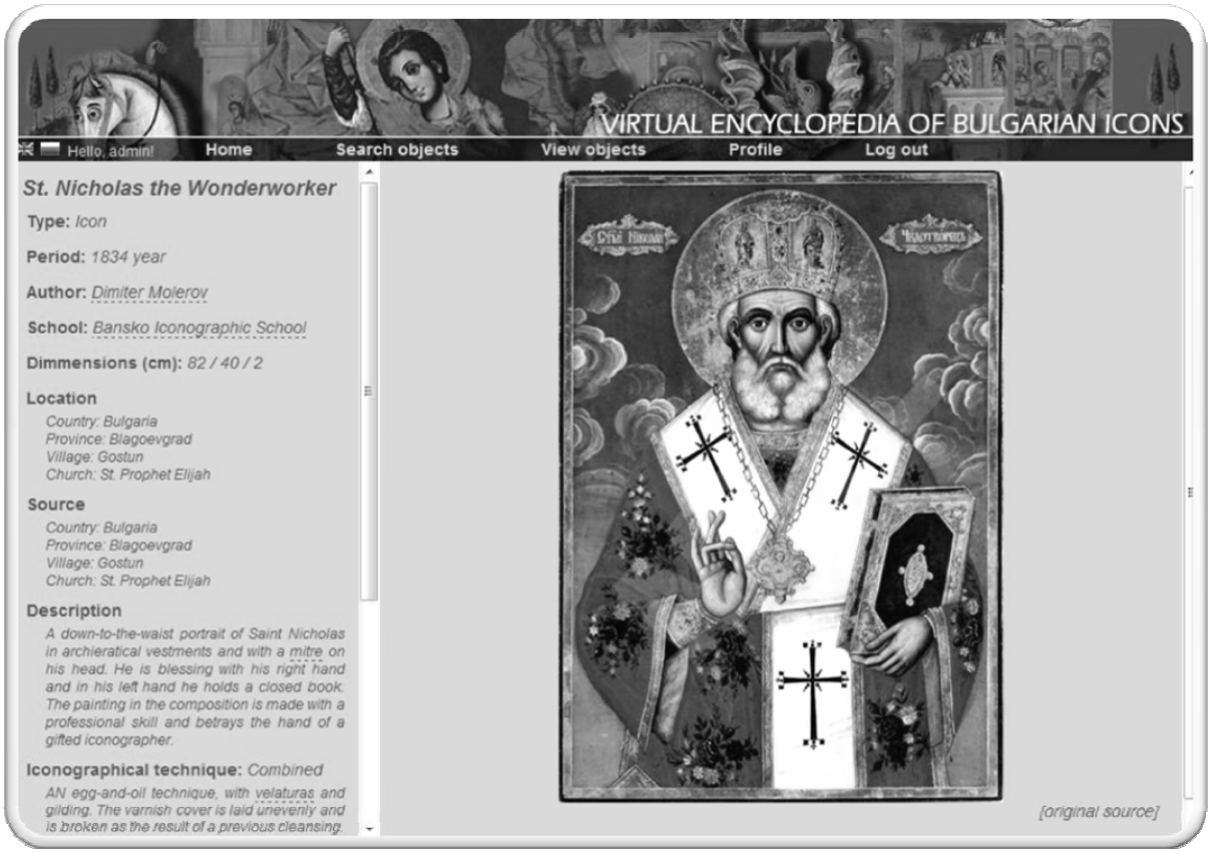
Virtual encyclopedia of the Bulgarian Iconography MDL

Information content and digital objects with a detail semantic description synchronized with CIDOC Conceptual Reference Model standards

Functionality

- Content creation: add (annotate and semantic indexing), store, edit,

preview, delete, group, and manage multimedia digital objects (images, text, sound, video) and collections;
- Manage metadata (ontological and technical);
- Innovative tools and techniques for navigation, preview, access, and browse of digital objects, collections and their descriptions;
- Simple and extended keyword search, complex semantic and context-based search, selection and group of objects;
- Multilinguality (English and Bulgarian);
- Protection and preservation of the digital content (Watermarking, CopyRights);
- Administration and data tracking services; analysis services;
- Data export;
- Personalized and adaptive access to the digital content.



SINUS e-learning scenario

The environment guides and consults the learners for the assigned tasks on the base of its internal domain and pedagogical knowledge, considering the shortage, inaccuracy and even incorrectness of the initial learners' knowledge.

Scenario characteristics:

Learning goals:

- improving and mastering domain knowledge;
- development and application of learners' analytical skills;
- mastering professional DL usage.

Learning tasks: development of educational projects for assigned analyses of given characteristics of the objects under study by:

- Constructing multimedia collection of DL objects to be analyzed;
- Comparison of objects characteristics;
- Development of the project as a multimedia document (text + collection of objects).

Methodology - The main learning goal of the use case scenario is the project development. Examples of learning sub-goals in the scenario are: the learner has to analyse a character, the learner has to find iconographic objects, the learner has to track iconographic technique, the learner has to develop iconographical object, the learner has to compare iconographic objects according to used iconographic technique, *etc*. In order to achieve the main goal the following theoretical and experimental methods are used: comparison and differentiation, analysis, and interactive methods including group work, discussion and debate.

Basic resources - The basic types of resources managed or provided by the SINUS platform are: primary annotated digital resources, semantically annotated digital resources, learning resource, semantic resources (ontologies), and profiles of users.

Users - the developers of various resources (*i.e.* authors of semantic resources, authors of semantic digital resources (annotators), authors of learning resources) and the consumers of those learning resources (*i.e.* academic users, researchers in the target learning domain, non-academic users). Academic users and researchers as the major learners can also be authors of learning resources. These users should normally possess a medium or high level of knowledge in the target learning domain or should plan to use the SINUS platform to reach a high level in this domain. They actively search and use the digital resources found to accomplish their learning goals (examples, development of thematic projects, term projects, graduation works, preparation of analysis and analytic searches of various problems in the area, performing formal TEL education, *etc.*).

SINUS use case

- *Use case title*: Development of the project - The Iconography of Christ in the Historical Territories of Bulgaria
- *Learning domain*: East-Christian culture and art.

- *Primary source of digital objects for the learning domain*: "Virtual Encyclopaedia of the Bulgarian Iconography" multimedia digital library
- *Users*: developers of learning resources and consumers of those learning resources (students and lecturers)
- *General scenario situation*

Tasks:

- to make an analysis of the theological meaning of the iconography of Christ (the Theology team);
- to make an art critical analysis of the chronological development of the iconography of Christ in the different iconographical schools in Bulgaria (the Art Critics team);
- to examine the main iconographic techniques used in the best Bulgarian examples of iconography of Christ (the Art Technique team);
- to make an icon of Christ or a part of a mural painting depicting one of the Christ's feasts (the Artistic team).

Arts Critics team task: Make an art critical analysis of the development in time of the iconographic image of Jesus Christ in the various iconographical schools on Bulgarian land. Steps to be performed:

- Select a minimum of 6 iconographic object containing the image of Jesus Christ in a one-figure composition.
- Arrange the iconographic objects in groups by school of iconography.
- If a school of iconography's group contains objects by an eminent author and founder of the school, place these high on the list. Among the objects designated for art critical analysis there should be at least one by a prominent author/school founder, if available.
- Ensure that the iconographic objects designated for art critical analysis are currently in good condition.
- Ensure that at least one primitive iconographic object and at least one Renaissance iconographic object are included in the iconographic objects designated for art critical analysis.

Art Technique team task: Find iconographic objects containing the image of Jesus Christ in order to compare their specifics from a technological point of view

- Find all the iconographic scenes with Jesus Christ.
- Choose one iconographic scene with a Christ's feasts ((Holy Cross, Nativity, Epiphany, Palm Sunday, Ascension, Pentecost and Transfiguration), with the most samples (iconographic objects), minimum 6.
- Ensure the selected iconographic objects are on solid base (wood, stone

and metal, bone, glass).
- Ensure only iconographic techniques (tempera, oil, mixed) are used in the painting of the iconographic objects.
- Ensure the iconographic objects contain gilding.
- Ensure the Iconographic objects are arranged by temporal characteristics, for example, century.

Team analysis presentation

- With a multimedia demonstration (multimedia presentation, film) for a collaborative discussion forum
- On the basis of the discussions and presentations a specific task for the artistic team to draw an iconographic object is collectively chosen.

Project evaluation -according to:

- Completeness, adequacy and correctness of the text material (choice of collection, choice of base characteristic/s of the iconographic objects to use when implementing the analysis, adequacy of the findings and conclusion of the analysis);
- Attractiveness of the multimedia presentation of the theses and results of the analysis;
- Questions/comments, their meaning and correctness, creative ideas and thinking.

The LOGOS project - Knowledge-on-Demand for Ubiquitous Learning

- Contract no.: EU 6FP IST-4-027451
- Started: 2006 February
- Duration: 3 years
- Website: http://www.logosproject.com/
- Partners: 15 from 8 countries
- Coordinator: Antenna Hungaria, Hungary

Aims

- The development of a new cross-media platform for eLearning using current Internet, mobile phone and DVB technologies for knowledge delivery
- Development of a special authoring studio **using objects from existing digital archives (digital libraries and repositories)** for new cross-media learning content

LOGOS Courseware: Style and achievements of the Bansko-Razlog iconographic school

- LO1: Introduction to Bansko-Razlog iconographic school;
- LO2: Famous iconographic characters painted by iconographers from Bansko-Razlog iconographic school;

- LO3: Famous iconographic scenes painted by iconographers from Bansko-Razlog iconographic school;
- LO4: Saint Nicholas painted by iconographers from Bansko-Razlog iconographic school and other famous iconographic schools;
- LO 5: The Nativity of Christ scene painted by iconographers from Bansko-Razlog iconographic school and other famous iconographic schools.

http://bidl.cc.bas.bg

http://sinus.iinf.bas.bg

http://logosproject.com

Using Digital Libraries in the Teacher Education

Krassen Stefanov

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Digital Library (Repository)

- Library in which collections are stored in digital formats and accessible by computers
- The digital content may be stored locally, or accessed remotely via computer networks
- A digital library is a type of information retrieval system
- Data is indexed using metadata
- Based on OAI/PMH protocols for sharing

Main functions

- offer the outputs to the world
- maximise the visibility and enhance impact
- showcase and sell results / products
- to collect and curate digital collections
- to manage research and teaching activities
- workspace for collaborative projects
- development and sharing of digital teaching
- materials and aids
- access to student achievements

Some issues

- How to collect content
- How to look after the content
- How to add value to the content
- How to share information with other digital libraries
- How to offer services to end users
- How to ensure legally sound operations
- How to ensure interoperability
- How to make it sustainable

Metadata

- Data about data
- Describe various characteristics of the digital objects stored in the

library
- Used for cataloguing purposes
- Many standards available (metadata schemes)

There is no official only one standard set - Dublin Core (DC) is de-facto standard

Open Access Initiative (OAI)

- *Main goal:* open access as the worldwide electronic distribution of peer-reviewed literature and completely free and unrestricted access to it by all scientists, scholars, teachers, students and other curious minds
- First declared in Budapest, best known as Berlin Declaration (http://www.openarchives.org/)
- Includes
  - authors grant free access to users;
  - full version available in at least one digital library

Teachers expectations and requirements analysis

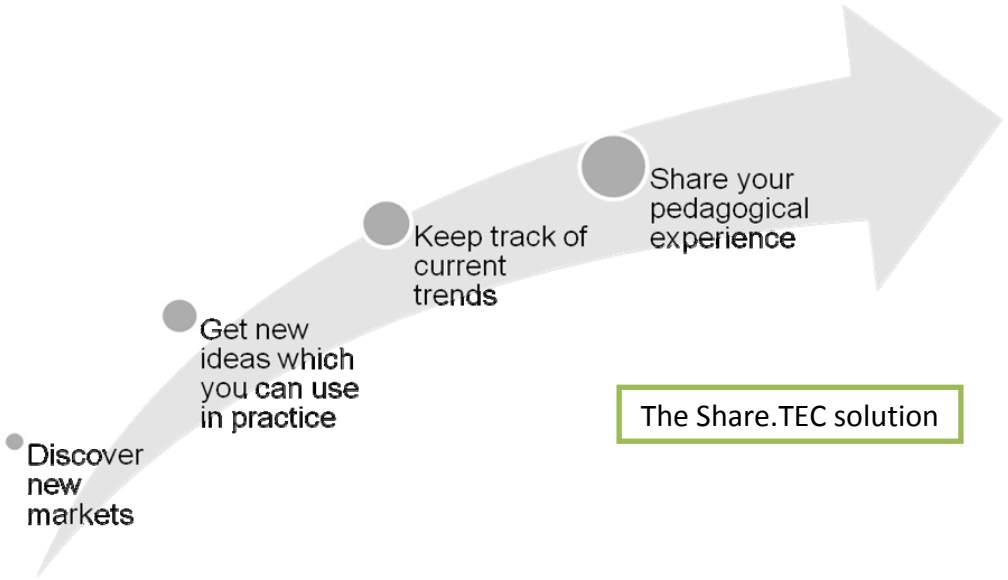
- Detailed surveys performed in 7 countries
- Three international workshops
- Internet surveys
- Scenarios and use cases developed

Share.TEC vision

- **unlocking** - teacher education resources & expertise
- **building** -a teacher education hub
- **connecting** - teacher education networks
- **bridging** - cultural differences
- **combining** - market and open potential

The Share.TEC vision for teacher education

- To offer services for locating and sharing teacher education specific digital content
- To strengthen the European dimension in sharing teacher education digital resources
- To encourage the exchange and reuse of quality contents for teacher education at a European level



Share.TEC – the project

- EU project within the eContentplus program during 2008-2011 which has produced a new product for teacher education
- The project consortium:

• Istituto per le Tecnologie Didattiche, CNR (IT) (Coordinator) • Trinity College Dublin (IE) • Università Ca' Foscari, Venezia (IT)	universities, research inst., schools of education
• Stockholm University (SE) • Open University of the Netherlands (NL)	educational technology developers
• Universidad de Valladolid (ES) • Sofia University (BG)	educational publisher

Share.TEC – the platform

- A platform granting unified access to digital resources across Europe that specifically target the domain of Teacher Education
- Share.TEC will help practitioners across Europe search for, learn about and exchange resources of various kinds, and will support the sharing of experiences.
- May 2011: 27 376 objects and 786 registred members
- Create your own profile and enjoy customized solutions for the full Share.TEC experience
- A core of tested teacher education content
- Several different repositories are connected to Share.TEC, broadening

reusability perspectives across Europe.

- Sophisticated system achieved via a model that helps overcome language barriers and captures pedagogical descriptions
- A gateway to specific teacher education resources
- User focused services
- A boost for the teacher education content market in Europe
- Share your material with others and create new discussion groups

… finding your way through the platform

- familiar terms to search for resources
- personalised options for performing queries
- personalised ranking of results
- social networking functionalities

Why is Share.TEC beneficial to teacher education?

Teacher education

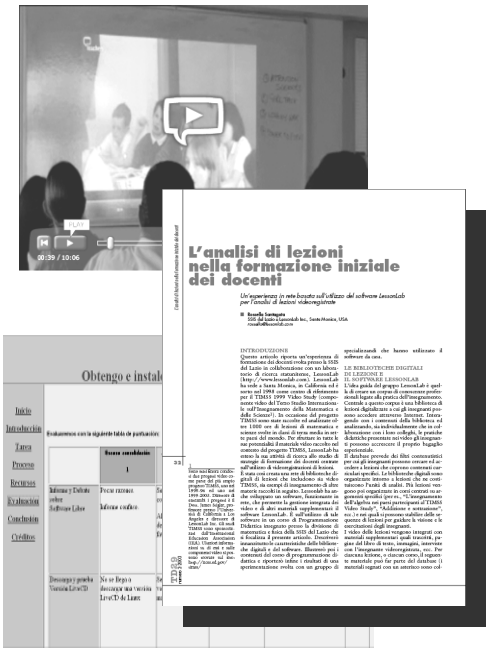
- requires change from traditional culture to shared academic practice
- has limited resources
- needs a unique common teacher education ontology
- needs renewable learning and teaching material

Teacher educator *Student teacher* *Practising teacher*

Professional practice *Student learning practices* *Professional development*

All three need digital resources that are

- easy to find and applicable to teacher education
- trustworthy and "road tested"
- (potentially) reusable
- (potentially) multimedia and innovative



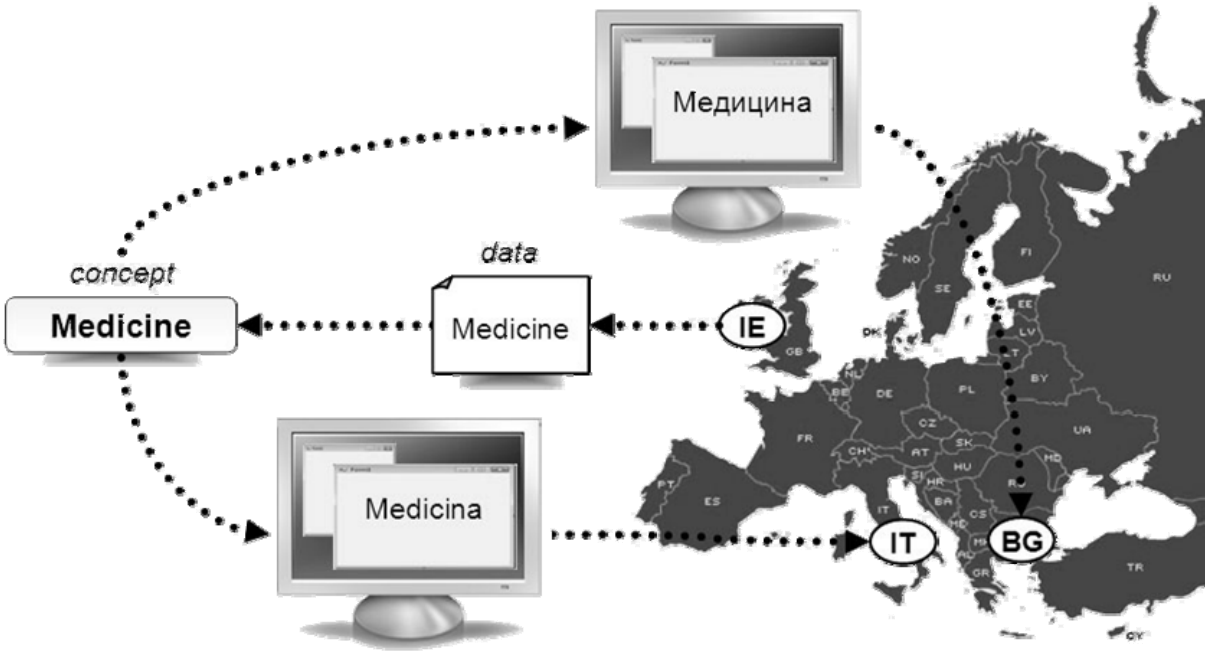
Share.TEC resources

- addressing actors in the teacher education world (*not K-12 students directly*)
- encompassing lessons plans, teaching modules, best practices, reference material, etc.
- coming from sources across Europe
- combining "open" and commercial approaches

Special features – the semantic layer of the Share.TEC system

- TEO (Teacher education ontology) is a representation of teacher education-related concepts, and a framework for mapping culturally and linguistically diverse versions of that representation.
- CMM (Common metadata model) is a prerequisite in the process of harvesting metadata from repositories inside and outside the consortium.
- MMM (Multicultural metadata model) is a set of language/context specific derivations.

Special features - multilanguage layer



Networking

If Only I Had Such a Math Teacher…

Toni Chehlarova

BAS

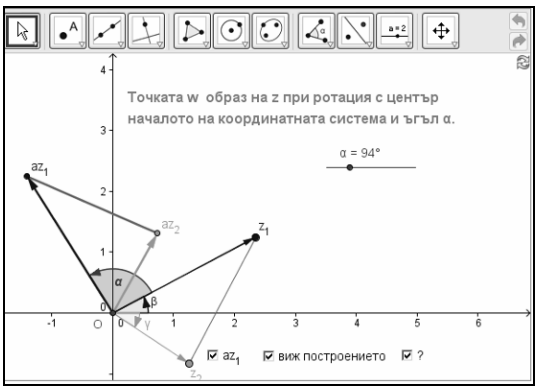
From 13th to 16th Sofia hosted two wonderful educational events overlapping in 2 days – the UNESCO International Workshop *Re-designing the Institutional Policies and Practices to Enhance the **Q**uality of **E**ducation through Innovative Use of **D**igital Technologies* and the regular workshops with 25 of the most active Fibo-teachers in Bulgaria organized by the Bulgarian Fibonacci Team. The latter was attended additionally by 4 observers from Skopje, Republic of Macedonia, and a number of school students who work on their own research projects. The idea was to provide opportunities for the Bulgarian and foreign participants in the two workshops to merge and interact, thus giving a new, international dimension to the efforts and the results obtained within Fibonacci Project in Bulgaria. The programs of the two events were coordinated so that participants in one of the workshops could, at least partially, follow what happens *with the neighbours*. Important in this respect was also the fact that Prof. Dr. Peter Baptist from University of Bayreuth was one of the key-note speakers at the UNESCO Workshop.

Addressing the participants at the opening of the Fibonacci workshop, the Project coordinator Petar Kenderov expressed his hope and belief that the number of Bulgarian teachers and students for whom the inquiry will be the natural approach to education and to problem solving will be increasing at least as fast as the famous Fibonacci sequence. Then the participants introduced themselves and formulated explicitly their expectations of the workshop's outputs. These expectations included not only novel ideas, problems, solutions, but also the establishment of a network of people working with dedication for an inspirational cause.

The Project team members demonstrated their most recent ideas implemented in dynamic learning environments:

- E. Sendova and T. Chehlarova - *Dynamic Tessellations*

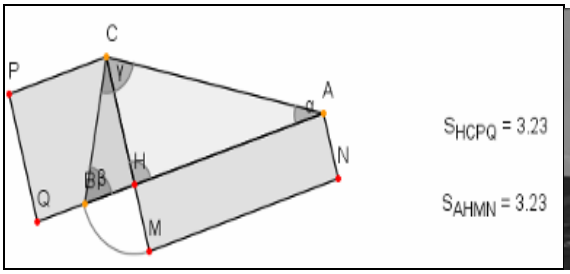

- D. Dimkova and G. Dimkov – Dynamics with complex numbers

- Albena Vasileva – Directing towards the vectors


- P. Boytchev - An embryonic approach towards the exploration in mathematics classes

The teachers K. Chalakova, N. Sheynkova and the expert Y. Elenkova shared their experience in organizing and implementing the Inquiry Based Mathematics Education (IBME) approach within various groups of teachers and students

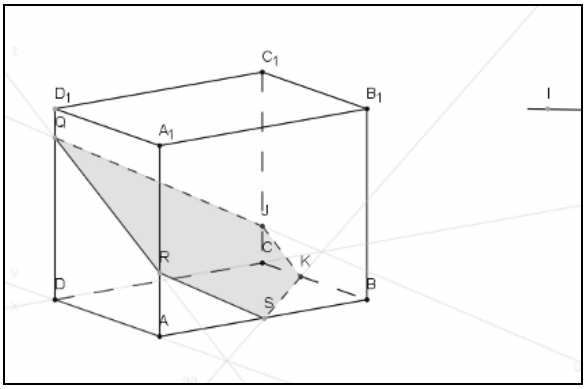


The school students were those who impressed the audience the most with their originality, courage and passion! Two students of S. Atanasova (Sofia school # 119) showed the way they have traveled along in search of a locus, as well as their further ideas for explorations. Their joy of being given the chance to touch the "real math" and share this with educational experts was sincere. The expectations of the Project team that it is worthwhile to involve high school students in more complex problems, requiring time-consuming explorations, have been justified.

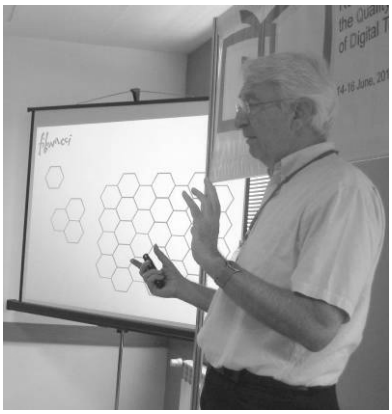
Ideas inspired by Fibonacci Project were implemented even during the breaks. For the photo in front of the "Book Monument" some of the workshop's participants ordered themselves in rows representing the first several Fibonacci numbers.

At a special session some good practices of Bulgarian Fibo-teachers were

presented to the international audience of the UNESCO workshop. D. Petrova showed a learning environment for 3D geometry developed with a student of her. T. Terzieva and S. Aneva demonstrated how to organize inquiry based process in informatics setting A. Gushev showed projects of his students published on the site of Veliko Tarnovo mathematics school. S. Atanasova focused on the motivation factor when solving problems on loci going beyond the traditional math curriculum. A. Revalska demonstrated an experimental version of discovering properties related to parallel projection. N. Hristozova presented projects of her 5th and 6th grader on 3D modeling of rotational solids by means of *Elica* software applications. M. Brauchle presented a teacher's guide for developing educational materials with dynamic flavor.



S. Kokinova shared in the context of exploring parabolas that thanks to the IBME approach neither her, nor her students are afraid to jump in the unknown and find their own answers.



Everything might have been said but our Fibo-mentor Prof. Peter Baptists was not tired to say it again…

All the participating teachers were able to re-think their ideas in an international setting and to realize that it is thanks to their efforts that the IBME approach could be more widely spread among the students.

After the session, Emma Kiselyova, UNESCO Chair in e-Learning, said that if she had had such teachers, she would have loved mathematics for sure!

At the closing ceremony of UNESCO workshop two of the Fibonacci Team members, S. Atanasova and E. Sendova, got the *Golden feather* Award of Bulgarian Teacher's Syndicate.

This is a well-deserved and highly obliging and stimulating recognition.

ANNEX 4 A SAMPLE OF THE QED WORKSHOP PHOTO ARCHIVE

14 June 2011
Inter-Expo Center

16 June 2011
State University of Library Study and Information Technologies (SULSIT)