Challenges of Global eLearning

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CONTENTS

PREFACE

This publication contains selected full papers presented in the International Workshop "Ubiquitous ICT for sustainable education and cultural literacy", held in Hämeenlinna, Finland, 6–7 October 2008. The summary proceedings of the workshop have been published by the University of Tampere, German-Jordanian University and the Finnish National Commission for UNESCO in 2009 at: http://www.minedu.fi/OPM/Kansainvaeliset_asiat/ kansainvaeliset_jaerjestoet/unesco/suomen_unesco-toimikunta/sutjulkaisuja?lang=fi

The aim of these papers is to advance education for better technological and cultural literacy in the global context; identify the potential of ICT to advance and improve education; share knowledge and best practices about successful policies in global education; create venues of collaboration; and consolidate responsible communities for multi-literacies.

The SECL workshop was a continuing effort of academics representing consortium institutions from Finland, Germany, Sweden and Jordan and other countries collaborating on an EU Tempus funded project. The main objective of the project is to advance the frontiers of knowledge in ICT education as a core driver for Jordan national prosperity. The academics envision a collaborative atmosphere among Jordan and EU institutions for advanced teaching, applied research, staff/student exchange, and development for better quality of ICT education and relevance knowledge in a socioeconomic development context.

The contributions of this publication include experts of e-learning and communication in global educational contexts, who come from Sweden, Germany, China and Finland. The articles reflect a wide variety of current issues surrounding these themes.

The contributions also reflect the activities of the UNESCO Chair in Global e-Learning of building Global University System (GUS). The report is a product of a series of collected efforts from academic research expertise put together with international leaders to better understand challenges in an era of global education and cultural dialogue. The report provides findings and thoughts that could assist in enhancing mutual understanding among nations, and in building communities that will collectively lead to sustainable education in the global context. Our findings may be used to guide the efforts of governments and policies leading to a future success for better cultural understanding.

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GLOBAL KNOWLEDGE SOCIETY AND COMMUNICATION POLICY

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ABSTRACT

The concept of digital literacy in a broad sense is a way of thinking but it can also be understood as complementary to the concept of media education and even synonymous with media literacy. Digital literacy as media literacy aims to develop both critical understanding of and active participation in the media. Digital and media literacy is about developing people's critical and creative abilities. Using a computer requires diverse and complex previous knowledge. It also introduces the individual and humanity to new contexts, which demands mental, intellectual, profound and complex changes. In essence, digital literacy is a complicated process that consists of acquiring a new tekne, ability of art or craft. Creativity and culture become essential raw materials for the knowledge economy.The Social Web refers to an open global distributed data sharing network similar to today's World Wide Web, except instead of linking documents, the Social Web will link people, organizations, and concepts. In an intercultural world communication necessarily mediates different values and cultural behaviours. Great civilizations and cultures have very different patterns of communication and use different senses in a different way. In consequence, if a truly global information society is to be created, more attention should be given to the diversity of cultures and the co-existence of different civilizations and cultures. The UN Alliance of Civilizations (AoC) Rapid Response Media mechanism, in close cooperation with UNESCO, is promoting these goals.

Keywords: media literacy, digital competence, critical thinking, UN Alliance of Civilizations, UNESCO, European Union

INTRODUCTION

Globalisation is consolidated by the extraordinary invasion of education and learning by new technologies, especially the Internet. The development of communication and information technologies makes it possible for distance teaching institutions to strengthen their position in the educational landscape. They also pave the way for lifelong education for all and at the same time are spreading the traditional universities, more and more of which use distance teaching methods in their activities, thereby making the distinction between the two types of institutions virtually meaningless. There are an increasing number of university networks of this kind all over the world, and the use of computers in the learning process, access to the Internet by students as a vehicle for self-directed learning, educational broadcasting and video-conferencing are all being stepped by.

Virtual education in Europe has mainly taking place within national level so far and there is not much transnational collaboration yet. National consortia with centre of expertise has been formed in many countries (France, the Netherlands, Finland, etc) while some single e-universities and project-based national initiatives also exist. Public-private partnerships are also developing and there are new providers of content from corporate and media linked sources. The issues of quality assurance and accreditation as well as international strategic alliances are widely discussed.

In Finland, the following progress has been made in recent years in introducing e-learning to higher education:

1. Changes in management: Earlier the leadership of the university gave orders to departments and faculties to make progress in applying e-learning in their work. The solution then was further training of the faculty members. Now there are strategic services to the universities to have the departmental level involved. This middle-out approach involves the operative directors of departments and faculties.

2. The trend is to promote cooperation between the best research and teaching universities so that materials of high quality will be available to all. A European learning portal between universities is being constructed. In addition to the materials also tools for teaching are being developed. For example, questionnaires on how to start e-learning courses and quality instructions are well developed. These e-learning teachers' skills are developed especially in the Universities of Applied Sciences. These skills cross traditional boundaries between disciplines. A key requirement for participation in e-learning teams is the ability to work effectively in a team whose members may have very different skills and backgrounds. The skills depend on the goals and nature of the training and the specific activities it entails. Thus virtual training programmes, with a strong emphasis on digital learning materials involve a different set of activities and competencies than learning processes, where the emphasis is on the teacher/tutor (Vainio – Listemaa 2004).

3. Common support structures and credit system is being developed between selected European universities which would guarantee mobility and operative infrastructures. Students of any of the participating universities could participate in research-based education. Also search engines for the courses are being developed.

The introduction of e-learning requires also new competencies. A competency is an area of knowledge or skill that is critical for producing key outputs. The competencies can be grouped into generic categories such as general, management, distribution method,

and presentation method which help illustrate the relationship among certain competencies.

Transnational education is not necessarily international in the sense that this term has been used before in the context of international education. Courses and learning materials and environment are simply offered beyond national borders. However, a university is more than a library of courses. It is still the college and the professional faculty who can give the quality guarantee to credits and credentials, degrees and diplomas. Governments will have their responsibility in quality assurance especially in courses delivered from non-accredited institutions from abroad.

The quality assurance for virtual education can follow external and internal models. The external models include multi-lateral agreements, accreditation, licensing, kite-marks, and consortia arrangements. The internal models include codes of practice and quality, and management systems. The assessment of on-line universities is often accompanied by three principles. First, the institution must demonstrate how it will achieve its goals, particularly student learning goals, and maintain high standard of quality in doing so. Goals must be stated which are specific and assessable. Second, the assessment should provide assurance that standards of quality are successfully maintained at an appropriate level regardless of the medium of the course or the methods of instruction adopted. This is a concern that students have a reasonable assurance that the course offerings they believe they are taking, based on public descriptions, are accurate regardless of where or under what format the course is offered. Third, the responsibility for the conduct of assessment should be appropriately delegated and shared.

The philosophy of e-learning focuses on the individual learner although it recognizes that most learning is social. In the past training has organized itself much for the convenience and needs of instructors, institutions, and bureaucracies. Now eLearning is the convergence learning and networks, the Internet. New university systems are being developed to new global needs (Utsumi – Varis – Knight – Method – Pelton 2001). The experience and critical function of the traditional universities is central in the efforts to create new e-learning environments.

Open educational resources (OER) are an Internet empowered worldwide community effort to create an education commons. The term "open educational resources" was first adopted at UNESCO's 2002 Forum on the Impact of Open Courseware for Higher Education in Developing Countries funded by the William and Flora Hewlett Foundation. Open educational resources are educational materials and resources offered freely and openly for anyone to use and under some licenses to re-mix, improve and redistribute. Open educational resources include:

- *Learning content*: full courses, course materials, content modules, learning objects, collections, and journals.
- *Tools*: Software to support the creation, delivery, use and improvement of open learning content including searching and organization of content, content and learning management systems, content development tools, and on-line learning communities.
- *Implementation resources*: Intellectual property licenses to promote open publishing of materials, design-principles, and localization of content.

According to the UNESCO International Institute for Educational Planning higher education institutions worldwide face significant challenges related to providing increased access, while containing or reducing costs. Meeting increasing and increasingly varied demand for quality higher education is an important consideration in policy debate and institutional development in many countries. New developments in higher education – from virtual universities and cross-border education to e-learning, blended learning and open educational resources – all speak to the efforts on the part of the traditional higher education community, as well as new providers, to address the challenges they face in increasing provision. (Unesco International Institute for Educational Planning 2005)

The UNESCO open source movement has potential for higher education. Higher education is based upon a collegial sharing of information and new discoveries through the peer-reviewed academic publication process, which supports the sharing of knowledge. The development of the Internet and Linux operating system "emerged from professionals – inside and outside of higher education – who support open-source values and processes.

The term, "Open Educational Resources", was originally defined by UNESCO as follows as the open provision of educational resources, enabled by information and communication technologies, for consultation, use and adaptation by a community of users for non-commercial purposes. In UNESCO´s view, open source courseware, whether full course materials or course elements, constitutes an important resource to higher education institutions, teaching staff and learners. However, if there is little or no awareness of availability, open educational resources cannot be exploited, and even with awareness of availability, there are challenges and barriers to their effective use. Raising awareness and supporting informed discussion and debate can contribute to promoting informed decision making on the part of current and potential users and providers of openly available course content.

The new literacies can be approached as functional literacies in the same way as traditional reading, writing and calculating. The new abilities are believed to have a strong correlation with the traditional ones but in fact seem to do so much less than expected (Aunion 2009). The evaluation tools are quite advanced in assessment of access (MeAC 2007) and information literacy competence standards (ACRL 2000), for example. But the assessment of media and digital literacy still requires as lot of research work.

In a broad sense the concept of digital literacy is a way of thinking but it can also be understood as complementary to the concept of media education and even synonymous with media literacy. Digital literacy as media literacy aims to develop both critical understanding of and active participation in the media. Digital and media literacy is about developing people's critical and creative abilities. Using a computer requires diverse and complex previous knowledge. It also introduces the individual and humanity to new contexts, which demands mental, intellectual, profound and complex changes. In essence, digital literacy is a complicated process that consists of acquiring a new tekne, ability of art or craft. Creativity and culture become essential raw materials for the knowledge economy (Varis 2008).

DIGITAL LITERACY

It is widely understood that the most important skills of the future would be communication skills. Today everyone is able to access vast amounts of data without a mediator. Critical thinking skills are needed as a productive and positive activity. Critical thinkers see the future as open and malleable, not as closed and fixed. They are aware of the diversity of values, behaviours, social structures, and artistic forms in the world. Critical thinking is a process, not an outcome, and it is emotive as well as rational.

In my understanding we face three kinds of problems. First we have to try to understand what is the learning process of becoming literate and what does communication competence and media skills mean in the information society. Second, we have to analyse the increasing neo-illiteracy. Third, we should discuss of what kind of skills we should give to the citizens now as compared to the earlier skills of writing and reading.

In an intercultural world communication necessarily mediates different values and cultural behaviours. Great civilizations and cultures have very different patterns of communication and use different senses in a different way. In consequence, if a truly global information society is to be created, more attention should be given to the diversity of cultures and the co-existence of different civilizations and cultures.

Media literacy has been defined as the ability to access, analyze, evaluate, and communicate messages in a wide variety of forms. Media literacy is a concept whose broad definition and range of applications lead to diverse approaches, creating some intriguing conflicts and tensions. Educators and scholars with disciplinary backgrounds in media studies, the fine and performing arts, history, psychology and sociology, education, and literary analysis each may vigorously defend one's own understanding of what it means to access, analyze, evaluate, or create media texts without a full awareness of the extent of complexity, depth or integrity of various other approaches (Hobbs 1998).

The concept of digital literacy in a broad sense is a way of thinking but it can also be understood as complementary to the concept of media education and even synonymous with media literacy. Digital literacy as media literacy aims to develop both critical understanding of and active participation in the media. In the discussions in UNESCO Communication and Information Sector, for example, digital literacy is understood to enable people to interpret and make informed judgements as users of information supports and sources and it also enables them to become producers of media in their own right. Digital and media literacy is about developing people's critical and creative abilities.

According to José Manuel Pérez Tornero digital literacy is not just a simple operative and technical consciousness that is made up of nothing more than technical knowledge. Digital literacy is the complex acquisition process of an individual of humanity combined with their abilities and intellectual competencies (perceptive, cognitive, emotive) and practical competencies (physiological and motor). In Pérez's view these correspond to the technological transformation of the last decades in the twentieth century – the technological change of the Information Society.

To reduce digital literacy exclusively to the skills of using a computer is a crude simplification and a loss in meaning. Using a computer requires diverse and complex previous knowledge. It also introduces the individual and humanity to new contexts, which demands mental, intellectual, profound and complex changes. In essence, digital literacy

is a complicated process that consists of acquiring a new tekne. This Greek term means the ability of art or craft by an individual or humanity. According to Pérez we are facing the transformation of the most profound tekne that humanity has ever experienced (Pérez Tornero 2004).

The challenges to peace and open, multicultural communication can be characterized by the transition from an industrial society to an information society with the need of digital competences. The dynamics of globalization, mobility and pluralism result in a multicultural world. A higher degree of individual flexibility in combination with the need for tolerance and responsibility are connected to the demand for sustainable development. The promotion of higher quality and equal educational opportunities become central issues of educational institutions.

The study of complexity has brought science closer than ever to art, Knowledge has gone through a cycle from non-specialism to specialism, and now back to interdisciplinarity, even transdisciplinarity. Art deals with the sensual world (media as the extension of senses) and the holistic concept of human being. Traditional knowledge has been disciplinary based although increasingly interdisciplinary. In the vocational field knowledge is also contextual and needs to be created in application - learning by doing. This also reflects local and regional realities. The Western philosophy is characterized by analytical, scientific, objective, rational and critical thinking while the Eastern approach is characterized by synthesis, literature and art with a subjective and emotional thinking. Both cannot and should not dominate other, but should have close dialogues between them. In a sense, many of the basic issues where already discussed in ancient Greece by Socrates, Plato and Aristotle. Aristotle´s "Poetics" is of particular importance to understand the balance between different senses of the human being and the combination of sound, drama, and text like in modern multimedia. Also Aristotle´s definition of rhetoric as the faculty of discovering in any given case the available means of persuasion is a relevant approach to analyse the influence of modern media.

In order to learn new technologies and become digitally literate new forms of learning paths have to be developed utilizing all forms of learning, especially at work and non-formal environments. At the same time special attention should be given to teacher education in information and communication skills and competences. The period of transition that we are now living differs from the periods of change of older dominant media. Traditional print and electronic media were introduced within a period of reasonable length and when we moved to the active use of a new form of communication, we could also have a rough estimation of the economic and social impacts of it, and train new professionals for the media and support people for the institutions. Now different forms of communication and technologies integrate and converge with a speed that hardly anyone has the time or ability to assess all of the consequences, real possibilities, or problems. In a positive sense, people may be able to speak more directly to each other without former restrictions.

The cultural dimension in the communication and technology applications bring also the dimension of emotions and affection and the spirit of sharing and caring to the process. The social dimension require inclusive policies. Internet does not automatically promote social understanding and integration. In an intercultural world communication necessarily mediates different values and cultural behaviours. Great civilizations and cultures have very different patterns of communication and use different senses in a different way. In

consequence, if a truly global information society is to be created, more attention should be given to the diversity of cultures and the co-existence of different civilizations and cultures.

The European Union Digital Literacy Expert Group proposed in 2007 concrete measures to evaluate and promote digital literacy. The Group concluded in 2008 that connectedness in the digital world is increasingly becoming integrated with other forms of social and societal interaction. Questions of digital and media literacy and e-inclusion can no longer be artificially separated from wider questions of social inclusion or engaged citizenship. As 'quality of use' becomes a dominant theme, it will be necessary to develop appropriate criteria, evaluation methodologies and benchmarks that can be used effectively to target resources to areas of need and to measure impact and value for money.

The Group recommended to develop and use appropriate evaluation and impact assessment frameworks including more socioeconomic background variables and more indicators related to motivation, critical thinking and quality of use. It also supported research leading to the development of more sophisticated evaluation and benchmarking tools for digital and media literacy programmes, and critical academic research.

Our study "Current trends and approaches to media literacy in Europe" in 2008 pointed out that the new digital technologies present unprecedented opportunities for far wider participation in the continuing development of Europe's cultural heritage and civil traditions in a global context. At the same time however, these technologies offer profitable opportunities for misinformation, unwanted surveillance, abuse of the vulnerable and infantilization of public discourse. The rapid development of digital technologies has thus made more urgent an issue that has been pressing for some time: the need for European citizens to fully understand the means by which information, ideas and opinions are now created, circulated and shared in modern societies: in other words, for a media literate population.

Promoting media literacy among European citizens has become a **strategic and integrationist objective** for the whole of Europe. A fundamental requirement for the promotion of this new capacity is to have a suitable model for media literacy, and to know all its dimensions, its strategic value and the specific benefits that it can bring to the development of information society in Europe. The question facing the European Commission, therefore, is what can be offered at Commission level that will add value and encouragement to National efforts, diverse as these are. Using this model, we will describe the existing and possible approaches to media literacy and their implications for a policy of promotion and support.

The skills related to media literacy can be summarised in four areas of ability: *access, analysis, evaluation* and *creative production*. All of these skills boost aspects of personal development: *consciousness, critical thinking* and *problem-solving abilities*.

When considering other elements that help to define the field of media literacy conceptually and thematically, one must remember that it is the result of a process of learning (and teaching) in any given context, but particularly in formal, informal, social, family and media settings. This multi-contextual process leads to the acquisition of specific abilities and competences, in addition to attitudes and values. This process is known as *media education*.

Media literacy should not be treated as an isolated or independent skill. On the con-

trary, it is a skill that involves and encompasses other skills and forms of literacy: ***reading and writing literacy, audiovisual literacy*** (often referred to as image or visual literacy) and ***digital or information literacy***.

Furthermore, media literacy is a necessary part of ***active citizenship*** and is key to the full development of ***freedom of expression*** and the ***right to information***. It is therefore an essential part of ***participative democracy*** 29 and ***intercultural dialogue***.

It is convenient to develop with greater precision the different components of the media literacy and digital literacy abilities. We have distinguished between operative, cognitive, and social abilities:

Operative or technical abilities – that is, the ones related to the technical devices – include capacities related to the comprehension and use of these instruments, as well as others that are developed in order to adapt these tools to the specific users and their needs.

However, due to their very nature, technical abilities include some aspects related to certain decoding capacities (especially interfaces) and of personal appropriation – for specific ends – of the functionalities – and of the interfaces, that media tools have. From this point of view, they could to some extent be integrated in the cognitive field. However, given their relative simplicity, we prefer to see these as belonging to the operative field.

Cognitive abilities, include capacities related to the production of meaning that affect media texts (messages) and their signification. In general, they are the abilities of capturing, assimilating and producing information; they include also the use of this information for generating outlines and models of comprehension that allow to obtain an appropriate diagnosis of the external environment and to use the information obtained for strategies oriented by individuals' actions: problem-solving, strategies of creation and production of meaning, etc.

Finally, **communicative and social abilities** are the result of applying technical and cognitive abilities in the development of communication and social relations. These abilities allow possibilities that range from a simple contact to the creation of complex cooperation and collaboration strategies that use media tools as their base.

Another relevant summary has been given by Henry Jenkings and his colleagues for the Macarthur Foundation (2007). They found that according to a recent study from the Pew Internet & American Life project (Lenhardt & Madden, 2005), more than one-half of all teens have created media content, and roughly one third of teens who use the Internet have shared content they produced. In many cases, these teens are actively involved in what we are calling *participatory cultures*. According to them a participatory culture is a culture with relatively low barriers to artistic expression and civic engagement, strong support for creating and sharing one's creations, and some type of informal mentorship whereby what is known by the most experienced is passed along to novices. A participatory culture is also one in which members believe their contributions matter, and feel some degree of social connection with one another (at the least they care what other people think about what they have created).

Jenkings identifies the following forms of participatory culture: **affiliations** (memberships in online communities), **expressions** (producing new creative forms), **collaborative problem-solving** (working together in teams), **circulations** (shaping the flow of media), **the participation gap** (the unequal access to the opportunities), **the transparency problem**

(the challenges young people face in learning to see clearly the ways that media shape perceptions of the world), and **the ethics challenge**.

The study emphasizes that schools and afterschool programs must devote more attention to fostering what we call the new media literacies: a set of cultural competencies and social skills that young people need in the new media landscape. Participatory culture shifts the focus of literacy from one of individual expression to community involvement. The new literacies almost all involve social skills developed through collaboration and networking. These skills build on the foundation of traditional literacy, research skills, technical skills, and critical analysis skills taught in the classroom.

The new skills that Jenkins present could well be the base for assessing digital literacy. These skills include include:

Play — the capacity to experiment with one's surroundings as a form of problem-solving

Performance — the ability to adopt alternative identities for the purpose of improvisation and discovery

Simulation — the ability to interpret and construct dynamic models of real-world processes

Appropriation — the ability to meaningfully sample and remix media content

Multitasking — the ability to scan one's environment and shift focus as needed to salient details.

Distributed Cognition — the ability to interact meaningfully with tools that expand mental capacities

Collective Intelligence — the ability to pool knowledge and compare notes with others toward a common goal

Judgment — the ability to evaluate the reliability and credibility of different information sources

Transmedia Navigation — the ability to follow the flow of stories and information across multiple modalities

Networking — the ability to search for, synthesize, and disseminate information

Negotiation — the ability to travel across diverse communities, discerning and respecting multiple perspectives, and grasping and following alternative norms.

Many concepts are related to media literacy, including: Access, Understanding and Create, 3Cs Culture, Critical and Creative, 5Cs adding Comprehension and Citizenship, Read and Write the media, 3Ps Protection, Promotion and Participation, etc.

Therefore it may be productive to convert media and digital literacy criteria into social indicators to provide a multi-layered instrument and involve different indicators that can be pulled together to form an overall picture of a people's media literacy competence across different media, different age groups of people and including the dimension of critical understanding. According to the European understanding media literacy is the **competence** (skill, ability) to cope, autonomously and critically, with a communicative and media environment established by the information and knowledge society.

VOCATIONAL SKILLS AND COMPETENCIES

The Director-General of UNESCO, Mr. Koichiro Matsuura, defined the general role of the UNESCO Chairs in 2003 as follows: "It is necessary to build up large movement to humanize globalization, based on solidarity, on the spirit of caring for and sharing with others". In order to achieve these goals UNESCO has promoted the Open Educational Resources (OER) initiative as a cooperation mechanism for the open, non-commercial use of educational resources.

Education has largely contributed to an increase in developing knowledge, providing an enabling environment for innovation, and in building human capital required for a potential future knowledge economy. Global reforms in education and challenging ICT demands have made a remarkable shift in the structure of the enabling ICT environment and the utilization of ICT technologies in education. Such technologies have become the key driver of the digital network in an era of technology-driven education. More schools and communities now have access to ICT resources to join the global economy with knowledge workers who have 21st century skills and are inspired by life-long learning. Much effort has been made for the advancement of education and multiliteracies.

Dakar Framework of Action for Education for All (EFA), adopted in 2000 as a roadmap to meet the Education for All goals by 2015, highlights the role that ICT has to support EFA goals at an affordable cost. ICTs have great potential for knowledge dissemination, effective learning and the development of more efficient education services.

UN GAID (Global Alliance for ICT and Development) has been established in 2006 to address globally cross-cutting issues related to ICT in development and respond to the need for cross-cultural and cross-sectoral dialogue among diverse stakeholders.

Some of these issues and challenges are: Lowering cost of access in the developing world; developing inclusive technologies for the disabled; producing low-cost computers; and reducing barriers to ICT use and diffusion in key sectors of the economy and society, including enterprises, governments, education, tourism, agriculture, financial services and rural and civil society institutions.

Alliance of Civilization (AoC) established in 2005, to explore the roots of polarization between societies and cultures, and to recommend a practical programme of action to address this issue. AoC's main objectives: develop a network of partnerships to share the goals of the Alliance of Civilizations, to reinforce their interaction and coordination with the UN system; develop, support, and highlight projects that promote understanding and reconciliation among cultures; and establish relations and facilitate dialogue among groups that can act as a force of moderation and understanding during times of heightened cross-cultural tensions.

The AoC is a results-oriented UN initiative aimed at improving understanding and co-operative relations among States and peoples across cultures and religions in the areas of youth, media, education and migration. For this purpose the Open Educational Resources (OER) initiative as a cooperation mechanism for the open, non-commercial use of educational resources.

The significant influence of the media in shaping how we see the world and our perception of other cultures is widely recognized. While media organizations are often criticized for producing generalizations and clear-cut assessments of complex issues, the media can

also be a potent force in challenging stereotyped perceptions and become a channel for new ideas and perspectives. Through balanced news coverage, analysis and debate, journalists and editors can play a positive role in reducing cross-cultural tensions and ensuring that a broad diversity of voices are heard on potentially divisive issues.

In order to capitalize on the positive, constructive role the media can play in bridging cultural gaps and helping to build understanding among nations and cultures, the AoC is developing a Rapid Response Media Mechanism. The aim of this initiative is to provide a platform for voices that can help reduce tensions in times of cross-cultural crises. To this end, the AoC is creating an on-line Global Experts Resource to support the work of journalists covering stories of religious, cultural, and political tensions among diverse groups and communities. With a specific focus on issues that threaten to widen cross-cultural divides, this resource will provide journalists with access to a network of individuals who can speak to these issues with a level of knowledge and discernment that may ultimately help improve cross-cultural understanding (globalexpertfinder.org).

GLOBAL LEARNING

There are majors challenges for development of working-life skills that are not bound to any continent or historical tradition but globally equip students with skills that enable them to build up their own future and life in global and multicultural environment. Some educational institutes are already expanding out of the geographical borders to global actors on the field when utilizing e-learning and possibilities of ICT. Learning community and tutors may be distributed in various countries and cultures. The trend is also towards examinations and qualifications of skills that are internationally recognized.

With the steep rise of multiculturalism, there is an increasing need for people to be able to deal effectively and competently with the diversity of race, culture and ethnicity. In general terms, one's ability to deal effectively and appropriately with diversity is referred to as intercultural competence (ICC).

Intercultural competence is a relatively new concept and there has been no consensus about it so far. The concept of intercultural competence is also referred to with different terms; some refer to it as multicultural competence while others call it cross-cultural competence. Traditionally speaking intercultural competence or competence in general is often divided into three main components:

1. **Knowledge**: also known as cognitive factors
2. **Motivation**: also known as attitude
3. **Skills**: also known as competence in social relations and communication behavior

Intercultural competence scholars consider Knowledge, Attitude and Skills to be the key components of ICC and each of these components alone is not sufficient to achieve intercultural competence. Overall, the process of intercultural learning is intense for numerous reasons and its content can be difficult to grasp. Firstly, it requires learners to reflect upon matters with which they have had little firsthand experience. Secondly, unlike more con-

ventional approaches to education, which tend to emphasize depersonalized forms of cognitive learning and knowledge acquisition, it includes highly personalized behavioral and affective learning, self-reflection, and direct experience with cultural differences. Thirdly, "learning-how-to-learn", a process-oriented pedagogy, replaces learning facts, a product-oriented pedagogy, as a major goal. Fourthly, intercultural education involves epistemological explorations regarding alternative ways of knowing and validating what we know, i.e. the meaning of truth and reality (Paige 1993).

Additionally, becoming inter-culturally competent demands a wide range of culture-general knowledge from peoples' behavioral repertoires and people are also required to apply that knowledge to the culture that they interact with. People also have to be emotionally and skillfully responsive with various ranges of choices in order to act competently depending on the limitations of any given situation. They also have to have extensive inter-cultural interaction experiences and have the know-how of adjusting to different patterns of thinking and behaving.

There is a long tradition of international cooperation in the field of higher education. It is evident that the common global challenges are leading to a intensified regional and international cooperation also in the field of skills. Good example of this is the growing emphasis on skills and competencies in the common policy of the European Union. Another example is the intensified global cooperation within the framework of skills competitions. International skills competitions offer an excellent tool for the analysis of the common future needs of industry and societies all over the world, for the determination of the key skills needed in different trades, for cooperation between skills and working life and for improving the quality of for skills by transferring good practices and new innovations and by giving a possibility to international benchmarking. The number of member countries of the WorldSkills International, the organization responsible for the skills competitions of young professionals, has gradually increased, being at the moment 48. The members represent countries from all continents and from industrial to newly industrialized and less developed countries.

The challenge now in the 21st century is to bring together scientists, public authorities, businesses, academics, civil society organizations and other interested groups and stakeholders to understand challenges for sustainable education and cultural literacy in the global context; identify the potential of ICT to advance and improve education; share knowledge and best practices about successful policies in global education; create venues of collaboration; and consolidate responsible communities for multi-literacies. (Varis & Alagtash 2008).

In the UNESCO Report on Knowledge Societies (2005), there is a general agreement on the appropriateness of the expression "knowledge societies"; the same cannot be said of the content. Special efforts have been made to develop the new renaissance education and build global cultural bridges together with artists. It is widely understood that the most important skills of the future will be communication skills. Critical thinking skills are needed as a productive and positive activity. Critical thinkers see the future as open and malleable, not as closed and fixed.

In his epilogue on "Education for a multicultural world" to the International Commission on Education for the Twenty-first Century published by UNESCO in 1996 Rodolfo Stavenhagen pointed out that most modern nation-states are organized on the assumption that

they are, or should be, culturally homogeneous. That is the essence of modern ´nation-hood´, upon which contemporary statehood and citizenship are founded. But a truly multi-cultural education will be one that can address simultaneously the requirements of global and national integration, and the specific needs of particular culturally distinct communi-ties, both in rural and urban setting (Stavenhagen 1996, p. 230–231).

The concept of digital literacy in a broad sense is a way of thinking but it can also be understood as complementary to the concept of media education and even synonymous with media literacy. Digital literacy as media literacy aims to develop both critical under-standing of and active participation in the media. Digital and media literacy is about devel-oping people's critical and creative abilities. Using a computer requires diverse and com-plex previous knowledge. It also introduces the individual and humanity to new contexts, which demands mental, intellectual, profound and complex changes. In essence, digital literacy is a complicated process that consists of acquiring a new tekne, ability of art or craft. Creativity and culture become essential raw materials for the knowledge economy.

References:

Altbach, P. G. & Davis, T. M. (1999). Global Challenge and National Response: Notes for an Interna-tional Dialogue on Higher Education. In P. G. Altbac (Ed.) *Higher Education in the 21st Century: global Challenge and National Response*. IIE Books, New York.

Aslaksen, K. O. (2001). Virtual Challenges to Education. Paper given at ACA/SIU Conference, Fjaesland 10–12 June 2001, Norway.

Association of Collage and Research Libraries (ACRL): Information Literacy Competency Standards for Higher Education, 2000. http://www.ala.org/ala/acrl/acristandards/informationliteracy-competency.htm.

Chen, G. M. & Starosta W. J. (1996). Intercultural Communication Competence: A Synthesis. In B.R. Burelson & A.W. Kunkel (Eds.) *Communication Yearbook 19*. London.

Confronting the Challenges of Participatory Culture: Media Education for the 21st Century, Henry Jenkins, Director of the Comparative Media Studies Program at the Massachusetts Institute of Technology, MacArthur Foundation 2007, An occasional paper on digital media and learning.

Current trends and approaches to media literacy in Europe. http://ec.europa.eu/avpolicy/media_literacy/studies/index_en.htm.

Dias, M.A.R. (1998). Higher Education: Vision and Action for the coming century. *Prospects*, Vol. XXVIII, No 3, September 1998.

EU Digital Literacy Expert Group Digital Literacy: High-Level Expert Group Recommendations 2008. European eLearning Summit, May 10–11, 2001. Workshop Papers.

FinnSight 2015 (2006). The Outlook for Science Technology and Society. The Academy of Finland & TEKES 2006.

Foster, P. (1965). The Vocational School Fallacy in Development Planning. In C. Anderson & M. Bow-man (Eds.) *Education and Economic Development*. Chicago: Aldine Publishing Company.

Grubb, W. N. (1985). The Convergence of Educational System and the Role of Vocationalism. *Com-parative Education Review,* 29 (4), 526–548.

http://www.oecd.org/document/22/0,3343,en_2649_201185_39713238_1_1_1_1,00.htm.

ILO (2004). World Report "A Fair Globalization: Creating Opportunities for All", ILO 2004. Avalilabe at www.ilo.org/fairglobalization.

InfoDev (2005). Scaling Up Innovation and Entrepreneurship in Developing Countries: The Role of Private Sector Finance. Information for Development Program. Available at www.infodev.org/en/Document.115.aspx.

INFOSOC (2006). Efficiency and vitality in future Finland, The Information Society Council's Report 2006, Kukkila 2006.

Kafka, N. & Stephenson, J. (2006). *Self-Sufficient Schools: Fostering Entrepreneurship to Finance Sustainable Education*. Paper presented at APEID Conference "Learning Together for Tomorrow: Education for Sustainable Development", Bangkok, December 2006.

Landes D. (1998). *The Wealth and Poverty of Nations*. New York: Norton.

Landis, D. & Wasilewska, J. H. (1999). Reflections on 22 years of the International Journal of Intercultural Relations and 23 years in other areas of intercultural practice. *International Journal of Intercultural Relations*, 23 (4).

Lingelbach, D.C., De La Vina, L. & Asel, P. (2005). *What's Distinctive about Growth-Oriented Entrepreneurship in Developing Countries?* UTSA College of Business Center for Global Entrepreneurship Working Paper No. 1. Available at SSRN: http://ssrn.com/abstract=742605.

MeAC – Measuring Progress of eAccessibility in Europe: Assessment of the Status of eAccessibility in Europe. Executive Summary, Bonn, October 2007.

Mundle, S. (1998). Financing Human Development: Some Lessons from Advanced Asian Countries. *World Development*, 26 (4), 659–672.

Paige, R.M. (1993). On the nature of intercultural experiences and intercultural education. In R. M. Paige (Ed.) *Education for the intercultural experience*. Yarmouth, Maine: Intercultural Press.

Perez, C. (2002). *Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages*. Cheltenham: Edward Elgar.

Pérez Tornero, J. M. (2004). Promoting Digital Literacy. European Commission 4th Workshop "Media Literacy, Digital Literacy, e-Learning", 27 February, Brussels.

Pugh, D.S. & Hickson, D.J. (1996). *Writes on organizations*. London: Penguin Books.

Schumpeter, J.A. (1975). *Capitalism, Socialism and Democracy*. New York: Harper & Row.

Singh, M. (1998). *School Enterprises Combining Vocational Learning with Production*. UNESCO-UNEVOC International Centre.

Somavia, J. (2006). A Fair Globalization: Tackling the Global Jobs Crisis. In P. Ruohotie & R. Maclean (Eds.) *Communication and Learning in the Multicultural World – Festschrift for Professor Tapio Varis*. University of Tampere, Finland.

Stavenhagen, R. (1996). Education for a multicultural world. In *Learning: The Treasure within*. Report to UNESCO of the International Commission on Education for the Twenty-first Century. Paris 1996.

Tuomi, I. (2002). *Networks of Innovation: Change and Meaning in the Age of the Internet*. Oxford: Oxford University Press.

UNESCO (2005). *Towards Knowledge Societies*, UNESCO World Report 2005. Paris.

UNESCO "World Declaration on Higher Education for the Twenty-first Century: Vision and Action." ED-98/CONF.202/3, Paris, 9 October 1998.

UNESCO "International Institute for Educational Planning," Forum on Open Educational Resources/Open source courseware, background paper 2005.

Utsumi, T., Varis, T., Knight, P., Method, F. & Pelton, J. (2001). Using broadband to close the digital

divide. *Intermedia*, 29 (2).

UNEVOC (2006). Orienting Technical and Vocational Education and Training for Sustainable Devel-
opment. Discussion paper 1. UNESCO-UNEVOC International Centre for Technical and Voca-
tional Education and Training. Bonn, Germany. Available via http: //www.unevoc.unesco.org/
publications/.

Vainio, L. & Listemaa, J. (2004). Teachers need special competencies for e-learning. In J. Saarinen
(Ed.), *eValuator*. DLL-project. Häme Polytechnic and University of Tampere.

Varis, T. (2008). European and Global Approaches to Digital Literacy. Digital Kompetanse, *Nordic
Journal of Digital Literacy*, 1 (3).

Varis, T., Utsumi, T. & Klemm, W. (Eds.) (2003). *Global Peace Through The Global University System*,
University of Tampere, Finland.

Varis, T. & Saari. S. (Eds.) (2003). *Knowledge Society in Progress – Evaluation of the Finnish Electronic
Library – FinELib*, Publications of the Finnish Higher Education Evaluation Council, No 4, Helsinki.

Varis, T. & Alagtash, S. (Eds) (2008). *Ubiquitous Ict for Sustainable Education and Cultural Literacy*.
Available at http://www.minedu.fi/OPM/Kansainvaeliset_asiat/kansainvaeliset_jaerjestoet/
unesco/suomen_unesco-toimikunta/sutjulkaisuja?lang=fi.

THE DEVELOPMENT OF NATIONAL EXCELLENT COLLEGE COURSES (NECCs) AS OER IN CHINA[1]

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ABSTRACT

This paper presents the development of the National Excellent College Courses (NECCs) in China. It covers the background of the initiative, the purpose, characteristics and the application protocol of the NECCs, an analysis of the structure, use and impact as OER and a discussion about the pros and cons of the current situation of the usage of the courses, as well as its future developments.

Keywords: National Excellent College Courses (NECCs); Open Education Resources (OER); mass higher education; lifelong learning; knowledge society

CONTEXT OF THR NECCS

Higher education in China has witnessed great expansion since June, 1999. The gross enrollment rate (GER) of the age-cohort (18–22 years) increased from 6.8% in 1998 to 17% in 2003, demonstrating that China has entered the stage of mass higher education, according to Martin Trow's theory (Trow, 1974). In 2007, the GER further increased to 23%. Figures 1 to 4 show the expansion of higher education in China over the past decade. Student number in Chinese HEIs increased from 6.43 million in 1998 to 27 million in 2007, almost about 4 times that of 1998. The number of Regular HEIs increased from 1022 in 1998 to 1908 in 2007. The number of Adult HEIs decreased from 962 in 1998 to 413 in 2007, thus the total number of higher education institutions increased from 1984 in 1998 to 2321 in 2007. Staff

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and teacher numbers increased from 1.02 million in 1998 to 1.945 million in 2007 (For details, please see from Figure 1 to Figure 4, consolidated from 1998–2007 Annual Statistics Review of Development of Chinese Education.)

Although the rapid expansion of higher education created a miracle in the history of the world's educational development, and Chinese higher education became the biggest educational system in the world, the scale of education system in China is too large for a developing country. The people's growing demand for education and the lack of high qual-

Student number

number of students in millions

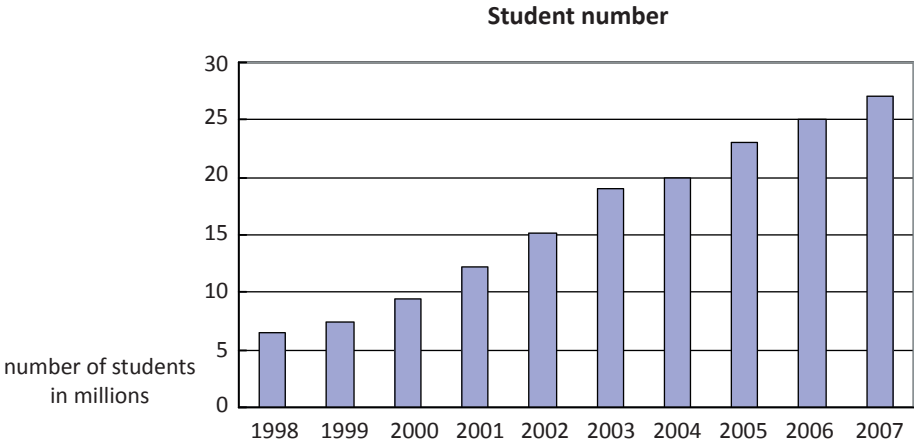Figure 1. Increase of the student number in Chinese HEIs from 1998–2007
Source: Consolidation of the statistic from 1998-2007 Annual Statistics Review of Development of Chinese Education.
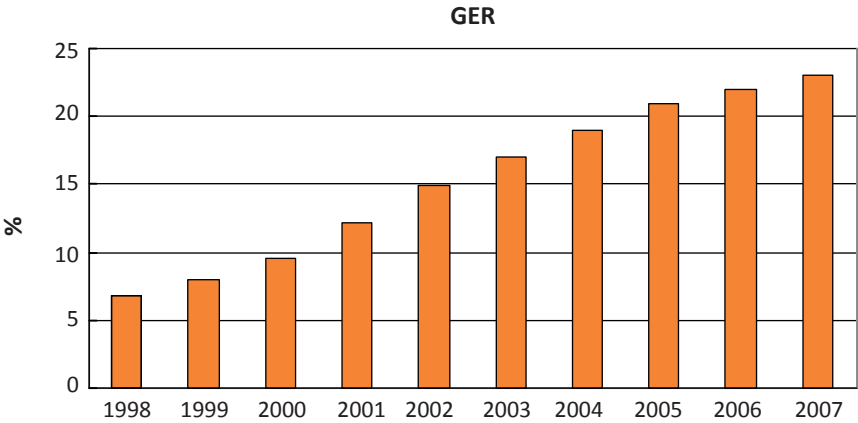
GER

%

Figure 2. Increase of the gross enrollment rate of age-cohort (18–22 years) in Chinese HEIs from 1998–2007.
Source: Consolidation of the statistic from 1998-2007 Annual Statistics Review of Development of Chinese Education.

Changs of Regula/Adult HE Institutions
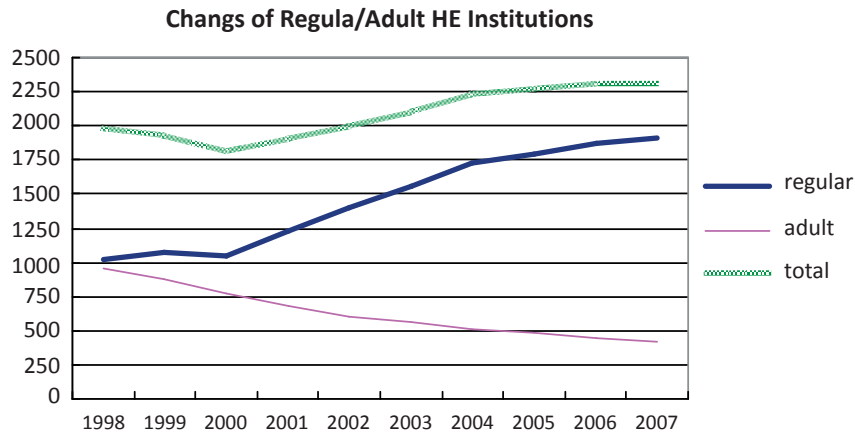
Figure 3. The changes of the number of Chinese HEIs
Source: Consolidation of the statistic from 1998–2007 Annual Statistics Review of Development of Chinese Education.

Increase of the Number of Staff and Teachers
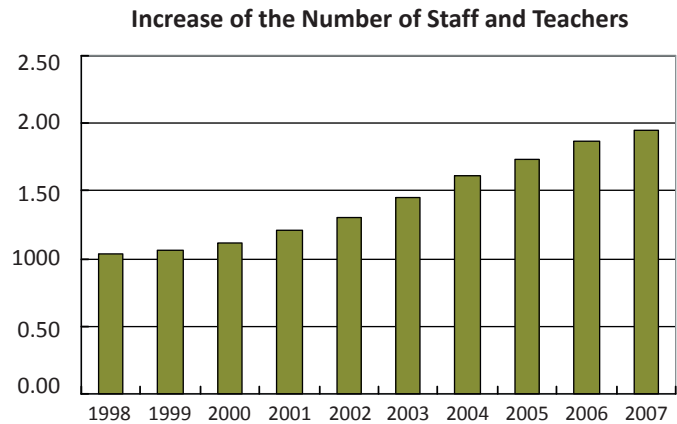
Figure 4. Increase of the number of staff and teachers in Chinese HEIs
Source: Consolidation of the statistic from 1998-2007 Annual Statistics Review of Development of Chinese Education.

ity education supply is the basic dilemma that the higher education system in China is facing. The serious shortage of educational investment, the level of education infrastructure and teaching staff are far behind the needs of educational modernization. We are facing an unprecedented challenge concerning how to keep the continuous improvement of the educational quality in the condition of the continuing growth of the scale of higher education.

Facing the tremendous changes and demand of higher education in China, plus further needs of facilitating lifelong learning and building a knowledge society, the Ministry of Education (MOE) of the People's Republic of China promulgated Project Plan on Developing *National Excellent College Courses of China* (NECCs for short in this paper) in 2003.

The project plan was to develop 1500 NECCs in 5 years from 2003–2007 and to publish all the course materials on the internet as Open Education Resources (OER) enabled by modern educational information technology. In 2007, the Ministry of Education (MOE) and the Ministry of Finance (MOF) jointly issued "The Ideas on Enhancing University Education Quality and Teaching Reform in Higher Education Institutions (HEIs)", launching plans for further developing 3000 more NECCs from 2007 to 2010.

Even before the above mentioned policy plans, in 2001, there has already been a big MOE policy initiative "The Ideas on Enhancing University Education and Improving Teaching Quality" (MOE HE Document No.4 file for short) proposing 12 measures to enhance university education and to improve teaching quality. In curriculum development, the policy was to make special effort to invite professors to teach undergraduate courses. The NECCs project mainly strengthened the initiative by providing professors with better teaching methods and content, and further developing the whole course package online as OER so to enable more students and independent learners to enjoy quality education.

This study mainly serves as an introduction and overview of the NECCs in China. It is done mainly through policy document studies and literature review. In recent years there are a series of studies on the development and implementation of NECCs. Liang and Jia (2007) made a study of the 2003–2005 NECCs, offering an analysis of the regional and disciplinary distribution of NECCs, the development of the project teams, and the overall teaching and learning profile of the NECCs (pp. 48-51). Huang and Xiang (2007) made a thorough analysis of important elements of 688 accessible courses from the 2003-2006 NECCs, including NECCs resource building, curriculum implementation, access to and the use of NECCs, and offered some comments and recommendations (pp. 72-76). Gong (2008) engaged in a study of the 2003-2007 NECCs and offered a policy understanding, the implementation of NECCs and what kind of Higher Education Institutions (HEIs) play an important role in the development of NECCs. He maintains that the building of the NECCs pays more attention on construction of the courses and resources, but he would like to see more active use and more sharing of the NECCs resources. The most important element of NECCs, he stresses, is to establish an appropriate mechanism to promote the openness and sharing of the course contents and resources (47–49).

Consolidating what we find from the policy studies and literature review, the following parts of the paper presents the development of NECCs. It covers the purpose and the characteristics of the NECCs, an analysis of the structure, use and impact of NECCs as OER and a discussion about the pros and cons of the current situation of the usage of the courses, as well as a foresight of its future developments.

CHARACTERISTICS AND APPLICATION PROTOCOL OF NECCS

The purpose of the NECCs initiative is to establish the National Excellent College Courses as model courses through rallying the first-class teaching team, creating the first-class course contents and resources, utilizing the first-class teaching methods, applying the first-class teaching management and developing the state-of-art course materials as Open Education Resources.

Characteristics:
The MOE set up the criteria for building National Excellent College Courses, including the following six characteristics:

- Forming of the teaching teams:
  The strategy is to gradually form a teaching group for each course project which is led by a responsible professor, supported by a reasonable team of teachers from different stages of their careers, maintaining a stable personnel, striving for high teaching standard, in the effort to achieve excellent teaching result, together with a certain percentage tutors and lab teachers joining the group.

- Employing advanced teaching methods to develop teaching content:
  The teaching methods should be up-to-date; teaching content should be advanced, scientific and can reflect the latest scientific and technological achievements of the subject.

- Making course materials open and accessible as OER:
  Relevant syllabus, teaching plans, exercises, lab guide and references of resources should all be developed as OER to be published on the internet for enabling more learners to be able to share the high quality educational resources.

- Constructing of textbooks:
  To build or use excellent textbook series and multi-media textbooks including a variety of media forms;

- Designing lab experiments:
  To strongly reform the contents and forms of lab teaching, to encourage teachers to develop integrative, creative lab courses and research–based courses, to encourage undergraduate student to participate in scientific research activities;

- Offering incentive and reward mechanism:
  There must be appropriate incentive and evaluative mechanism to encourage professors to take charge of the construction of excellent courses and a new reward mechanism to ensure the construction of excellent course (MOE. 2004).

MOE also sets up an application procedure that encourages the universities and colleges to develop the NECCs first and then to apply through the municipal, provincial or regional Education Department for NECC status and award. Certain projects, if not up to the national standard, can also win provincial or municipal award for Excellent College Course award. National NECCs status and grant will be awarded after the application evaluation and will be given in three phases, for further construction of the courses and for maintaining the courses.

Application protocol
If you want to apply for NECCs status, your course must meet the following requirements.
Undergraduate course must be a basic course or a basic disciplinary course or a profes-

sional course which has a large body of audience or learners. It must have been taught in the university for more than three years. The primary responsible instructor of the course should be a full-time teacher in the university or college and have a title of professor. The content of the course should fully meet the requirements of the NECCs evaluation guidelines. The guidelines can be found in the website of Chinese National Excellent College Courses Construction.

Higher vocational course must be constructed jointly by colleges, industries and enterprises. Full-time teachers in the higher vocational institution should be the primary responsbile instrictor of the course. The content of the course should fully meet the requirements of the higher vocational NECCs evaluation guidelines which can also be found in the website of Chinese National Excellent College Courses Construction.

Then the course profile will be submitted to the MOE by provincial, regional or municipal education department after selection. In order to display more outstanding courses, the MOE particularly add a channel for directed recommendation from the Committee of Disciplinary Experts and some Expert Organizations or Associations.

All the application materials of the commended courses are filled out and submitted online to the MOE. Then it must be evaluated by eligibility review, online teaching resources assessment, experts meeting review and publicity online. These evaluation processes are not only supervised by experts but also moderated by a large number of teachers and students, which help to assure the quality and feasibility of the NECCs. After published online for one month, if no objections, the course will be given the status and honor of the National Excellent College Course. And you must maintain and update its content in at least five years and keep the network unimpeded.

All the application forms are open be downloaded in the site of Chinese National Excellent College Courses Construction and the site of awarded courses can be found in a hub site.

ANALYSIS OF NECCS

The disciplinary distribution

The analysis of the outcome of the National Excellent College Courses in recent years showed that engineering and science courses have been the top priority in the construction of national excellent undergraduate courses. According to the study of Gong (2008), in the of four-year development of NECCs from 2003 to 2006, engineering and science courses had occupied 54% of the total courses (see the table below). Following was the medical science (Iatrology as shown in the Figure 5), which accounted for 11% of all courses. Literature, management and agriculture (Agronomy ass shown in the figure 5) were respectively 9%, 7% and 6%. In contrast, economics, education, history, law, and other strong liberal arts fields occupied relatively small proportion of the courses. Philosophy only took one percent of all courses (Gong 2008).
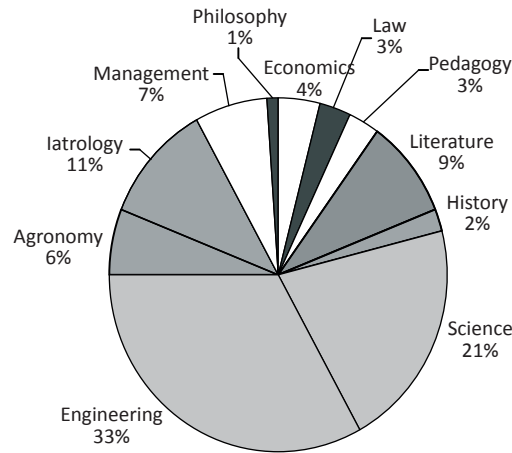
Figure 5. Subject distribution of NECCs (2003–2006)
Source: Gong, Z. (2008). The Research and Practice of University Quality Course Construction, *Modern Distance Education Study*, (1), pp. 47–49.

The distribution of universities contributing to the NECCs

From the distribution of universities contributing to the NECC (the proportion of contributions to all types of HEIs, 985, 211 universities (211 Project funding sponsored universities: MOE specially sponsored universities for developing to be world class universities in the 21 Century), and vocational colleges), we can tell that universities and colleges with academic and disciplinary strengths are taking the lead in various related fields (see Table 1 below), such as Beijing University taking the lead in science, literature, history and other subjects. Qinghua University, takes the lead in developing engineering courses that are of the top rank in the country.

Table 1. The top contributing HEIs to NECCs

Representative HEIs	Subject Areas	Contribution (2003–2006)
Peking University	Science, Literature and History, Law	NECCs: 46, Municipal advanced courses: 62, School level courses: 52
Tsinghua University	Engineering	NECCs: 42
Central South University	Iatrology	NECCs: 20
People's University	Management	NECCs: 15, Municipal advanced courses: 24, School level courses: 42
Xiamen University	Economics	NECCs: 15, Provincial courses cannot visit
Huazhong Agricultural University	Agronomy	NECCs: 14, Provincial courses: 7
South China Normal University	Pedagogy	NECCs: 15, Provincial courses: 34
Shenzhen Professional Polytechnic College	Information Science	NECCs: 14, Provincial courses: 21

Source: Gong, Z. (2008). The Research and Practice of University Quality Course Construction, *Modern Distance Education Study*, (1), pp. 47–49.

Below is the distribution of what kinds of HEIs contributed to all the 1100 National Excellent College Courses in 12 disciplines from 2003 to 2006. All the 325 universities and colleges that developed the NECCs are divided into 3 types, 211, ordinary universities and vocational colleges. (Details are in table 2 below).

Table 2. Distribution of Universities Contributing to NECCs.

Sort	211 universities	Ordinary universities	Vocational colleges	Total
Number	90	132	103	325
Scale	27.69%	40.62%	31.69%	100%
Illumination: "Ordinary universities" refers in particular to universities that except for "211" and vocational college.				

Source: Huang, B. & Xiang, G. (2007). Analysis of the Construction of National Star Courses, *Higher Education Study in China*, (9), pp. 72–76.

From the discipline level, engineering and science subjects remain the main body of the NECC in the 2007–2010 plan, although various disciplines has increased the intensity of construction to varying degrees. From the qualification level, the proportion of undergraduate education, still the main objective of the NECC system, declined from 84% in 2003 to 65% in 2007; reversely, the proportion of vocational education increased each year. In 2007, 49 courses of Distance Education had been selected as NECCs, which indicated the modeling for all the Distance Education in China and the approval of Distance Education from Minister of Education. We can see the trend of the construction of NECCs will be a multiple system, which includes undergraduate education, vocational education, junior college education and distance education. (Huang, B. & Xiang, G, 2007).

Analysis of the course structure of NECCs

Various learning resources
For sharing high quality resources, the core teaching materials such as courseware should be published on the Internet. But the content of an excellent course is more than that. Generally, a National Excellent College Course must consist of the following parts: the course information, teaching resources, teaching results and interactive platform.

The national criteria set the tone for the development of the NECCs, including the following details:
- The course information includes the brief introduction to the course, syllabus, calendar, examination method, faculty profile, etc.
- Teaching resources include courseware, electronic lesson plan, exercises and keys, textbooks and reference books, teaching video, examination question bank, other referenced materials, etc.
- The teaching result includes the honor the course received, scientific research achievement of involved teachers, outstanding works of students, assessments from students and experts, etc.
- Interactive platform includes online FAQ, forums, online quizzes and examinations, etc.

Since the National Excellent College Courses were developed and implemented by strong policy support and have detailed standard requirement there displays more comprehensive contents and uses more extensive interaction. The following gives further explanation of the resource building of the NECCs.

First of all, the important criteria and guideline of the National Excellent College Courses is the building of the teaching team, with the profile of the teaching team displayed in detail on the course website. Besides the introduction to the teaching and scientific research achievements of the primarily responsible professor, the website also introduces the knowledge structure, age structure, educational credentials and the role each teacher plays in the team, displaying the measures and effect of teacher training for the project. This criteria and guideline has not only promoted the interdisciplinary cooperation, but also conducive to the development of young teachers.

Secondly, the National Excellent College Courses project pays great attention to the development of textbooks. It encourages teachers to edit textbook by themselves, to update the teaching contents and to design multi-media textbook. The project uses a lot of excellent project-produced textbooks which have strong pertinence. Some websites also provide multi-media textbooks. As the MIT OCW, materials that relate to the course such as syllabus, teaching plan, exercise, guide book of experiment and references are published on the website and can be shared free. In addition, the National Excellent College Courses also offer teaching videos of the primary responsible professors. The videos are more visual than simple texts and images. Both students and teachers can use them for more detailed references.

There is also a space for putting up outstanding works of students and scientific research achievements of teachers. These achievements are the direct embodiment of the effect of teaching. They have reference value for students to master and to complete their courses and for other teachers to develop their teaching plans and methods.

Finally, the interactive platform is a highlight of the National Excellent College Courses. Most of the websites of excellent courses can realize online FAQ and discussions by the form of forums. Some websites even offer QQ and other interactive modes. There are also some sites offer online testing and online examination. Interactive platform improve the interaction between students and teachers. It can help students solve their questions promptly and operate self-test and self-evaluation. It is propitious for teachers to improve the course according to students' characteristics. At the same time, it provides a platform for teachers to share this course with colleagues at other universities or colleges to develop academic exchanges.

The integration of learning resources for the courses
In the website of a national excellent college course, all the resources are published for this course. Teaching is a process of interaction between teachers and students. The teacher takes resources which are suitable for his teaching, combining with his experience to compose a course which meets the actual characteristics of the students and provides it for the students. Students can also browse the source for learning by themselves and have a communication with teachers through interactive platform.

The "course information" provides overall information of the course. Through this part,

students will form a holistic understanding of the course, including the requirements of the course, the schedule, important points of the course, method of exam and so on. Then they can download relevant courseware, electronic lesson plan and exercises from "teaching resources" according to the schedule. Educators may specify courseware or references as the materials for students' previewing and extensive reading after-school. Resources also include lab work guide or research topics, which provide students with guidance of lab work or research. When students encountered difficulties in the learning process, or some other teachers want to explore further on an issue, they can communicate with the primary responsible professor of the course through interactive platform.

The R & D Model of NECCs

Policy and funding support

Policy support:
The Ministry of Education *Guideline on Enhancing University Education and Improving Teaching Quality* (MOE 2001), and The Ministry of Education initiated *NECCs for Strengthen the Quality of Learning and Teaching Reforms in Colleges and Universities* (MOE 2003) are the major policy documents that promoted the development of NECCs.

To better implement the policy plan, the government established a three-level status of NECCs, national, provincial and university level. The idea is to build a multi-level synergy for building up this NECCs system to achieve the following outcomes:

- to improve the understanding of the importance of Personnel training quality
- to firmly grasp the lifeline that improve the quality of talents
- to ensure that the teaching is the centre
- to meet the training needs for national and local development of high-quality personnel
- for the goal to enhance the international competitiveness of students' ability
- to focus on integrating various achievement of teaching reforms and intensifying the use of informational technology in teaching
- to strengthen the connection with scientific research and teaching closely,
- to vigorously promote and facilitate the students taking the initiative and independent learning
- to impeding the irrational mechanism and the system,
- for colleges and universities to increase the investment of the teaching

Procedurally, each year, the Ministry of Education gathers all the courses sent in from the Provincial Education Commission and selects the standard ones to give the honor of NECC status, and offers certain funding for the further development of the NECCs. The NECCs websites are open to colleges and universities nationwide free of charge. The achievement will also serve as one of the important contents of the building of colleges and universities teaching evaluation and to make the famous teachers' teaching more accessible both in colleges and universities and beyond.

Financial support:

The NECCs have been financed by the special support from the central finance channel. Special funds were in accordance with the principle of unified plan, operated by separate accounts, and concentrated for targeted use. Special funds were implemented with project management.

In 2003, the Higher Education Department of the Ministry of Education allocated 80,000 yuan for every NECC; in 2004 and 2005, allocated additional 30,000 yuan for every NECC; by 2006, every NECC were totally entitled with 100,000 RMB Yuan funding to develop the course.

The following table demonstrated the top three funded universities for developing undergraduate-level NECCs during the period 2003–2006.

Table 3. The top three funded universities for developing undergraduate-level NECCs (2003–2006)

Year	Rank	1	2	3
2003	HEI	Peking University	Tsinghua University	Shanghai Jiaotong University
	Courses	9	9	7
	Funding (yuan)	720,000	720,000	560,000
2004	HEI	Peking University	Tsinghua University	Zhejiang University
	Courses	14	13	10
	Funding (yuan)	420,000	390,000	300,000
2005	HEI	Peking University	Tsinghua University	Wuhan University
	Courses	10	10	10
	Funding (yuan)	300,000	300,000	300,000
2006	HEI	Peking University	Tsinghua University	Wuhan University
	Courses	13	10	9
	Funding (yuan)	1300,000	1000,000	900,000

Source: http://www.jpkcnet.com/ , Chinese National Excellent College Courses Construction website.

R & D personnel

At Undergraduate level: the chief lecturers should have profound academic achievements, with rich teaching experience. Through the building of excellent courses, gradually form a teaching team of an optimal structure, for the purpose to achieve personnel stability, high teaching standards and good teaching effects. It also requires a certain proportion of experiment teachers and tutors to be in the teaching team, and encourage doctoral students to participate in the developing of the quality courses.

For vocational College: the chief lecturer and persons in charge should have rich experience in both theoretical and practical sense and should have at least associate professor status or above, and personally committed to the design and the guide teaching. The project team should have members who have high credential, qualification, and of different age group, thus achieving staff stability, high teaching standards and good teaching effects. The team should contain a sufficient number of teachers and teachers for experi-

ments, and have a certain proportion of bi-path teachers who also work in enterprises.

Software features and infrastructure

Software features:
The software employed for the NECCs emphasizes the analysis of learner applicability, the feasibility and the adaptation between teaching and learning, enabling a change from content-oriented teaching to facilitate activities and interactions, highlighting the transition of the resources from random accumulation to interactive learning in order to achieve harmonious and ecological environment construction.

Operation mode:
In their study of the 688 sites of the NECCs Huang and Xiang (2007) find that 67.30 percent of the web sites used static operation forms, while 32.70 percent of the sites run by dynamic forms. At the same time, 2.62 percent Excellent Course supported bilingual version-Chinese and English, so that learners have a choice on which language to use.

Learning Management Platform in Use:
In the 688 quality courses, Huang and Xiang (2007) maintain, 109 courses used the Learning Management Platform, of which 66.06 percent used the Sky Classroom, 21.10 percent used Blackboard, 5. 51% use the Matlab, 3.67% used eYouCT, and Fangzhengaosi platform. Moodle platform accounts for 1.83 percent.

   In 2003, MOE formulated technology standards for on line video development. Standards included audio and video materials collection technical requirements and basic technical request for on-line video sharing. For example, the audio and video must match well, store format for audio should be WAV, MP3, MIDI or other Streaming Media format, and for video should be AVI, QuickTime, MPEG or other Streaming Media format. System should run stable, reliable, with more redundant capacity, supporting services for 24 hours everyday to ensure regular visiting during assessment, publicity and distribution.

ACCESS, USE AND IMPACT OF NECCS

Access
Log on the URL http://www.jpkcnet.com/ you can access to the website of Chinese National Excellent College Courses Construction. At the present stage, this website only has Chinese version. It is equipped with an excellent course retrieval system which is divided by year. The part of 2007 in the system is divided concretely into excellent courses of undergraduate education, of higher technical and vocational education and of online education. In addition, the system also provides URLs of all the provincial excellent college courses.

   After getting access to the retrieval system you can find the information and website link of every course. Or you can retrieve information using province, school, level of the course, level of the subject, name of the course as keywords to locate a specific course. Each excellent college course has its special website. Most of them don't require registra-

tion or password. Some sites that need to log in have provided username and password for users to use.

Use

Offering free sharing of high-quality teaching resources is one of the purposes of NECCs, so there are no prerequisites to use NECCs materials. All of the materials are meant to be free and will be constantly updated in at least five years. You only need to access to the site and click the appropriate link to read them online or download for offline use. But higher-speed web connections are preferable to best view and use the sites. Slower connections would allow users to view some materials on the site, but it will take a longer period of time if you want to watch the videos or download materials. Besides, the video files may require media player software such as QuickTime®Player, RealOne™ Player, or Windows Media®Player to use.

If you want to communicate with the teachers who design the courses, you can find their email addresses or other contact information in the *Information* part of the courses, or you can access to the site of the courses to search for other exchange platform.

Impact

Tang (2007) reports that since the project "National Excellent College Course" launched by MOE from 2003, up to October 2007, according to the statistics of MOE, the average number of daily visits of the website of National Excellent College Courses at a certain observing period was about 200,000. And the average number of daily visits of the National Excellent Course resource-sharing system is about 400,000. The total number of page views of these two sites had been more than 200 million times. Tang claims that there are many students and teachers have benefited from these OER courses.

At the same time, the national excellent course has also stimulated the construction of more than 6,500 provincial-level and school-level excellent courses.

Furthermore, the construction of excellent courses promotes the optimization of college teaching staff, updates educational content, and innovates teaching methods. Colleges generally increase their investment in teaching as a result of this promotion. Many colleges have established some incentive policy specially to reward the leaders of national excellent courses, which greatly arouses the enthusiasm of teachers.

DISCUSSION AND FUTURE DEVELOPMENT OF NECCs

Though NECCs accomplished tremendous achievement in the development of 5–6 years, there are areas need to be further improved. This section discusses the pros and cons of the NECCs and gives an account of the future development of NECCs.

Discussions

The construction and development of NECCs resulted in a great number of high quality higher education resources. But most of the courses before 2007 were designed by professors teaching on campus and the starting point of their course design is for students and teachers on campus. But since the opening nature of the NECCs, there should be more effort to include more designing concepts for independent learners. Also, as Gong's study revealed, the access to the NECCs courses varies from time to time. During the evaluation and assessment period, there are more links that can be accessed, other times there will be less. More effort should be made for maintaining the accessibility and sustainability of the courses, as well as publicity of the courses. In this way, it will serve not only on-campus users, but also off-campus users. Only in this way, the NECCs will serve its real purpose to promote lifelong learning and building knowledge society. MOE has realized this needs and started to invite distance learning programs to apply for the NECC status and awards in 2007. The first round 49 courses of Distance Education had been selected as NECCs. This effort boosts the development of a set of modeling courses for off-campus learners. Apart from the above mentioned issues, the following are issues are also of legitimized concerns.

Intellectual Property Issues: It needs a reasonable system to guarantee shared interests in the managing mechanism. Lacking of a reasonable and effective intellectual property protection system plays a passive role in sharing excellent courses. The public awareness for using internationally accepted common intellectual property features is relatively weak, with the serious reality of piracy. Despite their hard work in putting a lot of manpower, material and financial resources in the development of quality teaching resources, colleges and universities can not escape such a worry: their intellectual property rights in the process of sharing may be unrespectable, even core technology of network resources of the quality teaching courses may have been imitated or stolen by others.

Technical Specifications: in terms of technology level, there are no uniform standard technical specifications in the development of excellent courses. At present, the Ministry of Education only draws up a unified technical specification for the online video. Therefore, current network resources lack of uniform standards for classification. University teachers and staff are developing, classifying and defining the teaching resources according to their own understanding and awareness, resulting in different platforms, which harms the effectiveness for exchange and sharing.

Unified teaching management platform: at the present stage most of the excellent courses use their own platforms whose costs of update and maintenance are high. A unified teaching management platform is propitious to reduce maintenance costs and improve the efficiency for updating and will be more convenient for learners to use.

Process evaluation: many testing system and self-examination system the excellent courses provided are rather content-based. These evaluated systems focus on the result of study. Actually, process evaluation can better reflect the change of the learner's knowledge structure and competence development. Increasing some electronic portfolio and process-oriented assessment approach in the learning process can help know the characteristics of learners and improve the effectiveness of the courses.

Concerning the content of the courses, most of the courses are mainly built around the conventional disciplinary concept. We would like to see more courses developed really with interdisciplinary awareness in the designing and more effort to be made into integrat-

ing knowledge and facilitate competence-based learning. We would also like to see more courses addressing the global issues such as cultivating global citizen and solving global problems.

Future Development

The Ideas on Enhancing University Education Quality and Teaching Reform in Higher Education Institutions promulgated by MOE and MOF in 2007 pointed out that the MOE will continue to promote the construction of National Excellent College Courses and select around 3000 new NECCs in the next five years, further promoting teaching reform and course construction. It stimulated greater improvement in teaching contents, teaching methods, teaching groups, construction of textbook and teaching effect in order to achieve a comprehensive advancement of course and curriculum development and teaching quality enhancement.

In their study and analysis of the NECCs, Xie, Jiang & Zhang (2008) predict the change of standard and the tendency of future development of NECCs as the following:

- Emphasize advanced ideas for teaching, such as, Investigative Study, Inquiry-Based Study, Collaborative Study, and so on.
- Emphasize an integrative view in developing course content, for example, paying special attention to appropriate incorporation of knowledge cross disciplines, balancing between the traditional disciplinary view and the current and emerging needs for more integration of knowledge.
- Toward a more student-oriented approach. Putting students at the center of teaching and learning activities. Using multiple methods and approaches to motivate students to engage in active study. Supply the materials, resources or lists of data to facilitate Investigative Study and Independent Study.
- Emphasize instructional design for designing the content, teaching methods, evaluation procedure, course webs and so on.
- Emphasize the application of information technology, for instance, digital resource for teaching, the teaching method and media based on modern educational technology.

MOE and MOF launched another project aiming at Developing 10,000 New Textbooks (2007) to strengthen the building of new textbooks and multi-media textbooks, to encourage project teams to write their own textbooks, to popularize high-quality teaching materials and to select new textbooks. The project will promote actively the development of web-based educational resources and the construction of open and shared platform, building a digital resource center that functions as the hub of the National Excellent College Courses and multi-media teaching materials, with a number of regional digital learning centers for demonstration and offering support services. It will facilitate open access to all the teaching resources of NECCs such as syllabus, teaching plan, exercises, lab teaching materials and references. Thus more and more teachers and students and independent learners will be able to get free access to quality educational resources, and in turn to reinforce the life-long learning support system.

An online examination system and relevant standards will be developed to gradually

realize a national wide online examination of College English and of nationwide web-based courses, creating a safe, convenient and efficient online platform for examination.

REFERENCES

Gong, Z. (2008). The Research and Practice of University Quality Course Construction, *Modern Distance Education Study*, (1), pp. 47–49.

Guideline for 2008 NECCs Application. http://www.jpkcnet.com/new/zhengce/Announces_detail. asp?Announces_ID=121

Huang, B. & Xiang, G. (2007). Analysis of the Construction of National Star Courses, *Higher Education Study in China*, (9), pp. 72–76.

Liang, L. & Jia, R. (2007). Analysis of the Current Situation of National Star Courses, *Higher Technology Education*, (4), pp. 48–51.

MOE. (2001). The Ideas on Enhancing University Education and Improving Teaching Quality. *HE Document* [2001] 4.

MOE. (2003, April). Initiating Project on Enhancing Quality College Education and Developing Excellent Courses for Teaching and Learning Reform. *HE Document* [2003] 1.

MOE. (2003). Guideline for Implementing NECCs. *HE Document* [2003] 3.

MOE. (2004, Feb.) Implementing Excellent Course Construction, Improving Quality of Teaching and Talent Cultivation,

MOE & MOF. (2007). The Ideas on Enhancing University Education Quality and Teaching Reform in Higher Education Institutions. *HE Document* [2007] 1.

MOE & MOF. (2007). On Developing 10,000 Kinds of Textbooks, *HE Document* [2007] 22. http:// www.moe.edu.cn/edoas/website18/77/info37077.htm.

MOE Education News. (2004). Ministry of Education Launching a National Project on Enhancing Education Quality through Developing College Excellent Courses. http://www.edu.cn/ 20040210/3098663.shtml.

National Excellence College Courses Building Site. http://www.jpkcnet.com.

Ministry of Education of the People's Republic of China Official Site. http://www.moe.edu.cn/.

Minister of Education, Technical Standards and Construction Guideline for National Excellent College Courses, http://www.jpkcnet.com/new/zhengce/Announces_detail.asp?Announces_ ID=23.

Resource Bank of NECCs. http://jpkc.seu.edu.cn/resourcelib/default.jsp.

Tang, J. (2007). Total Traffic to the Sites of National Excellent College Courses Construction Exceeds More than 200 Million times. *China Education News*, 2007-9-30(1).

Trow, M. (1974). "Problems in the Transition from Elite to Mass Higher Education." In *Policies for Higher Education*, from the General Report on the Conference on Future Structures of Post-Secondary Education, 55–101. Paris: Organisation for Economic Co-operation and Development.

Wu, Q. (2004). Publishing 1.000 College Excellent Courses on the Internet, Building New Quality of Higher Education. News Press. http://www.moe.edu.cn/edoas/website18/level3. jsp?tablename=207&infoid=7539.

Xie, Y., Jiang, S. & Zhang, Y. (2008). The Analysis of National Excellent College Courses Supported by Educational Technology. *Distance Education in China*, (1), 44–48.

M-LEARNING: PROSPECTIVE ISSUES

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ABSTRACT

M-learning (mobile learning) is the new trend in learning. It is the natural upshot of the holy alliance between education and technology and lies in line with the remote engineering trend. The need for M-learning is global and becoming more and more acute to come over the escalating barriers of education in different parts of our world.

E-learning as a form of learning depending on networks and computer devices has been expanding extensively the last few years. M-learning which is a special developed form of E-learning aims at the use of mobile devices anywhere at any time by anybody. However, M-Learning faces a lot of challenges to be considered as a successful method of learning. These challenges are summarized and discussed in this paper. One is the technologies to develop a M-learning system, The second is the standardization in M-learning in order to accelerate the development and make the M-learning more enticing. The third is the quality of experience (QoE); i.e. the experience of the user. Finally, the fourth, the social aspects of equality, known as the digital divide which should be overcome by technically and economically reasonable methods.

The technologies, standardization and evaluation are discussed based on literature review [1].

Moreover, digital divides are discussed enhanced by own experience and thoughts [2].

INTRODUCTION

E-learning is a learning environment supported by continuously evolving, collaborative processes focused on increasing individual and organizational performance [3]. E-learning is the acquisition and use of knowledge distributed and facilitated primarily by electronic means. This form of learning currently depends on networks and computers but will likely evolve into systems consisting of a variety of channels (e.g., wireless, satellite), and technologies (e.g., cellular phones, PDA's) as they are developed and adopted.

E-learning can take the form of courses as well as modules and smaller learning objects. E-learning may incorporate synchronous or asynchronous access and may be distributed geographically with varied limits of time [4]. In short, E-learning is the learning facilitated and supported through the use of information and communication technology [5].

At the initial stage, E-learning was mostly targeted toward PC users using fixed line access to Internet (e.g., KBS 2000, CBR 2002, SQL 2002, Blackboard 2002, VEDA 2002, Prentzas 2002). With the availability of high bandwidth wireless channels such as 3G telecommunication infrastructure and wireless LAN, M-learning is becoming more feasible now [6].

With respect to technologies, 'mobile' generally means portable and personal [7], like a mobile phone. M-learning (mobile learning) is a kind of E-learning which based on the use of mobile devices (PDAs, mobile phones, notebooks or Tablet PCs) anywhere at any time [8]. These devices must support wireless communicational technologies (GPRS, GSM, IEEE 802.11, Bluetooth, IrDA) and have a possibility to present teaching materials, and to realize an asynchronous/synchronous communication between learners and teachers [9].

In this paper, we focus on the technologies, standardization and evaluation of M-learning by the literature review in mobile technologies and E-learning. Firstly, M-learning system overview and its layer model are given in this paper. The technologies and characteristics in M-learning are deeply analyzed. M-learning is a special E-learning supporting mobility and needs existing E-learning application improved from media content to transmission technology. Secondly, the line map and practical method of developing M-learning standards are researched. As a kind of network application based on mobile communication platform, M-learning is related to equipment provider, network provider, content provider, technology provider and service provider. In the process of disseminating and applying M-learning technology, the standardization of M-learning will play a leading role. The investigation of usability and user-based methods in quality estimation of M-learning system are discussed from the view of QoE (quality of experience). End-user's QoE is undoubtedly the sole effective norm to judge the success or failure of M-learning technology. Finally, the digital divide is discussed with M-learning in mind as an effective instrument to leap over barriers.

M-LEARNING TECHNOLOGIES

M-learning system

Several technologies are available to implement a dynamic and adaptive M-learning system. Server side techniques using Java servlet, JSP, ASP, PHP and other proprietary authoring tools such as macromedia flash with action script can be used. Other enhanced servers such as CoCoon or Xalan are capable of implementing device adaptable system. Figure 1 shows an overview of M-learning system, where XML files are used to store the content (questions), directions for multimedia representation of revision material for the students, and the user model. These involve the content and user dimensions [6]. M-learning systems can support different types of mobile devices, such as wireless laptops, iPods, cell phones, PDAs, Tablet PCs, and smart phones.
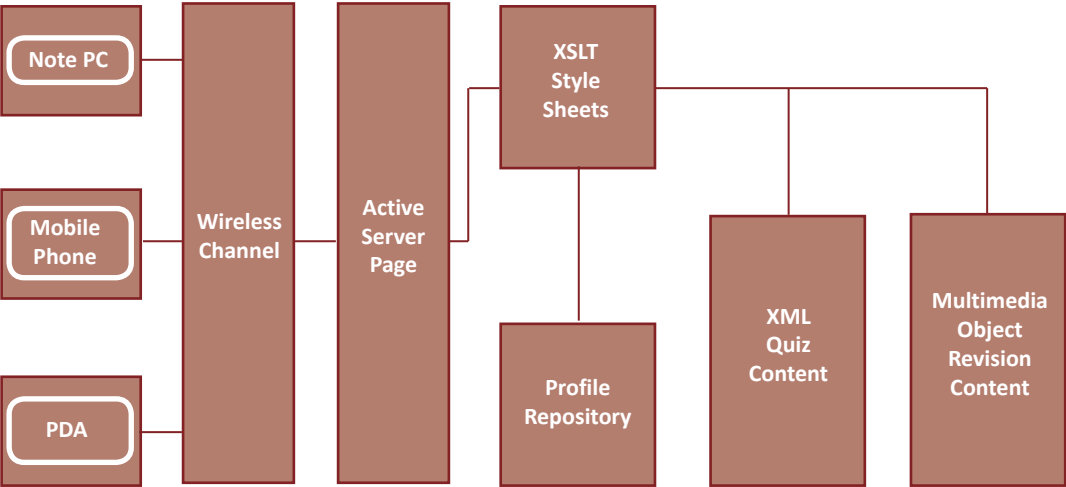
Figure 1. M-learning system overview

M-learning is a special E-learning supporting mobility. M-learning takes wireless communication instead of wire communication in E-learning to build the network platform. Since both M-learning and E-learning are the systems on Internet network environment, we can reference TCP/IP layer model [10–11]. From the viewpoint of layer model, M-learning system is composed of learning application layer, transport layer, network layer, and data link layer (physical communication platform). Figure 2 shows the layer model of M-learning system. At the bottom layer of M-learning layer mode, optional wireless communication technologies include GPRS (General Packet Radio Service), 3G, IrDA (Infrared Data Association), Bluetooth, IEEE 802.11 (Wireless LAN), IEEE 802.16, WiFi, WiMAX (Worldwide Interoperability for Microwave Access), etc.

Figure 2. M-learning layer model

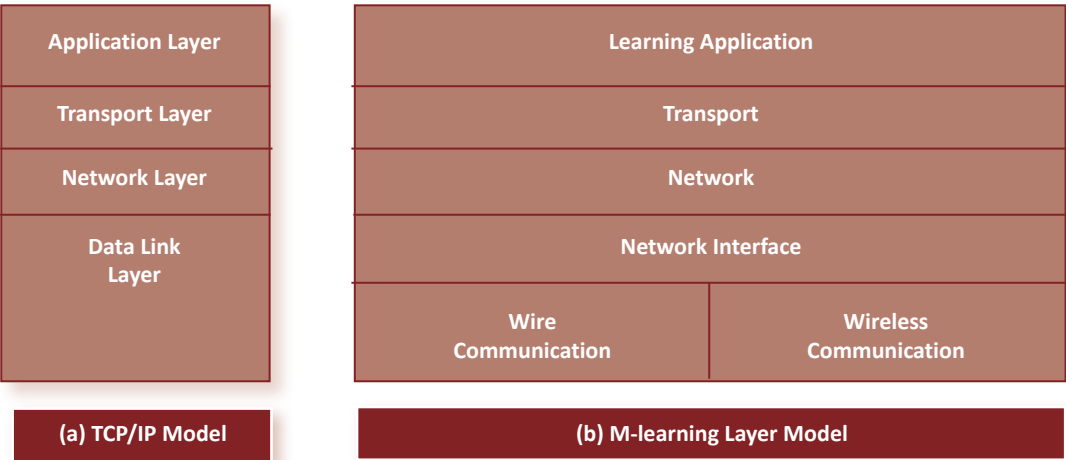Nowadays vast majority of mobile equipments are able to support IP networking with NOS. Optional OS platform includes Windows CE, Pocket PC, Symbian OS, Palm OS, J2ME (Java 2 micro Edition), and Pogo Linux. Moreover, optional development languages include Flash, C, WML, VoiceXML, HTML, XHTML. Multimedia application information, including video, audio files, Phone calls, voice recognition, still Images, mobile Web, interactive media, can be delivery between server and client through many kinds of transport protocols such as WAP (Wireless Application Protocol), E-mail, SMS (Short Message Service), MMS (Multimedia Messaging Services), and HTTP. From the viewpoint of communication service character, M-learning is the integration of data service and mobile service. WAP is the standard for mobile data service support by many equipment providers, and has been widely applied in wireless Internet. WAP protocol stack is compared with Internet protocol stack, as seen in Figure 3. In order to understand their difference, lower layer protocol is also given in Figure 3. Now WAP has developed from initial V1.0 (WSP/WTP/WTLS/WDP) to V2.0 (WP-TCP).

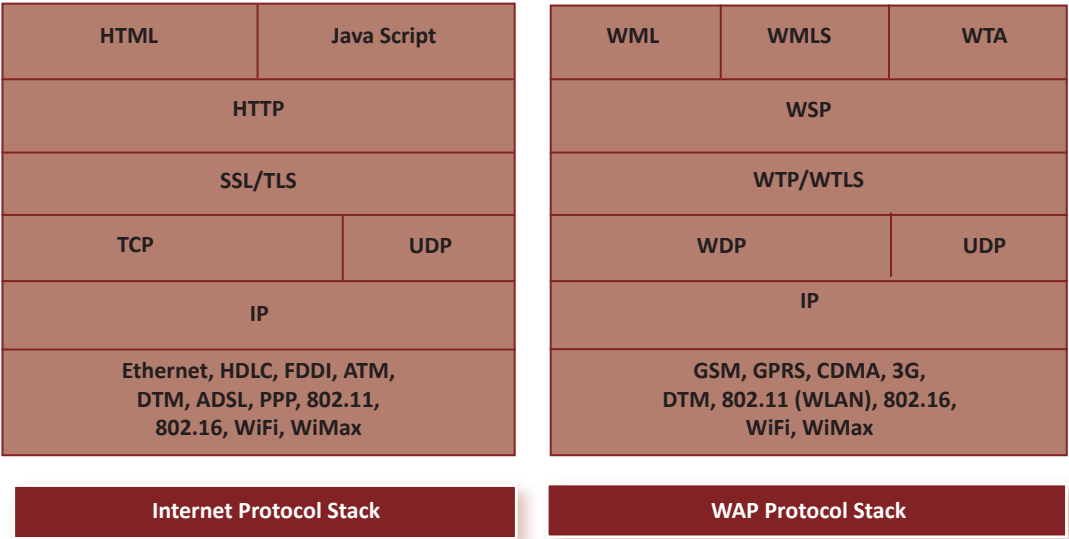| HTML	Java Script		WML	WMLS	WTA
HTTP			WSP		
SSL/TLS			WTP/WTLS		
TCP	UDP		WDP		UDP
IP			IP		
Ethernet, HDLC, FDDI, ATM, DTM, ADSL, PPP, 802.11, 802.16, WiFi, WiMax			GSM, GPRS, CDMA, 3G, DTM, 802.11 (WLAN), 802.16, WiFi, WiMax		
Internet Protocol Stack			**WAP Protocol Stack**		

Figure 3. Protocol stack comparison

Above analysis shows that five broad categories of information and communication technologies (ICT) [12], namely transport, platform, delivery, media technologies, and development languages, should be considered in considering the implementation of M-learning.

   Further investigation on M-learning system shows that Different Delivery Platforms and Removable Storage Memory Formats should be considered in Client Platforms; in the respect of Mobile Content Development, Different media (audio, video, Web, images, document, Flash Lite) and their relevant questions, such as Resolution, Compression, Codecs, Local Playback, and Wireless/Streaming Access, should be separately examined in its entirety; in the respect of Mobile Content Support, a comprehensive programme should be made for accessibility, content packaging and metadata; in the respect of Mobile Content Delivery, we should focus on mobile Web services, wireless data connectivity (IrDA,

Bluetooth, WiFi, GPRS, et al) and proximal learning technologies (GPS, RFID, 2D Barcodes) .

M-learning Characteristics

M-learning is the integration of E-learning and mobile communication technologies. Above analysis shows apparently that existing E-learning system also needs to be improved from the learning application at upper layer to transmission technology at lower layer in order to support user's mobility.

An essential distinction between M-learning and general E-learning is that the former has mobility. In other words, E-learning system is able to support mobile data service. From the viewpoint of information and communication technologies (ICT), the mobility of M-learning lies in the following main indicators:

support of mobile devices;
support of wireless communication technologies.

Since M-learning is a kind of special E-learning, it has also the same characters as general E-learning. From the viewpoint of educational technologies, common characters of E-learning lie in the following main indicators:

(1) support of synchronous and/or asynchronous education;
(2) support of on-line and/or off-line mobile learning;
(3) support of user's location (on-campus, off-campus);
(4) access to learning materials and/or administrative services.

M-LEARNING STANDARDS

From the viewpoint of application, M-learning is a kind of network application based on mobile communication platform. Like the other applications, it is also related to equipment provider, network provider, content provider (specialized website), technology provider, and service provider. In the process of disseminating and applying M-learning technology, all the above roles have their own duty, location, and function. For example, portable terminal equipment should not only possess abundant interface to support some mainstream wireless communication technologies, but also possess appropriate OS and application software to support mobile learning environment including different kinds of media content and interactive mode. Wireless network should possess better signal coverage and connection performance, and provide more bandwidth and higher rate. It is also necessary to provide better interflow of service, especially M-learning service, between different networks or different ISPs. The trend of learning materials (content) is the integration of text, photograph, audio, video, et al. The content design should take into account the limit of mobile learning environment including transport protocol and terminal ability.

It is very important to coordinate all above roles to promote M-learning application, and M-learning standardization would play an important part in this course. History shows that revolutionary changes do not take off without widespread adoption of common standards. For Internet, this was the common standards of TCP/IP, HTTP, and HTML. Common

standards for metadata, learning objects, and learning architecture are mandatory for similar success of the knowledge economy.

Unfortunately, there are no unified international specifications and standards for M-learning at present. Since M-learning is the subset of E-learning, it is reasonable for M-learning to refer to E-learning specifications and standards at first. Fortunately, the work to create such standards for learning objects and related standards has been going on around the world for the past few years. This includes the creation of accredited standards from the LTSC (IEEE Learning Technology Standards Committee) for Learning Object Metadata, Computer Managed Instruction, Course Sequencing, Learner Profiles and much more [13].

Currently, E-learning standards are being developed by four main organizations: IEEE LTSC, AICC (Aviation Industry CBT (Computer-Based Training) Committee), IMS (Instructional Management System), and ADL (Advanced Distributed Learning). Based on accepted technology standards, including XML and JavaScript, SCORM (Sharable Content Object Reference Model) is fast becoming the de-facto E-learning technology standard widely embraced and supported today by world-leading corporations, universities, system providers, and content vendors. The SCORM standard comprises of four major elements: an overview, Content Aggregation Model, IMS guidelines, and the run-time environment. The SCORM standard is focused on enabling the plug-and-play interoperability, accessibility, and reusability of Web-based learning content [14].

However, M-learning possesses itself characteristics which needs appropriate standards. The need for standards in M-learning has been well established by educators and education support professionals over the last few years [15]. To define appropriate standards and best practices for M-learning, a practical method is to utilize the activity-based model as following [16]:

Step 1: By identifying the learning activities associated with the practice of M-learning, a learner-centric standards model may be developed to support the known activities of teachers and learners.

Step 2: By utilizing this activity-based model of M-learning, a literature review was conducted that accumulated a body of knowledge of best practice, and then standards and best practice in M-learning might be informed.

Step 3: It is the peer consultation phase to present the findings of the literature review and accompanying research to M-learning practitioners, mobility and mobile content experts, and associated support professionals, so as to complement with anecdotes and recommendations drawn from practical experience.

The development of M-learning standards and best practices must address issues affecting the creation, delivery, interoperability, and discovery of mobile learning resources. In the investigation of these issues, equity and accessibility issues should also be given due consideration, to reduce barriers to accessing M-learning content.

The development and popularization of M-learning should be step by step, accompanying by the development and popularization of common mobile communication technology (such as 3G, 4G), and it should also be compatible with some new technologies, such as Ad Hoc, universal computing, and grid. Undoubtedly, the standardization of M-learning will play a leading role.

M-LEARNING EVALUATION

Technical standards for M-learning are used in guiding its system design and technical implementation in order to get better application results. But how to determine the value of a realized M-learning system? Usability is the basic parameter for the evaluation of M-learning technologies and systems. Usability means quality and puts the users and their real needs in the center. Therefore, investigation of usability and its integration or contribution to the learning process is worthwhile.

It is known that the major dimensions of usability defined by ISO (1993) are effectiveness, efficiency, and satisfaction. As to their refined meanings in the M-learning context, we may refer to the definition for the instructional interface design process [17].

(1) Effectiveness: Learner interprets instructional interface function correctly; instructional interface function performs according to the learner's expectations.
(2) Efficiency: Learner experiences minimal frustration interpreting instructional interface function; learner experiences minimal obstacles in using instructional interface element.
(3) Satisfaction: Learner seems comfortable in the environment overall.

For evaluating the usability of interactive systems, user-based methods and inspection methods are the most commonly adopted. User-based methods [18] mainly consist of user testing, in which usability properties are assessed by observing how the system is actually used by some representatives of real users. Meanwhile, usability inspection methods [19] involve expert evaluators only, who inspect the application and provide judgments based on their knowledge and experience.

Here we focus on user-based usability in the evaluation techniques of M-learning, so that we can do our best to realize and implement the learner-centered design paradigm, reflect upon learners' needs, and understand their attitudes. It is suggested that such a method incorporate the following basic characteristics [20]: ① It must be built upon the creative integration of the usability and instructional design; ② It must take into account the learners' perceptions themselves; ③ It must be short, easy to deploy so that M-learning economics can afford its use.

We can adopt the three-step approach to learner-centered usability testing [21]. First, designers and usability experts do a quick run through of the instructional interface to see if it is addressing some of the most basic types of learner questions. Second, a check sheet matrix is employed to guide the usability testing. The matrix consists of two sections: a) user actions that evaluators can observe, and b) questions that evaluators can ask the users. Observation and interviews are the main methods proposed. Third, thinking aloud protocol is employed in usability tests with users' involvement.

In fact, Quality of Experience (QoE) from end users is the best criterion to evaluate M-learning, because practice is the sole criterion for testing truth. Nowadays, service accessibility, retainability, availability and integrity define the QoE performance and competitive advantage across packet-based communications networks. A very well known and widely used approach to measuring QoE is service level performance measurement using statistical samples [22].

This methodology relies on a statistical sample of the overall network users to measure

the QoE for all the users in the network. This process involves the determination of key service weights (in the case different metrics are combined to form an overall user satisfaction index); the identification of QoE key performance indicators (KPIs); definition of a proper statistical sample (time of day, traffic mix, geographic areas, etc.); collecting measurements utilizing mobile QoS agents in handsets; and giving an overall QoE score (index) from KPI values for each separate service and service mix.

M-LEARNING OVERCOMES DIGITAL DIVIDES

General Aspects

Education is a basic human right for people no matter how old they are and irrespective of their race or religion [23]. Although a lot has been made and plenty is said about equality, justice and human rights the author believes that still there are a lot of divides and barriers in our world to overcome. The world was and still is divided into A-category with access to a wide spectrum of general and advanced education and B-category with no or perhaps a very limited access. The earlier introduction of traditional distance learning partially helped some of those of the B-category to get access to education. But the gap was apparent. Distance learning, nowadays well known as E-Learning is run to meet important national and international needs based upon economical, political, geographical and demographical conditions. It is the conditions of the local and global societies that motivate the utilization of E-learning, not only the strained economical conditions of the individual student [24]. The transition of traditional distance learning into E-learning introduced new conditions and digital educational platforms that caused persistence in the gap in education. These platforms imply that the user has access to a terminal for communications and interaction in addition to infrastructure. A major and highly topical divide is the digital divide where some people have access and benefit from the digital technology and some do not. According to statistics from the United Nations [25], the digital divide is still wide. In developed countries, 58 per cent of the population was using the Internet in 2006, compared to 11 per cent in developing countries and only one per cent in the least developed countries. The digital divide arose as a result of the vast and fast development in information systems, digital media and communications technologies.

However, we cannot put all the blame on the progress of technology; social, political, economical, environmental, geographical and demographical factors play a prominent role in this aspect. These and other global factors lead to divides among nations and sometimes among the same nation. The digital divide may be seen as a difference between generations where the younger generations born in the digital world are considered as natives while the older generations are considered as immigrants. Still, the most important feature, but not the only one, which characterizes the digital divide is the issue of infrastructure or more correctly the absence of it. How to deal with this issue in education and how to make use of M-learning in this aspect is another main purpose of this papHow can we make education available to everyone who has the right to it? Traditional learning methods in education imply physical accessibility. Educational institutions must be within safe

physical reach for all involved in teaching and learning activities. As this is not always the case due to long distance as the case in the northern part of Sweden or to some specific security measures as in the Palestinian territories virtual accessibility and virtual reach become inevitable. E-learning turns to be the alternative. E-learning is the delivery of a learning, training or education program by electronic means. It involves the use of a computer or electronic device such as a mobile phone or an iPod in some way to provide training, educational or learning material. E-learning also means the use of electronic applications and processes to learn. This includes among others web-based learning, virtual classrooms and digital collaboration. Content is delivered via the Internet, intranet/extranet, audio or video tape, satellite TV, etc. E-learning is nowadays very demanding; it should maintain high social status and keep a high quality standard to meet the requirements of accreditation.

Traditionally, interactive communications facilitating the use of Internet either through desk computers, laptops or mobile units as PDAs and mobile phones needs a well established communications infrastructure. M-learning is a special E-learning supporting mobility. M-learning takes wireless communication instead of wire communication in E-learning to build the network platform [1].

Infrastructure, however, is not available everywhere and thus not everyone is reached. This means that the alternative to traditional learning, e.g. E-learning or M-learning fails to accomplish the intended goal. Populations living in areas with no infrastructure for Internet and mobile phones have no chance to learn, i.e. no chance to build a knowledge-based society. Education may not reach all; the world is going to Web2.0 and some are still at Web Zero!

It is thus apparent that to have just education through E-learning two main issues need to be met simultaneously. One is the communication terminal and the other is the communication network that guarantees the real-time video necessary in live lecturing and social interaction as mentioned above. It is of no use to give a laptop, a mobile or smart telephone to a person in an area where no communication coverage exists. On the other hand, it is meaningless to furnish a communication network with excellent communication coverage if people there cannot afford having a laptop or any of the known communication terminals. In this aspect there are a lot of ongoing efforts with noteworthy progress like the "One Laptop Per Child" project, OLPC, and hopefully this issue will be solved when every child in the developing countries can have one. However, the other issue of network communication in spite of the numerous research projects still needs more efforts to be satisfactorily solved furnishing access to every user.

In this paper we present a possible solution to come over the problem of infrastructure and student satisfaction described above. The proposed solution presents an alternative to the availability of infrastructure. It is simple, cheap and effective. It can be used alone and independent of infrastructure or in coordination with it. The suggested solution is based on wireless ad-hoc networks. It is a tailor made wireless solution that can work well together or as a complimentary to an existing or a nearby base station. The laptops provided by the OLPC project will have the possibility to run ad-hoc networks based on the IEEE 802.11s standard [26]. However, the main purpose of that ad-hoc network is for applications having very low Quality of Service (QoS) requirements, for example e-mail and web browsing. We suggest a new routing protocol better suited for real-time communication,

for example real-time video conferencing. This will enable the possibility to provide high quality E-learning material to the users. We also suggest adding solar powered communication nodes in the network to be able to guarantee network coverage at times when the number of clients is few.

Scenarios

Infrastructure may cover a lot of places but still there are places not covered because they are remote from the main cities and the population density is very low. People in such remote areas will not have equal opportunity even in a knowledge-based society. On the other hand, there are societies where high density populations due to one reason or another do not have access to infrastructure or it is too expensive to use it. The solution of wireless ad-hoc networks can be applied to both scenarios of remote low density population and high density population. 5.3 below describes the ad-hoc network hardware platform we use to provide E-learning.

Platforms

Here we present our platform for providing a practical and reasonably priced communication network. This platform is based on wireless ad-hoc networks and can be used to provide high quality E-learning. The platform consists of a set of nodes that are connected by wireless links. In this network the nodes are free to move and the topology of the network may therefore change. The nodes can forward data for each other in multiple hops and the path between two nodes is set up dynamically depending on the connectivity between the nodes and without the support of any central coordinator. The coverage of this network is increased when more users are added to the network. This type of network is very robust since nodes can be added or removed from the network dynamically and the routing will adjust rapidly to the new conditions. Even thought the capacity for end to end communication is decreased when data is forwarded in multiple hops [27], the capacity provided by an ad-hoc network is high enough to enable real-time video communication.

Our network is built up using two different types of nodes (see Figure 4). One type of nodes is the ad-hoc clients in the network. These nodes can be for example a laptop equipped with an IEEE 802.11 wireless interface. This type of nodes can relay traffic for other nodes, but also be sink or source for traffic. They are both routers and hosts. These nodes are mobile and can also be switched on and off randomly thus creating fast changes in the network topology. The other type of nodes is mesh nodes that will only relay traffic for other nodes. They are needed to guarantee connectivity even at times when the number of mobile clients is few. These nodes can be located at rooftops or other positions providing a high level of coverage.
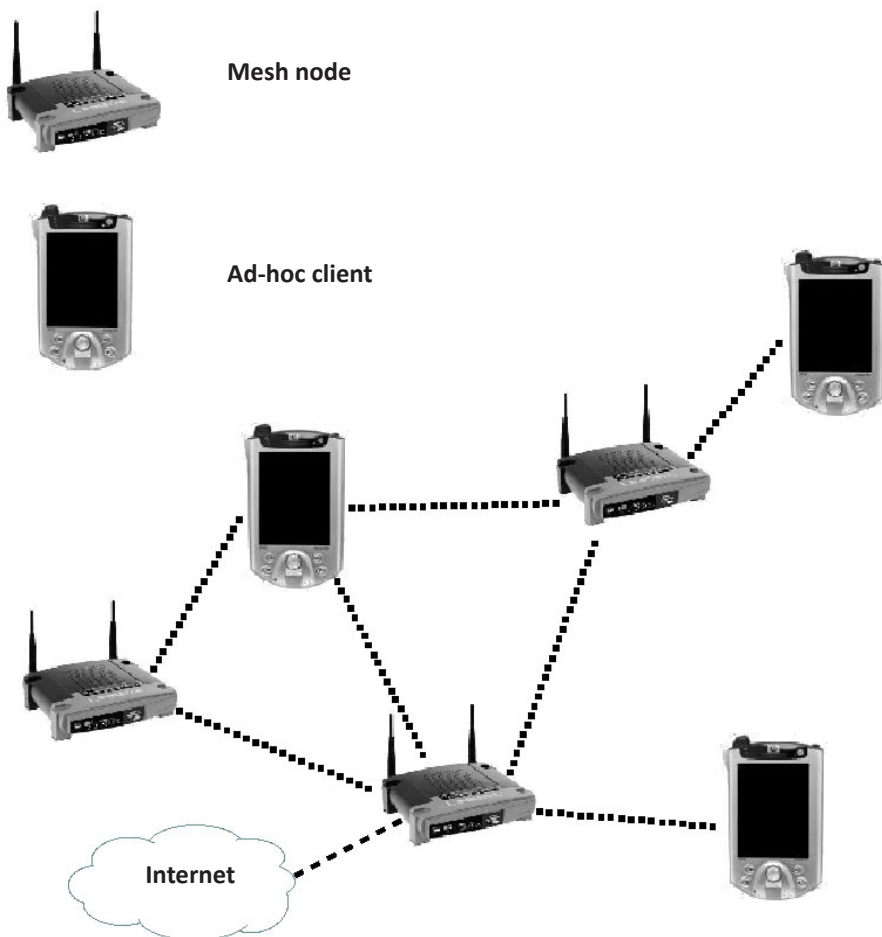
Mesh node

Ad-hoc client

Internet

Figure 4. An overview of a network consisting of mesh nodes and mobile ad-hoc clients

CONCLUSION

Technology is the foundation of realizing M-learning, standardization is the guarantee of a good M-learning system, and evaluation is the approach to examine the effect of an M-learning system. With this paper, technologies, standard and evaluation in the reconstruction of M-learning systems have been analyzed. For the better comprehension and practical use of above concepts, related model, methods and detail realization steps were also provided.

Learning is eternal theme in both M-learning and E-learning. Learning is a deeply personal act that is facilitated when learning experiences are relevant, reliable, and engaging. Different kinds of learning demand appropriate strategies, tools, and resources. Therefore, technology in and of itself may not guarantee better learning. Successful M-Learning

should emphasize user's experience, encourage contacts between students and faculty, develop reciprocity and cooperation among students, and give prompt feedback in order to improve itself ceaselessly.

Also, a solution to counteract the digital divide was referred to. A possible solution was presented for providing high quality E-learning to people living in areas with no infrastructure for Internet and mobile communication or where the cost to use the existing infrastructure is too high. This solution is based on wireless ad-hoc networks. The hardware platform presented is built using low cost high volume consumer products. Applying this system in practice would probably make it possible to reach everybody interested in using his or her right in education independent of the place of living or surrounding environment.

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REFERENCES

[1] Adi Anani et al., "M-learning in review: Technology, standard and evaluation", *Journal of Communication and Computer*, 5 (11), November 2008.

[2] Johannes Karlsson, Adi Anani and Haibo Li: Enabling Real-Time Video Services Over Ad-Hoc Networks Opens the Gates for E-learning in Areas Lacking Infrastructure, *International Journal of Interactive Mobile Learning* (iJIM), 3 (4), October 2009.

[3] Robert K. Logan, "What is eLearning?", http://www.managersforum.com/eLearning/ Index.htm

[4] Tim L. Wentling, Consuelo Waight, James Gallaher, etc. "e-learning - A Review of Literature", http://learning.ncsa. uiuc.edu/papers/elearnlit.pdf.

[5] JISC, "Strategic themes: e-Learning", http://www.jisc. ac. uk/whatwedo/themes/ elearning.aspx

[6] Goh T. T., Kinshuk and Lin T, "Developing an adaptive mobile learning system", International Conference on Computers in Education. December 2–5, 2003, Hong Kong, Norfolk, VA, USA: AACE, 1062–1065.

[7] Naismith, L. et al., "Literature Review in Mobile Technologies and Learning", NESTA Futurelab Series, Report 11, 2004, United Kingdom.

[8] Georgiev, T., E. Georgieva, A. Smrikarov, "M-Learning - a New Stage of ELearning", Proceedings of the ComSysTech'2004, June 17-18, 2004. Rousse, Bulgaria, pp. IV.28-1 to 28-5.

[9] Evgeniya G., Angel S., Tsvetozar G., "A general classification of mobile learning systems", International Conference on Computer Systems and Technologies (CompSysTech'2005), pp. IV.14-1 to 14-6.

[10] R. Bush, D. Meyer, "Some Internet architectural guidelines and philosophy", RFC 3439. December 2002.

[11] B. Carpenter, "Architectural principles of the Internet", RFC 1958. June 1996.

[12] Attewell J., "From research and development to mobile learning: Tools for education and training providers and their learners", Proceedings of mLearn 2005. Retrieved December 20, 2005,

http://www.mlearn.org.za/CD/papers/Attewell.pdf.

[13] Wayne H., Marcia C., "Everything you ever wanted to know about learning standards but were afraid to ask", Fall 2000, http://www.linezine.com/2.1/features/ wheyewtkls.htm.

[14] Ryann K. Ellis, "E-Learning Standards Update", July 2005, http://www.learningcircuits.org /2005/jul2005/ellis.htm.

[15] Grohmann G., Anja H., Martin G., "ARIS MOBILE: Helping to Define the Future of`Mobile Learning", International Conference on Mobile Business (ICMB'05), Germany: IEEE Computer Society. pp. 213–219.

[16] Leonard Low, "M-learning standards report: Background, discussion and recommendations for usable and accessible m-learning", 2007.1.8, http://e-standards.flexiblel earning.net.au/docs /m-standards-report-v1-0.pdf.

[17] Lohr L., "Designing the instructional interface", *Computers in Human Behavior* (2000) 16 pp. 161–182.

[18] Dix A., Finlay J., Abowd G., et al., *Human-Computer Interaction* (3rd Edition), Prentice Hall Europe, London, 2003.

[19] Nielsen J., *Usability Engineering*, Academic Press. Cambridge, MA. 1993.

[20] Panagiotis Zaharias, "Usability and e-learning: the road towards integration", *eLearn Magazine*, Vol. 2004, No. 6, June 2004, p. 4.

[21] Lohr L., Eikleberry C., "*Learner-Centered Usability: Tools for Creating a Learner-Friendly Instructional Environment*", 2001.

[22] D. Soldani, M. Li and R. Cuny. *QoS and QoE Management in UMTS Cellular Networks*, John Wiley & Sons, June 2006, p. 450.

[23] "The universal declaration of human rights, general assembly resolution 217 a (iii) of 10 december 1948."

[24] Adi Anani, "A Distance Learning Program in Action", Proceedings of the 29th IEEE Frontiers in Education Conference, November 10–13, 1999 San Juan, Puerto Rico.

[25] "The Millennium Development Goals Report 2008", United Nations.

[26] Michael Bahr, "Proposed routing for ieee 802.11s wlan mesh networks," WICON'06: Proceedings of the 2nd annual international workshop on Wireless internet, New York, NY,USA, 2006, p. 5, ACM Press.

[27] Jinyang Li, Charles Blake, Douglas S. J. De Couto, Hu Imm Lee, and Robert Morris, "Capacity of ad hoc wireless networks," in *Proceedings of the 7th ACM International Conference on Mobile Computing and Networking*, Rome, Italy, July 2001, pp. 61–69.

WEB-BASED KNOWLEDGE BUILDING AND TEACHERS' PROFESSIONAL DEVELOPMENT

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ABSTRACT

The goal of this article is to open new perspectives on teachers' technology-supported professional development and offer advice, ideas and meta-policies, for educational policy makers for planning innovative, effective and cost-efficient models for teacher training.

The goal is to learn what possibilities, challenges and problems teachers confront when implementing synchronous, web-based knowledge building in their in-service training and to find out what kind of advantages a web-based learning environment offers to teachers' collaboration.

The findings of the study indicate that synchronous web-based knowledge building, which is based on clear, authentic, real-life problem statements, supports teachers' collaborative problem-solving and professional development in a meaningful way. The findings also indicate that a web-based learning environment provides, as a collective memory and a platform for shared writing, a unique possibility for the development of teacher communities. It is suggested that for supporting teachers' professional development better in the future, educational policy makers should implement web-based knowledge building as an innovative model for teacher (in-service) training and foster genuine collaborative cultures in teacher communities.

Keywords: synchronous web-based knowledge building, teachers' professional development, in-service teacher training

INTRODUCTION

What is happening in the professional development of teachers? How can we benefit from new technologies to empower teacher development and collaboration in the context of educational change? I believe the potential in using web-based technologies both for

supporting teachers' individual development and in fostering communities of teachers is great. The goal of this article is to offer new perspectives on teachers' technology-supported professional development and offer advice and ideas, meta-policies, for educational policy makers when planning innovative, effective and cost-efficient models for teachers' in service training in future.

This article is divided into five chapters. In the introduction, I present the key concepts of this study and the latest findings from educational research which is of most interest in relation to professional development, teacher collaboration and use of new technologies. At the end of the chapter, the objectives of the present research are described in more detail. In the second chapter, I introduce the context of the research and have a closer look to the web-based knowledge building, which is an innovative, technology-supported model for teacher in-service training. Then, in the third chapter, I describe the research process, methods and results. In the fourth chapter I present my research results and in the fifth I make my conclusions on the results and offer some new aspects on technology-supported professional development and ideas for planning innovative policies for teachers' in-service training.

Collaborative learning, web-based knowledge building and professional development

The most essential concepts in this study are *collaborative learning, web-based knowledge building* and *professional development*. They all offer useful aspects to the dynamic process, in which teachers learn to benefit new technologies meaningfully in their pedagogical practises. In next sections I will introduce these concepts in more detail for encouraging policy makers to critically reflect and assess how teachers' professional learning in collaborative context could be supported by new technologies.

The idea of *collaborative learning* is not new for educators. However, it has been strongly emerging again in educational literature in the past two decades. Collaborative learning entails that new knowledge is not simply assimilated but actively constructed through joint problem-solving. Through intensive collaboration resources of the all participants may be used to facilitate advancement of learning. (Bereiter & Scardamalia 1987; Hakkarainen 2003.) Collaborative learning relies on dialogue (see e.g., Freire 1970; Senge 1990); it attempts to encourage people's active involvement in questioning and in creation of knowledge instead of receiving information passively. Dialogue enables people to find new insights which they would not have achieved on their own; it creates richer understanding of the matter in hand and involves the free flow of new ideas. Collaborative learning is also closely related to the conception of collaborative knowledge building, but they are not synonymous. Instead, one could say, that in its' best case, collaborative learning can lead to collaborative knowledge building.

In this research, the concept *web-based knowledge building* means the facilitated, collaborative process, which takes place in a Knowledge Building tool of a web-based learning environment, which is software designed for supporting collaborative pedagogical practices. Currently, there are several software *programmes* planned for supporting shared discussions and group work on the market and also freely available on the Internet. One often hears mentioned the term, "online discussion", which refers usually to synchronous

or asynchronous virtual conversations supported by the Internet in general. Web-based knowledge building has a more specific meaning. The software described in this article is designed for a particular social activity, which emphases participants as subjects and knowledge as object that is handled and processed by the participants (Leinonen, Ryymin & Korhonen 2005). In the Knowledge Building tool of the web-based learning environment, groups may carry out knowledge building dialogues and debates by storing their thoughts into a shared database. Knowledge building differs from other online discussions or chats in its means to achieve something more than just "information exchange". Knowledge building has its bases on pedagogical approach called *progressive inquiry learning* (Hak-karainen 2003) which means a sustained process of advancing and building knowledge characteristic of scientific inquiry. An essential aspect of this kind of inquiry is to engage collaboratively in improving shared knowledge objects; hypotheses, theories, explana-tions, or interpretations. Knowledge building can be described as collaborative working for developing conceptual creations, for example practices and theories. (Hakkarainen, Lonka & Lipponen 2000, 274; Scardamalia & Bereiter 1992; 1994.) Benefits of knowledge building are that it makes the thinking of participants with different expertise open and perceptible. According to Scardamalia, Bereiter, McLean, Swallow and Woodruff (1989) it is easier for the community to discuss and adopt written rather than spoken thoughts. In this way the members of the community are able to learn developed cognitive practices to solve intricate problems.

The days when teachers entered their classroom, closed the door and got on with teaching, to be visited only on occasion by inspectors, are gone. There is now an emphasis on self-evaluation, reflective practice and continuing personal and *professional develop-ment* in teacher's profession. Teachers are encouraged to take responsibility for their own careers. (Neil & Morgan 2003.) But what is the difference between professional growth and professional development? According to Beairsto (1996), intellectual growth means the acquisition of more knowledge and skills, basically within already familiar realms. Intel-lectual development, instead, involves an extension into the unfamiliar and the emergence of new concepts, skills and behaviour. On the other hand, professional growth might be used to describe the broadening of expertise while professional development might be used to describe the process of extending into qualitatively new areas of knowledge or ability. In this article, teachers' professional development is related to teachers' process to develop new skills and practices when implementing innovative, technology-supported pedagogical practices. The qualitatively new areas of knowledge are aimed for within this process. For this purpose the concept of teachers' professional development has been chosen to clarify the specific nature of the development described here. The context of the research and teachers' in-service training are introduced in more detail in the second chapter. Before we go on, I think it would be useful to have a glance at the findings of lat-est educational research about professional development, teacher collaboration and use of new technologies. These notes are important to bear on mind when reading this article further and planning school development projects in future.

Informal, personal and interpersonal dimensions in professional development
Many policy makers are aware of the basic principles of professional development, but

there are some new aspects, which might be beneficial when planning policy making related new technologies and networking. As we all know, the modern world is characterized by pervasive and rapid change. Professionals can no longer think in terms of being educated but in terms of becoming educated or enhancing our competence. Especially, according to Ruohotie (1997) ongoing learning and self-development by employees is critical to the success of competency-based organizations, such as educational institutions. Ruohotie (1996) introduces Dubin's (1990) findings on phenomena which make continuous professional development essential: rapid creation of knowledge, complexity of knowledge, technological innovation and global competition and concludes, that when external factors create a need for organizational changes to tasks and duties, individuals must respond to these changes in order to retain their competence. However, all authors who are trying to manage with reforms know that uncritical acceptance of every new development leads only to stress and confusion. Also, the role of the educators is far more active and autonomous than just responding to the need of global competition. For instance, here in Finland teachers are quite independent, highly-educated players, who actively participate into curriculum development (not only implementation), creation of new pedagogical practices and public discussion of educational and social values in the society. The critical question is then, as Ruohotie (1996) puts it: "when does a failure to change result in obsolescence and when is it an indication of stability and mature judgement"? An interesting view to teachers' professionalism is offered with the concepts of *competent and obsolete professionals* (Kaufman 1974; 1990; see in Ruohotie 1996). Obsolescence of skills and knowledge can be defined, for example, as a lack of the up-to-date skills and knowledge necessary in order to perform in current and future tasks. A competent professional demonstrates innovative solutions to problems, seeks challenging assignments which involve advanced knowledge and have active interaction with colleagues. An obsolete professional, in turn, is no longer inclined or able to solve novel problems, is not familiar with the latest strategies and equipment for his / her work and experiences decreased respect and credibility among colleagues.

Why, then, teachers get involved with professional development, what makes them interested? Maurer and Tarulli (1994) have found some factors, which influence an individual's decision to participate in development activities at work: perceptions related to the working environment, beliefs regarding the benefits of development, values and judgements and personality factors such as identification with work and self-efficacy, which means how confident the individual is of his / her ability to learn new skills. Also, Ruohotie (1994; 1996) and Ruohotie and Nokelainen (2001) emphasise the motivational basis for professional learning: self-efficacy and personal effectiveness in the learner, as well as expectations of success, have a positive impact on achievement. In addition, the motivation to grow, the desire on the part of the learner to develop and experience new things, is one of the key factors in professional development.

Leithwood (1999) writes that teachers learn through quite informal means from their colleagues and from the opportunities to socially process new information. Ruohotie (1999) introduces also another interesting, colleague-related insight for reflection teachers' professional development. He talks about *relationship-based learning*, which emphasises horizontal growth and interactive relations in working life. A career is defined in term of increasing competence, resulting from both developing expertise and *expanding*

personal networks. Educational policy makers know well, that the application of career research, which is based on experience in business life, in public school system, requires consideration of the unique circumstances of the school environment. Anyhow, I believe, that career research is relevant to education. For instance, a teacher's personal life, formal and informal relations and accumulating experience are all having an effect on his / her work behaviour. This realization broadens the perspective on professional development of teachers and could have implications on the way in which educational authorities support professional learning in working life.

Genuine collaboration and contrived collegiality

Collaboration is generally seen very positively in the educational field and several researchers have pointed out that teacher collaboration, dialogue in teacher communities or professional sharing and caring empowers teachers to put into practice new teaching skills, adapting new technologies and creating new pedagogical solutions (Coronel, Carrasco, Fernandez & Gonzalez 2003; Snow-Gerano 2005; Kohonen 2001; Butler, Novak Lauscher, Jarvis-Selingr & Beckingham 2004; see also Boudah, Logam & Greenwood 2001; Briscoe & Peters 1997; Rennie 2001). Also, several educational researchers recommend, that an important factor in future is to establishing stronger teacher networks and communities for scaling up technology-supported pedagogical innovations (Granger, Morbey, Lotherington, Owston & Wideman 2002; Ilomäki, Lakkala, & Lehtinen 2004; Sleegers, Van Den Berg & Geijsel 2000; Spillane 1999).

Strong partnership in a teacher community is founded on perseverance, empathy, common focus, equity and trust (Hargreaves & Fullan 1998). Hargreaves (1996) also talks about "moving mosaic", the creative, flexible and collaborative culture of teachers, which enables individual community level development. However, research has also noted that collaboration is not easy to establish or maintain. There may be a lack of time and space for collegial interaction during the school day and the need for continuing pedagogical support for teachers after official interventions (Ryymin, Veermans & Lakkala, 2005), may mean that teachers feel unsafe when changing individual practices to work alongside colleagues (Lacey 1996; see in Neil & Morgan 2003) .There may also be school subcultures, such as isolation, contrived collegiality or balkanization, which means that competitive territorial groups, (Hargreaves 1994; 1996) may prevent collaboration and professional development.

Hargreaves (1996) presents an interesting point of view for educational authorities: he claims, that the challenge in developing extended cultures of collaboration within teacher culture is, basically, a question of purpose and power. Collaborative cultures foster and build upon qualities of openness, trust and support between teachers and their colleagues. They capitalize on the collective expertise and endeavours of the teaching community. They acknowledge the wider dimensions of teachers' lives outside the classroom and outside the school, blurring the boundaries between in-school and out-of-school, public and private, professional and personal, grounding projects for development and change in a realistic and respectful appreciation of teachers' broader life. In turn, contrived collegiality reconstitutes teacher relations in the administrators' own image – regulating teachers' lives so that they support the predictable implementation of administrative plans,

rather than creating the development of teachers' own (Hargreaves 1996, 283). Contrived collegiality is, as well, meant to assist the successful implementation of new approaches but it is characterized by a set of formal, bureaucratic procedures and, at last hand, does support neither individuals nor communities. In line with Ruohotie's (1996) findings, that personal and interpersonal factors are meaningful in professional development, also Hargreaves (1994; 1996) emphasises the importance of interweaving of the personal and the professional in collaborative cultures that enable teachers' development and educational change.

Many development projects of new technologies are empowered by local educational authorities and university partners of schools. Triggs and John (2004) researched the development and dissemination of professional knowledge as it relates to teaching and learning with ICT. They challenged the linearity embedded in the professional development processes and demonstrated, instead, how "micro"-, "meso"- and "macro-communities" in a development project inter-connected and improved professional development between teachers, teacher educators and researchers. I find it a very important realization that knowledge related to new technologies and professional development flows freely among development project participants, not from trainers to trainees or authorities to teachers. This research result supports, again, Hargreaves' (1996) findings of "moving mosaic"; flexible culture of collaboration.

Teachers and web-based discussions

This research focuses on in-service teachers' technology-supported collaboration, which is synchronous and situated in web-based learning environment. This is why I find it relevant to introduce some previous findings on using online (web-based) discussions in teacher collaboration, and in adult education in general, in following sections.

Several studies have determined that both synchronous and asynchronous online discussions are useful in educational purposes with adults but under certain critical criteria. Next, I'll refer to a couple of the most frequent findings. At first, as all educators already know, writing (for instance, a response to a question in an on-line discussion forum) requires greater reflection from an individual than face-to-face discussions (Harasim 1995), and this can, even, in the best case, contribute to the participant's intellectual growth (MacKnight 2000). Secondly, it has also been shown, that online discussions offer teachers new opportunities to talk and participate (Williams 1997), share and exchange their knowledge with colleagues (Dillon 2000; Selwyn 2000), and once again, interact in day or night with each other about things that matter most to them (Hargreaves & Fullan 1998). But still it raises the question; are there other benefits that web-based forums can offer to teachers' professional development?

Professional development by web-based interaction can't be considered as a self-evident fact. Many challenges are already well known among policy makers, and some of them are constantly emerging in educational debate. Lets have a quick glance to the challenges and problems next: virtual discussions are not very well structured and can be quite confusing, they can end up as open-ended and interest of participants can collapse before the discussion ends (Shafquat & Salter 2004), the loss of face-to-face interactions disturbs interpreting the discussion (Winter & McGhie-Richmond 2005) and too big discus-

sion groups decrease individual contributions (Chidambaram & Lai Lai 2005) and, in worst case, there's no interaction at all; Selwyn (2000) found that over a third of the requests for information in a teachers' discussion forum remained unanswered.

In this study, I describe especially teachers' synchronous knowledge building in the Knowledge Building tool of the web-based learning environment. Are there some differences then between asynchronous and synchronous virtual interaction then? At least it seems, that synchronous interaction requires even more planning and guidance for resulting coherent and deepening conversation than asynchronous. Recent research has revealed, however, the following encouraging results and advantages in using synchronous interaction in adult education: the participants receive immediate feedback and they have ability to affirm implicit assumptions in conversation. With facilitative design (course design, group dynamics, questioning skills) it offers more coherent and a deeper argumentation process than asynchronous discussion and even more inclusive and intensive learning conversations than in face-to-face interaction. (Dracopoulos 2003; Cox, Carr & Hall 2004; McAlister, Revenscroft & Scanlon 2004; Wang 2005.) Still, is there something more to offer?

The objectives of the study

In addition to research results reported earlier, it would be interesting to find teachers own experiences on using synchronous interaction. Do they find it meaningful to their professional development themselves? If so, how does it support development? Also, can teachers genuinely gain new knowledge through collaboration, or as Senge (1990) puts it, "gain insights that could not be achieved individually"? Or are the web-based discussions always more or less "artificial" (Selwyn, 2000) with fatal problems and hazards? Also, by inspired by Hargreaves (1994; 1996) I wonder, could the web-based knowledge building, in general, be applied for empowering genuine collaborative cultures of teachers instead of contrived collegiality?

In this article, I introduce a process, which offers some new views to these questions and can help creating such innovative teacher in-service training, were web-based tools are implemented meaningfully. In the development project described within this research, teachers participated in synchronous conversation with more ambitious goals than just knowledge exchange or debate, they participated in "knowledge-building". They aimed to solve accurate problems in their process of educational change. At the same time, they participated in the critical process of developing synchronous interaction so, that it would better benefit them in future too. From this basis, the new knowledge which is offered in this article, involves above all teachers' own perceptions and experiences on benefits and challenges of using synchronous web-based knowledge building supporting their professional development.

The objective of the present research is to determine what kind of possibilities, challenges and problems teachers report when they participate in the synchronous, web-based knowledge building.

The other objectives are to search for answers to the questions of what kind of synchronous, web-based knowledge building support teachers' collaborative problem-solving meaningfully and, finally, what kind of advantages a web-based learning environment,

which includes the Knowledge Building forum, offers to teachers' collaboration that no other media can offer?

SYNCHRONOUS, WEB-BASED KNOWLEDGE BUILDING IN TEACHERS' IN-SERVICE TRAINING

Context of the development was the ITCOLE-project

In this chapter I introduce the context of the development and research project, where synchronous web-based knowledge building was developed. The reason I'm describing you this case is because it's important to know the general pedagogical initiative, which was behind the teacher training: development of new technology-supported pedagogical practices in teaching and learning.

Synchronous, web-based knowledge building, which is called "virtual workshop" within the project and also in this article, was a part of teachers' in-service training (Haatainen & Korhonen 2002; Ryymin & Korhonen 2003) which was created within the EU Commission's ITCOLE-project (www.euro-cscl.org/site/itcole). The project was coordinated by the University of Art and Design of Helsinki, it was carried out in 2001–2003 and it had three scientific and technical goals: to develop new pedagogical practices for technology-supported collaborative learning and *progressive inquiry learning* (Hakkarainen 2003), to design web-based learning environments that support the pedagogical models and to disseminate good pedagogical practices in European schools. I find it important to remind the reader, before I go further in the project description, that the design process of the web-based learning environments of the ITCOLE project, Synergeia (http://bscl.fit.fraunhofer.de/en/about.html) and FLE3 (http://fle3.uiah.fi), are still continuing and the software for both are available in the Internet.

The initial pedagogical approach of the ITCOLE project, *progressive inquiry learning* means a sustained process of advancing and building knowledge characteristic of scientific inquiry. It entails that new knowledge is not simply assimilated but constructed through solving problems of understanding. An essential aspect of this kind of inquiry is to engage collaboratively in improving shared knowledge objects; hypotheses, theories, explanations, or interpretations. Through intensive collaboration and knowledge building, resources of the whole learning community may be used to facilitate the advancement of inquiry. Facilitation of progressive inquiry at school appears to require a change in the traditional division of cognitive labour between the teachers and students and to encourage students to take responsibility for their cognitive (e.g., questioning, explaining) and metacognitive (e.g., goal-setting, monitoring, evaluating) aspects of inquiry (Bereiter & Scardamalia 1987; Hakkarainen 2003). However, proper balance should be pursued in each pedagogical situation between teacher-controlled and student-controlled aspects of inquiry. Teachers should not rely too much on students' creativity, but should provide intervention with careful pedagogical guidance and expert-model when a student is not able to make progress (Hakkarainen, Lipponen & Järvelä 2002).

The project was divided in three research stages. In the first stage, the pedagogical

models and research made on computer-supported collaborative learning (CSCL) in Europe were surveyed (Lakkala, Rahikainen & Hakkarainen 2001) and the alpha version of the project's web-based learning environment application was built on the European models of CSCL. Then, teachers' pedagogical and technical training was carried out in participating countries. In the second stage of the project teachers implemented their learning projects with the support of the alpha versions of the web-based learning environments and gave feedback on the usability of the applications. On the basis of the teachers' feedback, the software was developed into the beta versions. In the third stage of the project teachers implemented learning projects in the beta versions and gave again feedback on the usability. The web-based learning environments were developed in to the final versions and the good practices of computer-supported inquiry learning (hereafter, in this article, "technology-supported inquiry learning") were disseminated, for instance, through the web site of best practices, Ideabank (http://www.euro-cscl.org/Ideabank) and leaflets (http://www.euro-cscl.org/site/itcole/itcole_brochure.pdf).

Finland's specific efforts in practical implementation

This article concentrates on describing Finnish teachers' experiences of synchronous web-based knowledge buildings. The teacher in-service training practices, especially virtual workshops, were implemented and further developed in every detail only in Finland, where the participants' goal was also to develop new, applicable strategies for teacher training, which would be maintained and further developed after the project too. The teachers' training during the ITCOLE project was organized according to an in-service training and consulting model (Ryymin & Korhonen 2003). The goal of the training model was to empower teachers' professional development in the context of new technology and foster educational change. The contents of the training included the following topics: the pedagogical model of progressive inquiry, web-based learning environments and principles of change management. The training lasted about four months, and was carried out two times during the three phases of the project. The training was organized as face-to-face meetings, school consulting occasions, and in web-based environments. The training was divided in four stages typical for a development process: orientation-, action-, assessment- and dissemination phases. The orientation phase consisted of introduction to the technology-supported inquiry learning. In the action phase, the teachers implemented the inquiry learning projects and were supported, in addition to school consulting, by face-to-face workshops and virtual workshops (the synchronous web-based knowledge buildings). In the assessment phase, the process was evaluated and then, in dissemination phase, teachers participated into the distribution of the project results by presenting their outcomes in their schools and in national and international teacher conferences. In the first and second stages of the project there were 10 teachers and 235 students participating in the project from Finland. Teachers who joined in the project's first and second stages are called the pilot teachers. In the third stage of the project there were 21 new teachers and 448 new students participating in the project in Finland.

    In this phase, it is good to clarify a bit more Finland's role in the project. Among university partners, there were also local educational authorities participating in the project from Finland; the Media centre of the education department of Helsinki City. The goal of this

Finnish partner was then more policy- and practice-oriented; the partner was aiming to empower educational change by embedding new technology-supported pedagogical practices in everyday school and maintain them after official project by new teacher training strategies. The training models were anyhow developed in collaboration with international project partners, the efforts appointed to implementation was decided independently in participating countries. In Helsinki, the project was situated into a wider national and local frame of reference of promoting web-based learning in schools. The national curriculum reform (in 2003) in Finland involves progressive inquiry learning (problem-based learning) and web-based learning (learning in networks, technology-supported learning) into the national curriculum of nine years comprehensive school and the secondary school. In addition, educational authorities and politicians in the City of Helsinki have empowered special regional emphasis on the development of web-based learning in all educational levels, from preschool to secondary school and vocational learning. Besides the ITCOLE project, there were several other pilot projects going on, different web-based learning environments and training models were evaluated and further developed in teaching.

Finland's specific efforts in practical implementation can be concluded also from the evaluation of learning projects within the ITCOLE project. All teachers from participating countries (the Netherlands, Italy, Greece) implemented progressive inquiry projects supported by a web-based learning environment within the project. When comparing Finnish projects to the projects carried out in other participating countries one learns that the Finnish projects were, firstly, longer and, secondly, aimed more clearly towards the principles of progressive inquiry, such as collaborative knowledge-building and pursuing students' own explanations. Brief descriptions of all projects carried out within the project are available in the final report (Emans & Sligte 2003) of the ITCOLE-project. The Finnish teachers implemented technology-supported inquiry learning projects on several school levels and in various subjects and projects varied from one-classroom projects to international networks and from mainstream education to special needs education. In the second development stage, there were 8 different project plans and in the third stage 23 plans, one of them implemented in two different groups.

The virtual workshops were organised in a Knowledge Building forum

The synchronous web-based knowledge buildings were organised in the Knowledge Building forum of the web-based learning environment when in-service teachers were practically implementing technology-supported inquiry learning. The goal of virtual workshops was to support the process of implementing new pedagogical practices by offering teachers opportunity to collaborative solve problems emerged in the process. The goal of organising the virtual workshops was also to research and assess the model of synchronous, web-based knowledge building with teachers and improve it according to teachers' feedback. The knowledge building discussion was scaffolded and structured by Thinking Types, which label the thinking mode of each discussion note and are named according to the elements of interaction that are typical for a problem solving process. Thinking Types used in the virtual workshop were, for example: Problem, Own explanation, Comment, Deepening knowledge, Evaluation of the process, Summary and Organising work. Thinking Types have been developed earlier and used, for example, in CSILE-system (Scardamalia

& Bereiter 1992; 1994; Lipponen & Hakkarainen 1998). Usually Thinking Types raise many critical questions in aware readers, so let me spend a moment on the topic. Thinking Types are also called Knowledge Types (see Leinonen et al. 2005) and their usability as well as development is under continuous critical debate. For instance, although their purpose is to support, scaffold and clarify the problem-solving process, in some cases they may also district participants' contributions in discussion. Within the ITCOLE project the Thinking Types were tested and developed in several phases together with teachers. The goal was to find the most coherent and reliable set of Knowledge Types for flowing problem-solving process. Teachers were not only testing the Types but also developing their labels and defining their meanings. Unfortunately it is not possible to go into this specific process in more detail here. In the latest version of the web-based learning environment, users can also define labels for Thinking Types themselves or choose the Thinking Types set from several different options. I encourage all those interested to look closer at the software's web site mentioned earlier or even to send their own suggestions to the development team.

The synchronous web-based knowledge building sessions within the ITCOLE project were guided by teacher trainers, who represented both the training organization of local educational authority and university partners. There was one facilitator in each session. Before the virtual workshop, facilitator offered user support in general on functions of the web-based learning environment. The facilitator also divided teachers into groups of 6–10 persons so that there were teachers from different schools school levels. During the virtual workshops facilitator guided knowledge building with questions, by encouraging teachers and by acting as an example in using the Thinking Types.

Facilitators also took care of time, for instance, hinting at the need to move on to the conclusion making phase and closing the workshop when time ran out. They also made final summaries on teachers' suggestions at the end of the workshop. During the process, the facilitators paid special attention that their guiding was very careful and balanced between scaffolding and offering space for teachers' expressions. Guiding, but not leading, was very demanding and facilitators developed their practices by collecting feedback from teachers, by monitoring each other's actions and by analysing the saved database of knowledge buildings. It is not possible to discuss the role of facilitator deeper in this article, but some more information and reflection can be found from other publications (Ryymin & Korhonen 2003; 2004a; 2004b).

RESEARCH AND DEVELOPMENT PROCESS

Next, I will take a closer look at the research and research methods: how the data was gathered from teachers, and how it was analysed and interpreted. The development process of the synchronous web-based knowledge building included three research phases, in which teachers' descriptions on their experiences were analysed. The process followed partly the stages of the ITCOLE project. The third research phase was, anyhow, one and a half years after closing the ITCOLE project.

Phenomenographic approach

The analysis of teachers' reports was carried out within the framework of a research approach called *phenomenography* (Marton 1988). It aims to reveal the qualitatively different ways in which people experience and conceptualise various phenomena in the world around them. People are considered to be conscious subjects, who can build different conceptions of phenomenon and express these conceptions by language. In this research the empirical data includes 27 teachers' written reports and five interviews in which teachers reflected their experiences on virtual workshops and which were gathered in 2002–2004. From the point of view of the development process, I believe that the use of longitudinal data is an advantage, because it provides greater variation than a research based on only one interview or questionnaires.

By adopting the phenomenographic approach I identified and grouped teachers' expressions describing synchronous, web-based knowledge building on the basis of similarities, differences and complementarities. Marton, Dall' Alba and Beaty (1993, 282) found that expressions often represent different fragments of the same conception. In order to see expressions as representing different fragments of the same whole, researcher has to have an idea what the whole is like. To be able to decide whether or not two expressions reflect the same conception, the researcher must have an idea as well what the conception is; the conception is abstracted from the expressions that are considered to reflect it. These principles underline the participatory and active role of the researcher in the process of interpreting the research data.

There were different aspects of conceptions that emerged from the data in my analysis. In this article, I have characterised and presented the categories of description for the grouped conceptions. Marton (1988; Marton & al. 1993, 283) makes a distinction between conception and categories of description. The conception refers to actual experiences, understandings and conceptualisations that people have of various phenomena. Categories of description are abstract tools used to characterise the conceptions. I consider that the categories of description, which emerged from the data, are meaningful in understanding the characteristics and contribution of synchronous web-based knowledge building in teachers' professional development. The phenomenographic approach is purposeful in this study, because it supported to find out teachers' own experiences and the personal meanings they gave to the knowledge building. By adopting this method I reached the teachers' immediate feedback; their spontaneous, free and genuine perspectives. This method offered teachers also possibility, besides expressing themselves freely, to emphasise those aspects they found most important.

When assessing research, one has to pay special attention to the relationship the researcher has to the research object as well as to the research context. In this study, I was one of the learning partners collaborating with teachers and developing the research context, because I represented the training organisation of the local department of education. This means that both my assumptions and concrete actions have had an effect on the research process, pedagogical settings and research context. For the phenomenographic approach it is, however, typical that the research is strongly related to the researcher's presumptions and interpretations. According to Laine (2001), researcher's awareness of her / his presumptions and starting points support to assess and monitor their impacts on interpretation of research. The assumptions and starting points involve, first of all, researcher's

theoretical (the previous research concerning the phenomena) and subjective framework in perceiving the world. In the process of this research I have needed constant critical reflection, conscious introspection and continuous open discussion about my presumptions and interpretations of research results with teachers and other project partners. Finally, I can conclude, that the analysis of the data has been iterative and interpretative by its nature and the meanings that emerged from the data have been analysed several time under critical evaluation and aware of researchers' partnership within the process.

The three phases of data collection

The first phase

The data was collected through e-mail questionnaires, in the web-based learning environment's Knowledge Building forum and by interviews in three phases, from 2002 to 2004. In the first phase, in spring term 2002, there were 10 pilot teachers participating in the two synchronous knowledge buildings, which were organised in the Knowledge Building forums of the alpha version of the Synergeia web-based learning environment (http://bscl. gmd.de). Discussion was supported by following Thinking Types: Research problem, Own explanation, Deepening knowledge, Comment, Evaluation of the process, Summary and Help request (Rubens, Emans, Leinonen, Skarmeta, & Simons, in press.). Besides two synchronous knowledge buildings, teachers participated into the long term (two weeks), asynchronous knowledge building. (See more about Synergeia from http://bscl.fit.fraunhofer. de/download/SynergeiaManual.pdf.)

There were four (4) teachers from lower level comprehensive school, two (2) teachers form upper level comprehensive school and three (3) teachers from upper secondary school participating in the knowledge-buildings. Teachers were divided into two groups so that there were five teachers and a facilitator in each group. Both workshops had the same problem statement: "How can a teacher guide pupils to start their individual inquiry processes?" and they lasted about two hours. After participating in the knowledge buildings teachers were either interviewed (5 teachers) or answered an open e-mail questionnaire (5 teachers). Additionally, seven (7) teachers evaluated virtual workshops in the semi-structurated questionnaire at the end of spring term 2002. Teachers were encouraged to give their descriptions freely but, in addition, were also asked to reflect on do they prefer to participate in the short-term (two-hour), intensive knowledge building or long-term (two weeks) knowledge building.

The second phase

There were 31 teachers participating in the second phase of the process in the autumn term 2002. Teachers were from lower and upper level comprehensive school and from secondary school. Seven (7) of the pilot teachers continued the project and 24 new teachers joined. In this phase, teachers worked mainly in teams. There were all together nine (9) virtual workshops organised for the teachers in this phase. 21 teachers participated in those four (4) virtual workshops, which were evaluated. (There were about 5–6 participants and a facilitator in each group.) Evaluation of the workshops was ended, when it was noticed that the teachers' descriptions didn't bring any new information. According to Eisenhardt

(1989) the ideal number of cases in a research cannot be defined in advance and acquisition of the cases can be finished when theoretical saturation is reached. 12 teachers from 21 participants answered the open questionnaire in the Knowledge Building forum of web-based environment right after the virtual workshops.

The synchronous knowledge buildings were one and a half to two hour guided sessions. Compared to the first phase workshops the problem-statements were formulated more clearly and the problems chosen were authentic, real-life problems, initiatives of participating teachers. The first problem statements were, in any case, the same as for the pilot teachers in the first research phase: "How a teacher can guide pupils to start their individual inquiry processes?". The problems of the third and the fourth workshops were: "How can evaluation support achieving the goals of learning?". There was special attention paid to guiding the workshop, for instance, the workshop was divided in phases for helping the collaboration. (See in more detail: Ryymin & Korhonen 2003.) The knowledge buildings of the second research phase were organised in FLE3 web-based learning environment (http://fle3.uiah.fi). Following Thinking Types were used in this time: Problem, Own explanation, Deepening knowledge, Organisation and Summary.

At the end of the knowledge buildings teachers answered the following questions: "How did the virtual workshop work? Did you gain new knowledge? Were you able to present your own thoughts? Did you get answers to the questions that were on your mind? Did the Thinking Types help knowledge building? Is it worth while to organise virtual workshops in the future? Do you have any development ideas for the virtual workshop?". Teachers were, especially, encouraged to give their free description and to highlight perspectives that they perceived most important.

The third phase
In the third phase of the process teachers, who had participated in the ITCOLE project in Finland, answered to the delayed post-measurement about one and a half years (1,5) after finishing the official project. This questionnaire made it possible to acquire valuable data of how teachers were implementing technology-supported progressive inquiry after the project. From the 26 teachers, who responded to this questionnaire, the ten (10) most active were chosen to answer an additional, more in-depth questionnaire. These teachers had been actively implementing technology-supported inquiry learning in their work and acting also as tutors for other teachers. (In this article this group of teachers is called "advanced teachers" hereafter.) Through an additional questionnaire, it was wanted to discover these teachers' experiences and opinions of web-based knowledge building long after the official project. Secondly, it was interesting to find out how teachers had implemented web-based knowledge building in practice and, thirdly, to acquire information about teachers' actions as promoters of technology-supported inquiry learning. The in-depth questionnaire consisted of 17 open questions which focused on the following four themes: 1) Teachers' actions as tutor for colleagues (dissemination of technology-supported inquiry learning), 2) Teachers' participation in other pedagogical development projects, 3) Teachers' professional networks and collaboration and 4) Knowledge building.

The theme "Knowledge building" included seven (7) open questions: 1) Have you implemented web-based knowledge building with your colleagues after the ITCOLE-project?

For what purposes? 2) Canvweb-based knowledge building support teachers' professional knowledge building according to your experiences?, 3) What kind of advantages or disadvantages have you found when using Thinking Types in knowledge building processes?, 4) What kind of benefits, problems or challenges do you find when participants in the web-based knowledge building are representing different schools and school levels?, 5) What kind of advantages can the web-based learning environment, which includes Knowledge Building forum, offer to teachers' collaboration that no other media can? 6) Would some other media, than the web-based learning environment, support teachers' collaboration? and 7) Have you implemented Knowledge Building forum in the web-based learning environment with your students? It is good to notice that the concept web-based knowledge building involved both synchronous and asynchronous practices in this questionnaire. The three phases of data gathering are described in detail in Table 1.

Table 1. The three phases of data collection.

Phase 1.	Phase 2.	Phase 3.
Spring term 2002	*Autumn term 2002*	*Spring term 2004*
10 Pilot teachers participate in two virtual workshops.	21 Teachers participate in four virtual workshops.	26/31 Teachers answer the delayed post-measurement questionnaire.
10/10 Pilot teachers answer the open e-mail questionnaire or were interviewed.	12/21 Teachers answer the open questionnaire in the web-based learning environment's discussion forum.	10/10 Teachers answer the additional open questionnaire.

RESEARCH RESULTS

Results of the first phase: teachers preferred brief synchronous knowledge building

All Ten (10) pilot teachers prefered the short-term, synchronous knowledge building to the long-term and asynchronous. The following three categories of conceptions emerged from the teachers' descriptions: I) Time management, II) Need for clear problem stating and III) Technical challenges (Table 2). Typical for the teachers' descriptions was that the virtual workshop was reflected only by the conceptions associated with the practical conditions and workshop facilities. Teachers, for instance, didn't use conceptions related to the virtual workshops goals, such as generating new knowledge or solving the problem stated. Teachers didn't reflect their own contributions on the knowledge building process either. Below I present the themes of the categories in more detail and give examples from each category.

I) Time management:

"*From the point of view of the teacher the two-hour period is better. Then you really con-centrate on the topic*."

The first category, Time management, means, that teachers emphasised the benefits of the brief (about 1,5–2 hours) and synchronous virtual workshop. They argued that it is difficult to find time for a long-term asynchronous discussion, which also loses cohesion easier or can be forgotten even. When the time of the virtual workshop is agreed early enough, and when a facilitator takes care that the duration of the workshop is not ex-ceeded, the synchronous, web-based knowledge building can be useful. When discussion was kept brief it gave teachers the feeling of efficiency and they described that they can participate more easily in this kind of workshop, for instance directly after lessons at their own PC, than in traditional face-to-face meetings in other places. Everyone in interviews and in written feedbacks stressed the benefits of brief workshop.

II) Need for clear problem stating:

"*The clear problem-statements would keep discussion on the subject.*"

The second category, the need for clear problem stating, is critical, and almost all teach-ers had some feedback related to organising workshop in coherent and meaningful way. They found that a clear problem-statement, a question, which is simple enough, guides the interaction and scaffolds participants to stay on the point. For example, not so many supportive or clarifying questions which were presented, at the beginning of knowledge building is needed. One leading problem presented is a good and clear starting point and guides the discussion to stay on the right subject.

III) Technical challenges:

"*Unfortunately I couldn't log in at the beginning.*"

The third category, Technical challenges, is about the technical problems that emerged. Fortunately, only a couple of the teachers had problems in technical use of web-based learning environment and the problems were easily solved. This was anyhow very critical, because if teachers couldn't, for instance, log in synchronously and joined in later, it was difficult to find the current stage of the debate.

Table 2. Categories of description in the first research phase. Teachers' experiences on the possibilities, challenges and problems of the virtual workshop.

I Time management

II Need for clear problem-stating

III Technical problems

Results of the second phase: synchronous knowledge building generated meaningful knowledge

There were altogether twenty one (21) teachers participating in those four workshops, which were evaluated and twelve of them (12/21) wrote their descriptions in a Knowledge Forum. The following categories emerged: I) New knowledge, II) Encouragement to implement web-based knowledge building in teaching, III) Feeling of participation, IV) Usability of the Thinking Types and V) Technical challenges (Table 3).

The first category, New knowledge, was an essential theme from the point of view of knowledge-building's goals. Ten out of twelve (10/12) teachers described that they had acquired new and useful knowledge as a result of the knowledge building. There were different emphasis on the component parts of descriptions, but the conceptions teachers used (such as "knowledge", "perspectives", "ideas") were related strongly to gaining new, meaningful and usable knowledge or creating richer understanding of the matters of problems at hand. This supported teachers in the process of implementing technology-supported inquiry learning in practice. Teachers expressed that the knowledge-building had genuinely supported them in their process of learning and implementing new pedagogical practice.

The second category, Encouragement to implement web-based knowledge building, emerged from the descriptions of six (6) teachers. They emphasised that the web-based knowledge building was an encouraging experience, which supports them in trying new pedagogical practices in their teaching. There was a relationship found between the first and second categories: conception of encouragement emerged in the same descriptions where the experience of the workshop was experienced as meaningful new knowledge. In this sense, the experience of reaching new knowledge seemed to motivate and also emotionally support teachers to develop their pedagogical practice. Anyhow, I chose to create two different categories, because not all teachers, who reported gaining new knowledge, underlined that it was also encouraging them in particular.

In the descriptions of the first or second category there was no conceptions related to the organisation of the workshop, for example controlling time or topic, used. This was a difference when comparing the results to the categories found in the first research phase. The emphasis of the assessment was, this time, on the qualitative analysis of the knowledge building's contents and goals.

Here are two examples from the first and second categories of description.

I) New knowledge:

"I gained new knowledge and something to think of."
"The problem was interesting and important in this moment. My thoughts around the subject became more clear."

II) Encouragement to implement web-based knowledge building in teaching:

"I acquired new tips and encouragement to my own attempt."
"A good experience that helps when I plan the start of my own course[with web-based knowledge building]!"

The third category is an important fiding too, Feeling of participation. This reminds Hargreaves' (1996) descriptions of genuine collaborative cultures, where teachers are participating with their personal efforts to the collaboration. The twelve (12) teachers described very positively their experience of the feeling of participation in knowledge building process. They also assessed that the problem-solving process progressed well or at least quite well, and the group-size was sensible. Ten (10) teachers reflected especially their own contributions and impacts on solving the problem. They found it positive that they had influenced the progress of the knowledge building. Typical for this category of description was, that teachers experienced that their own participation in the knowledge building was meaningful. Reading others' current thoughts and the feeling of being noticed by other participants increased their experience of collaboration. Teachers' feedback, in this category, described strongly their personal experience of the workshops' reciprocity, their own influence and ability to build new knowledge together with other teachers. Only two (2) teachers brought up problems in participation. The other teacher felt that knowledge building had ended too fast. The other teacher described, that it was unclear whether other participants answered his notes or not. Also from these descriptions emerged the importance of feeling of personal participation. The virtual workshop doesn't become a meaningful experience to a person, if she / he experiences that she / he doesn't have any personal influence on the process. Here are some examples from the third category:

III) Feeling of participation:

"The discussion progressed at the right speed. I had time to read the questions and it really felt good when someone commented to my notes."
"The size of the group was good. The discussion didn't get out of hand and I had time to read everyone's notes."

In fourth category, Usability of the Thinking Types, the criticisms of Thinking Types were presented. This was an important theme, which, on the other hand, told that the Knowledge Building forum of the web-based learning environment still needed development so that it would better support teachers in collaborative knowledge-building. On the other hand, the appearance of criticism and ideas for further development told also about the commitment of teachers and the safe atmosphere within the process: teaches felt safe to show their real opinions and they could trust, that they would be heard. Altogether eight

(8) teachers paid attention into the usability of the Thinking Types that were used in the knowledge building and reflected how they supported problem solving and knowledge building. Six (6) teachers criticised Thinking Types for simplicity and wished to have more different Thinking Types in future. Here is one example of this category:

IV) Usability of the Thinking Types:

"*I would like to have more Thinking Types. I use Own explanation -thinking type almost all the time and sometimes there would be a need for a Comment -thinking type. And sometimes there would be need for Help.*"

The fifth category, Technical challenges, is related, again, to the technical problems that emerged. It is a meaningful contribution, because according to previous research (e.g., Butler & Sellbom 2002) technical issues are still one of the biggest barriers preventing every day use of learning technologies. Five (5) teachers described different technical problems in their feedback. Four (4) of the descriptions were related to problems of Internet access. The technical problems that bothered teachers in the second phase are reported in more detail in the ITCOLE project's report (Haatainen & Korhonen 2002, 31-32). Here is an example of description of technical challenges:

V) Technical challenges:

"*In the beginning I had problems with the Internet connections. But when I finally logged in, there were no more problems with the technical sides this time.*"

Table 3. Categories of description in the second research phase. Teachers' experiences on the possibilities, challenges and problems of the virtual workshop.

I New knowledge
II Encouragement to implement web-based knowledge building in teaching
III Feeling of participation
IV Usability of the Thinking Types
V Technical challenges

Results of the third phase: web-based knowledge building can benefit teacher' collaboration in an unique way

One and half years after finishing the official ITCOLE project ten (10) advanced teachers were sent an in-depth questionnaire by e-mail. The advanced teachers reported that they had disseminated technology-supported inquiry learning to hundreds of teachers and tens of schools. Five (5) of them had became part-time teacher trainers with support of local educational authorities, and all of them had led at least three training sessions for colleagues. All advanced teachers still used pedagogical models of progressive inquiry and the ITCOLE project's web-based learning environment in their teaching. Teachers reported that they had been continuing implementing both synchronous and asynchronous knowledge building with their students and their colleagues. All teachers, except one, used web-based knowledge building in collaboration with other teachers. The web-based knowledge building had been adopted also in curriculum work, planning courses, sharing knowledge and collaborating with educational researchers outside of the school, for instance. The teacher, who didn't implement the knowledge building with colleagues, used it anyway with his students. All teachers, expect one, implemented web-based knowledge building also in their teaching. The teacher, who didn't use it in teaching, had adopted it, in turn, to the collaboration with colleagues. Nine (9) of ten advanced teachers had experienced that web-based knowledge building supports teachers' professional knowledge building. One teacher didn't have an opinion on this matter.

It is typical for the phenomenographic method to find the most essential characteristics to generalize the phenomena under research. During this research process, new questions emerged, for instance: how teachers, who had actively implemented technology-supported inquiry learning and collaborated with their colleagues longer than just within official project, describe the meaning of web-based knowledge building in teacher collaboration? Or is there any specific meaning in this model within teacher collaboration: is the innovativeness or speciality just a presumption of the research? Also, from the point of view of educational policy makers, it is useful to critically research the elements of web-based knowledge-building and reflect, is the dissemination of the modern technologies, last, worth the political and financial effort?

With these questions I thought it relevant to research the answers to the question "What advantage does the web-based learning environment (which includes Knowledge Building forum) offer to teachers' collaboration that no other media can?" in more detail. This question was included in the questionnaire for advanced teachers introduced in the chapter "The three phases of data collection".

All ten teachers answered the question. The answers were analysed by phenomenological approach for finding out the qualitatively different ways in which teachers experience and conceptualise the meaning of the web-based learning environment and knowledge building in teachers' collaboration. The following three categories of description emerged from the data: I) Saving the process of knowledge building as a collective memory, II) Developing thinking through the shared writing process and III) Independence of time and place (Table 4). In the first and second categories of description teachers' conceptions were strongly associated with collaborative learning and knowledge building. The third category descriptions the web-based learning environment was perceived as a traditional file of documents, but free from time and place distinctions.

In first category of description, Saving the process of knowledge building as a collective memory, seven (7) teachers reported that the web-based knowledge building serve teachers' collaboration uniquely because of the process of knowledge building can be saved to the Knowledge Building forum. The saved process becomes, in time, a collective memory where teachers can return later. This supports, according to teachers' descriptions, the progress of collaborative knowledge building in a teacher community. Teachers perceived that the web-based learning environment is not just a database for the new knowledge generated. The knowledge building process itself was considered to be meaningful in teachers' collaboration. The web-based learning environment can become, in the best case, a unique, collective memory for collaborators. Teachers can later monitor the different phases of the process and learn from them. Here are examples of teachers' replies in the first category:

I) Saving the process of knowledge building as a collective memory:

"*The web-based learning environment serves as a collective memory and at the same time as a memory of development process itself.*"
"*Discussion on the web is saved and one can return to it later on.*"

Also the second category, Developing thinking by shared writing process, was a critical finding from the perspective of teachers' professional development. Six (6) teachers experienced that the special value of the web-based knowledge building in teachers' collaboration is related to the development of thinking by writing and sharing thoughts collaboratively by writing. In these descriptions, teachers linked the conception of learning strongly to the conception of collaboration and they found the web-based learning environment unique tool in supporting collaborative learning. Säljö (1979) and Marton and colleagues (1993) have investigated how learning has been conceptualised. They found several conceptions of learning with different emphasis, but none of them was related to the collaborative learning or conception of collaboration. Learning is traditionally very strongly associated as an individual pursuit. When interpreting data of this research, it is important to remember the context of the research: teachers had been taking part into professional training, where collaborative learning methods were actively developed. According to the findings described above, it seems that the intervention succeeded in empowering teachers to review conceptions of learning in a more collaborative context. It is also remarkable, that there were strong connections between the first and the second categories. Six (6) teachers' descriptions were grouped both in first and second category. However, teachers presented these arguments as independent entities so that grouping descriptions in different categories was found relevant. Here are some examples of the second category:

II) Developing thinking through the shared writing process:

"*Writing improves thinking and the result can be more organised than in oral face-to-face communication.*"
"*The participants from different schools, cities and even countries add the value of the virtual workshop. Saving knowledge building process into visible paths or layers is an absolute advantage of the virtual workshop.*"

Only three (3) of the advanced teachers emphasised that independence of time and place when describing the web-based learning environment, and the third category, Independence of time and place, was formed on the basis of these descriptions. Typical for these three reports was that there were no concepts related to knowledge building, collaborative learning, learning by writing or collective memory like in reports of other teachers. Here is one example of the third category:

III) Independence of time and place:

"*Independence of time and place is a practical benefit.*"

In addition, two advanced teachers reflected the meaning of the web-based learning environment from the point of view of democracy and equality in teachers' collaboration, for example: "*In ordinary teacher meetings and seminars the loudest teachers are leading the process. A shared memory is more democratic because every one has a right and responsibility to make his own conclusions.*" Although all teachers were asked to consider if some other media than a web-based learning environment would better support teachers' collaboration, only two teachers considered an option, which was a video conference. Also these teachers emphasised the meaning of shared, written document in collaborative learning: "*Organising a video conference could be almost as good as the using web-based learning environment. The disadvantage would be that the discussion can't be studied afterwards in written form.*" It is good to notice, that in third phase the question as well as teachers' answers involved both asynchronous and synchronous use of web-based knowledge building and their differences were not analysed.

   Further, one interesting aspect to teachers' professional development emerged within this research, that is worth of a section of its own. It is the development of the concepts in teachers' description from the first research phase to the third. Longitudinal perspective is offered by those seven (7) pilot teachers, who committed to the process from its first stage and finally became "advanced teachers". In the first phase they concentrated on technical and organisational aspects and the pedagogical meaning of web-based knowledge building wasn't found yet. In the second phase, when they already had more experience on technology-supported inquiry learning, they used more pedagogical concepts in their descriptions and emphasised, for instance, knowledge-generative elements of knowledge building. Finally, in the third phase, they described knowledge building by advanced pedagogical concepts and reported, such as "collective memory" and reported how they had been implemented it in both in teachers' collaboration and in teaching. In this sense, the professional development of these particular teachers seemed to have a sustainable nature and their expertise had extended into qualitatively new areas of knowledge.

Table 4. Categories of description in the third research phase. Teachers' experiences on the advantages of the web-based learning environment for teachers' collaboration no other media can offer.

I Saving the process of knowledge building as a collective memory

II Developing thinking through the shared writing process

III Independence of time and place

CONCLUSIONS AND DISCUSSION

In this chapter, first, I offer a summary of the research results and then conclude with some perspectives and advice, "meta-policy", for educational policy makers for considering synchronous web-based knowledge building as one innovative model for teachers' professional development.

Summary of research results

According to the research results synchronous web-based knowledge building, which was guided and facilitated by accurate Thinking Types and based on clear and authentic, real-life problem statements supported teachers' collaborative problem-solving in a meaningful way. It empowered teachers to create new knowledge, which they found usable when embedding new, technology-supported pedagogical practices in everyday schooling. One particular advantage of synchronous knowledge-building was also the feeling of participation: teachers felt that their thoughts were heard and they had a personal impact on the problem-solving process. Teachers also described that the two unique advantages, that a web-based learning environment, which includes Knowledge Building forum, can offer in general for teachers collaboration are the possibility to save the collaborative knowledge building process of a teacher community as a collective memory and the possibility to develop thinking by shared writing.

The challenges reported were related to technical problems and to the use of Thinking Types, although the technical problems didn't play a major role in teachers' experiences. The effect of technical problems on educational innovations is however crucial and I will discuss this matter later in this chapter. Instead, I have no opportunity to discuss on the development of Thinking Types in more detail here; the theme is wide and worth its own article. It is in any case important to conclude that the use of labelled notes in collaborative problem-solving process needs constant critical reflection. It is important to assess when they are genuinely scaffolding the collaboration and when, in turn, they are not supporting

the advancement of the dialogue in their best possible way. As a summary, the findings of the present research reveal that synchronous web-based knowledge building supports teachers' professional development meaningfully and when planning the implementation, it's important to pay attention to use of Thinking Types and technical challenges.

However, the limitation of the present study is that is focused on one development project only. Hence, it is difficult to judge the effects in the present case and it is possible that some of the teachers' descriptions would appear differently, and be far more critical, for a larger sample and in different school communities.

Knowledge-building and generation of new solutions to accurate problems

From the point of view of educational policy makers synchronous, web-based knowledge building offers one applicable tool for committing teachers personally to their professional development and for supporting them in educational change. This innovation enables them to generate new solutions to the problems at hand quickly, cost-efficiently and in a democratic way in the process of reforming pedagogical practices. The knowledge flows freely between knowledge building participants: it's not received outside of the schools from authorities, but the authorities involved in intervention can participate in to the knowledge building as well. However, it is important to realize that the efficient use of synchronous web-based knowledge building needs a facilitator, a co-learner, a guide, who is familiar with new pedagogical practices, aware of teachers' professional needs and the process of educational change. In this study there was a teacher trainer guiding the knowledge building, but a facilitator can also be, for instance, an experienced teacher from a school or region.

The more qualified goals than just information exchange

Most policy makers are familiar with the suggestions to create more possibilities for information exchange among teachers. However, web-based knowledge building can be used for reaching more qualitative goals than just information exchange: it can empower individuals to exceed their limits and open new perspectives. Web-based knowledge building can also be used as a tool for the whole school community, where participants can share their thoughts by writing and monitor their individual and collective development. This may strengthen schools to take more responsibilities of their own development and its assessment. Knowledge building is also a very democratic tool for collective purposes: all participants have equal possibilities to express their views by writing, not only the most out-going personalities, who easily dominate conversations in teacher meetings.

Interweaving informal and formal networks

A couple more advantages can be pointed out when considering embedding synchronous web-based learning in a teachers' in-service training. As a training occasion, it is easier to include in teachers' busy schedules than face-to-face-occasions, especially when there are teachers from several different schools participating. It can also be more efficient than a long-term asynchronous online discussion which is, after the initial enthusiasm, easily forgotten among everyday schooling rush. Web-based activities, in general, can also be

flexibly used as tools for interweaving the informal and formal contacts of teachers and other partners in educational interventions, which may increase teachers' motivation to participate in developmental activities in general. For instance, teachers who actively develop their technology-supported working practices and also mediate this new knowledge to their colleagues use web-based learning environments in many creative ways. Among other things, they communicate through web-based learning environment with their colleagues from other schools, study other teachers' learning projects, create resource banks and personal files for interesting topics, publish their own documents, plan new lessons and chat with their colleagues informally. The innovative use of web-based learning environment may play one supporting role when empowering teacher communities towards genuine cultures of collaboration.

Advantages of regional networking

Through web-based learning it is possible to promote teachers' collaboration at local, regional, national and even at international level. In this research, teachers created local, interschool networks from the same geographical area. Web-based learning environments offer useful possibilities for municipalities from different regions to collaborate and establish networks for reaching joint educational objectives cost-efficiently. In international networks, educational authorities and teachers can make pedagogical innovations available and further generate them even to a global extent. In practice, there are, however, many challenges associated with global learning communities, for instance, language barriers and cultural and political differences.

Teachers' partnership in development

I would like to emphasise, that it is important to involve teachers not only in the process of developing new, technology-supported pedagogical practices, but also in developing new models of teachers' professional development as well. Teachers should take, like any professionals today, more personal responsibility on renewing and reviewing their working practices. Policy makers should respect teachers' dignity and autonomy in this process. The traditional and hierarchical models of school reforms including "contrived collegiality" (Hargreaves 1994; 1996) won't sustain in practice, but still, the development projects need professional project management and responsibility-taking from educational authorities. Teachers should participate equally in knowledge creation and dissemination, which is advice easier to agree with in theory than put into practice. Proper balance should be created in each educational intervention between teacher-generated and authority-guided aspects of process.

New, innovative practices for policy-making needed

Many educational authorities represent governmental or regional public sectors, where divisions and departments have traditionally districted carefully their information dissemination and followed hierarchic implementing strategies. In addition, many municipalities are often sensitive to show the limits of their knowledge, which is needed when creating new knowledge (instead of information dissemination) in collaboration with others. Many

authorities would benefit of rehearsing new guiding and managing practices related to *participatory planning, co-learning* and *collaborative problem-solving*. One applicable tool in this task, supporting the professional development of educational authorities, could be, again, web-based knowledge building and web-based learning environment in general.

Combining web-based knowledge building to other training

The best benefit of the synchronous web-based knowledge-building is gained when it is linked to the larger and longer program of professional development which includes many different activities and is based on pedagogical principles and educational theory. As all policy-makers know, educational change needs time, debate and reflection: it goes through change resistance and early adopters to finally accepted new practices. Knowledge-building can be considered as one practical tool supporting the intervention. It can also offer a possibility to deepen the themes discussed within the program, monitor the change aimed in the process and even accelerate the educational change by making its phases more visible and concrete. It is good to realize, that synchronous web-based knowledge building doesn't replace face-to-face meetings and their meaning, for instance, in collaborative trust building. However, I don't see this innovation just a complementary action to the traditional training either: synchronous web-based knowledge building can be successfully used beside more traditional training occasions because it has its special elements other current practices of teacher in service training can't offer. When planning the training within a development project, it is crucial to realize that teachers need pedagogical support also after official intervention (Ryymin et al. 2005). In the context of educational change policy makers should then anticipate the need for continuous support, plan sustainable models for teachers' professional development and involve, for example, resources of web-based collaboration innovatively in to the process.

New innovations and public agreements

The special challenge for educational policy makers is to involve technology-supported educational reforms, which aim qualitatively at better learning and teaching, to political documents, declarations and public agreements. For instance, if policy makers genuinely aim for the innovations of web-based learning being implemented and disseminated in every school, schools must be obliged to include them to the curriculum, information strategy and annual working plans. Another concrete challenge policy makers may face is that schools still don't have, and they are not guided to make, a qualified plan for the teachers' professional development. With this question the principal of the school is in key role: she/he isn't a traditional school head anymore, but the leader of technology-supported learning community. In this means, also principal's professional development programs should be reformed and modernized.

School-based plans for teachers' professional development

In many schools, teachers decide alone in what training they participate and the training benefits often only individuals or small groups of teachers. Policy makers should support principals to create such an annual, community-level development plan where is clearly

agreed what is the most important training according to the school's curriculum, mission, visions and goals, who is to participate in the training and how the knowledge from it is shared with others. Also, when the whole school is joining in the development project an agreement is needed for making the decision visible and concrete for all members of the school community. Many schools are using school-based teacher tutors in empowering use of web-based learning and ICT in teaching in general. This so-called *peer training* has been noticed to be a useful, cost-effective way to offer professional development for teachers in their authentic learning context (Showers, Murphy & Joyce 1996). Unfortunately, in many cases, the concrete goals of peer training or tutoring in school are not agreed in detail, neither is who is to participate, how the time for tutoring is going to be fitted into the school day, how the process is to be reviewed and improved, what the guiding practices used are going to be nor what credit the tutor gains from his/her efforts. The tutors are also often very alone in the course facing the unpredictable, new problems related to technology-based reforms. Policy makers and principals can offer, among other professional guidance, the model of web-based knowledge-building for teacher tutors to make their work more collaborative and visible; improving the quality of their work.

Authority-level reforms required for relevant technical support

When planning better interventions in technology and education, policy makers will usually face quite disturbing technical problems at some stage of the process. The use of web-based learning environments should be so robust and non-problematic that teachers are totally free from technical worries and able to concentrate fully on the educational process. At least, technical support should be easily and immediately available for teachers. The persons responsible for technical infrastructure of schools and school regions should be seamlessly committed to the pedagogical development projects and strategies. This usually means lots'of arrangements and attitude changing on the educational authority level. In many regions public equipment and software investors and pedagogical reformers work separately and don't always even know about each others interventions. The responsibilities and the procedures of technical support should be crystal clear and openly agreed with all the participants within the development project. Once again, empowering free flow of knowledge between public sector departments and units needs even stronger efforts from policy-makers than fostering knowledge creation at school level. In addition, when equipment and learning are genuinely merging, there's need for a new kind of expertise among educational authorities: people, who know both technology and education.

Awareness of tensions and change resistance

It is also significant to realize that technology-supported collaborative processes are as full of tensions and contradictions as collaboration among humans in general, if not more because of its technological dimension. There can be many questions related to themes like commitment and disagreement, trust and control, traditions and modernization raised among participants, especially when the process of educational change is proceeding from early adopters to whole school community. Collaboration for collaboration's sake only is not beneficial: it must be constantly analysed and critiqued in order to define the most meaningful benefits for all. It is not enough that policy-makers know the risk elements

of collaboration and impacts of change resistance, even if they are specialists of the matter. Also school communities, especially teachers, who are in the middle of the process of educational change, should be offered knowledge as well as tools for analyzing and coping with these phenomena.

Future actions

The future offers variety of new media and technological tools for teachers' professional development. Innovative mobile phones, immersion of television and Internet as well as development of intelligent interfaces offer new choices for interaction and knowledge creation as well as widening the learning communities. Teachers and schools will act, and they are already acting, in networks, which consist of not only people, but intelligent, mediating tools, different information sources and interactive media. But as interesting as researching new technology is to research the meaning that teachers, students and other participants in modern learning communities give to the new technology in their personal and professional life. Understanding and supporting human development is most important, in future too.

REFERENCES

Beairsto, B. (1996). Professional Growth and Development: What is it and how do we know if it's working? In P. Ruohotie & P.P. Grimmett (Eds.) *Professional Growth and Development, Direction, Delivery and Dilemmas* (pp. 91–114). Saarijärvi: Saarijärven Offset Oy.

Beraiter, C. & Scardamalia M. (1987). An attainable version of high literacy: Approaches to teaching higher-order skills in reading and writing. *Curriculum Inquiry*, 17, 9–30.

Boudah, D. J., Logan, K.R. & Greenwood, C. R. (2001). The research to practice projects: Lessons learned about changing teacher practice. *Teacher Education and Special Education*, 24, 290–303.

Briscoe, C. & Peters, J. (1997). Teacher collaboration across and within schools: Supporting individual change in elementary science teaching. *Science Education*, 81, 51–65.

Butler, D. L. & Sellbom, M. (2002). Barriers to Adopting Technology for Teaching and Learning. *EDUCAUSE Quarterly*, 2, 22–28.

Butler, D. L., Novak Lauscher, H., Jarvis- Selinger, S. & Beckingham, B. (2004). Collaboration and self-regulation in teachers' professional development. *Teaching and Teacher Education*, 20(5), 435–455.

Chidambaram, L. & Lai Lai, T. (2005). Is Out of Sight, Out of Mind? An Empirical Study of Social Loafing in Technology-Supported Groups. *Information Systems Research*, 16(2), 149–168.

Coronel, J. M., Carrasco, M. J., Fernandez, M. & Gonzalez, S. (2003). Qualities of Collaboration, Professional Development and Teaching Improvement: an experience in the university context. *Journal of Education for Teaching*, 29(2), 25–148.

Cox, G., Carr, T. & Hall, M. (2004). Evaluating the use of synchronous communication in two blended courses. *Journal of Computer Assisted Learning*, 20(3), 183–193.

Dillon, K. (2000). 'OZTL_NET: An online professional community for teacher librarians'. *Australian Educational Computing*, 15(2), 11–14.

Dracopoulos, E. (2003). E-learning ESL: Bringing the world together. In T. Varis, T. Utsumi & W. Klemm (Eds.) *Global peace through the global university system* (pp. 274–288). UNESCO Chair in Global e-Learning. University of Tampere. Research Centre for Vocational Education.

Dubin, S. S. (1990). Maintaining competence through updating. In S.L. Willis & S.S. Dublin (Eds.) *Maintaining professional competence* (pp. 9–43). San Francisco: Jossey-Bass.

Eisenhardt, K. (1989). Building Theories from Case Study Research. *Academy of Management Review*, 14(4), 532–550.

Emans, B. & Sligte, H. (Eds.) (2003). *Final field test and evaluation report*. Deliverable 7.5. Helsinki: ITCOLE. Retrieved February 28, 2004, from the ITCOLE project Web site http://www.euro-cscl.org/site/itcole/D7_5_final_field.pdf.

FLE3 web-based learning environment http://fle3.uiah.fi.

FLE3 User Manual. Retrieved October 28, 2005, from Web site http://fle3.uiah.fi/papers/fle3_guide.pdf.

Freire, P. 1993 (1970). Pedagogy of the Oppressed. Penguin Books: London.

Granger, C., Morbey, M., Lotherington, H., Owston, R. & Wideman, H. (2002). Factors Contributing to Teachers' Succesfull Implementation of IT. *Journal of Computer Assisted Learning*, 18, 480–488.

Haatainen, E. & Korhonen, K. (2002). T*he Teacher Training and Consulting Model*. Deliverable 8.1. Innovative Technologies for Collaborative Learning and Knowledge Building. ITCOLE IST Project 26249. Retrieved July 28, 2005, from the ITCOLE-project Web site http://www.euro-cscl.org/site/itcole/itcole_training_consulting.pdf.

Hakkarainen, K., Lonka, K. & Lipponen, L. (2000). *Tutkiva oppiminen – Älykkään toiminnan rajat ja niiden ylitäminen*. Porvoo: WSOY.

Hakkarainen, K., Lipponen, L. & Järvelä, S. (2002). Epistemology of inquiry and computer-supported collaborative learning. In T. Koschmann, N. Miyake & R. Hall (Eds.) *CSCL2: Carrying Forward the Conversation*. Mahwah, NJ: Erlbaum.

Hakkarainen, K. (2003). Emergence of progressive inquiry culture in computer-supported collaborative learning. *Learning Environments Research*, 6(2), 199–220.

Harasim, L. M. (1995). *Learning networks: a field guide to teaching and learning online*. MIT Press.

Hargreaves, A. (1994). Collaboration and contrived collegiality: cup of comfort or poisoned chalice? In A. Hargreaves (Eds.) *Changing teachers, changing times* (pp. 186–211). London: Cassell.

Hargreaves, A. (1996). Contrived Collegiality and the Culture of Teaching. In P. Ruohotie & P.P. Grimmett (Eds.) *Professional Growth and Development, Direction, Delivery and Dilemmas* (pp. 263–290). Saarijärven Offset Oy: Saarijärvi.

Hargreaves, A. & Fullan, M. (1998). *What's Worth Fighting for in Education?* Buckingham: Open University Press.

Ilomäki, L., Lakkala, M. & Lehtinen, E. (2004). A case study about ICT adoption within a teacher community at a Finnish lower secondary school. *Education, Communication & Information*, 4(1), 53–69.

Ideabank. Descriptions of learning projects developed within the ITCOLE project. Retrieved October 28, 2005, from Ideabank Web site http://www.euro-cscl.org/Ideabank.

ITCOLE projects' brochure. Retrieved October 28, 2005, from the ITCOLE project Web site http://www.euro-cscl.org/site/itcole/itcole_brochure.pdf.

Kaufman, H. (1974). *Obsolescence and professional career development*. New York: AMACOM.

Kaufman, H. G. (1990). Management techniques for maintaining a competent professional work force. In S.L. Willis & S.S. Dublin (Eds.) *Maintaining professional competence* (pp. 249–261). San Francisco: Jossey-Bass.

Kohonen, V. (2001). Teacher growth and site-based curriculum development. Developing in-service teacher education. In E. Kimonen (Eds.) *Curriculum approaches. Readings and activities for educational studies* (pp. 35–53). Department of Teacher Education and Institute for Educational Research, University of Jyväskylä.

Lacey, P. (1996). Training for Collaboration. *British Journal of In-service Education*, 20 (1), 67–80.

Laine, T. (2001). Miten kokemusta voidaan tutkia? Fenomenologinen näkökulma. Teoksessa *Ikkunoita tutkimusmetodeihin II – näkökulmia aloittelevalle tutkijalle tutkimuksen teoreettisiin lähtökohtiin ja analyysimenetelmiin* (pp. 26–43). Chydenius Instituutin julkaisuja 3.

Lakkala, M., Rahikainen, M. & Hakkarainen, K. (2001). *A review of the state-of-the-art of pedagogical models of CSCL. Public deliverables*. Deliverable 2.1 for the European Commission, ITCOLE Project, IST-2000-26249. Retrieved 28 April, 2004, from the ITCOLE Project Web site http://www. euro-cscl.org/site/itcole/D2_1_review_of_cscl.pdf.

Leinonen, T., Ryymin, E. & Korhonen, K. (2005, September). *Designing Collaborative Software Tool to Change Educational Culture*. A poster presented at the First International Conference of Society and Activity Research (ISCAR), Sevilla, Spain.

Leithwood, K. (1999). How School Managers Foster the Professional Growth of Teachers "By Design". In B. Beairsto & P. Ruohotie (Eds.) *The Education of Educators. Enabling Professional Growth for Teachers and Administrators* (pp. 53–80). Research Centre for Vocational Education, Hämeenlinna. Saarijärvi: Saarijärven Offset Oy.

Lipponen, L. & Hakkarainen, K. (1998). *Tiedonmuodostus verkostopohjaisessa oppimisympäristössä. CSILE-projekti*. Helsingin kaupungin opetusviraston julkaisusarja A6: 1998.

MacKnight, C. B. (2000). Teaching Critical Thinking through Online Discussions. *EDUCAUSE Quarterly*, 4, 38–41.

Marton, F. (1988). Phenomenography: A Research Approach to Investingating Different Understanding of Reality. In R.R. Sherman, & R.B.Webb (Eds.) *Qualitative Research in Education: Focus and Methods. Explorations in Ethnography Series* (pp. 141–161). London: The Falmer Press.

Marton, F., Dall' Alba, D. & Beaty, E. (1993). Conceptions of learning. *International Journal of Educational Research*, 19, 277–300.

Maurer, T. J. & Tarulli, B. A. (1994). Investigation of perceived environment, perceived outcome, and person variables in relationship to voluntary development activity by employees. *Journal of Applied Psychology*, 79(1), 3–14.

McAlister, S., Revenscroft, A. & Scanlon, E. (2004). Combining interaction and context design to support collaborative argumentation using a tool for synchronous CMC. *Journal of Computer Assisted Learning*, 20(3), 194–204.

Neil, P. & Morgan, C. (2003). *Continuing professional development for teachers. From introduction to senior management*. London: Kogan Page.

Rennie, L.J. (2001). Teacher collaboration in curriculum change: The implementation of technology education in the primary school. *Research in Science Education*, 31, 49–69.

Rubens, W., Emans, B., Leinonen, T., Skarmeta, A. G., & Simons, R. J. (in press). Design of web-based Collaborative Learning Environments. Translating the pedagogical learning principles to human computer interface. *Computers & Education*.

Ruohotie, P. (1994). Professional Updating. In P. Ruohotie & P.P. Grimmett (Eds.) *New Themes for Education in a Changing World* (pp. 167–205). Tampere: Career Development Finland Ky.

Ruohotie, P. (1996). Professional Growth and Development. In K. Leithwood et al. (Eds.) *International Handbook of Educational Leadership and Administration* (pp. 419–445). Dordrecht: Kluwer Academic Publishers.

Ruohotie, P. (1997). *Oppimalla osaamiseen ja menestykseen*. Helsinki: Edita.

Ruohotie, P. (1999). Relationship-Based Learning in the Work Environment. In B. Beairsto & P. Ruohotie (Eds.) *The Education of Educators. Enabling Professional Growth for Teachers and Administrators* (pp. 23–52). Saarijärvi: Saarijärven Offset Oy.

Ruohotie, P. & Nokelainen, P. (2001). Factors Contributing to Teacher's Professional Growth and Development. In P. Ruohotie, P. Nokelainen, H. Tirri & T. Silander (Eds.) *Modeling Individual and Organizational Prerequisites of Professional Growth* (pp. 111–137). Saarijärvi: Saarijärven Offset Oy.

Ryymin, E. & Korhonen, K. (2003). *The Teacher Training and Consulting Model Summary*. Retrieved July 12, 2005, from the CSCL Community Web site http://www.euro-cscl.org/site/itcole/itcole_training_consulting.pdf.

Ryymin, E. & Korhonen, K. (2004a). Oppimiskumppanit verkossa. Yhteisöllisiä ratkaisuja opetuksen uudistamiseen. *Ammattikasvatuksen aikakauskirja*, 1, 64–74.

Ryymin, E. & Korhonen, K. (2004b). Virtuaalinen työpaja opettajan ammatillisen kehittymisen tukena. *Aikuiskasvatus*, 3, 257–264.

Ryymin, E., Veermans, M. & Lakkala, M. (2005). Dissemination Practices of Technology-Supported Inquiry Learning. L*earning the Skills, Special Edition of The Finnish Journal of Vocational and Professional Education*, 65–85.

Scardamalia, M. & Bereiter, C. (1992). An architecture for collaborative knowledge building. In L. Verschaffel (Eds.) *Computer-based learning environments and problem solving* (pp. 41–66). Berlin: Springer-Verlag.

Scardamalia, M. & Bereiter, C. (1994). Computer support for knowledge building communities. *The Journal of the Learning Sciences*, 3, 265–283.

Scardamalia, M., Bereiter, C., McLean, R., Swallow, J. & Woodruff, E. (1989). Computer-supported intentional learning environments. *Educational Computing Research*, 5, 51–68.

Selwyn, N. (2000). Creating a "connected" community? Teachers' use of an electronic discussion group. *Teachers College Record*, 102(4), 750–780.

Senge, P. M. (1990). *The fifth discipline: the art and practice of the learning organization*. New York: Doubleday.

Shafqat, A. & Salter, G. (2004). The Use of Templates to Manage On-line Discussion Forums. *Electronic journal of e-Learning*, 2(2), 6. Retrived June 25, 2005 from http://www.ejel.org/volume-2/vol2-issue1/issue1-art6.htm.

Showers, B., Murphy, C. & Joyce, B. (1996). The River City program: Staff development becomes school improvement. In B. Joyce & E. Calhoun (Eds.) *Learning experiences in school renewal: An exploration of five successful programs* (pp. 13–51). Eugene, OR: ERIC Clearinghouse on Educational Management. (ERIC Document Reproduction Service No. ED 401600).

Sleegers, P., Van Den Berg, R. & Geijsel, F. (2000). Building innovative schools: the need for new approaches. *Teaching and Teacher Education*, 16, 801–808.

Snow-Gerono, J. (2005). Professional development in a culture of inquiry: PDS teachers identify the benefits of professional learning communities. *Teaching and Teacher Education*, 21(3), 241–256.

Spillane, J. P. (1999). External reform initiatives and teachers' efforts to reconstruct their practice: the mediating role of teachers' zones of enactment. *Journal of Curriculum Studies*, 31, 143–175.

Synergeia web-based learning environment http://bscl.gmd.de.

Synergeia User Manual. Retrieved October 28, 2005, from Web site http://bscl.fit.fraunhofer.de/ download/SynergeiaManual.pdf.

Säljö, R. (1979). *Learning in the learner's perspective. I. Some common-sense conceptions*. Reports from the Department of Education, University of Göteborg, No.76.

Triggs, P. & John, P. (2004). From transaction to tranformation: information an communication technology, professional development and the formation of communities of practice. *Journal of Computer Assisted Learning*, 20(6), 426–439.

Wang.C.-H. (2005). Questioning skills facilitate online synchronous discussion. *Journal of Computer Assisted Learning*, 21(4), 303–310.

Williams, M. (1997). *On-line commnities: changing teacher practice*. In Challenge and change in science mathematics and technology: OECD regional dissemintion conference, Canberra, 14– 16 Septmber. Deakin West, ACT: Australian Teacher Association. Retrieved July 25, 2005, from http://magnet.educ.monash.edu.au/~roland/paperclip/mwilliams97.htm.

Winter, E. C. & McGhie-Richmond, D. (2005). Using computer conferencing and case studies to enable collaboation between expert and novice teachers. *Journal of Computer Assisted Learning*, 21(2), 118–129.

WHY DON'T YOUNG ADULTS CHOOSE COMPUTER SCIENCE STUDY PROGRAMS?

Self-Perception and Gender Aspects in Computer Science Education

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ABSTRACT

In this contribution, we describe the activities and promotion programs installed at the Bonn-Rhein-Sieg University as an institution and at the Department of Computer Science respectively for increasing the total number of computer science students and in particular the female rate. We report about our experiences in addressing gender aspects in education and try to evaluate the outcome of our programs with respect to our equal rights for women strategy. We propose a closer look at mental self-theories enabled by E-portfolios to address also gender issues in Computer Science. Moreover, reasons are identified and discussed which may be responsible for the reduced interest in particular of female young adults to choose a computer science study program.

Categories and Subject Descriptors: K.3.2 [Computer and Information Science Education]: Computer science education
K.4.0 [Computers and Society]: General

General Terms: Management, Measurement, Human Factors.

Keywords: Gender Issues in Computer Science Education.

INTRODUCTION

The total number of computer science students is decreasing in EU states and the female rate still keeps much too low. Far reaching economical and social problems stemming from

these developments become visible on the horizon. These problems will heavily influence prosperity and economical and social successfulness of states, nations and EU-wide. Therefore, we urgently have to understand the reasons, identify the real causes and take appropriate actions why young adults do not choose computer science study programs.

The Bonn-Rhein-Sieg University of Applied Sciences has been founded with the dedicated strategy to promote female employees and students. Therefore, we see back to quite a history in promotion programs for female students and faculty members.

In this contribution we report about our female promotion programs at the Bonn-Rhein-Sieg University, which are Girls' Day, audits for family qualification, day care centers for children, special working rooms for employees with children, holiday programs for the children of students and employees, help contact points, a special hiring strategy for increasing the female rate of the employees, and gendering of courses. These programs are described in the next chapters. In the remainder of this contribution the mental theories of young adults are investigated to understand the problem of choosing or more precisely not choosing computer science study programs. A basket of activities are proposed to tackle the gender problem in the student body of Computer Science as well as to improve learning and teaching methodologies in general.

IMPLEMENTATION OF GENDER ISSUES

Although equal rights for women was a given profile element during the foundation period of our university and still is considered as one of the four mission statements of our institution, the implementation of it, in particular if it is not understood literally, required specific approaches for the different needs, departments and disciplines. The more broad perception of this profile element with respect to education in computer science and the Computer Science department as a whole respectively was that the number of enrolled female students in computer science programs should be increased (dramatically). The low enrolment of female computer science students is a well-known effect in many but not all industrialized western countries. For years the ratio used to be more or less stable in the area of 17 to 15 percent in Germany, which was and still is considered as too low from various stakeholders in politics and industry. However, this low ratio in our department was and still is decreasing below or close to a level of 10% in the last few years (see Fig. 2.1). Therefore, special efforts have been developed to try to counteract this development.

One very critical observation which is considered to counteract the low enrolment rates of females in computer science and engineering was found in the self-perception influence of the image or better role model of engineers and computer scientists in the public or more specifically in the media. More details on associated reasons and causes are given in the next chapter. However, based on these findings the following activities have been developed and undertaken to react on the reduction of female enrolment numbers:

- development of gender specific advertisement strategies for addressing in particular female high school students
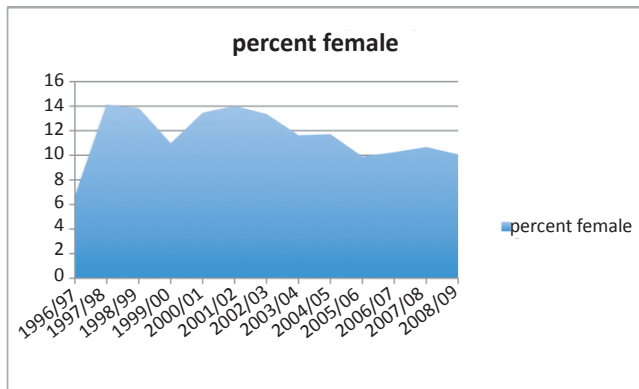- revision of the hiring strategy for faculty members

Figure 2.1. Slow decrease of female computer science enrolment. The graph shows the total enrolment over all study programs (undergraduate and graduate) offered at the Department of Computer Science.

- revision of the didactics of courses to adapt to the particular learning needs and priorities of female students.
- development of auxiliary means to enable to work and run a family in parallel

By designing and implementing these activities a common well known strategy is trying to work as much as possible with convincing female role models. This, however, as a side effect caused a high additional workload on the female faculty members already employed in our department which is a disadvantage to motivate faculty members to support these kinds of initiatives.

Specific Advertisement Strategies

A variety of activities have been developed and successfully implemented to address potential female students. The department organized for many years quite successfully special training courses for high school teachers in various special topics of computer science and we specially encourage and invite female teachers to join us. Moreover, we have participated many years in the national "Girls' days" activities and we even offer additional options as soon as the request is outperforming our capacity on this specific day.

Revision of the Hiring Strategy

To increase the number of possible positive female role models in computer science a university-wide hiring strategy has been adopted in our department. At least 50% of the voting members of a hiring committee must be staffed with female representatives. This guideline sounds easy to install in the first moment. However, the implementation turned out quite ambitious because of additional state constraints of the composition of hiring committees, e.g. the majority of votes must be guaranteed by the representatives of the teaching faculty. As mentioned above, this caused a very high workload on those female faculty members who were a member of the teaching faculty already. It turned out that some of our female faculty members have to serve for half of all committees for a number of years. This was a hard burden in particular considering that more than 30 teaching faculty members needed to be selected in the last 12 years.

Revision of the Didactics of Courses

Recent brain and learning research suggests that the classical teaching methodology of introducing a theoretical concept first and demonstrating it on a practical application later should be reversed. Problem based learning [6, 7] is considered to be particularly well suited for female students. However, as soon as you think of practical examples you have to evaluate how these examples address both genders. Typically there are areas in real life which address differently both genders, therefore a special focus has been put on examples which specially address female students. In addition to the overall motivation to improve the general didactics of a course, a further motivation was to gain experience in addressing female students by particularly adapted didactics. We want to keep at least those females enrolled and would like to reduce early drop-outs. In other words, "do not scare away those few females, who were bold enough to enrol at all". But what does it mean to gender the content of a lecture, and how do you apply it? The field of gender issues in university teaching is a very new discipline. Only few references are available at all [8] and there are no really clear recipes available on how to apply it. Some few guidelines are known, which however are considered already as general standards. For example, any content that might offend any minority or contain any racist, religious or sexual offending matters is not permitted for use in a lecture as reference material. However, it is hard to define where the borderlines are.

More importantly, the following question is of particular interest for this experiment: how do you identify reference material that catches the particular interest of female students. Our own findings and some literature references [8, 9] suggest that using sample material such as project results or reference applications, which have been made by female students, might qualify for good examples in this area. To conduct a first experiment to integrate gendering aspects, we have chosen a first year Computer Science course on "Introduction on Multimedia Sciences" in our department.

Two experienced female graduate students have been hired to support the revision and restructuring process of the course material and to integrate project results and reference applications made by females where appropriate. In particular, an existing blended learning application has been chosen for use in this course. This course was considered to be specially suited for such an experiment, since it aims to introduce a very wide and rich application area of Computer Science. Basic technology and terminology have to be introduced while giving the students a first chance to experiment with several tools in the multimedia domain. Moreover, this application area provides the opportunity to include numerous visual and audio stimuli through impressive examples in the lectures.

Reference media, sample applications and former student project results have been taken, updated, improved and incorporated as part of the revised course design and structure. Associated teaching labs have been re-organised and new assignments with new reference material have been developed. Another means to improve the efficiency of teaching was the introduction of the moodle e-learning platform to enhance individual communication between the student and instructor and teaching assistants as well as to facilitate communication amongst students. Despite the psychological barrier and the gender differences in applying these tools, the overall advantage of this platform was obvious.

The evaluation of our experiment has turned out to be challenging in particular with respect to the gender influence, since just the course performance of the participating fe-

male students might not provide all the required information to evaluate the impact of the changes. One of the major reasons for this is that one prerequisite to allow a comparison of the female performances would be that both cohorts must have the same pre-knowledge, which cannot be assumed without prior testing. Moreover, comparisons of the drop-out rate and student attendance do not really provide the information we were interested in because they are also influenced by additional external effects.

Therefore, the evaluation of the outcomes of the gendered "Introduction on Multimedia Sciences" course is based on the available students' course evaluation data. As points of reference, a course taught by the same instructor 3 years ago and a course taught by a different instructor a year before were used. In total ten different questions have to be answered by the students, which include a numerical mark followed by the option to provide written comments.

The evaluation of the revised course showed significant improvement of the four main criteria:

1. Coherent presentation of the content
2. Motivation to collaborate and to critically discuss the content
3. Instructor's availability during (non) contact hours
4. Level of the instructor's preparation

Moreover, the category of "Supporting media/means" and finally the "Overall judgement" increased significantly. It is worth to mention that no change in the student judgement was found in the categories "Opportunities to get actively involved" and "Level of difficulty". This indicates that the content was considered neither more difficult nor easier, which would have had an impact otherwise. A small decrease in the category of "Attendance" was identified, which however was considered to be insignificant and could be interpreted as noise. In conclusion, the experiment turned out to be very successful. This is mainly based on the personal communications of the instructor and the teaching assistants with the female students. The overall rate to feel comfortable in this first year course in comparison to other first year courses was significantly higher. Female students enjoyed this course the most. However the real impact on the gender issues could not really be evaluated, due to lack of data and methods to apply and test it. Therefore, more research on these aspects is needed to resolve the hidden aspects in this context.

Auxiliary Means

On top of the gendered course described before, there were a number of additional trails and experiments to improve or optimize the learning conditions of our female students, which the department of Computer Science has undertaken in the past.

Gender specific tutorial and lab time

Several years ago special tutorials and lab hours for our female students were only organized based on the feedback we obtained from female students in our regular feedback sessions. For that, female students were pooled in such a way that we were able to schedule special training and reviewing tutorials as well as labs. It was thought that in these tutorials, which were scheduled once a week for a double hour, students should be able

to review and discuss the material of the course, without feeling depressed or humiliated when they are asking possible stupid questions. Our motivation to apply such a trail was based on the feedback we obtained from some of our female students, that it was considered sometimes hard for them to actively participate in regular unisex tutorials and labs and ask questions as they would like to.

However, the feedback on the gender specific tutorials and labs from the females as well as from our male students caused us to stop it after a few semesters. It turned out that female students were complaining that they were taken out of their regular mixed gender learning groups, which they personally would prefer and they found it silly that we go back to a middle age style of gender separated teaching methodology. Moreover, some of our male students were complaining that they were excluded from these additional tutorials just because of their gender, although they were highly interested in participating because the content and material of the course was also hard for them to understand. Therefore, they would appreciate any additional tutorial. In conclusion, we continued this kind of service but not restricted to female students only. The result, however, was that the ratio of female students, who participated in "their" tutorial before, was decreasing from year to year until it reached the general gender ratio. In conclusion, this trial shows clearly that the gender issues in teaching computer science and most likely any technology matter is such complex that there is no easy solution possible. This was one reason to develop a comprehensive and integrated gender strategy at our department.

Moreover, a number of additional supporting means were installed to address the special needs of women looking for study programs in computer science. These means have been shown to have a fundamental impact on the circumstances for a number of women, in particular if these women are mothers, and therefore should be considered very seriously.

Day care
The university supported and helped to install a day care facility very close to the two university campuses. Although the day care offers very flexible opening hours, it has been shown that this does not match 100% with the university lecture schedule. The day care opening hours are from 7:30 to 17:00, but still it has been reported by some of the female students that this is sometimes not sufficient because some classes and labs are scheduled during evening times up to 19:00 or even 20:00. Since the day care is run by a service provider which has got a contract for many years, changing opening hours is not as easy as it might look like.

Figure 2.3. Daycare opportunies for female students with families is more than used a community service.

Vacation program Try it
One additional activity which has been successfully implemented is a vacation camp program for children in the age range of 6 to 15 years. This is in particular important at those vacation times when they are not synchronized with the term breaks, which is in particular during the Easter break in most cases in April and the fall break in most cases in early October, when lectures have already started. This program has been designed in such a way that it serves both intentions, the first to make the kids busy and the second to offer interesting content, which is trying to pass over science and engineering topics. The outcomes from the last two years show that the kids really loved it, are very interested to go to the place where mom and dad are working and are eager to return back in the next vacation. However, as mentioned above in the context of the day care, the opening hours were again an issue, since the camp hours where set from 9:00 to 15:00 which is not in line with the class schedules or working schedules. The result was that a considerable fraction of children continued staying at the University and needed to get entertained.

Help Contact point and mother – child work place
To assist women and mothers in their daily situations two additional means have been implemented. The first is a contact point staffed by a co-worker, which is responsible for coordinating all university wide activities of the gender aspects. Since we maintain two different campuses with a distance of 35 km in between, there is a "HELP" contact point installed at both sites.

The second support mean is to maintain a "mother – child emergency work place". The idea is that a particular work place is equipped in such a way that a mother with a sibling (0–3 years) could be easily accommodated when special situations might occur. This could be sickness of the children, which does not allow bringing them to a day care facility or temporal closure of day care facilities and other reasons. This work space can be booked on short notice and is equipped with toys and the necessary facilities for toddlers and babies. The booking records clearly show that there is a need for such an infrastructure, although we observed overbooking in particular in the fall season (flu season) while there were lots of empty spaces in the summer months.

MENTAL IMAGE OF COMPUTER SCIENCE

Many female promotion programs have been introduced into the computer science departments around the world in order to increase the rate of female students, but with little or no measureable success. The female rate at the Bonn-Rhein-Sieg University of Applied Sciences nevertheless stays at about 10% as shown in Fig. 2.1. Obviously, other trends and societal changes might have a greater effect than our female promotion programs. Therefore, we decided to review our programs and look for the real causes.

SWOT Analysis

Optimizing internal programs and methods does not yield the requested effects if external problems might impede better results. The SWOT analysis method is well known for the evaluation of strength, weaknesses, opportunities and threats taking into consideration internal and external factors. Therefore, a SWOT analysis has been undertaken at the Bonn-Rhein-Sieg University. The results are summarized in Table 1.

Table 1. SWOT Analysis

increase rate of female students in computer sciences	Helpful	Harmful
internal origin	university programs gendered courses	drop-out rate
external origin	state programs	self-theories and mental images of computer science

The obvious result from the SWOT analysis is that the self-theories and mental images of computer science play a central role in the choice of the study program. Therefore, we investigate mental theories more deeply in the next chapter.

Psychological Findings and Terminology

In order to be precise, first some basic definitions are given. A **life stance** is what drives people's decisions and actions (partly unconsciously) opposed to an explicit belief system, which is about their conscious thinking. The effective life stance can be detected by observing decisions and actions, not by questionnaires asking for beliefs. People live through their life stance comprising their world view and their self view. The **world view** (*Weltanschauung*) is a collection of hypotheses, mental images and implicit theories about the world. The self view (or **self theory**) is a collection of hypotheses, mental images and implicit theories about oneself. Both parts of the life stance become effective in decisions and actions, but may differ from conscious thoughts and explicit belief systems. E.g. someone may express beliefs in green energy (explicit belief system) and at the same time drives a large car, implicitly rating personal comfort or social status higher than energy saving (life stance).

Implicit self theories have been investigated by Carol Dweck in her book "Mindset" [2].

They may play an important role in personal achievements, sports, business, relationships and personal change. Dweck compared people with **static** and those with **dynamic** self theories and found significant differences. According to her study [2], people with static self theories perform worse than people with dynamic ones. Her research in psychology is on the dynamic adjustment of self theories. Research in computer science has come up with e-Portfolios to support this [1].

Formerly, family and tradition have determined the life stance of young people. Today, mass media (TV, internet) have the most influence. Children spend more time with media than with parents and teachers together. The choice of the study program is therefore mostly determined by a media determined life stance.

The reputation of computer science professionals presented in the media is misleading and quite negative. There is a huge gap between the views of young high school students and the real occupation of computer science professionals. The common mental image of computer science in this age group differs largely from the reality of the profession, in particular in terms of the social skills needed. The common mental image of a computer science professional is still that of a programmer, even worse a hacker, which differs widely from the real occupation of today's work situation.

But first of all, computer science teachers have to look at their own mental image of a computer science professional.

Computer science as a part of science?
The official view on computer science within the fields of science is as follows: The total scientific knowledge of human mankind is organized into a deeper and deeper hierarchy of sciences (see Fig. 3.1). Computer science is considered as a specialization of a specialization within this hierarchy.
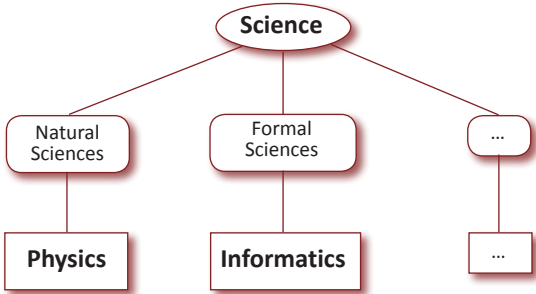

Figure 3.1. Informatics as a part of formal sciences

This **object-oriented view** is what we learn in academia. The attributes of this kind of computer science are scientific, formal, machine oriented. All these attributes are not very attractive, neither for young men, nor for young women. Why should they invest 3 to 5 of their best years of their lives into this very narrow formal subject? Aren't there more attractive and more urgent things to do on this planet? The young people are voting by choosing their study program.

Science as a part of computer science

In fact, the reality of the computer science profession is much more wide-ranging than just being a formal science. It is true that there are problems in practice, which can be best solved by using scientific methods. But are these problems the main part of the everyday work of an IT professional? The scientific part is obviously only one single aspect of the computer science profession, not the whole occupation. Of course, scientists might be rating the scientific aspects most important. But the reality of the computer science profession is much more wide-ranging and might be more interesting for young people than just being a formal science. In Germany, universities of applied sciences choose practitioners only for professors via their hiring strategy, those who know the other complementing aspects of their profession better than people with pure academic background. This is one major reason for the success of universities of applied sciences in computer science education.

The inversion of the object-oriented view on computer science being a part of a part of science is the **subject-oriented view** on how a computer science professional works and acts (see Fig. 3.2).
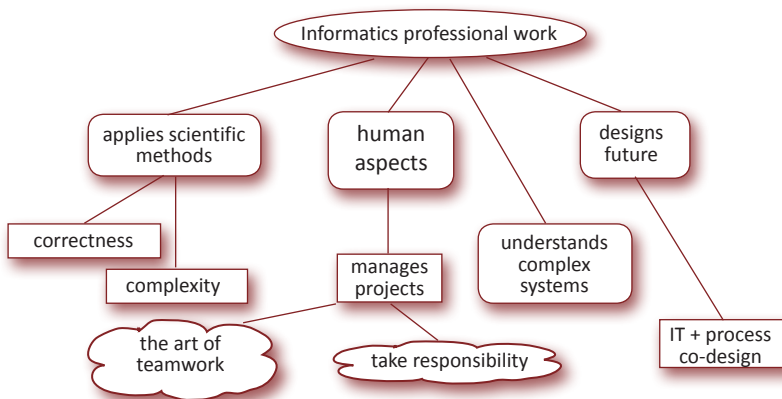

Figure 3.2. Subject-oriented view on the professional

The reality of the computer science profession is more attractive and more interesting for young people than the pure academic aspects. Designing their own future applications and environments is at the core of the interests of our students. They want to take responsibility as soon as possible. Promoting computer science effectively to meet these demands of the next generation could generate more interest in the computer science study program.

As pointed out in [1], for a long time computer science education has been centred on formal aspects, computing, data processing, process control via mainframes and mini computers. But the world has changed and is undergoing dramatic changes rapidly. In fact, the change rate is growing exponentially mainly due to technological advances. Applications of computers and software are becoming pervading in everyday life. Therefore, for young people there does not seem to be a need to study computer science in order to use computers. They are already using computers everywhere. Therefore, computer science education cannot stay the same. It has to embrace the trend towards applications based

on the modern advances in technology, insights in complex systems, and changes in work environments.

GUIDING PRINCIPLES

In this chapter, five guiding principles of a new approach are presented. After that, we discuss our concrete realisations.

• Female oriented applications
• Addressing self theories and mental images
• Addressing female and family needs
• Learning infrastructure becoming more important
• Learning environment and learning process co-design
• Female oriented applications

As a formal science, computer science can be applied to any application area. The choice of the application area differs by gender. In order to get more female students attracted to computer science study programs, more female application areas have to be addressed by special study programs, specialisations within existing programs or the gendering of courses. For example, Health Telematics is a new study program within the computer science faculty, which is supposed to attract more female applicants than other classical study programs.

Addressing self theories and mental images

One of the major reasons why young women do not choose computer science as their study program is a wrong mental image of the academic discipline of computer science and of the computer science profession. Media, films, TV soaps and shows have produced this mental image. Even large PR actions will not be able to change this image. Unfortunately, today it is in the responsibility of the media to guide young people into this direction and academia will not have the power to make significant changes. All we can do in our universities is to address these mental images and make them aware.

In Germany, the university rectors' conference (HRK) has issued a nationwide program to change university study programs from teacher centred towards student centred [3]. The student centred study starts with the student her- or himself, i.e. self presentation, self reflection and self managed learning. Transformative learning stems from a theory centred on the awareness of one's own mental images, prejudices, assumptions and expectations. This awareness starts with presentation and reflecting on those presentations. The key idea for understanding this kind of learning is the discovery of Carol Dweck [2], that a static self theory is the biggest learning impediment. Unfortunately most people are not aware of their own active self theory. The effects of the self theory become visible in self presentations, self reflections and in actions. Therefore, the study program and the study infrastructure have to be enriched by elements fostering the awareness of self theories. This is of special importance for the gender issue.

Addressing female and family needs

Since its foundation, the Bonn-Rhein-Sieg University of Applied Sciences has always taken female and family needs into consideration. Starting with the architecture of the building, the rooms and floors were designed bright and clear without dark corners. Special parking lots are reserved for women. On the Girls' Day female disciples are invited to get special introduction. Audits have been passed for family qualification. At day care centers children can spend their time while parents are at work or study. There are special working rooms for employees with children. Holiday programs were introduced for the children of employees.

Learning infrastructure becoming more important

Academic teaching includes an increasing amount of self-study units, e-Learning, learning in groups and distance learning. For all these new forms of academic teaching new and different infrastructure needs to be developed and managed.

Learning environment and process co-design

The university infrastructure will play an increasingly important role within the education system of the future. Self centred learning means that students invest more time on their own, using the infrastructure more intensively learning alone or in groups. As a part of the infrastructure, libraries have only been places for storing and delivering books and journals in the past. Today, libraries should be turned into learning centres, embracing more phases of students' learning and social life. The success of this transformation of libraries into learning centres depends on the usefulness for students and how well the learning process is supported by the new facilities. Therefore, it is essential to plan both the learning infrastructure and the learning process in a co-design.

BUILDING BLOCKS OF REALISATION

Having outlined our guiding principles we now discuss our concrete realisation.

Learning Centre

   Projects for restructuring the infrastructure of universities are common all over Europe. Libraries are transformed into learning centres offering more services, more places for work and more learning infrastructure. According to our principle of learning environment and learning process co-design, the learning centre facilities and usage are worked out in parallel.

e-Portfolio

Portfolios have originally been used by artists and architects as means for applications showing their clients their way of painting or house building and individual style.

Electronic portfolios (e-Portfolios) are means on the web for self-expression. All students can manage their own portfolios showing their personal documents, images, videos, blog entries or collections of bookmarked links.

E-portfolios do not only facilitate students' reflection on their own learning, but also on their own self theories and mental images. This is considered as essential for gender issues in computer science.

The main aim of the EU initiative "Objective 2010 – e-Portfolio for all" is that every EU citizen should use an own e-Portfolio by 2010. Thereby mobility within the EU states, transparency and recognition for lifelong and lifewide learning and work experience should be enhanced. "The e-Portfolio is the medium of choice for the 21st century lifelong learner and knowledge worker", as the initiator EIfEL states in [4].

In Germany, some universities are experimenting with e-Portfolios, but they have not yet become the medium of choice. The integration into all our learning processes is still missing. According to our guiding principle of infrastructure and process co-design, we have to design processes for e-Portfolio usage in parallel. The selection of applicants, monitoring learning expectations and experiences, alumni contacts and lifelong learning could all be based on e-Portfolios. The Internet generation of today lacks writing and reading skills, which could be faced by e-Portfolios: At some universities, student beginners have to write down a self-presentation before they enter the campus for the first time. At the beginning of every semester, students write down their expectations, motivation and future prospects. One year later they can look at their own writings and compare them to the most recent changes. Thereby they can learn much about their intrinsic assumptions about computer science as well as about themselves, their self-theories and their world view.

Microlearning

Microlearning means learning in small units, small steps and short time frames [5]. "Tip of the day" adages on calendars are well known microlearning applications. The repeating learning impetus of these small learning units provides the learning process with durability and persistence. It is well known from language learning that the last 20% of language perfection can hardly be attained in classroom, but by repeatedly memorizing small learning units. This kind of application makes sense for microlearning.

Modern technology adds new delivery chains, new platforms and new media to this quite old idea. Every student today is equipped with modern communication means (notebook and mobile) that can be used for delivery of microcontent. The essential challenge for designers of learning environments is the seamless integration with the other learning infrastructure, e-Learning and with classical learning processes. At the Bonn-Rhein-Sieg University we found some useful ways for combing e-Learning with microlearning: E.g. in classroom students build up a database of test questions and answers, which are used as units for a microlearning feed.

For microlearning no big time slots are needed. Micro units can be consumed anytime, anywhere, anyhow. This makes a big difference to the heavyweight learning processes at universities today. This is of essential help for students with families. Microlearning does not substitute other learning processes, but is considered a very useful supplement. Avail-

ability of microlearning feeds can easily be attained by modern technology via mobile phones or WLAN.

Part-time study programs

Students with children cannot study whole day long. Therefore, we introduced part-time study programs, in which all courses are offered in the first half of the day. The success was tremendous right from the beginning, as shown in Fig. 5.1.
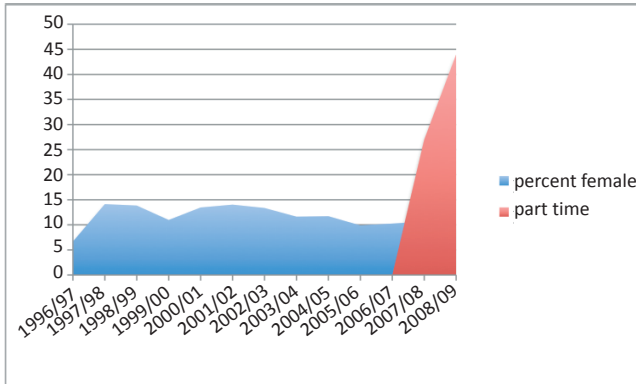

Figure 5.1. Percentage female students after introducing part-time study program

A demand for a program like this has been found in an evaluation of females contacted by our university. The undergraduate program is designed in such a way that the original three year program is spread to five years. In lectures and courses part-time students are integrated as much as possible in regular courses; however, as soon as it comes to tutorials, labs or other group activities these students are pooled (see Fig. 5.2).

Figure 5.2. Sample students of the first cohort of part-time students. The ratio of female students is significantly higher than in our regular undergraduate program(s).

New study programs

To address special interests of potential female students new study programs have been designed within application field, e.g. Health Telematics, which is considered to be more female oriented. Even before its inception it became clear that the female rate would in-

crease significantly due to the high number of female applicants. It has been shown that females are in particular interested in special application areas of computer science and information technology and the health care sector has been identified as one of the most preferred areas.

RESULTS

Project oriented courses in Software Engineering
In project oriented courses we have observed the following behaviours of female students:
- Female students form their own project groups without participation of any male students.
- Female students participate in mixed groups.
- The only female student of the group takes the leading role in the group.

All three behaviours deserve a different kind of support from teaching professional or instructors. This support could easily be addressed by including e-Portfolios into the normal classroom work. Female students writing down their personal view of their project and their teamwork contribute significantly to the project success. Typically students have very fine tuned sensors indicating ill-defined teams and behaviours.

Classroom time is typically too short to address all the needs of female students, management of mixed project teams and project leading by female students. Here microlearning yields a convincing supplement by offering female students micro lessons about gender issues, which can be attained anytime, anyhow, anywhere even outside the classroom.

Formal learning about software engineering and informal learning about management aspects and gender issues complement each other nicely in this setting.

Hiring Strategy
So far, the effect of the university wide hiring strategy which should support female teaching faculty is not really clear yet. It turned out in some hiring committees that not a single female applicant applied for the position offered or met the formal criteria of the position. However, overall the existent ratio of female teaching faculty outperforms with 15% by far comparable other computer science departments on university and applied university levels. From that perspective we are pleased with our departmental gender situation so far, although we are not really able to directly link this development to the revised hiring strategy.

Part-time and other new study programs
It turned out that the ratio of female students in our newly installed part-time study program is significantly higher (close to 44%) than in our regular undergraduate programs. However, these numbers are based on only two cohorts so far, since the part-time program has been installed in academic year 2007/2008. One additional finding is that the av-

erage age of the enrolled female students is 3-4 years higher than in the regular bachelor programs. Therefore, the students are more mature (see Fig 5.2) which has positive side effects on teaching and their learning outcomes. Furthermore, it has been shown that in particular the female part-time students are really actively studying, while some of the enrolled male part-time students do not show up in classes as frequently. In conclusion, the design of a special computer science study program for a female audience might be a successful way to tackle the gender problem in computer science. However, we have to follow up the development of our part-time program and the new designed Health Telematics program for a number of years to allow the derivation of solid evaluations.

Revision of the Didactics of Courses
Moreover, there are some important lessons learned from the experiment of gendering the "Introduction on Multimedia Science" course. Reviewing and improving the didactics is always good for students regardless of their gender. Students are more motivated and the content is easier to understand. The revised, updated and/or added media have been appreciated and the overall judgement of the instructor increased although this measure is always subjective due to the student evaluation data. The conclusion is that problem based learning has proven (again) to be successful with the teacher and student, regardless of gender specific information, student performance or drop-out rates. But what are the gender effects obtained? An important finding we observed during personal communication was that female students were really interested in the example applications and projects which have been created by female students. Moreover, since teaching labs were co-supervised by the two experienced female graduate students, a clear message was passed over to the female students in class that females can be successful in Computer Science. In summary, to improve the attractiveness of the content of a lecture, in particular for the female audience, one has to work on good practice examples done by females and supported by good female role models. However, gender issues in university teaching needs more research in the future to identify those aspects which are important.

In conclusion, the above mentioned set of activities shows clearly a variety of actions the University and the Department of Computer Science have undertaken to address seriously the gender aspect on different levels. One should not underestimate each of the single above mentioned activities even if the impact is not directly visible or measurable. One very important finding is that women are realizing more and more that our university and our department are taking gender issues very seriously and try to really improve the learning and living conditions of females. For that reason the University has been awarded several times in the recent past in competitions of a family and gender friendly environment. Since 2004 the Bonn-Rhein-Sieg University of Applied Sciences performed with its designated gender strategy three times best and one time second best in a row in a state-wide competition (NRW).

CONCLUSION

The Bonn-Rhein-Sieg University has a long and outstanding history in promoting study programs for female students and students with a family. Nevertheless, there are many extrinsic causes stronger than intrinsic that have to be dealt with especially in computer science. Therefore, we propose additional research, guidelines and actions. Academic education in particular in the field of science and technology is undergoing dramatic changes. Teachers are confronted with new problems but also with new means and tools to overcome them.

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REFERENCES

[1] Van Leeuwen, J. 2008. *Ten Ways to Attract More Students to Informatics*. IEE III.

[2] Dweck, C.S. 2006. *Mindset*. New York: Random House.

[3] Hochschulrektorenkonferenz (HRK) (2008). Für eine Reform der Lehre in den Hochschulen. DOI= http://www.hrk.de/109_4298.php.

[4] Ravet, S. 2007. ePortfolio for all. EIfEL. DOI= http://www.eife-l.org/activities/campaigns/.

[5] Hug, T. & Friesen, N. (2007). Outline of Microlearning Agenda. In Hug, T. (Ed.) *Didactics of Microlearning*. Münster, Germany: Waxmann-Verlag, 15–31.

[6] Shoemaker H. (1960). The functional context method of instruction. Human Resources Research Office, George Washington University. IRE Transactions and Education, V-E-3(2), 52–57.

[7] Stelzer-Rothe, T. (2005). *Komptenzen in der Hochschullehre. Rüstzeug für gutes Lehren und Lernen an Hochschulen*. Rinteln: Merkur.

[8] Schwarze, B. (2009). Gender and Diversity in Ingenieurwissenschaften und Informatik, FH-Osnabrück, http://www.ecs.fh-osnabrueck.de/21027.html, last accessed 18.08.2009

[9] Curdes, B., Marx, S., Schleier U. & Wiesener H. (2007). *Gender lehren – Gender lernen in der Hochschule, Konzepte und Praxisberichte*. Oldenburger Beiträge zur Geschlechterforschung Band 6. BIS-Verlag der Universität Oldenburg.

CHALLENGES FOR THE FINNISH VIRTUAL EDUCATION SYSTEM

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ABSTRACT

e-learning has been a strategically significant focus of development in the Finnish education system. In particular, ICT skills and deployment have been emphasised in the National Board of Education's strategies since the beginning of the 1990s. Other administrative bodies have also gradually recognised ICT utilisation as a significant skills area, and in various development strategies and ventures e-learning has been seen as a pivotal method to promote skill development and innovation. In this article e-learning strategies and their implementation in different educational sectors are described from the perspective of life-long learning. Current Finnish e-learning and b-learning best practices and development areas are also introduced.

Keywords: ICT and curriculum, didactic skills, in-service training, teachers' ICT skills, blend-ed learning, strategy planning

INTRODUCTION

The national strategies implementing ICT in education
The implementation and development of ICT in education have been directed through various strategies and development programmes for approximately twenty years in Finland. The objectives of an information society were defined in the Ministry of Education's strategies for the first time in 1994 for the years 1995–2000. Its aims included training teachers in basic ICT skills. The funds were allocated from the government for teacher in-service training. Also every school ought to be connected to the Internet by the end of year 2000. The government also supported all the municipalities with 50% of the costs incurred in creating these connections.

The next national strategy covered the years 2001–2004. In 1998, an extensive technology assessment project, Information and Communication Technologies (ICT) in Teaching and Learning, was completed in Finland. Initiated by the Finnish Parliament and carried out by the Finnish National Fund for Research and Development, the project assessed all formal education from kindergarten to universities. In addition, it examined some aspects of informal learning taking place in homes, libraries and adult education establishments. The study focused on the growing challenges presented by the information society both on individuals and on the Finnish society in general, especially when viewed from the perspective of lifelong learning (see Sinko & Lehtinen 1998).

The assessment verified that ICT has enjoyed a high priority in the Finnish society. However, according to the assessment, there was not enough high-quality e-learning materials. The pedagogic and technical support was still insufficient and teacher training needed to be increased and better focused. The dissemination of good practices needed to be organized. The Ministry of Education addressed these challenges in the second Finnish national strategy (Ministry of Education 2004) and the main goals were:

1. Information society skills for all;
2. The versatile use of networks in studying and teaching;
3. Accumulating digital information capital;
4. Strengthening information society structures in education, training and research.

The Finnish Ministry of Education launched a programme in 2002, called Ope.fi, in order to improve the ICT skills of in-service teachers and teaching personnel on all educational levels from kindergarten to universities. The Ope.fi programme was in accordance with the European Commission's action plan eEurope – An Information Society for All. The programme was divided into three steps. The first, (Ope.fi I), comprised knowledge regarding the common uses of a computer, mastery of word processing, Internet browsers and e-mail, and an understanding of the principles of the educational use of ICT. These are the skills that every teacher had to master by the year 2004. The second step, (Ope.fi II), provided skills in using ICT for educational purposes which at least half of all teachers had to master by the year 2004. These skills included the versatile use of e-mail, web environments and groupware; generic tools, pedagogical applications and digital materials available in the subject taught and the principles of digital learning material production. The third step, (Ope.fi III), included specialised knowledge which about 10% of teachers had to master by the year 2004. These included content-specific and professional applications, the production of digital learning materials, institutional information management, an ability to assist, support and train colleagues and develop the school community and act as a part of an expert network.

The third strategy of the Information Society Programme for Education, Training and Research 2004–2006 contained major priorities and actions for boosting information society development in education, training and research.

The strategy's core objectives were:
• to develop all citizens' information society knowledge and skills
• to enable educational institutions to use information and communications technology (ICT) in a versatile way in their activities
• to establish ICT-based procedures in education, training and research

- to promote social innovation through the use of ICT

The focus of the strategy was on three areas: knowledge in the information society, contents and operating environment.

The aim of the strategy was that Finland is an open and secure, networked society with high-level information society skills by 2007. All citizens should have opportunities and the basic capabilities to use electronic services (eService) and content. The fluent use of ICT in learning and in teaching ought to be a part of everyday school life as a learning tool. ICT should be used widely and appropriately in research. In addition, electronic materials should be of high quality, pedagogically justified and serve different user groups and be available openly.

The strategic objectives of the National Information Society Strategy (Prime Minister's Office 2006) concerning all citizens are in line with the educational objectives. By 2015 all citizens should have the opportunity to acquire basic ICT skills, media literacy skills and be equipped with skills in using electronic and other civic services. It is assumed that all Finns possess skills acquired at home, work and educational institutions, which can be employed to secure economic, social and mental success. The goal of basic education is that the entire youth cohort would be well equipped to utilise and apply the opportunities afforded by ICT. Basic education in Finland should be open and networked, as well as world renowned for its learning outcomes. Teachers' ICT skills should, by 2015, be high-quality and ICT a component of multi-modal teaching at all educational levels.

The National Innovation Strategy (Ministry of Employment and the Economy 2008) emphasises the significance of skill foundations and the construction of innovative encouraging learning environments. The virtual communities and electronic interaction are growing rapidly. For innovative individuals and communities, information society development opens up new channels of influence and opportunities to further enhance innovative capabilities. In a developing society there is a demand for innovative solutions and practices, which utilise the future educational theories, social media and business and workplace experts in new configurations. The implementation of web-based learning methods and blended learning methods provides new possibilities in maintaining contact and exchanging ideas with business and workplace experts or international partners.

The Innovation Strategy is informed to a large extent by the information society development in Finland and raises the significance of virtual communities and electronic interaction in innovative activities. The objective is to create a high-class learning development environment in Finland that is an international pioneer in the development of both educational content methodology as well as technical tools.

Creating new ways of participation as a part of the everyday life of citizens can be seen as an important factor in social equality. It can be assumed, for example, that disseminating skills in the use of eServices will prevent social exclusion of citizens and improve their ability to participate in decision-making.

The Active Citizen of the Open Learning Environment programme, supported by the European Social Fund and administered by the Ministry of Education, was initiated in 2008. The programme aims to enhance the ability of all citizens to utilise ICT in everyday learning and knowledge production through collaboration especially between the educational field, libraries and cultural institutions (www.aktiivi.info).

Strategically, the focus of ICT in education over the last two decades has shifted from technology to pedagogy and from an individual ability to supporting collaborative work, in which individuals have the possibility to choose learning paths suitable for their particular learning situation (Table 1). The rigorous utilisation of ICT in all activities is seen as a means to maintain competitiveness in the global world. It is important that all age groups are guaranteed skills and free access to sources of knowledge and that the production and construction of one's own knowledge in open learning environments is facilitated.

1990	1995	2000	2005	2010-
5–10 computers in every school School specific curricula, development of new teaching methods based on a constructivist learning concept Teacher in-service ICT training	Finland – an information society strategy Objective is for each school to have 1 computer/10 students Improving teachers' ICT skills – 1 teacher/school trained – Internet connection in every school	School specific ICT educational strategies – teacher training: technical skills, pedagogic skills – individual teachers trained as content producers Development projects Virtual school established Virtual University and Virtual UAS consortium established Production of learning material	Learning object production Virtual degrees Training of teacher teams and school specific development projects in addition to training of an individual teacher Internet connection from every computer in every school 1–5 students/computer Activity in networks	Open learning paths Utilisation of social media in networks Collaboration between different schools and internationally Combining physical and virtual learning environments

How have the strategies been implemented?

Finnish schools were equipped with computers and Internet connections in the 1990s and at the end of the decade the focus shifted from developing technology to content production, teacher training, the utilisation of information networks and collaborative learning in networks.

The objective was to construct diverse learning environments and produce innovative teaching and learning material. A further objective was that every school would have an institution-specific information strategy by 2003, which includes the definition of the educational goals and ways of teachers and other staff members, digital literacy levels of students in each education sector, and the implementation methods and resources of pedagogic and technical support. Continuing education for teachers was organised in each education sector, and a virtual school, a virtual university and a virtual university of applied sciences were established.

ICT is currently actively utilised in all educational modes, corporate staff training and citizen activities in Finland. However, ICT deployment is unevenly distributed. Several edu-

cational institutions at the different educational levels are pioneers and students have an opportunity for individual learning paths, but institutions employing very traditional educational implementation and models can also be found.

The use of ICT has not undergone a standardised assessment such as the evaluation project of 1998 (see Sinko & Lehtinen 1998). Evaluations have been conducted thematically and by target group. Below, we outline the results of a few of these evaluations, providing an overview of the direction of the overall development. We also describe several best practices found in various educational levels.

The situation in basic education and best practices

The greatest variations in ICT utilisation are found in the general education. The resources allocated to ICT strategy implementation vary greatly from one municipality to another. Ilomäki and Lakkala (2006) observed in their study that technological tools are readily accessible to teachers in Helsinki and Espoo: each teacher has a computer on the school premises, as do 90% of students. IT is, however, sparingly used in teaching; equipment location is problematic in terms of teaching or there is an insufficient number of machines for the student group. There are also pedagogic problems regarding equipment availability. For example, computers may only be booked for specific lessons or time periods, even though students are engaged in long-term projects. It seems, in fact, that a significant lack of usage access prevents teachers from employing computers on a continuous basis in teaching. But teachers are not a homogenous group, who 'know something' or 'can use to some extent'. Rather, age, gender and education level divide teachers into different groups that differ from each other in terms of competence, patterns of usage and attitude. (Ilomäki & Lakkala 2006.)

The extent and ways in which the use of IT is integrated in teaching practices was explained in the SITES (Second Information Technology in Education Study) study. The study also aimed to identify factors having the greatest impact on the effective integration of IT in teaching and learning. The use of IT in high schools, especially in the teaching of natural sciences and mathematics, was analysed in the study. In Finland, 266 principals, 279 IT persons-in-charge and 1078 teachers of natural sciences and mathematics from 311 schools participated in the project (Kankaanranta & Puhakka 2008).

According to the SITES study, in basic education in Finland there is an access to Internet connected computers, but there are large discrepancies between schools in the range of IT resources (Kankaanranta & Puhakka 2008). Nearly all schools have office software, while more simulation and modelling programmes, smartboards and study management systems are needed. Teachers consider the value of IT to lie in its positive impact on students' learning motivation and the greater range of available work methods and learning tools it offers. Finnish teachers who use IT stressed its value in networking and establishing connections outside school. IT is regularly used or extensively used at certain times during the school term by 43% of natural science teachers and 24% of mathematics teachers (Kankaanranta & Puhakka 2008).

Kankaanranta and Puhakka's (2008) study found that less than half of the participating principals considered the use of IT important in various pedagogic activities, and only 10% of teachers felt that the training of students to become competent users of IT is an impor-

tant goal. These attitudes explain to a large extent the existence of considerable differences in the use of IT between schools. If ICT is not considered a significant method, resources will not be invested in it. According to the principals, teachers' lack of time, insufficient IT equipment in science laboratories, limited range of digital learning tools and teachers' inadequate IT skills are barriers to the extensive use of ICT (Kankaanranta & Puhakka 2008).

Just over half of the teachers felt they received fairly good or very good technical support from the school or another source when needed. Principals were of the opinion that there was much support available for different pedagogic activities, although support was given to the realisation of smaller projects. The person-in-charge of IT was the primary person providing IT support. Very little use was made of the skills possessed by students in the provision of IT support. The index measuring the existence of pedagogic support was relatively low for Finland. Most educational organisations do not require their teachers to be trained in IT for educational purposes. Also, very few educational organisations have reorganised teacher workloads to take into consideration the possibilities of new working methods offered by technology. (Kankaanranta & Puhakka 2008).

The SITES 2006 study demonstrated that school-related factors, national curricula and educational policy decisions have a central significance in IT becoming more common in teaching. Especially the teachers' use of IT was influenced by how important the principal saw IT to be in students' learning, in issues related to leadership development, and in supporting teachers in the use of IT. In issues related to leadership management, the pedagogic use of IT correlated positively with collective decision making in schools and related professional cooperation. The technical and pedagogic support received by teachers was one of the permanent positive forecasters of increasing the pedagogic use of IT. And, conversely, teachers defined a lack of support as one of the most significant obstacles to the use of IT. Of factors relating to the education level, student/computer ratio as such did not have a significant connection to the deployment of IT in teaching. (Kankaanranta & Puhakka 2008).

Examples of Innovative ICT Projects

General upper secondary distance education was launched in Finland in 1997 as a joint project between the Finnish National Board of Education and the Finnish Broadcasting Company YLE. It was a part of the National Virtual School Project. In the initial phase, 11 educational institutions were selected as pilot schools.

The encouraging results led to a decision to continue the development of general upper secondary distance education for the period 2000–2004 by extending development activities to cover all the provinces of Finland. The Upper Secondary Distance Education Project has involved 86 educational institutions, accounting for almost 20% of all upper secondary schools in Finland. The national network of upper secondary distance schools has been open for all educational institutions, and their respective maintaining bodies decide whether or not to join the network.

The best practices and learning material accessible to all schools is collected into the Virtual School portal. New ventures include the Tips-Net service for teachers, which, employing social media, gathers together teachers, students and others interested in the new winds sweeping the school world to exchange experiences, share knowledge and together

construct new knowledge (http://vinkkiverkko.ning.com/, in Finnish). The predecessor of Tips-Net was Open Idea (www.edu.fi/openidea), which contains descriptions of web-based study modules developed in different projects in vocational and general education, ideas for teachers on how to use web-based learning materials and web-based learning materials.

Ideapaja (www.edu.fi/ideapaja) offers ideas for teachers on how to use web-based learning materials and the Internet in teaching. Anybody can share an idea or good practice by proposing it on the website. School level, school subject and cross-curricular themes divide the content.

The Finnish Broadcasting Company YLE has operated the Education's Learning Gate since September 2001. It offers free-of-charge educational and informative web content based on TV and radio programmes (http://oppiminen.yle.fi/). Additionally, teachers have an opportunity to interact with their colleagues.

Vocational education

In secondary level vocational education, ICT has been deployed in various development ventures in several educational institutions for over two decades. The development ventures have often been EU funded and either collaborations between several countries or local ventures implemented in partnership with the world of work. No evaluations or comparative studies have been conducted on ICT use. Especially in The Virtual School project (www.edu.fi/virtuaalikoulu, in Finnish), the vocational sector was engaged in several different virtual education development ventures regarding youth and adult education. Altogether 120 institutions were involved in these ventures. The implementations can be found at the Open Idea website www.edu.fi/openidea/ammatillinen.

The minimum goal for online studies, at least 2 ECTS in the 120 ECTS degree, was set for vocational education programmes by Finnish national board of education 2005 in the development and standardisation plan of online education in upper secondary schools, vocational education and informal learning. A few institutions offer broader online study programmes and currently some degree programmes can be entirely completed as online studies. In the vocational sector, networks of developers have been created around a specific qualification so that students can study parts or the whole qualification also online. Most often there is a combination of face-to-face and online learning.

The aim of online education in vocational education has been to offer students study opportunities independent of time and place, and facilitate networking with experts. Leinonen's (2008) dissertation focuses on Virtual School projects and she concludes that virtual education as such has not brought many changes to a teacher-centric teaching style – course textbooks and tasks are often replaced by the new technology. The student's role is that of a fairly passive recipient of knowledge and there is very little interactive study with different experts. It is impossible to construct learning processes required by active learning without pedagogic reflection (Leinonen 2008). The teachers who have engaged in deep pedagogic reflection have changed teaching practices, creating more interactive teaching and enabling students to become active learners. Much tacit knowledge on online education in educational institutions has been established in virtual ventures through these teachers and the outsourcing of the knowledge created in development ventures has a

key significance in the establishment of online education (Leinonen 2008). This statement holds true for the entire educational field – the exchange of experiences and receiving meaningful personal experiences promotes the taking up of online teaching in everyday work. In vocational education, online teaching is becoming an even more significant teaching method and, therefore, the exchanging of experiences and learning from each other has become increasingly important.

Higher education possibilities

The Finnish higher education system comprises 20 universities and 27 Universities of Applied Sciences. Important parts of e-learning in higher education are the Finnish Virtual University (FVU), created in 2001 as a collaborative initiative of all the 20 universities in Finland, and the Finnish Online University of Applied Sciences (VirtualUAS), created in 2002 as a collaborative initiative of all the 27 Universities of Applied Sciences in Finland. Both FVU and VirtualUAS serve regular students and lifelong learners and fulfil a variety of different functions – learning provider, academic network, technical service and laboratory for the development of ICT-based education. The FVU and VirtualUAS have served as a collaborative forum for universities when developing their e-learning approach. The basic idea has been to integrate the educational use of ICT in teaching and learning.

Up until 2008 the FVU and VirtualUAS functioned as separate units, but from 2008 they have engaged in close cooperation.

The Finnish Virtual University

Everyone of the 20 universities in Finland has its own virtual university activities. These activities include each university's own solutions on how to advance ICT, which is partially funded by the Ministry of Education. The Ministry funded virtual university projects and activities for the years 2001–2006 according to performance-based funding policies.

However, universities used the money granted by the Ministry of Education for virtual university activities more generally on teaching ventures. These projects included designing online courses and the preparation and publication of related learning material. Teaching projects were implemented in faculties. Their pedagogic and technical implementation was supported through various systems, often as cooperation between universities. Staff development was a component of some projects. Investing in teaching is understandable, as this is a question of the basic function of universities. A critical question is how permanent a new education practice has been achieved. A considerable amount of staff training has been organised in universities and support services for online education developed. The development of support services included the planning of technical and pedagogic support and teacher guidance and instruction (Ministry of Education 2007).

The Finnish Virtual University underwent an assessment in 2007 and it was noted that five years of development had resulted in:
- some degree of permanency in operations
- integration of activities
- new development actions and pilots
- enhanced skills
- networking

- more student-centric activity
- greater course selection
- creation of digital learning materials
- organisation of support services.

The assessment indicates that there are universities that have seriously taken on board the permanency of virtual education and invested in this, as well as universities in which, for example, the tenure structure indicates that little investment has been made to continue the virtual university's operations. A central objective of the FVU has been the natural integration of ICT's pedagogic use with the work of the university. Progress has, in fact, occurred. Development has accelerated now that virtual education is no longer implemented with special funding from the Ministry of Education. We can also talk of blended learning ICT in teaching. Responsibility for the FVU's operations can be transferred to individual teachers who employ the possibilities afforded by ICT in ways they deem best. Some universities have operated more systematically and further possibilities of ICT are genuinely considered. (Ministry of Education 2007.)

An example of university operations is provided by the Open University of the University of Jyväskylä (www.avoin.jyu.fi). It is an established part of the university, specialising in lifelong learning. The Open University offers plenty of different opportunities for those intending to do academic studies through distance learning. Multiple possibilities of blended learning have been in use for many decades and over 14 000 students are enrolled on courses annually.

The Open University offers over 50 Bachelor's level subjects in Finnish from all the seven faculties of the University of Jyväskylä and ten subjects entirely in English. Studies begin non-stop, and students study at their own pace following their personal learning plan. All subjects and courses available in English can be studied through distance learning.

Online studying can be employed in education in a variety of ways. The web can be a tool, for example, for notification, sharing of course materials and production of common material, or a medium for student interaction and discourse. In Internet-mediated online learning, the web can function as a material bank, from which knowledge and material is shared, often in addition to other didactic activity. The Open University's various courses have at their disposal online environments to support learning, from which students can access hints regarding study and the completion of tasks. Students are also able to watch online video recordings of lectures on the web.

The web is also employed as a tool for student guidance. Students can, for example, complete tasks on the web according to instructions given by teachers and they receive teacher feedback on the web. They may also be able to view other students' work, but there may not necessarily be any actual interaction between students. In some Open University courses students can participate in an online course or task to be completed independently in which studying progresses utilising self-study material.

As a tool for interaction among students, the web makes possible student discussion online either through one's own initiative or as part of the course requirements. Often online courses or tasks to be completed independently in an online environment include an opportunity for dialogue. Students can discuss, for example, issues related to study practices and learning tasks. Communication between students is best realised through actual

group-based online courses, in which learning is built on collective action and interaction. In this way, web-mediated education allows group-based work despite long distances and brings a change to independent distance learning.

The Virtual University of Applied Sciences

The universities of applied sciences aim to offer students the possibility of approximately 30 ECTS of online studies in the 240 ECTS degree programme. The number of online courses and study flow has significantly been affected by how higher education supports its staff in online education training and, on the other hand, the course counselling students receive concerning online study. Both pedagogic and educational technology support are required and peer support offered by institutions results in the best outcomes. Most universities of applied sciences have an online education team comprised of teachers and e-learning experts that supports teachers' online teaching and tests various tools and methods. Most universities of applied sciences also include research in these experiments and development projects. Online courses are offered at all universities of applied sciences and most institutions can offer online degrees completed entirely over the web.

The Finnish Virtual University of Applied Sciences mediates cooperation and educational offerings of web-based education between the various universities of applied sciences. The Finnish VirtualUAS is a cooperative network formed by the Finnish universities of applied sciences, which works in a dual model-based close cooperation with the Finnish Virtual University. The objectives include unrestricted student mobility, staff ICT expertise and collaboratively produced diverse learning material and courses (VirtualUAS, strategic policies for 2008–2015).

Online education at the universities of applied sciences underwent an assessment in 2008, which was interested in how web-based education was currently implemented. The data was comprised of presentations of good practices. The number of the university of applied sciences online courses is illustrated by the fact that, of 27 institutions, 25 submitted a good practice for the evaluation (Leppisaari et al. 2008). The good practices included examples of degrees completed entirely or partially online, international cooperation and student project guidance.

Interesting pedagogic solutions and didactic practices were raised in the evaluation. These included various applications in an online environment that support students' expert cognitive processes and promote collective problem-solving skills. It is, however, necessary to continue developing pedagogic models for web-based education. It is especially important to develop the purposeful discourse of groups in which a collective knowledge base is constructed. The continuous enhancement of teachers' skills and, in particular, online guidance ability demands continuous resources. Students and workplace representatives need to be an integral part of the development work (Leppisaari et al. 2008).

The Virtual University of Applied Sciences and the Finnish Virtual University have organised their own annual seminars from 2000 onwards, and from 2009 these have merged into one seminar.

The Finnish eLearning association (www.eoppimiskeskus.fi) holds the Digital Learning Competence seminar every autumn, targeted at staff trainers and businesses.

Lifelong learning and Adult education

There are excellent and extensive opportunities for lifelong learning in Finland after the compulsory education stage. Professional skills and abilities can be acquired at vocational institutions, universities, universities of applied sciences and through informal learning. All forms of adult education increasingly employ the possibilities offered by e-learning. Informal learning online courses include almost anything from handicrafts to languages, and social media methods are extensively utilised on different courses.

Adults also have a good opportunity to make use of courses offered online, as the majority of households in Finland have a computer and Internet connection. A total of 83% of 16–74 years old Finns said they had accessed the Internet during the last three months in spring 2008. The proportion had risen by 4 percentage points from the previous year. The Internet is accessed regularly and often. As much as 80% of Internet users said they accessed the Internet daily or almost daily. Only five percent said they used it monthly or less frequently. Many elderly people are daily users. As much as 60% of 65–74 years old Internet users said they had accessed the Internet daily during the three months of spring 2008. When considering the population as a whole, daily access of the Internet is widespread. A total of 66% of all 16–74 year-olds accessed the Internet daily or almost daily in 2008 (Bureau of Statistics 2009). The Internet is used for banking, reading and sending emails, purchasing and searching for information. But searching for educational courses and completing online courses is also becoming more common (Table 2.)

Table 2. Use of the Internet in spring 2008, percentage of Internet users in age cohorts

Purpose	All	16–29yo	30–49yo	50–74yo
Sending and receiving emails	90	95	91	83
Searching for information on products and services	88	92	92	79
Banking	87	84	92	82
Browsing travel and accommodation services	70	63	75	68
Reading newspapers, magazines, etc	69	68	73	66
Searching for information on illnesses, nutrition or other health related information	62	60	66	57
Searching for information on websites of various authorities	56	54	63	49
Searching for educational courses	44	57	46	28
Listening to the radio or watching TV	40	53	41	25
Listening to or downloading music to a computer or other device	39	64	37	16
Reading blogs	38	53	35	28
Searching for education related information	37	60	34	18
Using instant messenger	35	69	28	12
Downloading programmes to own computer	32	45	32	18
Job hunting or sending job applications	32	55	31	11
Writing messages in discussion forums or news groups	30	54	26	11
Buying second-hand goods on auction and shopping websites	23	30	25	13
Using browser-based news services (e.g. RSS)	23	31	23	14

Internet telephone	18	19	18	16
Selling objects, products or services on auction or shopping websites	17	22	19	10
Online education	17	29	15	8
On-going subscription to an online publication or news service	14	11	17	12
Playing games online	14	31	8	4
Video negotiations/conferences	10	12	10	7
Downloading games from the Internet to own computer	9	17	7	3
Using a peer-to-peer network to exchange movies, films, etc	7	18	5	0
Creating or maintaining own blog	5	9	4	2

e-learning is, therefore, increasingly a learning method for everyone and thus challenges schools to a better production of learning services and quality learning material.

Dissemination of the experiences

In this article, in connection with e-learning implementations in all institution forms, we have noticed that the sharing of knowledge and experiences and the acquisition of meaningful practical experiences is the best way to improve one's e-learning skills. Many events are organised in Finland annually, in which it is possible to meet e-learning experts, relate one's experiences, share experiences with others and test different tools. The range and quantity of events and the large numbers of participants underscore e-learning's significance as a facilitator of skill development.

For example, the ITK seminar focusing on pedagogic uses of IT has been organised in Hämeenlinna, Finland for over 20 years. Approximately 1500 teachers, researchers and experts attend this seminar annually to consider pedagogic uses of ICT as well as its employment in learning support. Furthermore, the international MindTrek seminar is organised every year in Tampere, one main theme of which is the use of ICT in educational institutions.

The National Board of Education organises the National Virtual School Conference every year. The aim of the conference is to disseminate information and experiences of web-based learning. Participating actors can discuss issues related to virtual learning, exploring and tightening collaboration possibilities between themselves.

But it seems that there are only three things missing in the e- and b-learning implementation; Firstly *TIME* to create the content and courses, secondly *TIME* to teach, tutor and guide the learning process and thirdly *TIME* to update, develop and maintain the ready made courses and learning processes.

It is very clear that the implementation of e-learning has to be planned very carefully. One could say that those institutes who think that the content creation process and e-learning are costs for the organization will regress, while those institutes who think it is an investment will develop.

LITERATURE

Ilomäki, L. & Lakkala, M. (2006). Tietokone opetuksessa: opettajan apu vai ongelma?. (The computer in teaching: a teacher's aid or problem?) In S. Järvelä, P. Häkkinen & E. Lehtinen (Eds.) *Oppimisen teoria ja teknologian opetuskäyttö*. Helsinki: WSOY oppimateriaalit Oy.

Kankaanranta, M. & Puhakka, E. (2008). *Kohti innovatiivista tietotekniikan opetuskäyttöä*. (Towards innovative educational uses of IT.) Kansainvälisen SITES-tutkimuksen tuloksia. University of Jyväskylä. Finnish Institute for Educational Research. Jyväskylä.

Law, N. & Chow, A. (2008b). Teacher characteristics, contextual factors, and how these affect the pedagogical use of ICT. In N. Law, W. Pelgrum & T. Plomp (Eds.) *Pedagogy and ICT use in schools around the world. Findings from the IEA SITES 2006 study*. The University of Hong Kong. Comparative Education Research Center, 181–219.

Leinonen, A. M. (2008). *Ammatillinen opettajuus kansallisessa verkko-opetuksen kehittämishankkeissa.* (Vocational teachership within the national developing project of Internet-based teaching.) Acta Universitatis Tamperensis; 1325. Tampere: University of Tampere.

Leppisaari, I., Ihanainen, P., Nevgi, A., Taskila, V-M., Tuominen, T. & Saari, S. (2008). Hyvässä kasvussa – Yhdessä kehittäen kohti ammattikorkeakoulujen laadukasta verkko-opetusta. (Growing well – Developing together towards quality university of applied sciences education.) Helsinki: Finnish Higher Education Evaluation Council. (Publications 4/2008). Available at http://www.kka.fi/pdf/julkaisut/KKA_408.pdf.

Ministry of Employment and the Economy. (2008). Kansallinen innovaatiostrategia. (National Innovation Strategy.) Available at <http://www.innovaatiostrategia.fi/fi/uutiset/body0=273> (accessed on 18.11.2008).

Ministry of Education (2004). Koulutuksen ja tutkimuksen tietoyhteiskuntaohjelma 2004–2006. (Information society programme of education and research 2004–2006.) Publications of the Ministry of Education 2004:12. Available at http://www.minedu.fi/OPM/Julkaisut/2004/koulutuksen_ja_tutkimuksen_tietoyhteiskuntaohjelma (accessed on 1.7.2009).

Prime Minister's Office. (2006). Uudistuva, ihmisläheinen ja kilpailukykyinen Suomi. Kansallinen tietoyhteiskuntastrategia 2007–2015. (A renewing, human-centric and competitive Finland. National Information Society Strategy 2007–2015.) Helsinki: Prime Minister's Office. Available at http://www.tietoyhteiskuntaohjelma.fi/esittely/fi_FI/1142405427272/ (accessed on 1.7.2009).

Prime Minister's Office. (2007). Pääministeri Matti Vanhasen II hallituksen ohjelma. (Prime Minister Matti Vanhanen's Second Cabinet Government Programme.) Helsinki: Prime Minster's Office. Available at http://www.valtioneuvosto.fi/hallitus/hallitusohjelma/fi.jsp (accessed on 1.7.2009).Sinko, M. & Lehtinen, E. (1999). The Challenges of ICT in Finnish Education. Report 227. Helsinki: Finnish National Fund for Research and Development. (Sitra). Available at http://www.sitra.fi/Julkaisut/sitra227.pdf (accessed on 20.7.2009).