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# Towards Web 2.0 Schools: Rethinking the Teachers Professional Development

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## **Abstract**

This paper aims at analyzing the Web 2.0 based distance education in the K-12 schools as an emerging phenomenon that catalyzes a new educational reform all over the world. Some pre-Web 2.0 best practice examples are analyzed in order to draw the main findings in the paper. The teacher's professional qualification designed to meet the new challenges is considered as a key problem for a successful penetration of this phenomenon in the schools. It is emphasized on the importance of designing a life-long teacher training strategy adapted to the new achievements in the technology enhanced learning research and the new learning theories. Building social skills and competencies appropriate to work in a Web 2.0 based learning environment and other global '*social software*' is recommended to be included both in the school curricula and the corresponding teacher development curricula. Such skills and competencies should penetrate the curricula of any life-long learning initiative dedicated to the citizens of the information society.

## **Keywords**

Technology enhanced learning, New Media, Teaching/learning strategies, Improving classroom teaching, In-service education and training, Information literacy, Best practice examples

## **INTRODUCTION**

Nowadays the school is no longer the sole and the most attractive source of information and knowledge. Quick access to unlimited sources of information is widely provided by Internet, digital and interactive TV, multimedia electronic messaging, electronic conference (asynchronous or on-line), computer-supported cooperative work systems, pay-per-view digital video programs on demand, full movies on demand, remote group computer games, generalized access to public digital libraries, topical news on demand, virtual access to real-time experiments, wikipedia, blogs, podcasts, etc. The traditional literacy has been gradually extended to a multimedia literacy related to the students' abilities for reading, writing, and communicating with digitally encoded materials - text, graphics, still and moving images, animation, sounds (Nikolov, 1997). "*Critical multimedia literacy is about all media. It is not an addition to studies of textual print literacy, it is a re-conceptualization of what literacy itself means now and in our students future lives*" (Lemke, 2005). All these developments offer a ground for a new educational reform that would better prepare the citizens to live in the information society. This reform would break the monopoly of the *print and paper based educational system* and would rely on learning environments incorporating *asynchronous space and time*,

*interactivity, and virtual reconstruction* (McClintock, 1992a).

Distance education might be considered as “*the most significant development in education in the past quarter century*” (Moore, 2003). Thompson reports that 98% of all U.S. schools are connected to the Internet and that “*it offers unprecedented opportunities for educators as well as their students to take advantage of "any time, any place, any path, any pace" e-learning to enhance their pedagogical and administrative skills in an ongoing manner*” (Thompson, 2006). 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 eLearning in the USA during the 2005-2006 school year (Powell & Patrick, 2006). Technology Enhanced Learning (TEL) and eLearning are among the main priorities of the European research- and educational programs. *Kaleidoscope*, a network of excellence in TEL, has built a research community comprising more than 1,095 researchers from 91 research units from 24 countries, plus Canada (<http://www.noe-kaleidoscope.org>). Research activities are multidisciplinary, spanning the fields of computer and social sciences and education. In the frames of Kaleidoscope the first international open archive in Technology Enhanced Learning research was established (<http://telearn.noe-kaleidoscope.org/>). The researchers could submit their research publications or videos to TeLearn and rely on better global exposure and impact of their research outcomes to a global audience of researchers and practitioners in this field. *eTwinning* (<http://www.etwinning.net>) is one of the main actions of the eLearning programme promoting school collaboration in Europe through the use of ICT. By the end of 2006 a network of 21913 schools involved in 3157 projects was established in the frames of the *eTwinning* action. The European Schoolnet (<http://www.eun.org>) is a not-for-profit consortium of 28 ministries of education in Europe that provides a number of European educational portals supporting teaching, learning and collaboration between the schools by using ICT. A substantial development in the area of Internet based distance education was observed in Bulgaria as well (Nikolova, 2003).

## **THE ADVENT OF WEB 2.0 IN SCHOOLS**

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...*”. He defines the core competencies of Web 2.0 companies:

- Services, not packaged software, with cost-effective scalability
- Control over unique, hard-to-recreate data sources that get richer as more people use them
- Trusting users as co-developers
- Harnessing collective intelligence
- Leveraging the long tail through customer self-service
- Software above the level of a single device
- Lightweight user interfaces, development models, AND business models

Such companies are: Google, Yahoo, Amazon, eBay, etc. The 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 use the O'Reilly's metaphor and define the Web 2.0 Schools as *schools that use predominately Web 2.0 based educational applications and services in their educational activities*. 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. Students can produce a new resource or edit existing ones for other students while they are learning themselves. Even the well-known PC applications, such as word processors and spreadsheets, come to a new life in the Web 2.0 world. With Google Docs & Spreadsheets (<http://docs.google.com/>) for instance you can get access to the nearest linked to Internet computer and:

- Use an online editor to format documents, spell-check and more.
- Upload Word documents, OpenOffice, RTF, HTML or text.
- Download documents to your desktop as Word, PDF and more.
- View your documents' revision history and roll back to any version.
- Invite others to share your documents by e-mail address.
- Edit documents online with whomever you choose.
- Publish documents online to the world, or to just who you choose.
- Post your documents to your blog.

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>), Edu 2.0 (<http://www.edu20.org/>), Change Agency (<http://www.ed421.com/>), Shambles: Education Project Asia (<http://www.shambles.net/>), Web 2.0 for the Classroom Teacher (<http://www.kn.pacbell.com/wired/fil/pages/listweb20s.html>), etc.

Some real experience in how the power of "*educational podcasting*" is used to turn distance education from an "*isolating experience*" to a "*real online community connection*" is reported in (Lee & Chan, 2007). 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 expansion of mobile phone use to younger age groups began in Finland in 1997 (Oksman, 2006). In 2002, over 90 percent of Finns aged 15 to 19 had a mobile phone. For several years, Finnish mobile phone penetration rates were the highest in the world. A study focused on recent trends in mobile communication, communities in the Internet and visual communication, especially picture weblogs, usage of MMS and mobile video, showed that the young people tend to "*consider mobile literacy and other ICT skills as important for citizens of the information society*" and that "*in order to do well in studies and succeed at work, the individual must master and*

*acquire the most recent technology*". The mobile has become an instrument that teens use to define their personal space in relationship to friends and parents. According to the Wireless Kids project, in the UK, teenagers see the Internet as highly useful for acquiring information, but preferred the mobile to the Internet in basic communication: *"I can take my mobile anywhere I want, unlike the Internet you have to go there and sit down"*.

## **SOME PRE-WEB 2.0 SCHOOL EXPERIENCE**

The Centre of Information Society Technologies has been involved in a several projects and activities which could be further developed in order to reach the requirements of the Web 2.0 School applications. The Centre plans to carefully analyze their features and build a strategy for their continuation as valuable Web 2.0 virtual learning environments.

A Web-based informatics teacher training project was conducted in the frames of the VALUE project in Bulgaria (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 is not only a technological one. It is much broader, concerns attitudes and a culture and refers to both professional and personal level. It was observed that the overall tendency of virtualization and globalization of teachers' professional lives is in many cases in conflict with their intuitive reaction to defend themselves from an intra-personal Internet invasion. On the other hand, armed with the modern technologies, we were able to establish a meaningful context for challenging and rewarding professional activities within an environment, which is still suffering from social, economic and organizational deficiencies. The need of building specialized competency in social skills by informatics teachers was recognized as well.

Similar experiment for training primary and lower secondary school teachers in informatics by using Comenius Logo (Nikolova, Sendova, Kurtev & Ivanov, 2000) was carried out in the frames of the NETLogo Project (Sampson, Patsouras & Terzopoulos, 1999). A virtual community model for K-12 teachers and experts as 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, is presented in (Ratcheva, Stefanova & Nikolova, 2006). The roles in the community are divided into three layers, with respect to the activities and related to them categories of people. Usually, most of the existing teachers' communities are formed around a web site that allows members to communicate by using forums or submit and download lessons' plans. All activities are supported by an integrated electronic platform with embedded communication collaboration and learning tools. However it is essential that a virtual community should follow the recent information technologies developments in order to promote their professional development, as well as to build skills in global communication, collaboration, share and reuse of educational resources.

The Sofia University internal project named *Elica* (<http://www.elica.net/>) has received a substantial international recognition among the mathematics educators. Some of the most important virtues of *Elica* are that an international virtual network of its users has been established; *Elica* has been used for in-service teachers training for more than 3 years; a virtual community of teachers using *Elica* in their educational practice has been established; *Elica* is free for download. *Elica*, as a general programming environment, was chosen as a development tool of an active learning environment for learning of stereometry in the frames of DALEST (<http://www.ucy.ac.cy/dalest/>) project (Boychev, Chehlarova & Sendova, 2007).

The Web Assignment Database (<http://wad.fmi.uni-sofia.bg/wad/>) was created in the frames of the multinational European project '*Innovative Didactics via Web Based Learning - IDWBL*'. This is a database which provides opportunities for building a community of teachers. The database helps them to communicate and to develop and retrieve web-based assignments for teaching and learning in several subject areas. Teachers and learners who are registered as users have access to a whole range of functionalities, such as: adapting assignments, allocating assignments to students, creating products, giving and receiving feedback on assignments developed by colleagues and rating learner's products. Some of the assignments emphasize on the importance of teaching students (and teachers) in *soft skills* in order to be prepared for the challenges of the information society.

The *Info ReDis* project (<http://www-it.fmi.uni-sofia.bg/RedisInfo/>) aims at establishing a Web based training for the purposes of full re-socialisation of disabled persons. The project goals are to implement (as part of the rehabilitation process) a sustainable Web based system for re-qualification of such people in the area of ICT. The Internet connection makes it possible for disabled people to work and establish social contacts. A system of medical supervision is envisaged in order to monitor the trainees' health state during the healing process and to prevent possible health state deterioration by the work overload. Some adjustment of the training model for the period after rehabilitation is envisaged as well.

An example of applying some innovative instructional strategy in a web based learning environment created in the frames of the European project *WebLabs*, is given in (Mor, Hoyles, Kahn, Noss & Simpson, 2004; Sendova, Nikolova, Gachev & Moneva, 2004). The *WebLabs* virtual environment provides the opportunity for *enhancing the scientist in the learner*. The students are involved in an international research project. They develop an understanding of mathematics as a science in which formulating hypotheses, carrying out experiments, solving open problems is its essence. The students are partners in a research process and can influence both the development of the computer environment and the design of the educational activities. They can communicate among themselves, with teachers and researchers both locally and globally. An important element for a good learning is the students' motivation. The teacher is seen as a facilitator and a guide in a discovery process. Children are faced with a typical problem while trying to learn collaboratively over distance – the language problem. In an attempt to overcome it, they reached the idea of designing a graphical scripting language for visual programming. During this communication they acquired specific social experience and were 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.

The objective of the Diogene project is to design, implement and evaluate with real users an innovative training Web brokering environment for ICT individual training based upon a domain-independent platform (Capuano, et al, 2005). The virtual learning environment is able to support learners during the whole cycle of their training, from the definition of learning objectives to the assessment of results through the construction of custom self-adaptive courses. The system uses several state-of-the-art technologies such as: metadata and ontologies for knowledge manipulation, fuzzy learner modelling, intelligent course tailoring, co-operative and online training support. Besides, it includes a set of innovative features such as: dynamic learning strategies, Semantic Web openness, Web services for Learning Object handling and property rights management, curriculum vitae generation and searching facilities, free-lance teachers support, assisted learning objectives definition. These characteristics make the system very close to the Web 2.0 main requirements and could be used for ad-hoc generation of learning materials.

Some directions of refining the above mentioned Web applications in order to upgrade them to real Web 2.0 educational services could be found in the O'Reilly's recommendations (O'Reilly, 2005). He points out for instance that while using Google you need a competency to work with databases, which is not typical for the current web browsers. Without the ability to collect and manage the data, the software is of little use – *“the value of the software is proportional to the scale and dynamism of the data it helps to manage”*. Such software is often referred to as *“infoware”* rather than *“merely software”*. O'Reilly defines some lessons of Web 2.0 software, such as: *“leverage customer-self service and algorithmic data management to reach out to the entire web, to the edges and not just the center, to the long tail and not just the head”*; *“the service automatically gets better the more people use it”*; *“network effects from user contributions are the key to market dominance in the Web 2.0 era”*; *“Web 2.0 is harnessing collective intelligence, turning the web into a kind of global brain”*.

## **THE NEED OF A NEW PEDAGOGY**

Barker & Wendel point out that there is a *small body of research relevant to today's conditions that can serve to guide instructors, planners, or developers* (Barker & Wendel, 2001). The educators and technologists tempt to apply or adapt findings from studies of K–12 classroom learning or adult distance learning, but K–12 distance education is fundamentally unique. The researchers should help also decision makers to answer a lot of crucial for the K-12 distance education questions in order to make it possible that *the power of e-learning be moved from bright promise to best practice*

The basic unit of the current school space is the classroom, where a teacher teaches about 25 students. The basic time units of such schools are: school period, school day, and school year. McClintock considers the existing schools as *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*. According to McClintock we are at the edge of a new ICT driven educational reform based on three key factors - asynchronous space and

time, responsive environments, and virtual reconstruction, which can *powerfully transform the way schools work* (McClintock, 1992a):

- *asynchronous space and time* - the ability of people who are not synchronized in the same place at the same time, to communicate easily with each other in a variety of responsive ways.
- *responsive environments* - the ability to endow spaces and periods with an electronic responsiveness to the particular people in them, and adapting the environments to the needs of their particular users.
- *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, structural changes in buildings.

The current distance education is based on large web-based 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 have to construct their own knowledge, to study individually according to their skills, interests, preferences and cognitive characteristics, to *learn how to learn*. Students can control their learning process, work in a team with other students, take part in discussions, and search for effectiveness of the learning. *Co-operative learning* dominates over *competitive learning*. The student works in a dynamic and interactive multimedia learning environment where aside from the tutor and the other students s/he can communicate and work with his/her virtual friends all over the world. When working in *flexible groupings, across ages and locations* students can interact according to their interests, needs, and curiosities and *...learning in the course of shared projects, become commonplace features of educational work, cooperation becomes the prime motivator* (McClintock, 1992b). Similarly to the classroom metaphor the learning environment metaphor gives emphasis to the *place* or *space* where learning occurs. The metaphor of constructivist learning environment emphasizes on peer group of learners collaboration and it could be defined 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). A future vision of learning is incorporated into the concept of *learning spaces* that embed a learner centered educational model and the learners are considered both as consumers of learning content and co-producers of such content (Punie & Cabrera, 2006). Learning spaces are:

- *connecting and social spaces* – to bring different actors together to share learning experiences and to link learning individuals with learning communities, organizations and even learning cities and learning regions;
- *personal digital spaces* - where all learning material is accessible anywhere, anytime, anyway via multiple devices and media;
- *trusted spaces* - provide trust and confidence when learning content is co-produced and shared.
- *pleasant and emotional spaces*;
- *creative/flexible spaces*
- *open and reflexive spaces* - enabling people to plug-in whenever they can.
- *certified spaces* - the skills and competence acquired either through formal or non-formal education, should be demonstrated, evaluated and also certified;
- *knowledge management systems* – support sharing of experience and knowledge within an organization and across organizations.

When designing instructional environments the educators mostly refer to the three most popular learning theories: *behaviorism, cognitivism, and constructivism*, which

were developed in a time when learning was not impacted through technology (Siemens, 2005). Siemens emphasize on some significant trends in learning that make most of the learning theories obsolete. He points out 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 understanding of where to find knowledge needed). He defines a new learning theory named “*connectivism*”. Some of the basic principles behind this theory are as follows: *“Learning and knowledge rests in diversity of opinions; Learning is a process of connecting specialized nodes or information sources; Learning may reside in non-human appliances; Capacity to know more is more critical than what is currently known; Nurturing and maintaining connections is needed to facilitate continual learning; Ability to see connections between fields, ideas, and concepts is a core skill; Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities; Decision-making is itself a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision”*.

## **QUALIFICATION OF THE WEB 2.0 SCHOOL TEACHERS**

The teachers are among the main actors that are involved in process of *school re-engineering* and the corresponding educational change. According to Fullan continuous development of all teachers and the school reform are interrelated (Fullan, 1991). He states that the educational change *...involves learning to do something new, and interaction is the primary basis for social learning. New meanings, new behaviors, new skills and new beliefs depend significantly on whether teachers are working as isolated individuals or are exchanging ideas, support and positive feelings about their work*. Teachers must know the most current research and practice which can be used effectively to match particular teaching procedures to children with particular needs. Friedman has compiled a very useful Web 2.0 Schools teachers oriented electronic book, which contains rich of expertise and experience papers of a number of leading-edge Web 2.0 in education practitioners (Freedman, Ed, 2006). He says: *“The web is, and always has been, an exciting place for education in terms of the possibilities it offers for research and collaboration. Now, it is even more exciting, with the appearance and development of new tools which have become collectively known as “Web 2.0”*.

The TENCompetence project (<http://www.tencompetence.org/>) aims at supporting individuals, groups and organizations in Europe in lifelong competence development by establishing the most appropriate technical and organizational infrastructure, using open source standards-based, sustainable and innovative technology. The freely available infrastructure will support the creation and management of networks of individuals, teams and organizations in Europe who are actively involved in the various occupations and domains of knowledge. These *'learning networks'* will support the lifelong competency development of the participants from the basic levels of proficiency up to the highest levels of excellence. The network consists of learners, educational institutes, libraries, publishers, domain specific vendors, employers, associations, and all others who deliver services or products in the specific field. A pilot experiment for lifelong competence development in ICT-enhanced (soft) skills based on the methodology derived in this project and the training strategy derived

from the *I\*Teach* project (Stefanova, Sendova, Nikolova, N, Nikolova, I., 2007) is in its initial period of design (Stefanov, Naskinova & Nikolov, 2007).

## CONCLUSION

The emergence of Web 2.0 Schools is a world-wide phenomenon. The educators should work on, in parallel with the Web 2.0 software application development, a large scale of life-long learning activities for building new competency of teachers, students and all citizens of the information society.

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## REFERENCES

1. Barker, K., & Wendel, T. (2001). *E-learning: Studying Canada's Virtual Secondary Schools*. Kelowna, BC, Society for the Advancement of Excellence in Education.
2. Boytchev, P., Chehlarova, T. & Sendova, J. (2007), *Virtual Reality vs Real Virtuality in Mathematics Teaching and Learning*, Proc. of the IMICT 2007 Conference, Boston
3. Capuano N., at al. (2005) *A Virtual Organisation for e-Learning*, Proc. of the Kaleidoscope Learning GRID Workshop, Napoli, March 14.
4. 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
5. Fullan, M. (1991) *The new meaning of educational change* (2nd ed.). New York, Teachers College Press
6. 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
7. Lemke, J. (2005), *Towards Critical Multimedia Literacy: Technology, Research, and Politics*, in: McKenna, M., Reinking, D., Labbo, L. & Kieffer, R. Erlbaum (2005), *Handbook of Literacy & Technology*, LEA Publishing
8. McClintock, R. (1992a), *Power and Pedagogy: Transforming Education through Information Technology*, Institute of Learning Technologies, New York
9. 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
10. Moore, M.G. (2003). Preface, in: Moore, M.G. and Anderson, W., Eds. (2003). *Handbook of distance education*. Lawrence Erlbaum Associates, Inc.
11. Mor, Y. Hoyles, C., Kahn, K., Noss, R. & Simpson, G. (2004). *Thinking in Progress*, Micromath Summer.
12. 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
13. 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.

14. Nikolova, I., Sendova, E., Kurtev, I., Ivanov, I (2000), *NETLogo: a Web-Based Course for Self-Learning of Teachers in Logo*, Invited Paper, Proc. of the 29<sup>th</sup> Spring Conference of the Bulgarian Mathematicians, pp 137-148.
15. Nikolova, I. (2003). *E-education in Bulgaria*. In *2003 Annual E-Readiness Report*. Center for Study of Democracy, Sofia, Bulgaria.
16. Oksman, V. (2006). *Young People and Seniors in Finnish 'Mobile Information Society'*, Journal of Interactive Media in Education, No. 2, November
17. O'Reilly, T (2005), *What Is Web 2.0: Design Patterns and Business Models for the Next Generation of Software*, O'Reily Net
18. Powell, A & Patrick, S (2006), *An International Perspective of K-12 Online Learning: A Summary of the 2006 NACOL Intern. E-Learning Survey*, NACOL
19. 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
20. Ratcheva, D., Stefanova, E., Nikolova, I. (2006). *A Virtual Teacher Community to facilitate professional development*. Proc. of ISSEP 2006, Vilnius, Lithuania.
21. Sampson, D., Patsouras, P. & Terzopoulos, V.. (1999). *NETLogo: The European Educational Interactive Site*. In Nikolov, Sendova, Nikolova, Derzhanski (Eds.) Proc. of EUROLOGO'99, Sofia, Bulgaria.
22. 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
23. Stefanova, E., Sendova, E., Nikolova, N, Nikolova, I.(2007), *When I\*Teach means I\*learn – implementing a new methodology for building up ICT-enhanced skills*, Proc. of the IMICT 2007, Boston
24. Siemens, G. (2005), *Connectivism: A Learning Theory for the Digital Age*, Intern. Journal of Instructional Technology and Distance Learning, V. 2. N. 1.
25. Stefanov, K., Naskinova, I. & Nikolov, R. (2007), *ICT-enhanced Teacher training for Lifelong Competence Development*, Proc. of IMICT 2007, Boston
26. Thompson, M. (2006), *Online K-12 Education: Opportunities for Collaboration with Higher Education*, Journal of Asynchronous Learning Networks, V. 10, N. 3
27. Wilson, B (1995) *Metaphors for Instruction: Why we Talk about Learning Environments*, Educational Technology, 35(5), pp. 25-30

## Biography



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