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DIGITAL LITERACY GAPS: ARE THEY CRITICAL FOR 21st CENTURY RESEARCHERS?

Oksana P. Chigisheva (a)*
*Corresponding author

(a) PhD (Education), Associate Professor, Department of Education and Pedagogical Sciences, Academy of Psychology and Educational Sciences, Southern Federal University, 105/42 Bolshaya Sadovaya Str., Rostov-on-Don, 344006, Russia, opchigisheva@sfedu.ru*

Abstract

The paper aims to examine the phenomenon of digital literacy from the perspective of its role in the career of the XXI century researcher and provides vivid examples of its influence on the career effectiveness. The author critically analyses contemporary challenges facing the sphere of science and education, i.e. globalization, internationalization, educational quality enhancement, digitalization of pedagogical theory and practice, lifelong learning and continuing professional development. Particular attention is paid to the study of Open Science phenomenon and the risks it brings into the life of modern researcher. Methodologically the research is based on the results of literature and documentary analysis, terminological analysis and comparison. The study revealed that digital literacy being a new type of the XXI century literacy has become a complex phenomenon characterizing various “life” or “gate” skills, qualifications and competences necessary to operate in the growing digital environments. The factors that significantly influence and affect modern researcher`s lifecycle were stated and relevant qualification criteria critical for the forming Open Science sector were provided. It was also stated that digital literacy gaps considerably minimize researchers` personal effectiveness, visibility and career progress. The article concludes with suggestions for digital literacy support of researchers that could decrease digital literacy gaps critical for their functional sustainability.

Keywords: Digital literacy, literacy gap, XXI century researcher, Open Science, internationalization, globalization.

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1. Introduction

The 21st century is promising to offer a strongly digitalized environment for educators and researchers that seems very promising on the one hand and very complex and challenging on the other. External factors such as urgent need for quality enhancement in education (Ivanova & Elkina, 2017), internationalization and globalization of science and education (Boguslavskiy & Neborskiy, 2017; Chigisheva, 2015a, Chigisheva, 2015b), fast development of Open Science (OS) area and emergence of citizen science (Providing researchers with the skills and competencies they need to practise Open Science. (Open Science Skills Working Group Report, 2017), mainstreaming of digital pedagogy and Open Educational Resources (UNESCO Institute for Information Technologies in Education. Medium-term strategy 2018-2021, 2018) significantly reshape general requirements for the qualification of the modern researcher and research procedures, his/her career development opportunities and the level of functional and digital literacy.

The following observation may be rightly attributed to the 21st century researcher "The illiterate of the 21st Century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn" (Toffler, 1971, p. 414). This idea of the 20th century philosopher is echoed in the European Charter for Researchers – The Code of Conduct for the Recruitment of Researchers (2005) where it is indicated that "Researchers at all career stages should seek to continually improve themselves by regularly updating their skills and competencies. This may be achieved by a variety of means including, but not restricted to, formal training, workshops, conferences and e-learning".

Thus, today continuing professional development of researchers comes to the forefront especially when it is related to the digital literacy agenda and it seems quite important for them to understand what is going on in the "research digital world" not be left behind the times.

2. Problem Statement

Digital literacy is undoubtedly an important development indicator for the modern researcher forced to practice Open Science. This movement has led to fundamental changes both in the performance and dissemination of research outcomes and researcher`s interaction schemes within research project fulfillment. It demands greater visibility, efficiency, collaboration, transparency, validity and accessibility. Obviously, all these points are easily achieved when using digital resources and tools efficiently. Figure 01 represents Open Science "Wheel" that was created by Open Science Monitor (2015) and vividly shows key Open Science characteristics and indicators.

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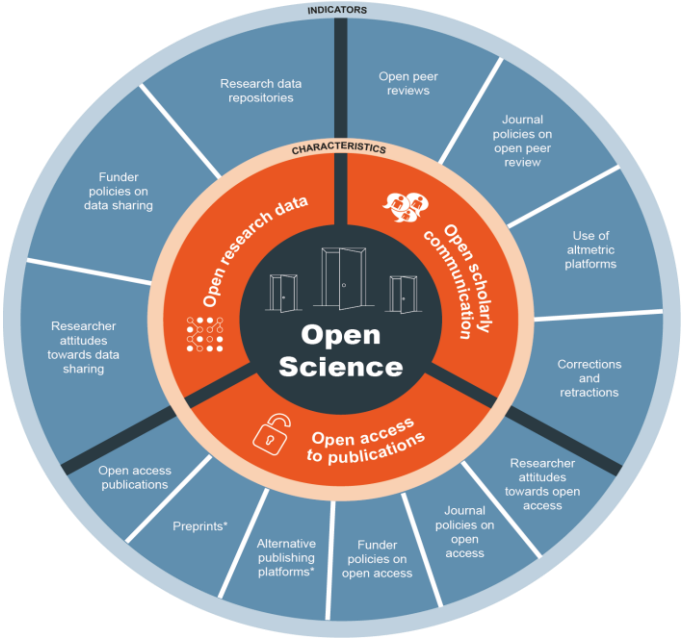

Figure 01. Open Science "Wheel".
Source: Open Science Monitor (2015).

From Figure 01 it is clear that Open Science is an umbrella term incorporating a wide range of activities starting from Open Access publishing, Open Data and Open Notebook to Open Peer-Review, Open Education and citizen science. It should be specifically noted here that Open Science phenomenon is not a new one originating from the beginning of the XXI century; nevertheless, as some European Union surveys demonstrate, researchers today "know *something* about Open Science, but their *knowledge* of different aspects of Open Science *varies*" (Providing researchers with the skills and competencies they need to practise Open Science. Open Science Skills Working Group Report, 2017, p. 3). Non-European researchers very often lack not only the latest information on Open Science, but also know *almost nothing* about interrelation of digital literacy and functional skills needed for Open Science data management. It forms a significant lacuna that should be addressed by researchers and educators to handle it in the shortest possible time.

3. Research Questions

While it was stated that contemporary research into digital literacy of the 21st century researchers at different stages of their career paths is rather acute and timely, the following conceptually relevant research questions were developed:

What constitutes digital literacy and how is it perceived in the new conditions of the 21st century? Is it really necessary to possess this "life skill" and even "gate skill" in the research sphere?

What are the factors influencing and dramatically affecting researcher`s lifecycle in the modern world? What sort of skills, qualifications and competencies are critical for researchers in the Open Science era?

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Is it possible to function successfully and efficiently for a modern researcher when having digital literacy gaps? And, if digital literacy is a critical condition for researcher`s progress, how existing digital literacy gaps may be minimized or even eradicated?

4. Purpose of the Study

The main objective of the present research study is to establish and critically assess the interrelation of digital literacy gaps and researcher`s career progress taking into account the 21st century challenges and growing mainstreaming of Open Science and ICT technologies.

5. Research Methods

Documentary analysis was used for systematic and thorough review and evaluation of the chosen educational policy documents that serve as a foundation for deeper understanding of the existing requirements to the minimum digital literacy level considered enough for quality research activities (Bowen, 2009, Research methods in education, 2007).

The article draws upon the data represented in the policy documents that include:

European Charter for Researchers – The Code of Conduct for the Recruitment of Researchers (2005);

Key Competences for Lifelong Learning. European Reference Framework (2007);

Transferable Skills Training for Researchers: Supporting Career Development and Research (OECD, 2012);

Providing researchers with the skills and competencies they need to practise Open Science. Open Science Skills Working Group Report (2017).

Special attention was paid to the study of publications reflecting the studied phenomenon at full. The research was also supported by the terminological analysis and comparative method (Phillips & Schweisfurth, 2014) that allowed highlighting the key transformations associated with Open Science agenda taking into account existing globalization and internationalization trends in the sphere of science and education.

6. Findings

6.1. Digital literacy as a new 21st century literacy

Modern research and economic competitiveness agenda provide a background for the accelerated development of existing information and communication technologies (ICTs), thus, naturally complicating the understanding of long established and new terms connected with their use.

Many scholars explore the phenomenon of literacy and digital literacy (Hallam et al., 2018, Kim, 2017, Tsatsou, 2018), however the simplest interpretation of literacy is always associated with the ability of the person to read and write while computer-related literacy is more about acquired technical capabilities. At the same time digital literacy is considered as an umbrella concept composed of significant skill clusters, such as:

“ICT literacy – a set of user skills that enable active participation in a society where services and cultural offerings are computer-supported and distributed on the Internet;

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Technological literacy (previously called computer literacy) – a deeper understanding of digital technology and comprising both user and technical computing skills;

Information literacy – a key aspect of Knowledge Society, the ability to locate, identify, retrieve, process and use digital information optimally" (Digital literacy in education. Policy brief, 2011, p. 2).

The theoretical umbrella of digital literacy may be associated with 21st century literacy, computer literacy, Internet literacy, online reading comprehension, information and communication technologies and much more. Digital literacy is rightly referred to the 21st century new literacy as:

"it includes the new skills, strategies, dispositions, and social practices that are required by new technologies for information and communication;

it is central to full participation in a global community;

it regularly changes as its defining technologies change;

it is multifaceted and the understanding of it benefits from multiple points of view" (Osterman, 2012, p. 135).

It seems that the definition offered by Y. Eshet-Alkalai (2004) may be considered as a working one within this paper – "digital literacy is a large variety of complex cognitive, motor, sociological, and emotional skills, which users need in order to function effectively in digital environments" (Eshet-Alkalai, 2004, p. 93).

It is obvious that continual development of digital technology in the 21st century significantly affects research process and researchers as well and digital literacy may be already considered as a "gate skill". It is proved by the fact that today professional computing skills are demanded when applying for any research position. Besides that digital literacy, being acknowledged by UNESCO as a "life skill" (Digital literacy in education. Policy brief, 2011, p. 2), targets all areas of researcher`s activities, i.e. "accessing, managing, integrating, evaluating, creating and communicating information individually or collaboratively in a networked, computer-supported or web-based environment for learning and working" (Digital literacy in education. Policy brief, 2011, p. 4). Thus, digital literacy has become one of the most required skills by the researchers in the developing information society.

6.2. 21st century researcher vs. new qualification criteria and research digitalization

Research digitalization and Open Science agenda have affected the research lifecycle and the meaning embedded into each stage. The most demanded classifications of researcher`s career development are represented in the publication of M. Bent, J. Webb and P. Gannon-Leary "Information literacy in a researcher`s learning: the seven ages of research" (Webb, Gannon-Leary, & Bent, 2007) and the grounding document in this sphere published by the EU Directorate general for research and innovation "Towards a European Framework for Research Careers" (2011). These publications will be considered separately in connection to digital literacy influence on researcher's skills; the first one - from the position of personalized (boutique) approach and the second – from the position of the functional one.

In the view of M. Bent and colleagues (2007) the research lifecycle is correlated with the following research roles (from minimum to maximum research load) in the academe:

masters students;

doctoral students;

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contract researchers;

early career researchers;

established academic staff;

senior researchers;

experts.

Each of the represented groups has different research skills and research needs that allow offering personalized kinds of digital research support services to the researchers within their institution (Secker, 2012). Research Information Network (RIN) goes even further when perceiving research as a 4 step iterative and cyclical process:

identification of knowledge (literature review etc.);

creation of knowledge (the actual research process);

quality assurance of knowledge (peer review etc.);

dissemination of knowledge (publication, presentation at conferences etc.) (RIN, 2011, p. 15).

This cycle is of use when preparing special programs for researchers` support when working with social media. Although analyzed classifications bear solid focus on the demands to the research process in the 21st century they do not provide quite clear connection to the growing Open Science area. In this respect European Framework for Research Careers (2011) offers a more cosmopolitan view on the matter, besides that global research career development levels (R1 – First Stage Researcher, R 2 – Recognised Researcher, R3 – Established Researcher, R4 – Leading Researcher) are easier matched to such Open Science skills as:

skills and expertise necessary for open access publishing (library and research information skills, open publication literacy skills);

skills related to data management and open data (data production, analysis, use, reuse etc.);

skills enabling professional research conduct (research management skills, legal skills, research integrity and ethics skills);

citizen science skills (interaction with general public) (Providing researchers with the skills and competencies they need to practise Open Science. Open Science Skills Working Group Report, 2017, p. 17-18).

Thus, researchers being at R1-R2 levels should perceive these skills as part of their learning process and clearly realize how acquiring and using OS skills could lead faster to the recognition and rewards. R3-R4 level researchers “need to take leadership and ensure that their mentees acquire the skills as well as the need to demonstrate to them the positive effects of sharing data and information” (Providing researchers with the skills and competencies they need to practise Open Science. Open Science Skills Working Group Report, 2017, p. 6).

6.3. Digital literacy gaps and their influence on research career progress

Today digital literacy gaps among researchers are considered as a divide between technological skills research activities require and the skills a researcher possesses. Very often it happens so that the lack of some digital literacy skill is felt by the researcher only when he/she needs to be engaged in a serious grant application proposal, international collaborative project or fulfill professional

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communication task of a new format. Inability to function properly for the individual in the required circumstances makes perceiving digital literacy as a prerequisite for professional sustainability leading to steady career development and growth.

Digital literacy skills are not limited by the ones mentioned earlier, on the contrary, they can be supplemented by a wider range of skills, qualifications and competencies that may be characterized as Open Science related (see Table 01).

Table 01. The European skills, qualifications and competencies landscape. Source: Providing researchers with the skills and competencies they need to practise Open Science. Open Science Skills Working Group Report, 2017, p. 22.

OECD: 7 innovative principles of Doctoral Training: Transferable Skills – Open Science elements	**Open Science & EC 8 - Key Competences for Lifelong Learning – Open Science elements**	**European Charter for Researchers: Open Science-related elements for Researchers**	**European Charter for Researchers: Open Science-related elements for Employers and Funders**
Research competencies: grant application writing skills; research management and leadership; knowledge of research methodologies and technologies; research ethics and integrity **Communication skills:** communication and presentation skills, written and oral; communication and dialogue with nontechnical audiences, public engagement, teaching skills; use of science and policymaking	**Digital competencies:** confident and critical usage of information and communication technology for work, leisure and communi-cation; **Learning to learn:** ability to effectively manage one`s own learning, either individually or in groups  **Social and civic competitive-ness:**  ability to participate effectively and constructively in one`s social and working life and engage in active and democratic participation, especially in increasingly diverse societies	**intellectual freedom;** adherence to recognized ethical practices; professional responsibility; professional attitude; contractual and legal obligations; accountability; good practice in research (e.g. reliable backing up of data); dissemination and exploitation of results is promoted; researchers should take advantage of available supervision in a structured way; senior researchers have a responsibility to manage and nurture younger researchers well; continual professional development is promoted	recognition of researchers as professionals on a career path (from postgraduate level upwards); research environment should be stimulating and safe; career development should be promoted; access to research training and continuous development; intellectual property rights should be protected; co-authorship should be viewed positively; evaluation/apprai-sal systems should be provided

To bridge digital literacy gaps by researchers these skills, qualifications and competencies should be also taken into account within training/retraining alongside with those merely related, for example, to data management, intellectual property or research ethics. At present, only 18 European stakeholders provide training in OS skills (see Fig. 02).

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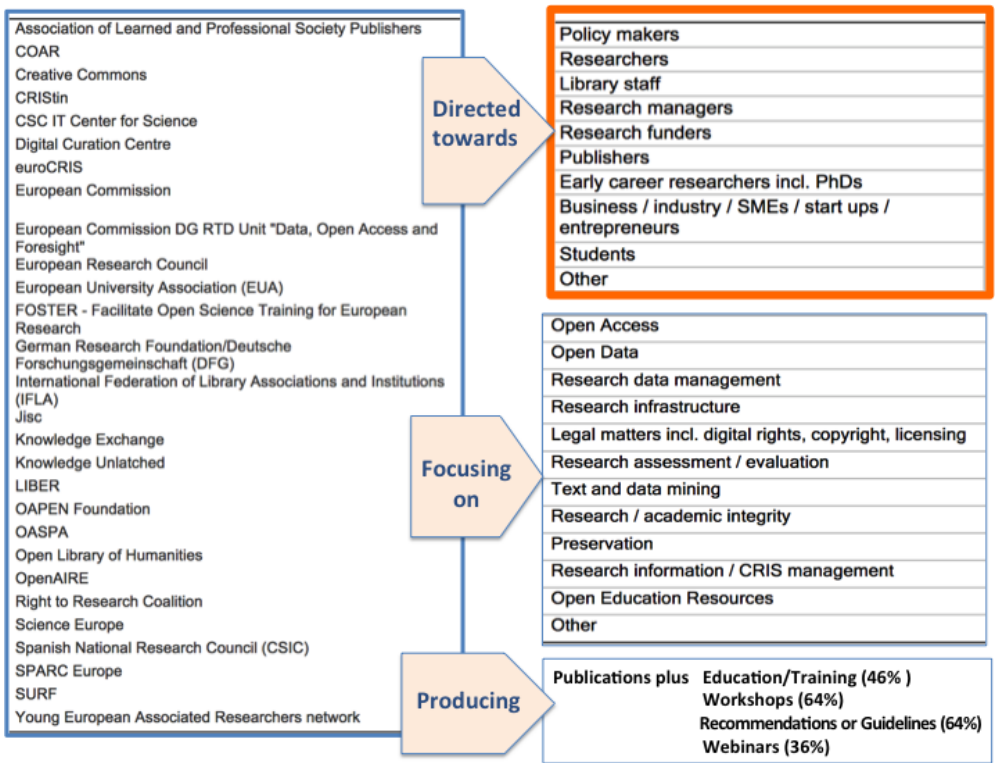

Figure 02. Research and innovation stakeholders providing training in Open science skills. Source: Providing researchers with the skills and competencies they need to practise Open Science. Open Science Skills Working Group Report, 2017, p. 22.

Thus, this fact is demonstrating that there is a huge stratum of digital literacy gaps unreached by professional development programs including those targeting researchers. Although, Vitae and Research Information Network are now progressing a lot in this direction.

7. Conclusion

The documentary analysis undertaken in this paper resulted in a substantial generalization on the digital literacy phenomenon and the specificity of its development in the 21st century science sector. A strong necessity for the creation of various supporting mechanisms for researchers urged to practice Open Science and function in a digitalized research environment is vividly demonstrated. It is reasonable to suggest that all stakeholders (government, funders, employers, support professionals, research community, and industry and business partners) should be involved into the process of discussion and policy making for this sphere. It seems really important to make researchers themselves understand that digital literacy gaps seriously prevent them from personal and professional growth and leadership in their research field and create significant obstacles for career development especially at the international level. The motivation of researchers to improve their digital literacy skills may be stimulated through forthcoming career benefits, recognition and reward, support and technical infrastructure offered by their home institutions. All researchers are supposed to have adequate access to Open Science skills training and professional development that will enable them to become open-researchers and lead from pre-digital

to digital academic practice. From this point, the experience of such UK organisations as Vitae and Research Information Network may be of much interest to policy makers and educationalists worldwide.

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