

# Open knowledge and e-research in the digital era

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*Abstract:* The present paper is built upon the new circulation of information in the scientific research and in the learning environments. Open Access revolution represents a new scenery that opens new possibilities to researchers, scholars, and all users. Starting from this point, the paper debates about the new practices in the construction and dissemination knowledge in the digital era. Internet and new technologies can be used to retrieve research materials, to organize, keep and treat information. These activities create a different way to scientific knowledge and also introduce important changes in the higher education system. In the recent scenario of transition, openness is a fundamental value to preserve the university's role in the access to educational content.

*Keywords:* e-research, open access, e-learning, scientific knowledge, electronic publishing

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## Introduction

Internet has completely changed scientific research and the process of knowledge construction. Like any important innovation, transformation is notable in our day by day activities such as the use of e-mails, the exchange of downloadable materials, public and private web sites, etc. These are simple examples of the current use of internet, it is a new way to let information flow and of course it changes our relations.

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The way to communicate and send information is changing fast. From 90's it is very easy to search and find a wide range of things that can become a part of our own files/archives. In this case the unsettled memory of the web can be stored.

An easier circulation of information also means an easier contact between researchers within a scientific international community. At the same time, web writing changes text composition. Nowadays, people are immersed in the information flow and become active parts in the process of knowledge, beyond mere passive fruition and reception.

The present paper is built upon the new circulation of information in the scientific research and in the learning environments. The aim of this work is to consider a theoretical and practical scenery in which knowledge is involved in the use of the web. Open Access revolution represents a new scenery that opens new possibilities to researchers, scholars, and all users. Starting from this point, the present paper debates about the new practices in the construction and dissemination knowledge in the digital era.

Internet creates a virtually unlimited access to a great amount of materials, of courses, all of them must be selected and chosen by the users in the research process. Therefore web is a powerful source of knowledge. It opens up also new ways for the communication field. In particular a fast contact between researchers, via internet, represents one of the main aspects of the revolution connected with new web technologies. Internet is the environment for a new scientific knowledge and a new scientific community. Web is a source and an environment for knowledge.

Internet and scientific research work together using gateway and libraries, catalogues and full text documents. They are useful instruments during the delicate selection of the sources and the organization of the materials. They help the researcher to select the huge information for his work.

The Open Access initiatives make clear the principle of source sharing and the action of a worldwide web researchers. They are based upon the free exchange of information, the "open access paradigm" (Budapest Open Access Initiative). The latter promotes a totally free availability of information which can be downloaded on any local pc in any part of the world.

Information sharing and new technology systems lead scientific knowledge to new frontiers. According to Tim Berners-Lee, internet means

cooperation, “mind to mind”. It is an open source of information and knowledge environment.

Before examining open knowledge practices, it is necessary to analyse some features of electronic and web systems during the process of handling knowledge. Pc in advance lead to new methods of text composition. It became an instrument to store and organize data and gave man an inconceivable memory.

Revolution took place only when computers became means of communication. The early computer has developed its functions. Besides archive features there has been new way to present multimedia contents. Then our pc started “communication” with other machines. Nowadays we can connect worldwide and be part of the the web simply by staying behind our office desk.

This operation (i.d. a quick click on our pc mouse) is the first step to interaction and hypertext. A researcher is introduced in a digital space in which different objects (texts, data, thoughts) can be decomposed and reset. These objects can also get new meanings. Nevertheless web is a virtual place where our interaction is influenced by a new representation of reality and determines new knowledge.

A researcher can connect his personal education and training to other paths that lead to a wide scientific community.

Besides storing scientific research materials in computers (formerly innovation), web allows “discussions” and sharing of researcher procedures according to a principle that recalls the ambitions of the internet founders (i.e. flowing and sharing of ideas/information in scientific field).

Spreading of communication and information makes available lots of materials (even non structured or proof) that are the result of a research method. It is about storing and sharing materials, fragments, scientific conference; all of them are susceptible of improvement, extension and correction.

In theory thoughts are stored and can be used by huge scientific community. Web is intended as a mega archive to keep and spread results of research/knowledge procedures.

Open Access is the best example of the ideology related to free circulation of ideas and materials; researchers gain access worldwide to scientific production. This helps multidisciplines and let research grow.

Internet therefore is a browsing and sharing instrument. It satisfies the need to archive and spread materials. It is also an environment where

communication lives and where interaction among people is part of information flow.

### **Web as a source of knowledge**

Internet and new technologies can be used to get research materials, to organize, keep and treat information. This creates a different way to scientific knowledge and also introduces important changes in the science system.

During the last ten years the development of technologies has changed – or even upset – the way we relate to information and system of knowledge in general.

Information is continuously composed and reviewed. Web system allows storing and gives aid to memory anytime we need to obtain thousands of news via browsing tools.

Documents can be archived considering its virtual weight (called bite or gigabyte) more than quantity. Our bookshelves are getting almost empty because resources are all kept in our computers.

Generally from the present technologies emerge two distinguishing characteristics. First of all the researcher has electronic access to information, he can connect to the main archives, databases and on-line libraries from his computer. This helps him to save time and money. In the second place information can be stored for his own use.

One of the question discussed currently is how to face *information overload* and how to organize data and archives.

One of the internet limits is its unlimited source of information. In fact, free circulation of materials represents an innovation of the web but it is very important to select and take into consideration all the data connected with our research purpose.

The main risk for a researcher, but also for all the users, is not to get materials but to select those that are useful for his job. Data must be organized to have easy access to resources.

All information cannot be downloaded on our computer desktop without a careful examination of the sources. Researchers and users need to catalogue the main sources of the web rather than create impossible index of all materials.

The question of external sources access is concerned with the access to digital data. Where, when and how to get them. (Zajczyk, 1997, pp. 59-60).

Users can handle brand new information connecting to database on-line. In Italy this method began at the end of 90's and led researchers to directly work on materials. (*ibidem*, pp. 61-66)

The new way to access via web is the most important innovation of research.

In any case on-line catalogues, articles, data banks, e-books and so on, are only few examples of the rich and wide universe available via web. Internet represents a free search engine and researchers can use it as they prefer. There are thousands and thousands of web pages. All of them are very important for research. The best catalogue is of course the one everyone has individually created and keeps it on his own virtual desk.

Internet cannot be considered only as a library but also like a workshop for thoughts. Together with mass or connective thought everybody can have own rooms where gather experiences, projects, texts, etc.

The more internet spreads materials the more it determines selection of documents and reliable sources. An alternative culture is taking place via web but it is not easy to qualify it. The main question is order the enormous information generated by internet (Fryes, 1997).

### **Web as an environment of knowledge**

Web makes easy connection between researchers and circulation of information in a new circuit of scientific communication.

The informal scientific sources not necessarily validated by editorial work are becoming more accessible through web sites.

To best understand this new web community it is important to examine some of the relations between science and web system. In particular we need to focus upon the story of Internet.

Manuel Castells (2001) analyses the relation between the new internet culture and science system. The story of Internet well defines its peculiar features.

One of this is information sharing: a constant part of the web.

The origins of internet is connected with Big Science technology, military research and sharing culture within academic and scientific laboratories. Castells points out universities as the ground where innovation

flow from exclusive Big Science network to improvised countercultural web sites. Internet culture is deeply marked from the beginning by academic and scientific community where took place “excellence” criteria opened to communication and research. (*ivi*, pp. 46-49).

Castells considers academic standard values as the base of praiseworthy internet culture. The principle of the open software communication declares that all discoveries must be communicate to let them be valued and criticized. Sharing criteria are the aims of the new internet culture. In his publication “Science de la science et reflexivité”, Pierre Bourdieu (2001) demonstrates how knowledge comes from relations among representants of scientific community. The so-called “scientific truth” is the result of the work in strong communities that gain authority through a series of relations and productions in a dominant field.

Publication of scientific studies is a moment of certification and increasing of scientific truth. All relations involving authority and strenght of institutions are according to Bourdieu the elements that regulate scientific knowledge (*ivi*, pp. 73-75).

Scientific capital is gained through public acknowledgement within the most important scientists.

What is the role of Internet in acquiring the hegemony of scientific opinion?

Web creates a new system of publications and maybe certification. New scientific communities emerge from new relations, contacts and comparison. They are international and multicultural and give way to a new ruling thought within the web. This situation strenghtens authority and prestige of the members in a scientific community.

New interests and new web relations create a new way to see the world. The question is to establish if new experiences of research can be part of the old ones and if new communities can substitute or defy authority of already well settled researchers. In the world.

Internet offers distinctions between different networks. Social Science Data Archives are a relevant experience of institutions for Research Networks, mainly academical. Their mission is explicitly dedicated to the development of social sciences through data sharing and therefore through the promotion of collection, archive activities and spreading on international scale.

In general archives collect research data, usually in a proof status and activity report. In some cases many sources are collected using texts. One

of the principle feature of these projects is represented by stimulating attention related to the use of new technologies to pursue the aims that are part of the general mission.

Once introduced into the web, network acquires a practical and easy task to pursue sharing sciences mission.

Inter-University Consortium for Political and Social Research (ICPSR), founded in 1962 by the University of Michigan, is one of the most important research network. Initially ICPSR was intended as a cooperation among 21 American universities, at present counts 300 colleges and universities of the United States and Canada and hundreds of different Institutions in Europe, Oceania, Asia and Latin America (more than 500 members totally).

Icpsr, “partner in social science research”, keeps and gives free access to a huge data archive for social science mainly in research and education fields. Furthermore it offers training on quantity methods to make easier a real and correct use of data. Mission is so built upon three main activities: acquire and keep social science data, give an “open and equitable” access to data collection and promote the real use of data.

To well understand revolution started by new means is fundamental to make a thorough study of the characteristics, premises and aims in the circuit of communication via Internet.

In this case we will consider some of the experiences that set the use of new net technologies within a clear principle of “common knowledge” (Ziman, 2000). This leads to a global knowledge network. (Ginsparg, 2001).

Essential reference is the “open access paradigm” to “release” scientific production (Budapest Open Access Initiative, BOAI, 2002).

To promote free access to scientific literature, Berlin Declaration (2003) suggests two complementary strategies i.e. self archiving and open access journal.

Self archiving is recommended by researchers when we need to archive our own research documents (articles, working papers, etc) to make them available through e-print archives on university server or similar Institutes according to OAI (Open Access Initiative) standards.

A second development of open access expects to support open access journal initiatives (<http://www.doaj.org/>) based upon free access. The user has the right to read, download, link all documents edited in full text.

BOAI promotes a “common scientific discussion” to evolve research. In the Budapest Manifesto is evident that literature available on-line is the one freely given by researchers.

Generally are peer-reviewed articles and preprints publications that researchers can make available on-line to inform colleagues about new outcomes or receive comments (BOAI, 2002).

Open Access purposes are efficaciously expressed by Steven Harnad (2001), Cognitive Science, University of Southampton. He is signatory of the Budapest Manifesto, promoter of self archiving initiative. According to Harnad “Post-Gutenberg galaxy” is characterized by a deep demarcation between “charged accessible works” those “open access”. An example is given by research articles edited in scientific reviews. Harnad therefore describes the “post Gutenberg anomaly”. While researcher obtains earnings with a publication, editors safeguard the author preventing free access to his work. Harnad states that firms impose price for their advertising.

According to Harnad, Post Gutenberg Era is mature to get over this anomaly. It gives all the instruments for open access via web. It is necessary that researchers self archive their articles. The creation of university open archives compatible with OAI standards grants constant exchange among different archives through free software.

### **Web Knowledge and Open Educational Resources**

We are moving from a culture that was dominated by writing on paper and by print to one that is more and more being dominated by electricity and various phases of electricity (Buffardi & de Kerckhove, 2011). Printing created a big leap forward in the evolution of language generating a situation of rapid change that, in no more than 35 generations arrived to the discovery and the use of electricity, yet another adventure of language.

Since the invention of the telegraph more and more internal linguistic environments, that is internal to the human body such as memory, imagination and thought have been repositioned externally by electricity. According to Richard Lanham (2006), “the center of the computer revolution, as a new system of human expression, lies in its central polyvalent code. The same code that expresses words can generate images or sounds. Information can be moved from one sensory modality to another while still being driven by the same data”. We are now into a situation

where people are developing (internalizing) a hypertextual kind of intelligence that links us to previous oral cultures. The way we deal with what we have inside our minds is hypertextual. Whatever you are thinking about, you're building it up from little bits and pieces stored in your mind that come together at the time you start thinking. You can manipulate what you are thinking, very easily, changing it, morphing shapes and situations at will. The information seems to come as a continuous linear line or as a film and it seems as if it is always holding together in a tight and undifferentiated way (Buffardi & de Kerckhove, 2011). The format of information capture and dissemination has changed from analog to digital, from tethered to mobile, from isolated to connected, from generic to personal, from consumers to creators, and from closed to open (Wiley & Hilton, 2009). In the recent scenario of transition, people are experiencing being "in front" and immersed in the information flow, users become active parts in the process of knowledge construction, hierarchical schemes and univocal classifications cannot describe scenarios that are in constant change (Buffardi & de Kerckhove, 2011). We are moving towards new literacies. In the words of David Booth (2006), "they are concerned with multi-modal texts, such as comics, magazines, newspapers, the internet, email, graphics, video, and sound". About the relationship between literacy and new media, Eric McLuhan (2009) says that "once transmuted into software, anything and everything becomes malleable, fluid, interchangeable. Each new medium is a new culture and each demands a new spin on identity; it is urgent that we begin to study all of the forms of knowing, now called literacies. Multimedia means simply compound literacies. As discourse shifts from page to screen and, more significantly, to a networked environment; that is, as discourse decentralizes, the established definitions and relations automatically undergo substantial change. The shift in our world view from individual to network brings with it a radical reconfiguration in culture".

Higher education is a dynamic, complex system embedded in an even more dynamic and complex supersystem – human society. Technological innovations have radically changed this supersystem in at least six ways that are critical for higher education to recognize and understand (Wiley, 2009).

Since the advent of the Internet - and especially the popularization of user contributed websites and social media - the university's monopoly position in providing tutoring and other learning supports has vanished

(Wiley & Hilton, 2009): “A student with a question can now turn to a number of free services”, including Yahoo! Answers, Facebook and Twitter, Wikipedia and so on, through web search engines, on-line discussion forums, blogs, education-specific sites. The university’s monopoly on access to educational content is gone and in many cases (like MIT) the universities have proactively undercut this monopoly themselves (Wiley & Hilton, 2009).

Nowadays, a confluence of technological advances, economic factors, and policy changes is resulting in a fairly radical restructuring of scholarly publishing (Borgman, 2007). Scholarly papers are being made available at no cost to the reader via personal websites, disciplinary repositories, and institutional repositories at universities. Open access journals are making papers free to readers under a variety of models that include author-pays, embargoes, institutional subscriptions, and assorted combinations thereof (Willinsky, 2006). Major research libraries are partnering with search engines, software companies, and non-profit entities to digitize millions of books and make them available on-line. Some of the experiments in new publishing models, and some of the technical development of repositories, are funded as part of e-Research initiatives. These new models are not going unchallenged by publishers and other stakeholders, of course. Some are concerned that short-term gains in access to scholarly content could come at the cost of long-term loss of control by the academic community (Waters, 2005). A number of organizations are already combining their particular business knowledge with openly available world-class educational material in order to compete with traditional universities. Organizations such as Peer-to-Peer University (see <http://p2pu.org/>), the University of the People (see <http://www.uopeople.org/>), and Tech University of America (see <http://www.techuofa.com/>) each bring a different set of internal capabilities to their relationships with “open service providers”. Open service providers are those individuals or organizations that provide access to world-class capabilities under open licenses and at lower transaction costs (Wiley & Hilton, 2009).

According to Wiley and Hilton, “there are a number of ways institutions can be more open, including programs of open sharing of educational materials”. Openness is a fundamental value underlying significant changes in society and is a prerequisite to changes institutions of higher education need to make in order to remain relevant to the society in which they exist. However, every institution must begin addressing openness as an

organizational value if it desires to both remain relevant to its learners and to contribute to the positive advancement of the field of higher education.

There are a number of ways institutions can be more open, including programs of open sharing of educational materials. The best known is MIT OpenCourseWare, an inspiration to institutions and universities around the world, but its exorbitant costs - \$4,000,000 per year – make it a model that no other school can afford to emulate. Hundreds of other schools have begun down the OCW path, publishing a few dozen courses. For example, the Open Yale Courses (see <http://oyc.yale.edu/>) publishes video of Yale courses, accompanied by only minimal textual materials. Webcast.Berkeley (see <http://webcast.berkeley.edu/>), a University of California, Berkeley open education program, provides podcasts and webcasts exclusively, with no textual material at all.

In Italy, Federica is the e-learning portal created by the University of Naples Federico II as an effort to provide free access to academic knowledge. It offers a single, free access to open educational resources, podcasting and living library, including syllabuses, lesson summaries, research materials and selected scientific sources.

The interface is structured through a single logical and graphic format that guarantees the modularity and uniformity of the material, as well as the simplicity of the navigation. The project is grand in scale: materials have been published to date including more than 5000 lessons, 40.000 images, 700 videos, 3000 study materials, 6000 web sources and 600 podcasts, available also through iTunes U. Materials produced by Federica are all open-access and free of charge, shared through a Creative Commons license.

Among the most innovative features of Federica is its Living Library, a unique gateway to an extraordinary selection of electronic sources. Drawing from a professional team of e-researchers, Federica offers authoritative guidance to the best on-line libraries and archives worldwide, a tremendous plus for all students searching for more content, more data, and more knowledge. All of its resources are classified according to the faculty and are accompanied by a description of its contents, degree of access and usability of each web site. Just like a real library, user can wander the bookshelves, choose the resource and browse through it in order to find out more.

Through its courses and its selected sources to the most authoritative scientific resources, Federica seems an interesting area, totally free, to

reliable and accredited knowledge. A web learning environment that aims to meet the web-knowledge's challenge.

Nowadays, authors, libraries, universities, and publishers are wrestling with the trade-off between traditional forms of publisher-controlled dissemination and author – or institutional controlled forms (Borgman, 2007). According to Calise and De Rosa (2010), the notion itself of publication is undergoing a deep transformation, as it is no longer the monopoly of a limited number of specialized companies and institutions, but, through the web, it has become an option available to an infinite number of collective and individual actors. We are only at the onset of a cultural revolution that is deeply altering established scholarly habitus. Regardless of the data and insights one may collect at the moment, we must be prepared for more, and deep, changes in the near future.

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