

DISTANCE EDUCATION IN SCHOOLS: REALITIES AND PERSPECTIVES

Roumen Nikolov & Iliana Nikolova

Faculty of Mathematics and Informatics, Sofia University

FMI, 5 James Bourchier, Sofia 1164, Bulgaria

tel. (+359-2)8161535, tel./fax (+359-2)8656157

roumen@fmi.uni-sofia.bg, iliana@fmi.uni-sofia.bg

Keywords: blended learning, design of distance education, distance education/learning, educational reform, flexible learning, learner-centered education, learning theories, online learning, open learning, open school, telelearning, virtual learning environments, virtual schooling, Web 2.0 schools

ABSTRACT

This chapter discusses the role of ICT as a catalyst of a new global educational reform in schools aimed to break the monopoly of the print and paper based educational system. Some basic definitions are given although it is emphasized that the area is very dynamic and the definitions are still evolving. The main conclusion related to the ongoing educational reform is that it is based on designing and using different virtual learning environments which do not put clear boundary between physical and virtual worlds. A key factor for success is to integrate them, instead to separate them, and to apply relevant instructional design strategy based on a current learning theory. Some constructivists learning theories are analysed as well. The effectiveness of ICT based distance education is also discussed and teacher education is considered as the major way (to struggle) for excellence. The future of ICT based distance education is mostly considered in the context of the so-called Web 2.0 schools.

1. Introduction

The phenomenon of Distance Education (DE) in schools is strongly related to the rapid developments in the area of Information and Communication Technologies (ICTs). During the last two decades a immense number of students and teachers got access to advanced ICTs and this changed dramatically the ways they communicate, use and create information. ICTs creates conditions for technology and minds to work together, and the capacity of this synergetic system could be much higher than the single mind one. The school is no longer the sole and the most attractive source of information and knowledge. Quick access to unlimited

sources of information is obtained due to modern technologies. The traditional concept of literacy has been gradually extended to *multimedia literacy* referring to students' abilities to read, write, and communicate with digitally encoded materials - text, graphics, still and moving images, animation, sounds (Nikolov,1997). Mioduser, Nachmias, and Forkosh-Baruch in this Handbook extensively discuss the '*new literacies*' for the 21st century.

The technological developments provide a ground for an educational reform that can help citizens better prepare for living in the global information society (Anderson, 2008). Such reform will break the monopoly of the *print and paper based educational system* and will rely on learning environments incorporating *asynchronous space and time, interactivity, and virtual reconstruction* (McClintock, 1992a). The main characteristic of such learning environment is the virtual reconstruction of the school space by building virtual places: auditoriums, labs, workshop rooms, cafes, libraries, etc., where students and teachers from different locations can meet, interact, and work together, as if they were face-to-face.

Looking back at the ICTs history one can clearly notice that the main attention of researchers and technologists has gradually moved from hardware to software, next - to human-computer interaction, and recently - to social issues related to global communication and collaboration (Nikolov, 2001). Communication is the most typical activity in a community. Computer mediated communications support the establishment of virtual communities formed on the basis of common (topics of) interest, collaborative work, or other joint activities (Fernback & Thompson, 1995). These communities are trans-national and trans-cultural and need re-conceptualization of the social life, including education.

A core assumption in education is that learning is a social process, rather than an individual one. Therefore ICT based DE fosters creation of learning environments where communication is easy and leads to some meaningful learning activities closely related to the pre-defined educational goals.

2. Defining the Area

The rapid development of ICTs and their applications to teaching and learning lead to some evolution of terminology as well. Terms are not well defined yet and still part of scholarly debate, but used in practice by policy makers and professionals. *Distance education* is defined by Moore as “*all forms of education in which all or most of the teaching is conducted in a different space than the learning, with the effect that all or most of the communication between teachers and learners is through communication technology*”

(Moore, 2003, p. xiv). Moore's definition comprises the use of ICT as a means to realize teaching to be spatially separated from learning, which distinguishes DE from the distance correspondence mode, which was common practice before the widespread infusion of ICT in society. In addition to Moore's definition Butcher & Wilson-Strydom (2008) in this Handbook also added temporal separation between teachers and learners. By adopting the above definition we accept *distance education* as a generic term which emphasizes on the separation (in space and time) of learners and teachers, and includes the wide use of ICTs. According to Moore most of (the) other terms (which are) used in the literature express subordinate concepts related to different aspects of DE but they are not considered as synonyms of DE. Because DE nowadays is closely related to the use of ICTs, other terms emerged as well, for instance, *telelearning*, *online learning* and *e-learning* emphasize the use of a particular communications technology, *distributed learning* and *distant learning* focus on the location of learners, *open learning* and *flexible learning* point out the relative freedom of distance learners to exercise more control over their learning than is normal in conventional education. Butcher & Wilson-Strydom (2008) illustrate the confusion that can be generated when concepts such as distance education/learning, open schooling and open learning are interchangeably used. They argue that DE can be very much instruction-driven, not allowing learners to take control of their learning, and therefore could not always be a convincing example of open learning.

Another term which is closely related to DE in the school setting is *virtual schooling*, which is defined as "*an educational environment in which K-12 courses and other learning activities are offered mostly or completely through distance technologies*" (Roblyer, 2008). A similar concept is *open school* which could be defined as "... *an educational institution delivering primary and/or secondary education, providing courses and programmes predominantly through use of distance education methods*" (Butcher & Wilson-Strydom, 2008). According to Roblyer (2008) the rapid growth of virtual schools in the last decade has become an unexpected success story in the history of ICT integration in education. Roblyer also argues that the spatial and temporal separation of teaching and learning, as main feature of DE, also caused problems such as a high drop out rate. For this reason mixed forms emerged also and the term *blended learning* was introduced. Singh defines the features of blended learning: "*Blended learning programs may include several forms of learning tools, such as real-time virtual/collaboration software, self-paced Web-based courses, electronic performance support systems (EPSS) embedded within the job-task environment, and knowledge management systems. Blended learning mixes various event-based activities,*

including face-to-face classrooms, live e-learning, and self-paced learning. This often is a mix of traditional instructor-led training, synchronous online conferencing or training, asynchronous self-paced study, and structured on-the-job training from an experienced worker or mentor” (Singh, 2003, p. 51). Blended learning is typically associated with corporate training and higher education, but it quickly penetrates the school education as well (see for instance: http://en.wikibooks.org/wiki/Blended_Learning_in_K-12). *“It is also possible that the blended model may prove to be attractive to K–12 schools, especially those that are struggling with issues of online learning quality, student readiness, and teacher professional development* (Picciano & Seaman, 2007, p.20). It is important to clarify, that the K-12 education in North America and Australia comprises all primary and secondary schools.

In summary, the evolving definitions and terms show the dynamics in the DE area of research, as well as the common understanding that the main feature of DE is the use of ICT to facilitate separation of teachers and learners in term of space and time.

3. The ICT based Distance Education in Schools Phenomena

(ICT based) DE is considered *“the most significant development in education in the past quarter century”* (Moore, 2003, p.ix). According to Powell & Patrick (2006, p. 3), there were more than 500,000 enrollments in online courses in grades K-12 and more than one-third of public school districts offered some type of e-learning in the USA during the 2005-2006 school year. A study of the North American Council for Online Learning, that surveyed over 30 countries, showed a fast growth of DE initiatives in many countries, such as: Australia, Canada, Japan, China, Kazakhstan, Nepal, New Zealand, Singapore, Zimbabwe, etc. (Hedberg & Ping 2004, pp. 200-205). UNESCO has established a database with 90 ICT projects in education in Asian countries (<http://www.unescobkk.org/index.php?id=1562>). Based on them, the countries in the region are roughly categorized into three types:

- Countries which are already integrating the use of ICT into the education systems and the delivery of education is increasingly online, with e-learning greatly facilitated by wide access to the Internet (Australia, South Korea, Singapore). South Korean schools, for example, have universal access to Internet.
- Countries which are starting to apply and test various strategies (China, Thailand, Japan, Malaysia, the Philippines and India). The online learning in these countries is still not widely applied.
- Countries which have just begun and are more concerned with ICT infrastructure and

connectivity installation (e.g. Viet Nam, Cambodia, Bangladesh, Maldives, Bhutan). There are countries, especially in the Pacific, which have not started online learning yet.

- Delrio and Dondi (2008) describe several DE initiatives of the European Union as part of their chapter of the ICT policy of the European Union.

The current paper aims at analyzing the ICT based DE in schools as a phenomenon in education that catalyzes new educational reform all over the world. As Holmberg states: “*Multimedia networks are expected to lead to or facilitate educational innovations*” (Holmberg, 1996, p. 488). However a lot of research is needed to determine the types of students that e-learning or effective school delivery mode is the most appropriate for and to help decision makers to answer some crucial questions in order to make possible “*the power of e-learning be moved from bright promise to best practice*” (Barker & Wendel, 2001, pp.129-131). Many educators and technologists tempt to apply or adapt findings from studies of traditional classroom learning or adult distance learning, but ICT based DE in schools is fundamentally unique (Cavanaugh, Gillan, Kromrey, Hess & Blomeyer, 2004, p. 6.).

4. The ICT Driven Educational Reform

McClintock describes the emergence of the traditional print-based school(ing) system as follows: “*Around 1500, a major pedagogical transition began as printing with moveable type made an unprecedented era of educational development possible. But the transition was not a quick and simple change: to bring it off, innovators had to develop a complex of different, yet interrelated, educational strategies, which together eventually made mass schooling for all a practical reality*” (McClintock, 1992a, p. 3). The main features of this educational system are: using printed textbooks; grouping children primarily by age, and secondly by ability, dividing curriculum into subjects, packaging the subjects into annual installments, and mapping them onto a sequence of grades the students should *climb up*. The basic unit of the school space is the classroom, where one teacher teaches about 25 students. The time units of such schools are: school period, school day, and school year. McClintock considers the traditional schools as a logistic construction to ensure (in most cases) students and teachers to be at the same place at the same time, i.e. the school is “*a means for synchronizing diverse activities in space and time. That is what scheduling is all about, and within a particular class, a teacher needs diverse arts for synchronizing effort on the subject at hand*” (McClintock, 1992a, p. 52).

During the last decade the role of the printed book dramatically changed. The vision of Alan Kay for a Dynabook, a ‘book’ ‘*which is active (like the child)*’, with ‘*the attention grabbing powers of TV, but controllable by the child*’, something like a piano, but which ‘*can be a tool, a toy, a medium of expression, a source of unique pleasure and delight ...and, as with most gadgets in unenlightened hands, a terrible drudge*’ (Kay, 1972, p.1), comes to a new life today. (See for instance <http://www.futureofthebook.org/>). We are witnessing an ICT driven educational reform now, which could be expected to take much less time than the one based on printing technology. The current educational reform is driven by three major factors - asynchronous space and time, responsive environments, and virtual reconstruction, that can “*powerfully transform the way schools work*” (McClintock, 1992a, p. 52):

- *asynchronous space and time* - the ability of people, who are not synchronized in the same place at the same time, to easily communicate with each other in a variety of responsive ways. This means that the classical schools would gradually lose their role as instruments for synchronizing the school learning activities.
- *responsive environments* – customized to the learners’ needs interactive learning environments which will help them better learn and communicate. “*Such personalization of the electronic environment can carry over from the personal computer to a network. When the user logs onto the network, he activates configuration programs that set the environment to his style and need, regardless of where in physical space the workstation may be*” (McClintock, 1992a, p. 54). Punie & Cabrera further develop the concept of *learning spaces* as one of the main features of the future learning (Punie & Cabrera, 2006, p. 12). Downes also analyses the future role of the personal learning environments: “*The idea behind the personal learning environment is that the management of learning migrates from the institution to the learner*” (Downes, 2007, p. 19).
- *virtual reconstruction* - the ability to use interactive multimedia components to redesign and reconfigure the human experience of existing physical spaces without (having to make) physical or structural changes in buildings. The virtual spaces could complement the physical spaces when designing an effective, student centered, learning environment.

The beginning of the new educational reform could be found in the late 70s, when a ubiquitous movement for introducing computers in education took place in a global scale. As Aston reports, microcomputers have been used in schools since 1979 (Aston, 2002, p. 62). An example of an early days project where some rudiments of the ongoing educational reform

could be observed, was the large scale educational experiment carried out by the *Research Group on Education* (RGE) in twenty nine schools in Bulgaria between 1979 and 1988 (Nikolov, 1987; Nikolov, 2001; Nikolov & Sendova, 1988). The main assumption was that due to the advent of mass produced microcomputers the educational system should be reformed as a whole as to embed their potential in education as an integrative component. A major educational principle of RGE was the *integration of school subjects* and enabling students to see world objects and phenomena from many sides while learning. Students looked for answers in various fields of human knowledge; took the role of researchers and experienced that knowledge was infinite, changing, and that nobody could possess it totally, including the teacher. Different activities were mixed in a mosaic that kept the students interests awake. The students learned individually and in teams, solved problems, designed, drew, played, sang, and used computers. The new role of the school was defined as *to guide students how to learn by themselves*. Learning was defined as an *active process*. The *interaction* in class was considered as a way students to overcome the information overload with the help of teachers and their schoolmates. The teachers and learners were given more freedom, but their responsibility increased. A *learning environment in informatics* was created as an integrated mix of computer equipment, information resources, educational software, textbooks and other learning materials. Although computer resources were limited by that time, some innovative approaches of school activities were introduced (Nikolov & Sendova, 1988), e.g. working on a project, collaborative learning, dividing students into groups of different size, collective discussions, experimenting in mathematics, filling up a database, language games, publishing a student magazine, students' software house, teaching students in a university laboratory, competitions, a final students' computer performance, etc.

RGE project did not change substantially the Bulgarian educational system as a whole, but it gave rise to several innovative educational initiatives and projects both at school and university settings. The early RGE experiences of IT in schools described above were embedded in the traditional concept of schooling where the printing technology and textbooks were still dominating and the (physical) classroom was the main place where learning activities took place. Some explanations of the RGE failure to achieve a complete educational reform in Bulgaria could be found in the words of Seymour Papert, whose book "*Mindstorms: Children, computers, and powerful ideas*" (Papert, 1980) and the experience of his research group at MIT substantially influenced the RGE experiment. Papert argues that *'the shift from a stance of reform to a stance of evolution does not exclude active intervention, but the role of the change agent becomes less like the architect or builder and more like the plant- or animal*

breeder whose interventions take the form of influencing processes that have their own dynamic' (Papert, 1997, p.421). He also states that many components of the educational system have to be appropriately changed and this would need time. He emphasizes that time would not be sufficient to change the educational system, e.g. school mathematics education: *'To learn French you certainly need time, but you would not learn it well unless you had the opportunity for engaging talk or reading in French. In the case of the parabola, if this were all that was available to the students of the new language they would be no more likely to show success in learning than students of French who had access to one short passage in that language. For success, there would have to have developed the analog of a diverse collection of books written in French and access to French-speaking people'* (Papert, 1997, p.424) .

RGE introduced some of the principles of the pedagogical re-engineering, which characterize the ICT based DE now, in the RGE experimental schools nearly 30 years ago. The RGE experience also proved that the educational innovations related to the ICT-driven reform could be hardly revolutionarily implemented, but should rather be a matter of evolutionary changes at all levels of the school educational system.

Technologies have made a remarkable progress since the early days of the IT in education. The current ICT based DE relies mostly on large online electronic libraries and rich multimedia resources rather than on printed materials. Students can study on their own using aesthetically formatted and interactive multimedia learning materials. They can construct their own knowledge, study individually according to their needs, learning styles, skills, interests and cognitive characteristics, and *learn how to learn*. Students can control their learning process, work in teams with other students, take part in discussions, and search for effectiveness in the learning process. *Co-operative learning* dominates over *competitive learning* (McClintock, 1992a p. 82.). Today's student can work in a dynamic and interactive multimedia learning environment where aside from the tutor and the other students he/she can communicate and work with his/her virtual friends all over the world. A new feature of the current stage of the educational reform is defined by McClintock: *"Now, thinking about educational time and space leads to conceptions of flexible groupings, across ages and locations, as people interact according to their interests, needs, and curiosities"* (McClintock, 1992b, p. 34.).

5. Virtual Learning Environments

Wilson defines the constructivist learning environment as “*a place where learners may work together and support each other as they use a variety of tools and information resources in their pursuit of learning goals and problem-solving activities*” (Wilson 1995, p.27). A learning environment contains at least a learner and a place “*wherein the learner acts--using tools and devices, collecting and interpreting information, interacting perhaps with others, etc*”. (Wilson, 1995, p.26).

When designing a Virtual Learning Environment (VLE) one could use different mental images (metaphors) of teaching and learning. Internet and Web gave rise of the *cyberspace* methaphor, i.e. an extension and a substitute of a physical environment. Dillenbourg emphasises that: “*What is specific to virtual environments compared to any information space is that it is populated. The users are inside the information space and see a representation of themselves and/or others in the space. As soon as students see who else is interested by which information, the space becomes inherently social.*” (Dillenbourg, 2000, p. 5). Another metaphor for a learning environment is *place*, which could be defined (in the physical world) as the “*setting that transforms mere spaces and activities into unique sociocultural events: the coming together of people to the same location, at the same time, for the purpose of participating in a common, authentic, one-of-a-kind, memorable activity*” (Kalay, 2004, p.195). The document metaphor (used by the designers of the Web) sees information as separate from the people who use it and from the environment in which it is used. Kalay makes a conclusion, that “*place-making, rather than page-making, is a more appropriate metaphor for designing cyberspace: in addition to communication and information management, this metaphor affords a contextualized locus for situating the activities themselves, much like physical places do. Thus, the virtual places will include socio-cultural and perceptual qualities, enriching them to the point where they may approach - perhaps even surpass - comparable physical settings*” (Kalay, 2004, p.196).

Although there are many examples of pure VLEs, some authors argue that most of the existing VLEs integrate not only a variety of software tools but also all the physical tools that can be found in a classroom (Dillenbourg, 2000, p. 12), such as:

- a variety of non-computerised learning resources: concrete manipulation tools, instruments, books;
- a variety of interactions that are not computer-mediated: face-to-face discussion among students, lectures by the teacher, group discussions;
- traditional media - letters, TV, phone and fax;

- a variety of activities that are not computer-based: field trips, role playing, etc.

In the context of the above said, Nikolov & Nikolova (1996) proposed a conceptual model for *Virtual Environment for Distance Education and Training* (VEDET) that offers a comprehensive metaphor to be used both for human-computer interface and instructional design purposes. The model suggests restructuring traditional education and training by complementing them with a virtual component. Thus VEDET does not intend to replace the traditional school, university or training department, but rather extend their facilities and tools and make learning activities more flexible and technologically enriched. This conceptual model gave rise of a number of complementary developments for reshaping academic practices through multi and hyper media (Nikolova, 1999).

Gachev & Nikolova (2005) report some results of a comprehensive survey of appropriate software tools to support learning activities in web-based Collaborative Environments (CEs). The analysis shows that the majority of CEs are *user-centric* rather than *task-centric*, i.e. they comply with the user needs, but tend to miss the learning activities and tasks compatibility. The main conclusion is that while *CE-to-user* interfaces are sufficiently well developed. *CE-to-task* interfaces still need substantial further development.

The emergence of adaptive and intelligent Web-based educational systems is observed as well. They '*attempt to be more adaptive by building a model of the goals, preferences and knowledge of each individual student and using this model throughout the interaction with the student in order to adapt to the needs of that student. They also attempt to be more intelligent by incorporating and performing some activities traditionally executed by a human teacher - such as coaching students or diagnosing their misconceptions*' (Brusilovsky & Peylo, 2003, p.156). (See also <http://aied.inf.ed.ac.uk/aiedsoc.html>)

The concept of VLE could be found in many research works and projects, as well as in many documents related to educational policy in schools. For instance, the British Educational Communications and Technology Agency (<http://www.becta.org.uk>) published an analysis of the current research related to the use of VLEs in education (BECTA, 2003). The European School Net (<http://www.eun.org/>), a non-profit consortium of 28 ministries of education in Europe, organized a survey comprising more than 500 schools and 17 ministries and national agencies for using VLEs in Europe (EUN, 2003). Some of the findings are (see p.4):

- In-house development of VLEs is booming in European school sector. Ten out of 17 national agencies fund the development and localisation of VLEs at the national level, and about 60% of them have a high priority for VLEs in their national policies. About

two thirds of respondent schools use an in-house or open source VLE, whereas commercial products represent about one third of the VLEs in the field.

- Teachers in the secondary education use VLEs mostly with their pupils in classes, suggesting that teachers mix different teaching styles such as computer-supported teaching with face-to-face teaching. Teachers use VLEs more than students. Teachers use them also for administrative tasks, and as a means of communicating with other educational staff in both their own and other schools. In many cases, this exchange takes place in the framework of international and European-wide school collaboration programs.
- VLEs are mostly used in teaching ICT and cross-curricular subjects. About 90% of teachers said that they teach ICT regularly and sometimes using VLEs, whereas for cross-curricular education VLEs are used regularly by 44% and sometimes by 40% of respondents.

We can argue that the ICT based DE tends to be mostly related to designing and using VLEs. However, a very important role in effective use of VLEs play the instructional designers who should apply some appropriate learning theories when defining the learning activities.

6. Pedagogical Dimension of K-12 Distance Education

When designing VLEs, educators mostly refer to one of the three most popular learning theories: *behaviorism*, *cognitivism*, and *constructivism*. Dede (2008) in this Handbook describes and discusses how different uses of ICT comply with these different approaches to learning. Nowadays many researchers and professionals refer to *constructivism* as the most popular theory in the area of ICT based DE. The theory states that by reflecting on our experiences and participating in social activities we construct our knowledge about the world around (Duffy & Cunningham, 1996). In a constructivist classroom, the teacher searches for students' understandings of concepts, and then structures opportunities for students to refine or revise these understandings by posing contradictions, presenting new information, asking questions, encouraging research, and/or engaging students in inquiries designed to challenge current concepts (Brooks & Brooks, 1993, p.3).

Among the most important recently developed learning paradigms and theories, derived or related to ICT, are: *cognitive flexibility theory*, *anchored instruction theory* and *minimalism theory*. The cognitive flexibility theory is a new constructivist based theory of learning and

instruction which emphasizes on the real-world complexity and ill-structuredness of many knowledge domains (Spiro, Feltovich, Jacobson & Coulson, 1992). Some of the basic assumptions in this theory are that understandings are constructed by using prior knowledge to go beyond the information given and the prior knowledge that is brought to bear is itself constructed, rather than retrieved intact from memory, on a case-by-case basis. In the core of the cognitive flexibility theory is that “*revisiting the same material, at different times, in rearranged contexts, for different purposes, and from different conceptual perspectives is essential for attaining the goals of advanced knowledge acquisition (mastery of complexity in understanding and preparation for transfer)*” (p.64). The authors claim that the design of hypertext learning environments could be done in systematic way in order to make them “*sensitive to and dependent upon the cognitive characteristics necessary for advanced knowledge acquisition in ill-structured domains*” (p. 69).

Anchored Instruction, also based on constructivist approaches to learning, is a learning theory which emphasises on the importance of motivating learners by involving them in problem-solving (including by using technology) in a meaningful context (Bransford, Sherwood, Hasselbring, Kinzer & Williams, 1990). The instructional designers should use ‘*anchors*’ based on concrete problem solving situation where students are actively involved.

The *Minimalist* theory of Carroll is closely related to the constructivist approaches to learning as well. It was developed on the base of studies how people are learning to use a variety of computer applications, such as word processing, databases, and programming, and it has been applied to the design of computer documentation and training materials for computer users (Kearsley, 1994). The basic theory principles are: all learning tasks should be meaningful and self-contained activities; learners should be given realistic projects as quickly as possible; instruction should permit self-directed reasoning and improvising by increasing the number of active learning activities; training materials and activities should provide for error recognition and recovery and, there should be a close linkage between the training and actual system. Hedberg & Ping emphasise that when learning tasks are designed it is important to take into consideration when the knowledge and skills are going to be used (Hedberg & Ping, 2004). Instead of focusing on *just-in-case* learning, *just-in-time* learning may be more effective - it provides students with more personal and relevant reasons for learning.

An example of applying innovative constructivist instructional strategy in a VLE created in the frames of the European project *WebLabs*, can be seen in (Mor, Hoyles, Kahn, Noss & Simpson, 2004). The *WebLabs* learning model and the VLE supporting it, facilitate *the*

scientist in the learner to be enhanced. 10-12 years old students, together with their teachers and geographically dispersed researchers are involved in science and mathematics explorations by means of technology (a software environment for visual modeling). The students are partners in a research process and get used to pose questions and search answers no matter how sophisticated they might be. They develop an understanding of mathematics as a science in which formulating hypotheses, carrying out experiments, and attacking open problems plays a crucial part. They communicate and share their experiences with peers, teachers and researchers locally and globally through *wplone*, a Web based collaborative system, by the so called Webreports (<http://www.weblabs.org.uk/wlplone>). During this communication they acquire specific social experience and are stimulated to build valuable personal skills such as:

- ability to generate and verbalize ideas;
- to present their results according to a concrete standard;
- to share their experience by means of electronic communication;
- to discuss their work and work in a team;
- to be (self-)critical to the work published in the virtual environment.

When facing a typical e-learning problem while trying to learn collaboratively over distance – the language problem - in an attempt to overcome it, the students reach(ed) the idea of designing a graphical scripting language, *Weblabetics*, for expressing and sharing their experience (Sendova, Nikolova, Gachev & Moneva, 2004).

Southworth, Ho & Narita (2008) in this Handbook emphasise the development of Distance Learning - Enrichment (DL-E) model as a means to provide global learning experiences for young people (and adults) living in Hawaii with their pen-pals from American Samoa, Guam, Rarotonga, New Zealand, Japan, Korea, China, Taiwan, Tahiti, France and Russia. DL-E provides opportunities for human-to-human communication with the machine serving merely as a transmission device to link the interacting people.

Changes towards the information or knowledge society (Anderson, 2008) also lead to new trends in learning. Some of the changes observed by Siemens are:

- Informal learning is a significant aspect of our learning experience. Formal education no longer comprises the majority of our learning. Learning now occurs in a variety of ways – through communities of practice, personal networks, and through completion of work related tasks;

- Learning is a continual process, lasting for a lifetime. Learning and work related activities are no longer separate. In many situations, they are the same;
- Technology is altering (rewiring) our brains. The tools we use define and shape our thinking;
- The organization and the individual are both learning organisms. Increased attention to knowledge management highlights the need for a theory that attempts to explain the link between individual and organizational learning;
- Know-how and know-what is being supplemented with know-where (the knowledge of where to find knowledge needed just in -time) (Siemens, 2005).

According to Siemens (2005) these changes might induce the development of new theories of learning, such as *Connectivism*, and this may also lead to new forms of ICT based DE. A concrete example is provided by Thompson (2006). She argues that school education can no longer be considered an isolated phenomenon – nowadays school education highly interferes with other arenas of life, such as the work environment and post-secondary education, including higher education. Thompson suggests that compartmentalization is no longer appropriate, whether for traditional or online education and proposes to establish an integrated online educational environment.

7. Teachers Education

Many scholars (e.g. Davis, 2008; Somekh, 2008) argue that teachers are a key in the implementation of IT in education. In addition they state that the implementation of IT requires teachers to fundamentally change their beliefs about teaching and the way they teach. These changes are related to the transition from a teacher-centered towards a student-centered approach of teaching and learning. This also holds for teachers teaching in ICT based DE environments. But teachers teaching in a DE setting need additional strategies and tactics to foster the teaching and learning process.

Project VALUE (Virtual Almanch of Logo Users and Educators) is a Web-based teacher training project (Nikolova, 1997). The Web was used as a supplementary channel for delivering instructional and other resource materials to teachers, getting feedback and establishing collaboration with motivated teachers. There were integrated tools for communication and discussion (*Conference Room metaphor*), event announcement (*Message Board*), building teachers' virtual community (*Guest Book metaphor*). The dimension of change illustrated by the above project is not only a technological one. It is much broader,

concerns attitudes and culture and refers to both professional and personal level. The overall tendency of virtualization and globalization of our professional lives is sometimes in conflict with the intuitive reaction to defend ourselves from an intra-personal Internet invasion.

A virtual community model for school teachers and experts was developed under the project *Innovative Teacher - I*Teach* (<http://i-teach.fmi.uni-sofia.bg/>). The project aimed at providing a means to support teachers in their daily work and professional development in building new knowledge and skills and to motivate and help them to collaborate, share and reuse educational resources (Ratcheva, Stefanova & Nikolova, 2006). Among the main goals in teachers development was the creation of a virtual community of teachers and experts. The roles in the community are (were) divided into three layers:

- *Conceptual/Methodology Layer*. This layer includes people involved in teacher training and education activities at university level who are responsible for conceptual driving of the virtual community, including development of new curriculum and methodology for how the curriculum could be implemented. They also provide guidance and support of teachers in application of the methodologies, facilitate the work of the teachers, coordinate activities, etc.
- *Continuous Development Layer*. The main participants in this layer are the initiators, i.e. the most active teachers and students. They are responsible for the development of supporting materials for the new curriculum, following the proposed methodology and expert guidance from the members of the conceptual/methodology layer. They store the developed materials in the virtual resource center and use them to apply the new curriculum in their classes. On the base of the performed pilot implementations of the new curriculum and developed materials, some best practice resources are identified in the virtual resource center.
- *Dissemination Layer*. This layer includes all teachers involved in the proposed community of practice. They can use developed materials and best practices in their regular activities at schools. They also could join the continuous development layer. In addition, the dissemination layer is used for the evaluation of the developed and stored in the repository materials, by measuring the interest shown to different materials, and by explicitly voting how useful each one of the available materials is.

The main advantage of VLEs is their flexibility which makes possible adaptation of learning to individual needs and preferred learning modes. Flexibility calls for new roles for teachers and learners and imposes higher demands for learner's self-initiative, self-

motivation, self-control (Nikolova & Collis, 1998). The *active learner* assumption is axiomatic. The teacher has to step out of the traditional instructor's role: instead, the role of a consultant, collaborator, facilitator, becomes dominating. Offering more flexibility to the learner puts higher demands for the teacher and often requires more teacher's time and effort. The role of the teacher evolves into navigating learning in VLEs and into designing learning environments that allow more flexible learning, mediated by technology (Nikolova, 2001).

Turcsányi-Szabó emphasises that "*building communities of practice has become a major theme of educators' professional development research and practice since it enables teachers to promote collaboration, increase idea creation, solve problems in time- and cost-efficient manners, and, therefore, foster social capital*" (Turcsányi-Szabó, 2008).

8. Effectiveness of Distance Education

The fast growth of distance learning students number and the well recognised role of e-learning for education pose the need to carefully study the factors that influence student learning in an e-learning environment. After a meta-analysis of 19 experimental and quasi-experimental studies including 929 students in K-12 schools it was found that DE can be expected to result in achievement at least comparable to traditional instruction in most academic circumstances (Cavanaugh, 2001). The only exceptions are the three foreign language studies reporting that students learning with DE systems performed demonstrably lower than students learning in traditional classrooms. Generally, the meta-analysis shows that the DE programs can be used to complement, enhance, and expand education options for students, at least at intermediate, middle, and upper grades levels. Interactive DE is a vehicle (an instrument) for extending the reach of student influence into the community, as well as a means of including the family and community in a learning conversation. Since the use of interactive DE grows and expertise develops, academic gains can be expected to increase.

A case based study aiming to examine the effectiveness of virtual schooling in comparisons with conventional schooling was conducted in three conventional and six virtual secondary schools in Canada (Barker & Wendel, 2001). The effectiveness is defined as "*the degree to which the school is able to meet the differing and various expectations of both providers and users or clients*" (p.6.). It was reported that there was enough evidence that virtual schooling could provide excellent learning opportunities to all children and improve the process and content of learning. Students in conventional schools and virtual schools acquire the same curricular content but it appears to be learning different skills. For instance

the students in virtual schools showed greater improvement than their conventional school counterparts in personal responsibility, critical thinking, researching, technological competencies, learning independently, problem-solving, creative thinking, decision-making, and time management. Less improvement is observed in the academic and communication skills of listening and speaking. The students in virtual schools could rely on quick feedback, instant work records, equal opportunity to participate in “class”, increased access for special needs students, greater opportunity for parental involvement, etc. In addition – all stakeholders in the virtual schooling process (students, teachers, parents and administrators) declared that they were very satisfied with and enthusiastic about virtual schools. The most common reason for selecting a virtual program was dissatisfaction with conventional schooling. It was also found that the costs per student in virtual schools were less compared to the ones in conventional schools, e.g the cost for the school staff was between 20% and 40% less.

However virtual schooling, like classroom schooling, has had limited success in some situations (Cavanaugh, Gillan, Kromrey, Hess & Blomeyer, 2004). In an on-line environment, students may feel isolated, parents may have concerns about children’s social development, students with language difficulties may experience some disadvantage in a text heavy on-line environment, and subjects requiring physical demonstrations of skill such as music, physical education, or foreign language may not be practiced?? in a technology-mediated setting (p.5).

Roblyer (2008) points out that typically, among the students entering DE, most successful are those who have had high school achievements in a classical school environment and who are well self-organized, motivated and technology literated. She argues that “*virtual courses, like most other distance learning activities, are usually primarily text-based, which can present difficulties for students with lower levels of literacy, who are non-English speakers, or who have English as a second language*”. Roblyer also states: “*As virtual schooling plays an increasingly large role in their total education options, students will need to make the transition from "learner" to "Information Age learner" and some will need help with this transition. Since distance learning is also growing in popularity in business and industry training, the ability to learn well in virtual classrooms is becoming a "basic skill" of the future*”. and “*When the first virtual schools sought startup funding in the mid-1990's, they often cited the potential for increased access to high quality education for all students, regardless of their location or the quality of local resources. Some ten years later, it is still not clear that this promise has been fulfilled*”.

Since quality of school education is the main goal of all stakeholders, the ICT based DE, that counts on some sound pedagogical principles and theories, could be considered as one of the most important instruments for achieving this goal.

9. The Future of Distance Education

A future vision for VLEs is incorporated into the concept of *learning spaces* (Punie & Cabrera, 2006). Learning spaces are:

- *Connecting and social spaces*: Since learning is a social process, it needs to bring different actors together to share learning experiences. Learning spaces are both physical and virtual ones that favour a learner-centred learning model but connected with the other actors involved in learning and with other social networks. As such learning spaces should also link learning individuals with learning communities, organisations and even learning cities and learning regions;
- *Personal digital spaces*: Every learner should have a personal, digital learning space where all learning material is accessible; anywhere, anytime, anyway (multiple devices and media);
- *Trusted spaces*: Learning spaces should provide trust and confidence (e.g. on quality and reliability) in a world where learners are connected digitally, and where learning content is co-produced and shared;
- *Pleasant and emotional spaces*. ICT could make learning content more attractive (e.g. media-rich virtual environments and simulations) and more emotional (e.g. by connecting people);
- *Creative/flexible spaces*: Learning spaces should be creative spaces, rather than focussing exclusively on reproducing knowledge;
- *Open and reflexive spaces*: Future learning spaces would need to be open and module-based, enabling people to plug-in again whenever they can;
- *Certified spaces*: Future learning can only be different from learning today if the current accreditation systems and learning assessment systems are adapted to the requirements of the knowledge-based society. The acquisition of ICT skills, digital competence and other new skills, be it through formal or non-formal education, should be demonstrated, evaluated and also certified (see also Roblyer, in this Handbook);
- *Knowledge management systems*: The strength of most organisations lies in their

people, hence the need to share experience and knowledge amongst colleagues, within the organisation, and even across organisations.

The concept of learning spaces is built upon the learner centred educational model. The new feature is that the learners are considered not only as consumers of learning content but rather as co-producers of such content. This concept is incorporated into the new generation Web.

The emergence of the so-called *Web 2.0 revolution* is widely recognized (O'Reilly, 2005). O'Reilly and his collaborators consider Web 2.0 as a synonym of a new generation web: "*The central principle behind the success of the giants born in the Web 1.0 era who have survived to lead the Web 2.0 era appears to be this, that they have embraced the power of the web to harness collective intelligence...*". Nowadays, Internet users can collaborate via getting access also to web services, such as:

- Building digital collections and content (Wikipedia, Wikibooks, YouTube, Flickr).
- Joining and creating social networks (Linkedin, del.icio.us, MySpace, Facebook, Piczo).
- Publishing one's own journals (Blogger, RSS, LiveJournal).

We can elaborate on O'Reilly's metaphor and define *Web 2.0 Schools* as "*schools that use predominately Web 2.0 based educational applications and services in their educational activities*" (Nikolov, 2007, p.3). The Web 2.0 virtual learning environments provide opportunities for students, teachers, parents and other stakeholders to contribute to creating useful and 24/7 available educational resources (Freedman, 2006). Students can produce a new resource or edit existing ones for other students while they are learning themselves. Even the well-known computer applications, such as word processors and spreadsheets, come to a new life in the Web 2.0 world. For instance with Google Docs & Spreadsheets (<http://docs.google.com/>) one can get access to the nearest linked to Internet computer and use them for creating and sharing documents in the global Web 2.0 environment.

A lot of Web 2.0 School oriented portals providing access to web services and content for educational purposes in different school subjects are emerging, such as: Schoolforge (<http://www.schoolforge.org.uk>), Change Agency (<http://www.ed421.com/>), Web 2.0 for the Classroom Teacher (<http://www.kn.pacbell.com/wired/fil/pages/listweb20s.html>), Shambles: Education Project Asia (<http://www.shambles.net/>), Edu 2.0 (<http://www.edu20.org/>), etc.

Lee & Chan (2007) report how the power of *educational podcasting* is used to turn distance education from an "*isolating experience*" to a "*real online community connection*" (p. 99). Podcasting is a low-cost, low-barrier technology, based on Really Simple Syndication

(<http://en.wikipedia.org/wiki/RSS>). It allows audio content from user-selected sources to be automatically downloaded to a computer and later on transferred to a portable MP3 playback device for listening at a convenient time and place. In addition – podcasts could be transferred to a mobile device and listened to in an appropriate for the user period of time. Such technology could contribute to a successful implementation of mobile learning as well.

The fast growth of the new generation technologies in school education, such as the Web 2.0 technologies and mobile technologies, triggered a new wave of pedagogical research. The DE stakeholders should also use these technologies in order to harness their collective intelligence for improving the quality of education.

10. Conclusions

The enormous information overload of individuals and organizations is among the most important changes nowadays due to low cost of multimedia information production and distribution and the diversity of distribution channels available. The information overload problem is being transformed to an information overkill problem as the filtering of the great volume of information can not be easily performed and only small amounts of information can be transformed into usable knowledge. Some new technologies that target this problem are under development. Dichev, Dicheva & Fisher (2007) argue that '*the key to solving the information findability problem is a subject-based organization of information*' (p.2) and they are developing an e-learning environment which utilizes topic maps as overlay semantic structures that encode domain knowledge and connect it to learning resources, which are considered relevant to that domain. (See also http://en.wikipedia.org/wiki/Semantic_Web). The competitiveness of individuals and organizations highly depends on their ability to rapidly transform such information into applicable knowledge, which should be selectively distributed and used for just-in-time decision making and learning. The new generation of highly interactive multimedia and hypermedia learning environments foster learner-centered educational models and provide a different perspective for school education. To make use of the new opportunities offered by the ICT based DE, the educators should gradually improve the educational system as a whole. In a world with powerful instruments of producing and getting access to any kind of information at any time and any place, the knowledge structure and content as well as the skills of people, capable to effectively use this information, have to be different from the one obtained through the traditional educational system. The

developments in the technology suggest that a *re-engineering* of the education system is necessary, focusing on better integrating physical and virtual learning environments.

There are many concerns that the most important driver for the DE phenomena in schools is increasing demand rather than some advanced pedagogical principles and best practices of DE in different settings. Virtual schooling attracts mostly students who are able to learn in every learning environment and not always those who are in disadvantaged position. Still worrying is the high drop-out rate of virtual schooling. There are many cases for applying ICT based DE in a teacher-centered and material-centered learning environment. Therefore teacher education could be the major way to struggle for excellence in ICT based DE.

References

- [1] Anderson, R. (2008), Implications of the Information and Knowledge Society for Education, *In Knezek, G., Voogt, J. (Eds.). International Handbook for IT in Secondary Education*. Springer, 2008. pp. 5-22
- [2] Aston, M. (2002), The Development and Use of Indicators to Measure the Impact of ICT Use in Education in the United Kingdom and other European Countries, Proceedings of the UNESCO Consultative Workshop for *Developing Performance Indicators for ICT in Education*, 1st, Manila, the Philippines, 28-30 August 2002, <http://www2.unescobkk.org/elib/publications/ICTindicators/ICTindicators.pdf>
- [3] Barker, K., & Wendel, T. (2001). *E-learning: Studying Canada's Virtual Secondary Schools*. Society for the Advancement of Excellence in Education, Research Series #8, February, ISBN 0-9685144-6-4, <http://www.sae.ca/>
- [4] BECTA (2003). A Review of the Research Literature on the Use of Managed Learning Environments and Virtual Learning Environments in Education, and Considerations of the Implications for Schools in United Kingdom, http://www.becta.org.uk/page_documents/research/VLE_report.pdf
- [5] Bransford, J. D., Sherwood, R. D., Hasselbring, T. S., Kinzer, C. K. & Williams, S. M. (1990). Anchored instruction: Why we need it and how technology can help. In D. Nix & R. J. Spiro (Eds.), *Cognition, education, and multimedia* (pp. 115-141), Hillsdale, NJ: Erlbaum
- [6] Brooks, J. G. & Brooks, M. G. (1993). *In Search of Understanding: The Case for Constructivist Classrooms*. Alexandria, VA: Association for Supervision and Curriculum Development.
- [7] Brusilovsky, P. & Peylo, C. (2003), Adaptive and Intelligent Web-based Educational Systems, *International Journal of Artificial Intelligence in Education* 13 (2003) 156–169 IOS Press
- [8] Butcher, N., Wilson-Strydom, M. (2008), Technology and Open Learning: The Potential of Open Education Resources for K-12 Education, *In Knezek, G., Voogt, J. (Eds.). International Handbook for IT in Secondary Education*. Springer, 2008. pp. 725-746
- [9] Cavanaugh, C. (2001). The Effectiveness of Interactive Distance Education Technologies in K-12 Learning: A Meta-Analysis, *International J. of Educational Telecommunications*, 7(1), pp. 73-88
- [10] Cavanaugh, C., Gillan, K., Kromrey, J., Hess, M., Blomeyer, R. (2004). *The Effects of*

Distance Education on K–12 Student Outcomes: A Meta-Analysis, Learning Point Associates.

- [11] Davis, N. (2008), How May Teacher Learning Be Promoted For Educational Renewal with IT, In Knezek, G., Voogt, J. (Eds.). *International Handbook for IT in Secondary Education*. Springer, 2008. pp. 507-519
- [12] Dichev C. , Dicheva D., Fisher, J. (2007). Identity: How to Name It, How to Find It, *Workshop on I3: Identity, Identifiers, Identification, 16th Int. Conference on World Wide Web*, WWW 2007, May 8-12, 2007, Banff, Alberta, Canada
- [13] Dede, C. (2008), Theoretical Perspectives Influencing the use of Information Technology in Teaching and Learning, In Knezek, G., Voogt, J. (Eds.). *International Handbook for IT in Secondary Education*. Springer, 2008. pp. 43-62
- [14] Dillenbourg, P. (2000), Virtual Learning Environments, EUN Conference 2000: “Learning in the New Millennium: Bringing New Educational Strategies for Schools”, Workshop on Virtual Learning Environments, <http://tecfa.unige.ch/tecfa/publicat/dil-papers-2/Dil.7.5.18.pdf>
- [15] Delrio, C., and Dondi, C. (2008), ICT and Educational Policy in the European Region, In Knezek, G., Voogt, J. (Eds.). *International Handbook for IT in Secondary Education*. Springer, 2008. pp. 1097-1108
- [16] Downes, S.(2007), Learning Networks in Practice, in: Emerging Technologies for Learning, V.2., BECTA, UK, http://partners.becta.org.uk/page_documents/research/emerging_technologies07_chapter_2.pdf
- [17] Duffy, T. M., Cunningham, D.J. (1996). Constructivism: Implications for the design and delivery of instruction. In D. H. Jonassen (Ed.), *Handbook of Educational Communications and Technology*, pp. 170-198. New York: Simon & Schuster Macmillan.
- [18] EUN (2003), Virtual Learning Environments for European Schools. A Survey and Commentary, http://www.eun.org/etb/vle/vle_eun_feb_2003.pdf
- [19] Fernback, J. & Thompson, B. (1995) *Virtual Communities: Abort, Retry, Failure?* presented at the annual convention of the International Communication Association, Albuquerque, New Mexico. <http://www.well.com/~hhr/texts/VCCivil.html>
- [20] Freedman, T. Ed (2006). *Coming of age: an introduction to the new world wide web. Featuring case studies and how-to articles by leading practitioners in the world of education*. Terry Freedman Ltd. http://edu.blogs.com/edublogs/files/Coming_of_age.pdf
- [21] Gachev, G. Nikolova, I. (2005). An Approach for Evaluating Web-Based Collaborative Environments. In *Proceedings, KAL Workshop*, November 2005, Sofia, pp 31-38.
- [22] Hedberg, J.G. & Ping, L. C.(2004). Charting Trends for E-Learning in Asian Schools. *Distance Education, Vol. 25, No. 2*, October, pp. 199-213
- [23] Holmberg, B. (1996) On the Potential of Distance Education in the Age of Information Technology. *Journal of Universal Computer Science*, vol. 2, no. 6, pp. 484-491
- [24] Kalay, Y.(2004), Virtual Learning Environments, ITCon, V.9, <http://www.itcon.org/2004/13/>
- [25] Kay, A. (1972) A Personal Computer for Children of All Ages, in: *Proceedings of the ACM National Conference*, Boston
- [26] Kearsley, G. (1994). Minimalism (J. M. Carroll). <http://www.gwu.edu/~tip/carroll.html>, last visited on January 7th, 2007

- [27] Lee, M, Chan, A. (2007), *Reducing the Effects of Isolation and Promoting Inclusivity for Distance Learners through Podcasting*, Turkish Online Journal of Distance Education-TOJDE, ISSN 1302–6488, Volume 8, No. 1
- [28] McClintock, R. (1992a), *Power and Pedagogy: Transforming Education through Information Technology*, Institute of Learning Technologies, New York
- [29] McClintock, R. (1992b), *The Educators Manifesto: Renewing the Progressive Bond with Posterity through the Social Construction of Digital Learning Communities*, Institute for Learning Technologies, New York
- [30] Moore, M.G. (2003). Preface, in: Moore, M.G. and Anderson, W., Eds. (2003). *Handbook of distance education*. Lawrence Erlbaum Associates, Inc.
- [31] Mor, Y. Hoyles, C., Kahn, K., Noss, R. & Simpson, G. (2004). *Thinking in Progress*, Micromath Summer.
- [32] Nikolov, R. (1987) A Learning Environment in Informatics, PhD Thesis, Sofia University (in Bulgarian)
- [33] Nikolov, R. (1997). Distance Education via Internet – Education without Borders, invited paper, Proceedings of the Twenty Sixth Spring Conference of Bulgarian Mathematicians, Plovdiv, 22-25 April, pp. 53-66
- [34] Nikolov, R. (2001). *Learners in a Global Knowledge Space*, in: Norris, K., Knezek, G., Campbell, N., Nikolova, I, Nikolov, R., Schrum, S., The Issues in Online Learning, Reader (First Edition), University of North Texas, Denton, August, 2001
- [35] Nikolov, R. (2007), *Towards Web 2.0 Schools: Rethinking the Teachers Professional Development*, Proc. of IMICT 2007, Boston (accepted for publication)
- [36] Nikolov R. & Nikolova I. (1996), *A Virtual Environment for Distance Education and Training*, IFIP WG3.6 Conference "Collaborative Learning and Working with Telematics", Vienna, Sep. 2-4
- [37] Nikolov, R, Sendova, E.(1988) Can the Teachers Creativity Overcome Limited Computer Resources, *Education & Computing* 4, Elsevier, pp. 179-184
- [38] Nikolova, I (2001) Teacher development in ICT: Vision and Implementation. In H. Taylor (Ed), *Information and Communication Technologies in Education*. Boston, USA: Kluwer Academic Publishers, pp. 71-82
- [39] Nikolova, I. (1997). Towards VALUE - A Virtual Almanac for Logo Users and Educators. In *Proceedings, Eurologo'97: Learning and exploring with Logo*, Budapest, Hungary, pp. 240-248.
- [40] Nikolova, I. (1999) Reshaping Academic Practices through Multi and Hyper Media. Invited paper for ED-MEDIA'99 – World Conference on Educational Multimedia, Hypermedia and Telecommunications, Seattle, Washington, June, 1999. In *Collis, B, Oliver, R. (Eds.) Proceedings of ED-MEDIA'99, AACE, USA*. pp. 36-49.
- [41] Nikolova, I., Collis, B. (1998) Flexible Learning and Design of Instruction. *British Journal of Educational Technology*, Vol. 29/1, pp. 59-72.
- [42] O'Reilly, T (2005), *What Is Web 2.0: Design Patterns and Business Models for the Next Generation of Software*, <http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html>, last visited on January 7th, 2007
- [43] Papert, S. (1980). *Mindstorms: Children, computers, and powerful ideas*. New York: Basic Books

- [44] Papert, S. (1997), Why School Reform is Impossible, *The Journal of the Learning Sciences*, 6(4), pp. 417-427
- [45] Picciano, A. G. & Seaman, J. (2007), K-12 Online Learning: a Survey of U.S. School District Administrators, Sloan-C™, http://www.aln.org/publications/survey/pdf/K-12_Online_Learning.pdf
- [46] Powell, A & Patrick, S (2006), An International Perspective of K-12 Online Learning: A Summary of the 2006 NACOL International E-Learning Survey, North American Council for Online Learning, <http://www.nacol.org/docs/InternationalSurveyResultsSummaries.pdf>
- [47] Punie, Y. & Cabrera, M. (2006), *The Future of ICT and Learning in the Knowledge Society*, Report on a Joint DG JRC-DG EAC Workshop held in Seville, 20-21 October 2005, EC, DG JRC-IPTS, EUR 22218 EN
- [48] Ratcheva, D., Stefanova, E., Nikolova, I. (2006). A Virtual Teacher Community to facilitate professional development. *ISSEP 2006: Informatics Education – The Bridge between Using and Understanding Computers*. Proceedings of the ISSEP2007, Vilnius, Lithuania, 7-11 November 2006, ISBN 9955-680-47-4, pp.297-305
- [49] Roblyer, M. (2008), Virtual Schools: Redefining “A Place Called School”, In *Knezek, G., Voogt, J. (Eds.). International Handbook for IT in Secondary Education*. Springer, 2008. pp. 695-712
- [50] Sendova, E., Nikolova, I., Gachev G., Moneva, L (2004). *Weblabs: A Virtual laboratory for Collaborative e-learning*. In Kloos, C. D. & Pardo, A. (Eds.) *EduTech: Computer-Aided Design Meets Computer Aided Learning*, Kluwer Academic Publishers, pp.215-221
- [51] Siemens, G. (2005), *Connectivism: A Learning Theory for the Digital Age*, International Journal of Instructional Technology and Distance Learning, Vol. 2., No. 1., http://www.itdl.org/Journal/Jan_05/index.htm
- [52] Singh, H (2003), *Building Effective Blended Learning Programs*, Educational Technology, Volume 43, Number 6, Pages 51-54
- [53] Somekh, B. (2008), Factors Affecting Teacher’s Pedagogical Adoption of ICT, In *Knezek, G., Voogt, J. (Eds.). International Handbook for IT in Secondary Education*. Springer, 2008. pp. 449-460
- [54] Spiro, R. J., Feltovich, P. J., Jacobson, M. J., & Coulson, R. L. (1992). *Cognitive flexibility, constructivism, and hypertext: Random access instruction for advanced knowledge acquisition in ill-structured domains*. In: T. M. Duffy & D. H. Jonassen (Eds.), *Constructivism and the technology of instruction: A conversation* (pp. 57-76). Hillsdale, NJ: Lawrence Erlbaum Associates
- [55] Thompson, M. (2006), *Online K-12 Education: Opportunities for Collaboration with Higher Education*, Journal of Asynchronous Learning Networks, Volume 10, Issue 3, July
- [56] Turcsányi-Szabó, M. (2008), Online Professional Development of Teachers, In *Knezek, G., Voogt, J. (Eds.). International Handbook for IT in Secondary Education*. Springer, 2008. pp. 747-762
- [57] Wilson, B (1995) *Metaphors for Instruction: Why we Talk about Learning Environments*, Educational Technology, 35(5), pp. 25-30

Draft version of a chapter, published in Knezek, G., Voogt, J. (Eds.). International Handbook for IT in Secondary Education. Springer, 2008. pp. 659-674