Policy Brief
May 2011

United Nations Educational, Scientific and Cultural Organization
UNESCO Institute for Information Technologies in Education

UNESCO Institute for Information Technologies in Education

DIGITAL LITERACY IN EDUCATION

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DIGITAL LITERACY: CONTENT, STRUCTURE AND DEVELOPMENT OF A LIFE SKILL

Information and communication technologies (ICTs) have penetrated all areas of contemporary life. In this context, *digital literacy* has become much more than the ability to handle computers – just like traditional literacy and numeracy, it comprises a set of basic skills which include the use and production of digital media, information processing and retrieval, participation in social networks for creation and sharing of knowledge, and a wide range of professional computing skills. Digital literacy improves employability because it is a *gate skill*, demanded by many employers when they first evaluate a job application. It also works as a catalyst because it enables the acquisition of other important life skills.

The origin of the word *literacy* refers to the ability to read and write. Early descriptions of computer-related literacies also focus on the acquisition of sets of rules and technical capabilities. However, by the end of the 20th century, this definition had expanded considerably. According to the working definition, agreed at the UNESCO June 2003 Expert Meeting in Paris, "literacy is the ability to identify, understand, interpret, create, communicate, compute and use printed and written materials associated with varying contexts. Literacy involves a continuum of learning in enabling individuals to achieve their goals, to develop their knowledge and potential, and to participate fully in their community and wider society." (UNESCO, 2004)

Components of Digital Literacy

Digital literacy is an umbrella concept for important skill clusters whose names are often used as synonyms; their content, however, is not exactly the same. *ICT literacy* refers to 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. *Technological literacy* (previously called *computer literacy*) entails a deeper understanding of digital technology and comprises both user and technical computing skills. *Information literacy* focuses on one of the key aspects of our Knowledge Society: the ability to locate, identify, retrieve, process and use digital information optimally.[1] In this paper, we will employ the term *digital literacy* because it retains a close connection with other basic literacies (e.g. reading and writing, mathematical competence) that are integral parts of education.[2]

UNESCO's *Information for All Programme*[3] (IFAP) recognizes the considerable effort being invested by many international organizations in "measuring the information society", defining **digital literacy as a life skill**. UNESCO identifies indicators for the development of knowledge societies and integrates them with more established milestone systems for other important skill areas. In May 2007, the Education Council adopted conclusions on a coherent framework of 16 core indicators for monitoring progress towards the Lisbon objectives in education and training. There are many of them with direct relevance to digital literacy – *ICT skills, civic skills, learning to learn skills, participation of adults in lifelong learning*. High values in these targeted areas certainly require the development of digital competence. Other indicators also may involve ICT skills. For example, *cross-national mobility of students in higher education* is made possible through blended learning courses that involve travelling students staying in touch with the learning process of their peers at home. Professional development of teachers and trainers, another key indicator, is mostly achieved through blended or e-learning courses in which new methodological skills are acquired and then applied in the workplace. These examples illustrate the importance of digital literacy for the achievement of Information Society goals. Digital literacy is a life skill because it targets all areas of contemporary existence.

In seven out of the sixteen literacy indicators, digital literacy plays a central role. In the last century, the shift from the manufacture of goods to the provision of services has resulted in an economy based on information and knowledge. Computers substitute for workers who perform routine physical and cognitive tasks, but they complement workers who perform non-routine problem solving tasks. Modern organizations and companies have been facing *a restructuring of work*, which means flatter organizational structures, decentralized decision making, widely shared information, flexible work arrangements and collaboration in project teams. Companies applying these changes in organizational structures and business practices require new skills, as wells as an increased role of ICT in the work place for communication, information sharing, and simulation of business processes. Routine cognitive and manual tasks in the economy decline, and non-routine analytic and interactive tasks rise. Resulting *new hiring practices* demand workers with the ability to respond flexibly to complex problems, communicate effectively, manage information, work in teams, use technology, and produce new knowledge.

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[1] An educationally relevant portal on ICT literacy: http://www.ictliteracy.info/

[2] For an overview of current literacy and competence studies, see the web site of the Partnership for 21st Century Skills, http://www.p21.org/

[3] http://portal.unesco.org/ci/en/ev.php-URL_ID=1627&URL_DO=DO_TOPIC&URL_SECTION=201.html

These capabilities are rarely taught in schools or measured on typical assessments.[1] The challenge school systems face today is to embed digital literacy in all levels of the educational system as well as in the professional development of teachers and trainers. This paper focuses on public education, and intends to provide an overview that policy makers of developing countries may use when planning for the development of integration ICTs in the curricula, communication, and management of their schools.

Digital literacy as a component of life skills

Modern life skills encompass an intricate system of knowledge, skills, abilities, and motivational factors that must be developed according to the needs of their specific domains. The populations where digital literacy is most important are ICT users, e-business professionals, and ICT professionals.

ICT user skills are those that should be learnt by all citizens of the knowledge society in order to:

- select and apply ICT systems and devices effectively;
- utilise common generic software tools in their private lives;
- use specialised tools for work;
- flexibly adapt to changes in infrastructure and applications.

e-Business skills are the capabilities needed to exploit business opportunities provided by Internet based applications. These skills are used, among others:

- to rationalise management;
- to promote more efficient and effective performance of organisations;
- to explore new ways of conducting established businesses;
- to establish new businesses.

ICT professionals' skills require high-level, specialized knowledge used for:

- researching, developing, and designing ICT tools;
- managing, producing, marketing, and selling tools and services;
- consulting, integrating, and installing ICT supported applications;
- maintaining, administrating, supporting, and servicing ICT systems.

[1] Partnership for 21st Century Skills Website www.21stcenturyskills.org

DIGITAL LITERACY AND BASIC COMPETENCES FROM THE TEACHER'S AND LEARNER'S PERSPECTIVES

Both educational theorists and practitioners agree that digital literacy has to be defined and developed in relation to general educational objectives: if ICT use is a basic skill, it must be included in all areas of school instruction. Digital literacy seems to have a beneficial effect on basic skills and competences. There is a growing body of national and international evidence demonstrating the positive impact of digital technologies on measurable learning outcomes as well. A study implemented by the British Educational Communications and Technology Agency (Becta) reveals that the integrated use of technology enables a range of positive outcomes for children and young people, including improved progress for both girls and boys in Key Stages 1 and 2 (age groups: 5–10 years). In Key Stage 1, students talented in math progressed much faster when their digital literacy was developed and when mathematics and science was taught using ICT tools and resources. Especially impressive gains in knowledge and learning motivation were found in English at Key Stage 2. The impact on attainment found in secondary school was also impressive. At the General Certificate of Secondary Education (GCSE) examinations, students with well-developed digital literacy skills scored better in all areas. Classes that were taught completely online or in a blended learning environment on average produce better learning results than those classes teaching face-to-face alone.

Digital literacy has positive effects on skills important for successful learning also. Students can *access information* more easily, as a growing amount of data is available in digital repositories that are much easier to access than traditional, paper-based resources for learning. *Managing information* is a digital literacy component that students acquire and use in their private lives when joining online communities and keeping up with the diverse networks they are a part of. *Integrating* and *evaluating information*, on the other hand, are skills that have to be taught in the classroom, with the teacher acting as an expert in evaluating information, showing students the differences between reliable and useless digital resources.

The most important components of digital literacy are common for future computer users and ICT professionals: *accessing, managing, evaluating, integrating, creating, and communicating information* individually or collaboratively in a networked, computer-supported, and web-based environment for learning, working, or leisure. These skills are directly related to basic competences; therefore, digital literacy is as relevant as traditional literacies – such as reading and writing, mathematics, or the management of social behaviour. Below is an overview of the relationships of digital literacy components and basic competences.

Accessing information, defined as identifying information sources as well as having the techniques for collection and retrieval of such information, is a basic component of all literacies. Digital literacy significantly broadens the scope of potential sources of knowledge. However, information search in this area requires more sophisticated *information management* skills than traditional literacies that use resources whose validity and authenticity is relatively easier to assess. When using an Internet-based knowledge portal, applying an existing organizational or classification scheme to evaluate its content is not always possible. Books and journals, for example, may be validated by the reputation of their publishers; most web sites, however, do not bear the label of a well-known institution. *Evaluating information* (making judgements about its adequacy, currency, usefulness, quality, relevance, or efficiency) comes to play here. Being able to determine the authority or time of the information retrieved online requires digital literacy skills that only the expertise and experience of education may furnish individuals

with. Thus, information management has become a compulsory part of digital literacy programmes – one that relies on other literacies and, at the same time, furnishes students with knowledge that is applicable in other literacies.

Integration is another skill that is relevant for all basic competences. In the case of digital literacy, it involves the interpretation and representation of information using ICT tools. Here, the most challenging task is to synthesize, summarize, compare, and contrast information from multiple sources. Integration poses technical challenges: often, different types of data must be handled simultaneously. Therefore, integration requires visual as well as verbal literacy, because texts, charts, and images have to be contrasted and interrelated. Teaching programmes that create synergies between ICTs and discipline-based studies are the most valuable to develop this interdisciplinary set of skills.

Creation of new knowledge is at the core of all basic literacies. Likewise, generating new information digitally by adapting, applying, designing, inventing, or authoring information is also at the core of digital literacy. ICTs were first considered technical skills that may support creative processes. With the development of increasingly innovative computer-supported research and design tools, however, they proved to be much more: today, ICTs have given rise to new creative methods and genres both in science and the arts.

Finally, *communication* is an important component of basic literacies, and one that has been profoundly changed by the emergence of digital literacy. ICTs provide means for transmitting information faster, more persuasively, and to a wider audience than any communication tool ever before. Digital literacy may support other literacies through the use of the most appropriate and relevant media in order to adapt and present information properly in a variety of sociocultural contexts.

In order to develop adequate 21st century skills among students, educators should be authentic ICT users and integrate digital literacy with other core competences in their professional and private lives. Young teachers born in the digital age may be good models of diverse, enjoyable, and empowering ICT use, but are not necessarily literate in the educational utilisation of ICTs. Teachers' digital literacy must involve knowledge and skills about educational policy and ethical use of ICTs, and they must keep abreast of innovation in digital pedagogy. Teachers' digital literacy must incorporate the ability to use ICTs effectively in teaching, learning, professional development, and school organisation – different sets of skills are required in each of those areas.

UNESCO has initiated activity on the development of the UNESCO ICT Competency Framework for Teachers (ICT-CFT).[1] The overall objective of the project is improving teaching practices to contribute to a higher quality education system – one that will produce a better-informed citizenry and a higher quality workforce that can, as a result, advance a country's economic and social development. The first stage of this work was implemented a few years ago and its main output was the elaboration of ICT Competency Standards for Teachers (ICT-CST), as well as the corresponding resources and guidelines for preparing teachers to play an essential role in producing technology-capable students. The second stage, "Alignment and Deployment" – currently being implemented jointly with UNESCO strategic ICT partners Microsoft, Cisco, Intel, and ISTE – is engaged in the creation of the Skills Matrix for Teachers and the elaboration of the corresponding syllabi and assessment requirements. The third stage will be related to the adaptation, localization, extension, application, and certification processes.

[1] UNESCO ICT Competency Framework for Teachers. http://portal.unesco.org/ci/en/ev.php-URL_ID=22997&URL_DO=DO_TOPIC&URL_SECTION=201.html

An example: **competences concerning ICTs policy development.** At the core of this cluster there are *personal skills:* critical reflection on ICT policies and strategies developed by government agencies, professional associations, or other stakeholders; as well as construction of a personal vision of the most important objectives of the use of ICTs in the unique cultural environment of an educational institution. *Digital pedagogy skills* are also important for policy makers: even though they may not be engaged in daily teaching practice, they have to implement actions that respond to educational challenges – instead of simply implementing ICTs to solve problems, they must pose new challenges for teachers to adapt them in an existing educational setting. *Interpersonal skills* are also relevant: the introduction of digital pedagogy demands a constant adaptation of tools to both teaching and learning methods, and sharing those developments with colleagues is crucial to fully realise the potentials of ICTs. The only way to maximize the impact of ICTs on the school system is for leaders to be both visionaries and managers of innovation at the same time: they must motivate and organise cooperation for the implementation and evaluation of computer-supported educational models. Finally, *environmental consciousness* is another important component of the skills cluster for the successful ICTs policy builder. In the 21st century, it has become a key requirement that any strategy for the construction of a school ICTs policy be environmentally sustainable. This is yet another skill in the digital literacy framework that is closely related to other basic literacies. In the next part of this paper, we will see how this is all put into action.

DIGITAL LITERACY IN EDUCATION, FROM THE POLICY MAKERS' PERSPECTIVE

Digital literacy has become a topic of discussion in all current educational theories, and most of them recognize the enormous potential of ICTs to personalise teaching and learning processes through making them more adaptive and interactive. ICTs in school education are an educational, not a technology issue. Digital pedagogy is promoted in two major ways: enhancing the teaching and learning processes through digital solutions, and facilitating access to educational resources.

In many countries, educational policies for the development of digital literacy first focused on the development of infrastructure, without training or motivating teachers to use it effectively. Thus the *digital pedagogy revolution* came decades after the first computerisation boom of the 1980s. At the end of the 20th century, ICTs became standard in most American and European countries for teaching, learning, assessment, management, and communication in schools. Computers have ultimately fulfilled their promise: they became catalysts of innovation processes in education.

The UNESCO's Annual World Report 2009, *Information Society Policies* (UNESCO, 2009) highlights the major challenge policy makers face: the widening of the digital divide, or the lack of improvement in the area of digital literacy in developing countries. In a growing number of developing countries, digital literacy has become a national priority. General benchmarks to evaluate results of education almost always target ICT-related issues by educational activities where ICT-supported methodology is widely employed. For example, the contribution of digital literacy to general reading literacy and lifelong learning skills is unquestioned. The quality of this contribution, however, has to be further clarified. Some researchers emphasize the importance of computer-supported reading and writing, while others see the "consumption" of digital texts as an obstacle for reading books. In the area of lifelong learning, however, the role of e-learning in providing access for a wide adult audience is unquestionable.

Different countries and cultures may have fundamentally different needs for digital literacy. Regular monitoring of school practices often reveals that a good solution in a western country may turn into a dead-end alley when applied in Africa or India. Teacher training is key; however, supplying teachers with "fish" (pre-packaged educational content) but no "net" (digital literacy skills to create locally relevant content) can be useless, even counterproductive. Differences among users' social backgrounds can represent an equally significant factor.

Educational leadership and digital literacy

Educational policies must take socioeconomic factors in consideration when planning curricula. For instance, ICTs should be taught as a separate discipline in countries where Internet and computer access at home is scarce. In others, where students may easily use digital media for homework and leisure, ICTs may be integrated in the curriculum of school disciplines and taught in an integrated manner.

Educational leadership should ensure that ICTs are incorporated in these key areas of school culture:

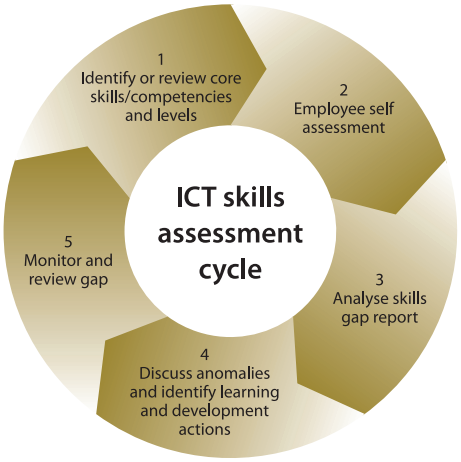
1. **Leadership and Vision:** Acquisition of skills needed for planning and developing an ICT strategy, suitable infrastructure, and staff development. This indicator relates to school leadership.
2. **Learning and Teaching:** Developing motivation, skills, and competences required for the successful implementation of the ICT strategy for the school. This indicator relates to teaching staff.
3. **Productivity and Professional Practice:** Quality of teaching aids and processes resulting from the realisation of the ICT strategy. This indicator relates to teaching staff and students.
4. **Support, Management, and Operations:** Quality of the realisation of the ICT strategy of the school and provision of technical, professional, and moral support to staff. This indicator relates to school leadership, and administrative and technical staff.
5. **Assessment and Evaluation:** Assessment of the quality of the educational process and the role of ICTs strategy within school culture. This indicator relates to school leadership, administrative, teaching and technical staff and may be realised at least partly.
6. **Social, Ethical and Legal Issues:** Quality of the ICT strategy concerning individual and group rights – issues that are legally regulated or individually solved by the school leadership and staff.

Digital literacy development strategies may be refined using these skill clusters. Five cross-national surveys have been or will be implemented in the next couple of years to explore the areas of the core indicators.[1] The results will show how digital literacy components may be evaluated and will provide benchmarks for institutions to assess their ICT-readiness and the competence level of their staff to use those resources effectively.

[1] The International Society for Technology Education (ISTE, http://www.iste.org) has also developed standardized performance indicators for administrators.

Evaluating the level of digital literacy

There is a vast and rapidly growing body of literature that maps the areas contribute to digital literacy. The Queensland Government ICT Skills Assessment Methodology established a four-phase cycle for assessing the digital literacy of both students and workforce (see chart below).



The ICT Skills Assessment Cycle
Source: ICT Workforce Ability project of the Queensland Government
http://www.qgcio.qld.gov.au/qgcio/projectsandservices/ictworkforcecapability/Pages/ICTSkillsAssessmentMethodology.aspx

Digital literacy may best be evaluated through digital assessment tools. Among them, electronic portfolios seem to be most widely used. An electronic portfolio, also known as an e-portfolio or digital portfolio, is a collection of electronic evidence assembled and managed by a user, usually on the Web. Such electronic evidence may include inputted text, electronic files, images, multimedia, blog entries, and hyperlinks. E-portfolios are both demonstrations of the user's abilities and platforms for self-expression, and, if they are online, they can be maintained dynamically over time. Some e-portfolio applications allow varying degrees of audience access, so the same portfolio might be used for multiple purposes. There are three main types of e-portfolios, although they may be referred to with different terms:

- developmental (e.g., working),
- reflective (e.g., learning), and
- representational (e.g., showcase).

A developmental e-portfolio is a record of things that the owner has done over a period of time, and may be directly tied to learner outcomes or rubrics. A reflective e-portfolio includes personal reflection on the content and what it means for the owner's development. A representational e-portfolio shows the owner's achievements in relation to a particular work or to developmental goals, and is, therefore, selective. When it is used for job application it is sometimes called Career Portfolio. The three main types may be mixed to achieve different learning, personal, or work-related outcomes; the e-portfolio owner is usually the person who determines access levels.

A more sophisticated but flexible tool to assess digital literacy "in action" is computer-supported or fully online testing. In 2006, the OECD Programme for International Student Assessment (PISA) employed computer-based assessment methods in its Science Survey (CBAS)[1]. Results showed that online assessment is an equivalent alternative to paper-based methods. Its results, however, are incomparably easier to analyse, and data can reach teachers and policy makers much more quickly. In developing countries, efficient computer-based testing may provide a more economical alternative to paper-based tests. National assessment projects that introduce new large-scale, computer-based assessment tools also call our attention on the importance of digital literacy skills.

Digital competence building at school and through life-long education should go beyond its current utilitarian agenda to include techniques for the creation, understanding, and safeguarding of culture. Cultural heritage should be made increasingly accessible through digital media that provide authentic information, and that media should educate, entertain, and provide inspiration at the same time.

TOWARDS A NEW DIGITAL LITERACY FRAMEWORK

Digital literacy has become one of the most frequent subjects in policy debates and educational research. Synergies among these two groups and other stakeholders – teachers, parents, students – will hopefully result in action plans grounded in scientific inquiry. In order to map out the current and future digital literacy needs of our society, digital literacy development requires data on skills development, analyses of user trends, and information about social practices of youth subcultures.[2]

An example: **developing the digital competence of women**. User surveys show significantly different patterns of computer and Internet use among women and men. However, only a few school systems develop special programmes for girls. Do we need such programmes at all, or are the methodologies currently employed satisfactory for all genders? Research in this respect is ambiguous. Some studies emphasize that there are no gender-related differences in computer skills acquisition; others document substantial gains when teaching strategies are specially tailored to the needs of female learners. In Malaysia, a project for transforming women entrepreneurship from material business to online venture proved to be successful and sustainable because it considered needs that were gender-specific and provided learning programmes targeted to the specific population of young and middle-aged women. In Australia, a national initiative called *Girls and ICTs* resulted in a showcase of hundreds of "best practice" examples about teaching girls computer-related knowledge more appropriately. In Switzerland, a social campaign was launched in collaboration with several teaching projects: Girls behind keyboards! *(Mädchen an die Tastaturen!)* occupied a prestigious place in the National Future Day of Switzerland.

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[1] For an analysis of results and introduction of the computer based assessment methodology, cf. http://www.oecd.org/document/2/0,3343,en_32252351_32236191_39718850_1_1_1_1,00.html

[2] The Malaysian 1NITA Project for workplace based digital competence development: www.1nita.my
The Australian Girls and ICT Project web site: http://www.learningplace.com.au/defaulteqa.asp?orgid=48&suborgid=286
Girls behind keyboards! (Mädchen an die Tastaturen!) – a project of the National future Day of Switzerland: http://www.nationalerzukunftstag.ch/de/maedchen/projekte/maedchen-informatik-los.html
Code of Best Practices for Women and Technology: http://ec.europa.eu/information_society/activities/itgirls/doc/code.pdf

As one of the newspaper titles ran, "We need socially inclined boys and technologically savvy girls!" – a sign of recognition of differences in attitudes and competences of the two sexes that education has to take into consideration. More than 50 companies – such as Cisco, Deutsche Telekom, France-Telecom, Google, Hewlett Packard, Microsoft, Orange, Panasonic, and SAP – have signed the ''*Code of Best Practices for Women and Technology*'' in December 2010, committing themselves to implement actions to eliminate women's underrepresentation in the ICT sector. The development of digital literacy among women is one of the key areas to target. In the coming years, new digital competence models will probably be increasingly gender-specific, where the special skills, abilities, user patterns, and attitudes of each gender will be more adequately represented and developed through more inclusive teaching programmes.

The content and development of digital literacy must be different in the 21st century, home to the fourth generation of computer users, the *Y generation*, children of the Netizens of the 1980s. Young people today, whose parents were already born in a digital age, require a reconsideration of our priorities about which ICT skills to develop. Our 20th century frameworks describe basic computer skills that have become everyday activities for many and will be for more. Digital literacy education also has to prepare for new challenges of the 21st century: the use of Social Web applications, ecosystems of participation that enable **collaborative knowledge construction and creativity**. These two concepts are likely to be in the centre of our discussions about the digital literacy of the future. Digital literacy may foster creative expression only if education embraces the wide variety of creative options ICTs may offer.

Digital child and youth art – a new, ICT-embedded developmental model for the visual language development of an ICT-literate generation – invites us to reconsider traditional ideas about the artistic development of children and young people. Similar developments in music or design education may lead to a new, creativity-oriented digital literacy. Creativity as a major component of digital literacy will probably characterise ICT use in the 21st century, just as consuming information was relevant in the last decades of the 20th century. If digital literacy will involve the development of creativity, educational methods are bound to change.

The effects of the social web on the way we learn inside and outside of school may also shed new light on the contents of digital literacy. Web 2.0 applications – blogs, wikis, social networking sites, micro-blogging, or social bookmarking —are likely to have a profound effect on the way we construct and extract knowledge. The effects these media have on our lives are widely published,[1] but, even today, they are rarely used in education.

Creating and communicating information are skills of growing importance as digital tools develop and make high-quality creative experiences available for increasingly broader user groups. Collaborative applications increase the importance of social skills in the learning process at all levels: young learners, adult learners, and teachers. In the new digital literacy framework of the 21st century, communication and creation in the digital media will take centre stage.

[1] Social Media Today – The Web's Best Thinkers on Social Media and Web 2.0. http://www.socialmediatoday.com

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Digital literacy has penetrated all areas of life and become one of the most important “life skills”. This policy brief gives an overview of its components and shows its relationships with other basic skills and competences. It compares and contrasts perspectives of the development and utilisation of digital literacy for educational policy makers, teachers, learners and other stakeholders and show how these ideas are put to practice in educational and assessment projects. In order to realize the potentials of digital literacy, educators have to target sensitive areas such as promotion of social equity, development of “digital creativity” or catering for the needs of women or learners with special needs.

In the new digital literacy framework of the 21st century, the effects of the Social Web on the way we learn inside and outside of school – the use of blogs, wikis, social networking sites, micro-blogging, or social bookmarking in education – should be seriously considered. The first literacy frameworks focused on teaching and learning, today communication and creation open up new perspectives for the integration of information and communication technologies in education.

Author: Andrea Karpati

Published by the UNESCO Institute

for Information Technologies in Education

8 Kedrova St., Bldg. 3

Moscow, 117292

Russian Federation

Tel: +7 (499) 129 29 90

Fax: +7 (499) 129 12 25

E-mail: Liste.info.iite@unesco.org

iite.unesco.org

Printed in the Russian Federation

ISSN 2221-8378