

V. E-LEARNING – GOOD PRACTICE OF EFFECTIVE USE IN EDUCATION

COLLABORATION IN RESEARCH ACTIVITIES: ICT TOOLS ASSESSMENT

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***Abstract:** The article describes some results of implementation of WorkPackage 4 (WP4) “Selection and testing new IT tools” in the framework of international research network IRNet and researchers from partner institution from Ukraine, Poland, other countries. These results concern analyzing and studying some category of ICT-tools for Research their assessment. The first part of the article includes the theoretical aspects of research as an activity: Research: activity profile, analysis of challenges of research collaboration, research collaboration quality requirement, forms of research collaboration and other items.*

The second part of the paper described some research conducted in the framework of Module 008 WP4 and includes: Research ICT tools typology according to education activities, Mixed features of Research collaboration Tools, Efficiency trend for top rated Research collaboration ICT tools. Model 1, Sample expert card, Sample tool expert rating, Final expert ranking of Research collaboration tools (all package period which has been divided on several main stages 1-5). The final part of the manuscript contains some conclusions and comment.

Keywords: research, innovation, research collaboration work, education, ICT tools, assessment, e-learning.

1. INTRODUCTION

Within the modern educational paradigm, the 21st century skills concept (Abbott 2013) is motivated by the belief that teaching students the most relevant, useful, in-demand, and universally applicable skills should be prioritized in today's

schools, and by the related belief that many schools may not sufficiently prioritize such skills or effectively teach them to students.

The basic idea is that students, who will come of age in the 21st century, need to be taught different skills than those learned by students in the 20th century, and that the skills they learn should reflect the specific demands that will place them in a complex, competitive, knowledge-based, information-age, technology-driven economy and society.

While the specific skills deemed to be “21st century skills” may be defined, categorized, and determined differently the term does reflect a general-if somewhat loose and shifting-consensus. The following list (ibid) provides a brief illustrative overview of the knowledge, skills, work habits, and character traits commonly associated with 21st century skills:

- Critical thinking, problem solving, reasoning, analysis, interpretation, synthesizing information;
- Research skills and practices, interrogative questioning;
- Creativity, artistry, curiosity, imagination, innovation, personal expression;
- Perseverance, self-direction, planning, self-discipline, adaptability, initiative;
- Oral and written communication, public speaking and presenting, listening;
- Leadership, teamwork, collaboration, cooperation, facility in using virtual workspaces
- Information and communication technology (ICT) literacy, media and internet literacy, data interpretation and analysis, computer programming;
- Civic, ethical, and social-justice literacy;
- Economic and financial literacy, entrepreneurialism;
- Global awareness, multicultural literacy, humanitarianism;
- Scientific literacy and reasoning, the scientific method;
- Environmental and conservation literacy, ecosystems understanding;
- Health and wellness literacy, including nutrition, diet, exercise, and public health and safety.

While many individuals and organizations have proposed definitions of 21st century skills, and most states have adopted learning standards that include or address cross-disciplinary skills, the following are three popular models that can serve to illustrate the concept and its applications in education (Abbott 2013):

- *Framework for 21st Century Learning* (The Partnership for 21st Century Skills);
- *Four Keys to College and Career Readiness* (David T. Conley and the Educational Policy Improvement Center);
- *Seven Survival Skills* (Tony Wagner and the Change Leadership Group at the Harvard Graduate School of Education) (Suto 2013).

In lieu of the fact that leadership, teamwork, collaboration, cooperation is considered an integral part of the 21st century marketable skills scope, **the objective** of this paper is to consider the placement of research activities and skills across a comprehensive expertise of required ICT tools in education.

2. RESEARCH: ACTIVITY PROFILE.

Innovation is generically defined as a "new idea, device, or method" (MWED). However, innovation is often also viewed as the application of better solutions that meet new requirements, unarticulated needs, or existing market needs (Maryville 1992). The term "innovation" can also be disambiguated as something original and more effective and, as a consequence, new, that "breaks into" the market or society. (Frankelius 2009).

According to Peter F. Drucker, the general sources of innovations are different changes in industry structure, in market structure, in local and global demographics, in human perception, mood and meaning, in the amount of already available scientific knowledge, etc. (HBR 2002).

On the other hand, according to Joseph F. Engelberger innovations require only three things:

1. A recognized need,
2. Competent people with relevant technology, and
3. Financial support.

Innovation processes usually involve: identifying customer needs, macro and meso trends, developing competences through education and finding financial support.

As a vehicle of innovation, research in education is commonly defined as creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of humans, culture and society, and the use of this stock of knowledge to devise new applications (OED 2015 (WTID 1993)). It is used to establish or confirm facts, reaffirm the results of previous work, solve new or existing problems, support theorems, or develop new theories. There are several forms of research: scientific, humanities, artistic, economic, social,

business, marketing, practitioner research, etc. (OD 2015), (OED 2015 (WTID 1993))

The major steps in conducting research (Creswell 2008) are:

- Identification of research problem
- Literature review
- Specifying the purpose of research
- Determine specific research questions
- Specification of a Conceptual framework –
- Choice of a methodology (for data collection)
- Data collection
- Verify Data
- Analyzing and interpreting the data
- Reporting and evaluating research
- Communicating the research findings and, possibly, recommendations.

Every step of research procedure requires a use of specific ICT tools and an engagement into collaborative activities.

In education and research collaboration is referred to as two or more people working together to accomplish some objective, to achieve shared goals (Boston KM 2014)

It is a recursive (Martinez-Moyano 2006) process where two or more people or organizations work together to realize shared goals, (this is more than the intersection of common goals seen in co-operative ventures, but a deep, collective determination to reach an identical objective) by sharing knowledge, learning and building consensus. Structured methods of collaboration encourage introspection of behavior and communication (Spence 2006). These methods *specifically* aim to increase the success of teams as they engage in collaborative *problem solving or research*.

It exists in two main forms:

- *Synchronous*, comprising of Same Place <-> Same Time, and Different Place <-> Same Time models;
- *Asynchronous*, comprising of Same Place <-> Different Time, and Different Place <-> Different Time models (Boston KM, 2014);

Principle models and corresponding features of research collaboration are:

1. Same Time, Same Place: Discussion, Brain storm, Communicative skills, Access to documents, Access to educator, Polling, Project/task management, Rosters of multiple types, Calendaring/scheduling

2. Same Time, Different Place: Lecture, Discussion, Workshop, Research, Tutoring, Conference, File sharing, Resources.

3. Different Time, Same Place: Resources, Control.

4. Different Time, Different Place: Message exchange, Review, Assessment, Resources.

Among the *indicators of effective research collaboration* are: group work, shared responsibility, shared decision making, co- depended work (Townsend, DeMarie and Hendrickson 2015). The given indicators are traced across educational paradigms.

The essential collaborative approach within the constructivist paradigm was derived by Lev Vygotsky, known for his theory of social constructivism, who believed that learning and development is a collaborative activity and that children are cognitively developed in the context of socialization and education (Greener 2015). The perceptual, attention, and memory capacities of children are transformed by vital cognitive tools provided by culture, such as history, social context, traditions, language, and religion. For learning to occur, the student first makes contact with the social environment on an interpersonal level and then internalizes this experience (Morze et al. 2015).

In terms of this approach, Research collaboration at the conceptual level, involves the following traits and features:

- awareness
- motivation
- self-synchronization
- participation
- mediation
- reciprocity
- reflection
- engagement

Of all the educational paradigms, e-learning and u-learning (Crowe 2007: 129) relies almost exclusively on collaboration as an educational template, skills formation and assessment tool and ultimate objective.

Forms of research collaboration at a means of critical thinking skills formation comprise of 2 groups:

- (1) Relationship oriented: Affinity networks, Learning communities
- (2) Task oriented: Communities of Practice, Project Communities

Needs and challenges of research collaboration in an open e-learning environment comprise of the following issues:

- sharing information and documents
- collaboration across physical locations
- sharing creation and access to work products
- identifying and accessing external experts and resources
- classroom with easy-to-use tools
- document repository
- management tools, including scheduling and task management
- lists, tables, rosters, tasks, score cards
- communication tools, including e-mail, discussions, conferencing, voting.

Participants of research are: Universities, Educators, Students

Hence, a **student's research environment includes:**

- Learning materials
- Manuals
- Video
- Words
- Corpora
- Audio
- Multimedia
- Text
- Visuals
- Maps
- Online libraries and databases
- Professional software
- For translation
- For statistics
- For polling
- For computation

- Specific (virtual labs)
 - Enterprises
 - Employment
 - Formal, informal and unformal education
 - Open sources
 - Wiki
 - MOOC
 - Corpus
 - Repositories
 - E-journals,
 - E-conferences
 - People
 - Peers
 - Experts
 - Supervisors

3. RESEARCH ICT TOOLS ASSESSMENT

Online or ICT enhanced research is the practice of using Internet information, especially free information on the World Wide Web, in research. It is:

- focused and purposeful (so not recreational browsing),
- uses Internet information or Internet-based resources (like Internet discussion forum)
- tends towards the immediate (drawing answers from information you can access without delay)
- and tends to access information without a purchase price (Aouil 2007).

The most popular search tools for finding information on the Internet include Web search engines, meta search engines, Web directories, and specialty search services. A Web search engine uses software known as a Web crawler to follow the hyperlinks connecting the pages on the World Wide Web. The information on these Web pages is indexed and stored by the search engine. To access this information, a user enters keywords in a search form and the search engine queries its algorithms, which take into consideration the location and frequency of keywords on a Web page, along with the quality and number of external hyperlinks pointing at the Web page (MacDonald 2016).

According to the authors' estimations and expert assessment, *needs and goals* of ICT research collaboration include the following groups of issues (Figure 1):

- key word search in search engines, Google, Bing
- metadata search
- wiki search
- social networks search
- library search
- blog search
- articles search
- book search
- MOOC search

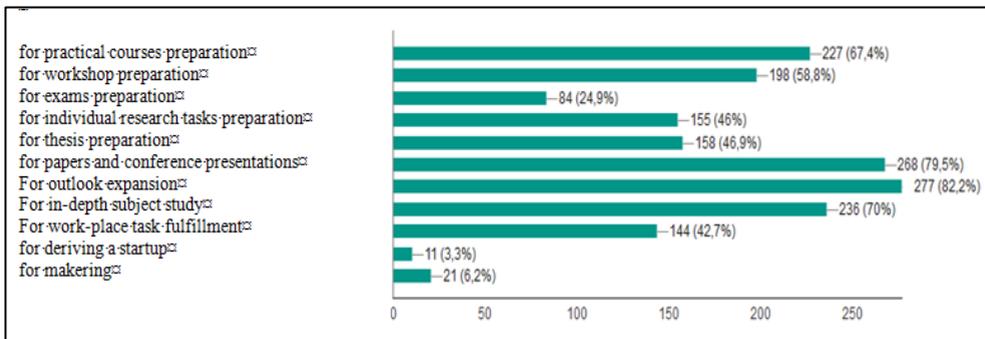


Figure 1. Distribution of ICT enhanced Research goals

Research ICT tools requirements, according to the authors' expert group estimation, comprise:

1. Type of communication (verbal)
2. Simple interface
3. Scheduling feature
4. File sharing
5. Timing
6. Environment
7. Technical architecture
8. Viewing information
9. Seeking information
10. Subscribing to information

11. Comparison of information
12. Networking
13. Writing

Among the requirements, the following features have been identified:

- Type of communication (verbal)
 - common
 - conference
 - private
- Simple and friendly interface
 - Intuitive
 - Voice oriented
 - Object oriented
- Scheduling feature
 - Long term project (Gantt chart)
 - workflow
 - Kahnban chart (crucial stages)
 - Brainstorm
- File sharing
 - Video
 - Audio
 - picture
 - Text
- Timing
 - Real time
 - Off-line
- Environment
 - Centralized
 - Decentralized

The research collaboration tools, identified for analysis (Hart 2015) have been subjected to typology according to the featured activity profile.

Thus, selected research collaboration tools have been identified according to collaboration models:

Same place, different time

Cloud, wiki, Academia.edu, Google Search, Pinterest, Khan Academy, Google Scholar, SharePoint, Schoology, Blackboard Collaborate, PaperRater, Google Classroom, Schoology, Poll Everywhere, Udemy

Same place, same time

mural.ly, <http://www.draftboardapp.com/>, MindMeister <https://www.mindmeister.com/ru>, Socrative, Adobe Connect, Diigo, SharePoint, Evernote, Cloud, wiki, Google Classroom, Lectora Inspire, Wordle

Different place, same time

blogs (blogspot, twitter, tumblr), social networks, Trello, WordPress, Scribblar, LinkedIn, Kahoot, Yammer, Blackboard Collaborate, writing.com, Red Pen (Criticism) <https://Redpen.io/>, Google Doc, WordPress, Kahoot, Scoopit

Different place, different time

Cloud, wiki, Academia.edu, Google Search, Pinterest, Khan Academy, Google Scholar, SharePoint, Schoology, Blackboard Collaborate, PaperRater, Google Classroom, Schoology, Poll Everywhere, Udemy

A total number of 242 Research collaboration ICT tools have been analyzed by the expert group, chosen out of the Top 100 Efficient Learning Tools ratings (Hart 2015).

Of them 47% prove to be of the mixed type, featuring indicators of Communication and Collaboration activity tools (Cf. Figure 2):

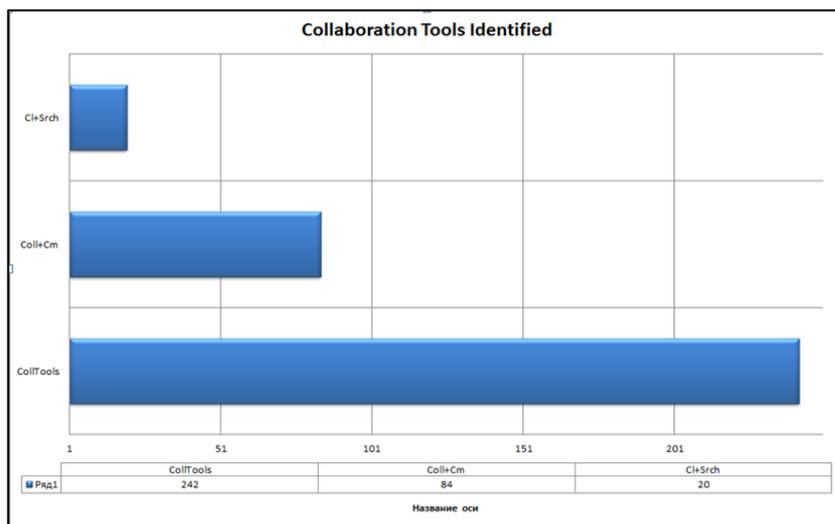


Figure 2. Mixed features of Collaboration Research Tools

The identified Research tools have been subsequently subjected to expert evaluation (Dos Reis 2015), featuring the efficiency per education activity as a main criterion (Cf. Figure 3)

Research ACTIVITIES	Research TOOLS															
	Google	Adobe Connect	Google Classroom	Google Doc	Google presentation	Google search	YouTube	Evernote	Writing.com	Scribblar	Trello	Mind	Mistral Social networks	Elogs	Red Pen	PaperRater
Discussion, Workshop, Brain storm, Lecture, Control	4	1	5	1	1	3	3	2	1	3	3	2	1	1	2	3
Access to educator, Tutoring	4	2	5	3	1	5	2	2	1	3	5	5	4	1	3	5
Conference	3	2	3	4	1	5	1	3	3	3	3	3	2	1	3	5
File sharing, resources	3	4	4	5	5	3	5	2	4	1	1	1	3	3	3	4
Project/task management	4	5	5	4	5	4	5	4	4	4	2	4	4	4	3	3
Peer review/evaluation	5	5	5	3	4	3	5	4	4	3	2	4	1	4	4	1
problem solving, argumentation	2	5	2	3	5	5	4	5	3	5	3	1	2	4	2	4
Role fulfillment	4	4	3	2	4	1	5	2	2	3	5	5	5	3	5	4

Figure 3. Sample expert card

The total number of 7 anonymous independent experts have been featured in Research Collaboration tools assessment. Each tool has been rated by all seven experts according to each activity efficiency estimation (see Figure 4):

No	Experts opinion							Sum 1-..	coefficient	Toal sum x coeff	
	Classify 1-5										
	Social networks	1	2	3	4	5	6	7			
1	Discussion, Workshop, Brain storm, Lecture, Control	5	5	5	2	5	5	5	32	0,91	29,26
2	Access to educator, Tutoring	2	3	5	2	4	5	5	26	0,74	19,31
3	Conference	4	4	5	1	5	3	3	25	0,71	17,86
4	File sharing, resources	3	4	5	4	4	4	4	28	0,80	22,40

5	Project/task management	2	2	4	2	4	5	5	24	0,69	16,46
6	Rosters of multiple types	5	4	5	1	4	5	5	29	0,83	24,03
7	Assessment, Control	4	4	5	4	4	5	5	31	0,89	27,46
8	Tutoring	1	1	4	1	3	4	4	18	0,51	9,26
9	Message exchange	5	5	5	5	5	5	5	35	1,00	35,00
10	Research task	4	4	5	5	5	5	5	33	0,94	31,11
Total n° of points		23,21									

Figure 4. Sample tool expert rating

The rating coefficient has been calculated as a \sum of points per activity divided by $35 = (7 \times 5) \Rightarrow 7$ experts, 5 points total per each activity.

The final expert ranking of Research Collaboration tools under consideration is as follows (Table 1):

Table 1.

Final expert ranking of Research Collaboration ICT tools

No	Tools	Points
1	Social networks	23,21
2	Google search (search engines)	21,05
3	Blogs	17,61
4	wiki	17,41
5	Mindmeister (mind maps)	16,81
6	Scribblar	16,74
7	Google Doc	15,75
8	Google presentation	14,55
9	Writing.com	13,8
10	Red Pen	11,86
11	Evernote	11,04
12	Cloud	11,01
13	PaperRater	9,48

CONCLUSION

According to expert model assessment – the top ranking research collaborative tool falls into the *social media* category (23,21 points) and search engine category (21,05). The *social network* engines are designed to store, share, promote, reference and review academic output. The network type interface is designed to facilitate students' and researchers' personal collaboration, navigation through the thematic span of academic output, uploaded into public domain.

The major purposes of this research collaboration tool include:

- store
- share
- interact / network
- review
- disseminate
- upgrade
- rate
- learn
- charter a comprehensive, customized reference stock of one's research and/or education interests

A social network interface comprises of the following elements:

- a personal profile (photo, basic personal data, interests, CV)
- an upload service to store one's work by type (books, papers, drafts, pictures)
- a newsfeed featuring recent uploads filtered by stated interests complete with bookmark service

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