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The role of educational technology in teaching and learning of science

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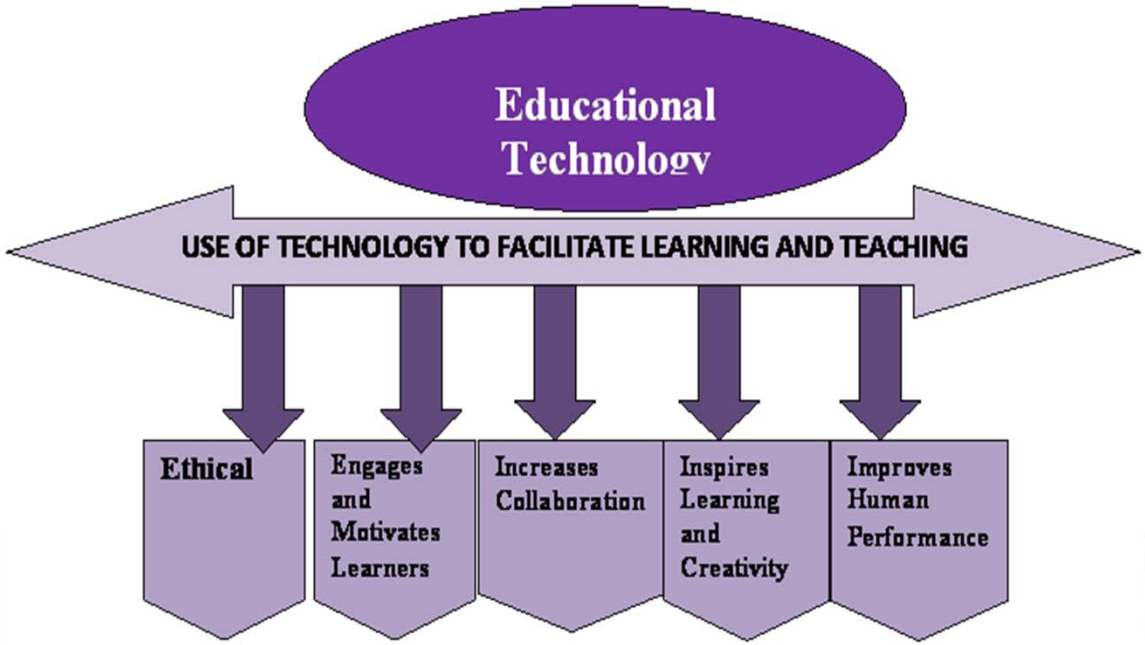
Technology will never replace great teachers, but technology in the hands of great teachers is transformational

George Couros

Background (1)

- Educational technology (ET) is the study and ethical practice of **facilitating** learning and **improving** performance by **creating**, **using** and **managing** appropriate technological processes and resources (Richey, R. C., Silber, K. H., & Ely, D. P. (2008).



Background (2)

- ICT is used in science may be divided into four broad areas:
  - **data handling**
  - **information**
  - **communication**
  - **exploration**

Research aim and question

- **Aim of the Research**
  - To study how ET facilitating learning by creating, using and managing appropriate technological processes and resources
- **Research Question**
  - Is there a diference between teachers and students using of technologies?
  - What are factors which does impact teacher and pupils activities in teaching and learning by using of ET?

Research design

- The **adapted** survey from Egyptians developed questionaire of the framework of the project *International Diploma for School Teachers in STEM Education* (eSTEM).
- The data have been obtained by using of closed-open items using 5-point Likert scale in online platform of QuestionPro.
- Quantitative data processing program **SPSS 23.0** was used. (Mann–Whitney U test and Spearman's rank correlation coefficient for statistical dependence between the ranking of two different target groups).

The structure of the questionnaire

General part	Conceptual Part
Demographic data	Curriculum
Level of education completed	Teaching Methods & Strategies
Teaching experience in STEM schools	Students' learning
Grade level	Teaching Aids
Etc.	Assessment
	School atmosphere & support (facilities)
	Etc.

The Sample of the present Pilot-research (1)

Viewed	Started	Completed	Completion Rate	Drop Outs (After Starting)	Average Time to Complete Survey
332	**81**	**81**	**100%**	**0**	**21 minutes**

Teachers (N=81)	Female (N=70)				Male (N=11)			
Subject	Science 11	Biology 19	Chemistry 13	Physics 17	Math 30	Geography 6	Technology 15	Others 3
Age	20-24 5	25-30 6	31-40 7	41-50 21	51-60 33	61-65 8	66-70 0	<70 1
Education level	Diploma 33	Diploma (professional) 14	Bachelor 10	Master 51	PhD 1	Others 2		
Experience	<1 Year 2	1 - 3 Years 5	4 - 6 Years 3	7 - 10 Years 6	11 - 20 Years 13	21 - 30 Years 22	>30 Years 30	
Grade	5th grade 13	6th grade 14	7th grade 9	8th grade 12	9th grade 17	10th grade 31	11th grade 31	12th grade 33	Others 21
Direction	No direction 55	Humanitarian 15	Science 29	Others 11				

The Sample of the Pilot-research (2)

Viewed	Started	Completed	Completion Rate	Drop Outs (After Starting)	Average Time to Complete Survey
549	**149**	**149**	**100%**	**0**	**13 minutes**

Students (N=149)	Female (N=88)				Male (N=61)	
Requirement for entry STEM school	Average mark 70	Passing test in science, mathematics, and technology 9			Passing IQ test 1	Passing a personal interview 31
Grade	10th grade 54		11th grade 49		12th grade 46	
Direction	No direction 2	Humanitarian 1	Science 58	Secondary school 24	Gymnasium 120	Others 15

Findings of the Research

There are no differences between teachers and students views of such technologies used in science education as

- Internet for searching of information
- Computer adapted microscope
- Tools for data capture, processing and interpretation – data logging systems
- Online discussions: chat rooms, e-mail, e-conference etc.
- Tablets

There are differences between teachers and students view of such technologies used in science education as

Technology	(ρ)
Electronic grade book	0.002
Computer laboratory simulations (multimedia software for simulation of processes and carrying out virtual experiments	**0.000**
e-folio	0.003
Online programs (e.g. Prezi, etc.) for presentations and handouts	**0.000**
Microsoft Office applications during lessons	**0.000**
Desktop publishing	**0.000**
MOOCs	**0.000**
A variety of means (models, drawings, graphs, concrete materials, manipulatives, etc.) to present phenomena	**0.000**
Interactive board	**0.000**
Voting consoles	**0.000**
Mobile computerclass	0.003
Smartphones	0.006
Educational computer games	**0.000**
E-learning resources	**0.000**
Other internet resources (DB, video, animations)	0.007

The main factors, which impedes the use of technology, are

Factors	Description	Spearman rho
Institutional	Lack of technology and infrastructure provision	0.89
	Computer and software moral depreciation	0.92
	There is not enough co-operation with teachers of other subjects	0.91
Personal	Costs required for the purchase, use and maintenance of a personal computer	0.76
	Too much of the information must be mastered in order for the technology to be efficiently used in the classroom	0.72
	Prolonged use of technology causes health problems	0.78

Conclusions

- There are **common and different trends** in the use of ICT between teachers and students. Unfortunaly, there is less evidence for use newer technologies: tools for data capture, processing and interpretation – data logging systems, and computer adapted microscope, as well online discussions: chat rooms, e-mail, e-conference etc. It means, that the impact of ICT in science are still largely tentative.
- Assessing the use of ICT **teachers demonstrated a more critical attitude** than students. This raises the question - do students use technology better than teachers or is students self-esteem higher? Have we smart students and non-smart teachers?
- The **institutional and personal factors** are main factors which does impact the use of ICT. Teaching using ICT puts 21st century demands on teachers and very important for integration technologies in classroom is **teachers motivation** as one of the personal key-factor.

ICT for Smart Learning

Preparing teachers for diversity: EU best practice

New case study released on preparing teachers for diversity (Mai 2017)

https://ec.europa.eu/education/news/20170510-diversity-teaching-report_en

Aim

- The study was drawn up to shed light on the challenges and opportunities of the increasing diversity of European classrooms, as well as to identify practical measures to support teachers in dealing with the challenges they are faced with.

Findings

- This study has helped to consolidate existing knowledge across Europe and beyond, and to gather new evidence on how student teachers are prepared for diversity in the classroom and to teach about diversity in society. - School Education Gateway

One of the 15 selected good practice cases

Master degree programm "Educational Treatment of Diversity" at University of Latvia

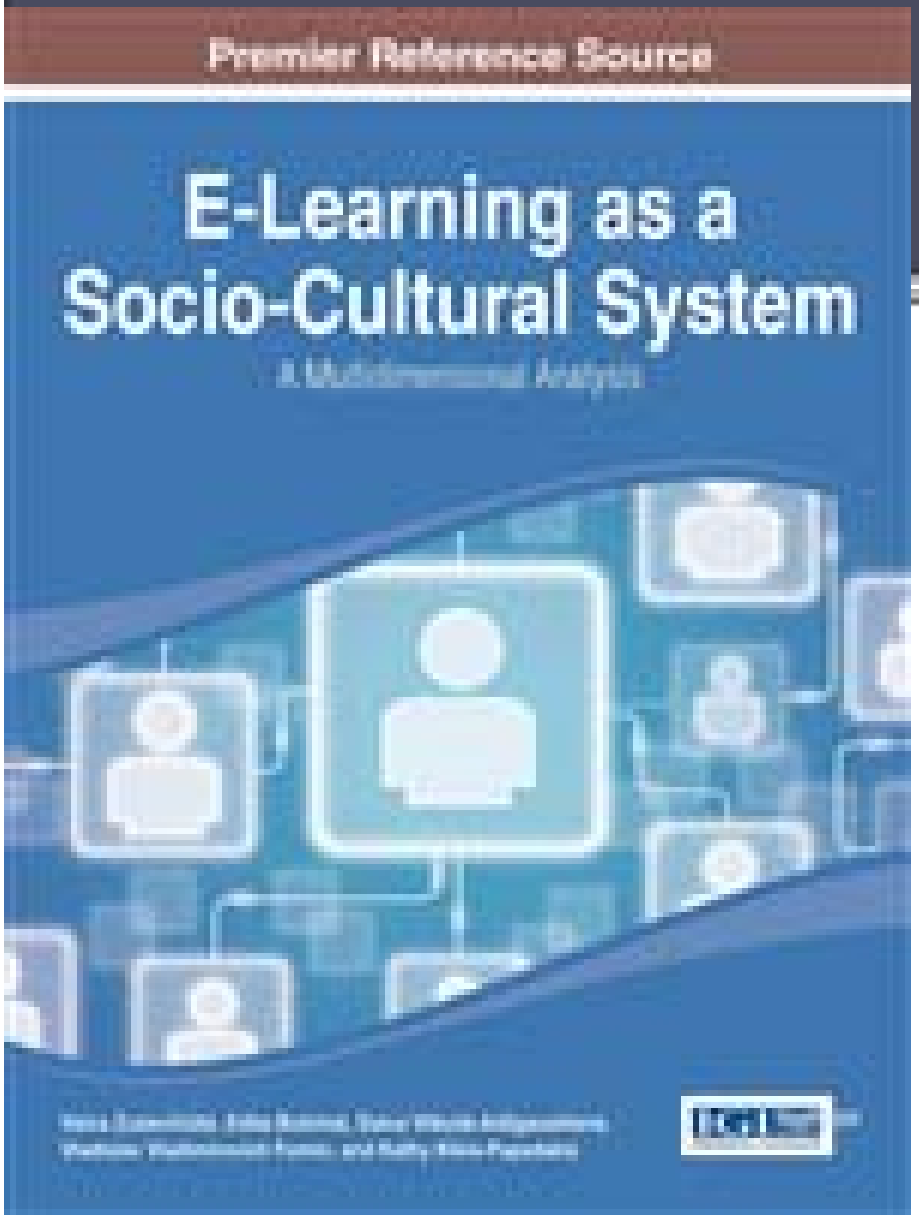
(ETD)

Evidence find out

The main strengths of ETD are to ensure the high qualification of experts in diversity-related issues in education to become future trainers, programme directors, or leaders in diversity management. The programme supports the development of multilingualism, the international dimension of students and guest lecturers, and competences (pedagogical, intercultural, linguistic, ICT, communicative, management/organisational competences). It also provides high employability prospects (through internship/research practicum) and the possibility of specialisation according to the mobility tracks (special education).

Scientific concept of ETD: Smart pedagogy

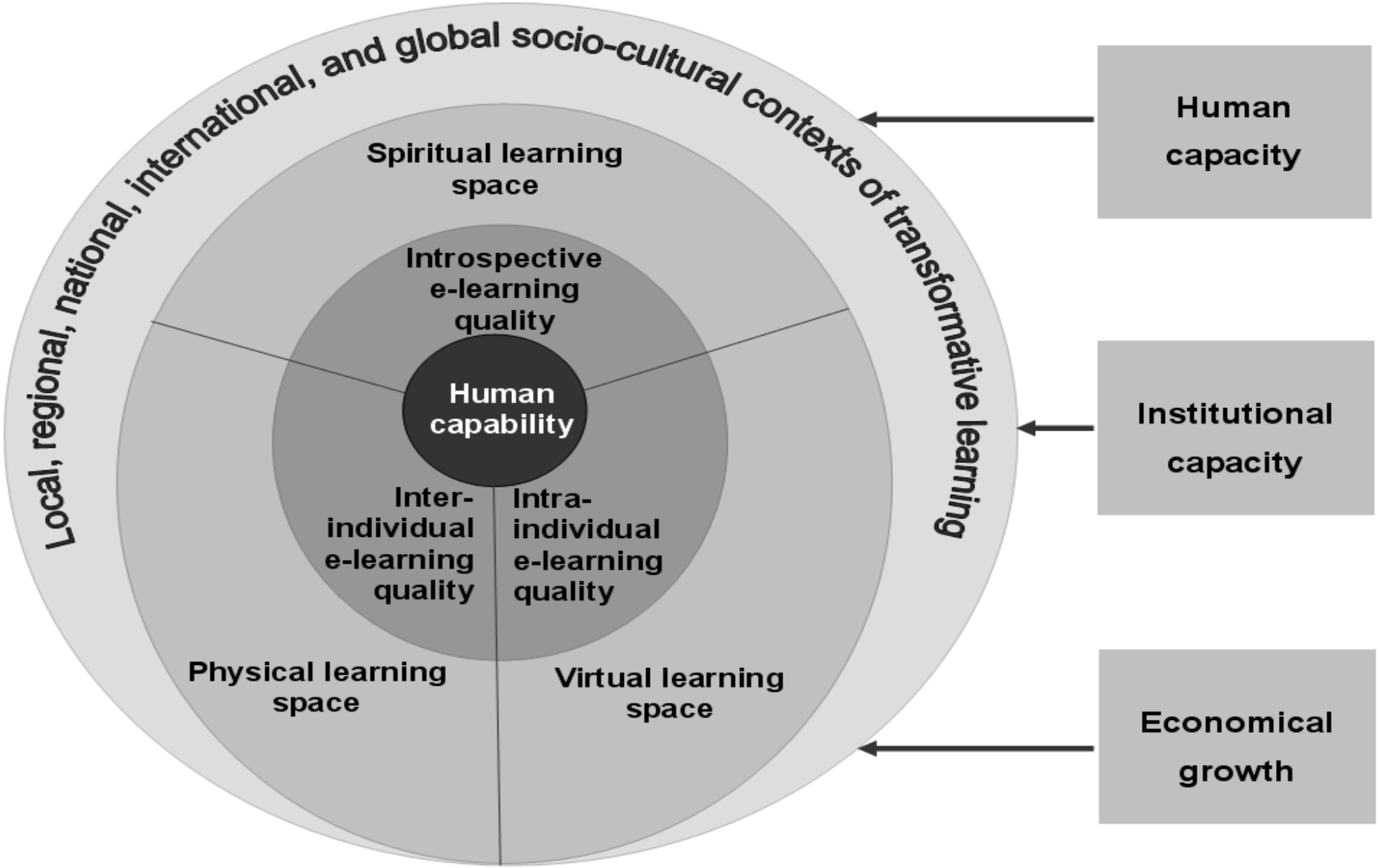
- **The concept of smart pedagogy is based on the synergy of the transdisciplinary science knowledge of human capacity and capability:**
- **The sustainable development of human life- and workforce capability happens in physical, virtual, and spiritual spaces in local, regional, national, international, and global socio-cultural contexts of transformational learning.**



Conceptualizing of e-learning as a socio-cultural ecological system exploring the empirical evidence on objective and subjective conditions for using this concept in practice.

https://www.igi-global.com/chapter/e-learning-for-widening-participation-in-higher-education/111633

E-learning as a socio-cultural ecological system



The objective conditions for implementation in practice

- integration of informal knowledge of information and communication technologies
- implementing pedagogical leadership in tandems for developing students' intrapreneurship
- self-evaluation and self-enhancement

The objective conditions for implementation in practice

- personal involvement
- supportive social climate
- eagerness for transforming challenges into new learning opportunities

Benefits

- E-learning as a socio-cultural ecological system fosters students' and faculty staff's participation, producing new scientific knowledge and pedagogical solutions that create synergy between science, education, and politics

Thank You for your attention!

University of Latvia

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