Challenges for the Future of Learning Until 2030
Foresight on Learning, Innovation and Creativity

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by Dr. Miriam Leis (TNO/The Netherlands)

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As scientific and technological knowledge spreads faster due to modern information and communication technologies (ICT) as well as improved research methods, the half-life of knowledge is getting increasingly shorter. This makes life-long-learning and constant skills and knowledge updating and upgrading a crucial element for maintaining competitiveness.

Education and training must be adapted to the requirements of the future. Therefore the possibilities of current and future technology as well as the requirements for anticipated needs have to be taken into account to find answers to the strategic challenges in the years to 2020:

- Make lifelong learning and learner mobility a reality;
- Improve the quality and efficiency of provision and outcomes;
- Promote equity and active citizenship;
- Enhance innovation and creativity, including entrepreneurship, at all levels of education and training.

Part I: The Project "Future of Learning 2030"

I. 1. About the project

The foresight study "The Future of Learning 2030" is a joint project being conducted by the Netherlands Organisation for Applied Scientific Research (TNO), the Open University of the Netherlands, the UK Media company Attic Media and the Institute for Prospective Technological Studies (IPTS) of the European Commission's Joint Research Centre (JRC).

The project acronym "FORLIC" stands for "Foresight on Learning, Innovation and Creativity" and the project is dealing with the structures, developments, chances and challenges of future education.

The study thus focuses on:

- Foresight analysis
- The role of technology for future education
- Changes and challenges of the future education system
- The development of scenarios

Some of the major questions being evaluated in the projects are

- How will we learn in the future
- What will we need in the future
- Can we deal with the challenges?
- What are the visions for future learning and education and what are the requirements?

I.2 Methodology of the project

Since this is a foresight research project it will be based on different methods used in professional foresight research.

I. 2.2.1 DESTEP Analysis

It started with the identification of demographic, economic, social, technological, ecological and political factors (often abbreviated with DESTEP) that could are reasonably to be assumed to play important roles in regard to the future structures, requirements, possibilities and challenges in the broad area of learning, training, education and knowledge. This analysis has been rather divergent and been conducted to provide a broadening overview about related issues and the interrelation of different factors.

Factors included demographic developments like the expected further continuation of low birth rates in many EU member states, the rising (healthy or unhealthy) life expectancy, economic developments and possibly new global economic players from South and East Asia and Latin America, tendencies towards globalisation as well as nationalism, the e-society, new scientific areas, the development of new technologies and possibly associated

worldviews and cultures, the growing urgency of ecological issues and political factors like administrative particularities, educational policy, tendencies towards privatisation and regulations in regard to school and university curricula and the evaluation of skills and competences.

I. 2.2.2 Foresight study analysis

In order to develop our own foresight analysis and visions for the future, current state-of-the art foresight studies dealing with the topics of future learning, education and training as well as expected skills necessities have been assessed in desk research.

Out of a pool of around 80 studies, 30 have been chosen for further analysis on basis of their quality, choice of topic, reputation of the authors or institution and publication date and 20 of these have been analysed in more detail.

In general it has been notable that the vast majority of studies deal with the current and future use of ICT and digital technologies for learning and training and that many studies have been quite technology-centred, i.e. very much focussing on the technological possibilities as such and less considering societal, political, structural and administrative factors. Also studies explicitly dealing with the content of learning and within this especially with subjects like arts, humanities and history were very rare. One exception has been a UNESCO document from 2006 titled: "Road Map for Arts Education. Building Creative Capacities for the 21st Century". (This issue will be explored in more detail in a later section of this paper).

Through this analysis it was also possible to identify possible shortcomings of previous foresight studies that should be taken into account within our project.

I. 2.2.3 Development of Visions

The next step within the FORLIC, which has only started recently, will deal with the development of visions for the future of learning and education. The development of visions will be constructed around three dimensions that include:

- Wishes for future learning and education based on current practices, challenges and calls for improvement
- An assessment of the requirements and implications associated with these wishes
- A feasibility analysis of the visions based on the requirements and the expected realisation of (external) circumstances associated with the visions

Especially the last two points are very important in order to avoid generally unrealistic visions that will be of no practical use until 2030. Although scientific and technological developments could change fast and lead to unexpected surprises and open up new opportunities barely imaginable today, the changing of social, political and administrative practices and acquiring the necessary resources (financial and personnel-wise) can take longer. Today, it would be technically possible to let students attend their lectures within virtual worlds, to have simulators installed within schools, equip students with smart phones and use games and social networks for learning, but nonetheless the vast majority of schools still follow the classic structures of single-subject-based presence education with a rather limited use of

computers and the internet during classes. The reasons for this are manifold and include factors like the lack of financial resources, insufficient competences of teachers in using these kinds of new technologies and media, political, legal and administrative factors (e.g. prescribed school curricula) and organisational shortcomings (e.g. the structure of times and lessons and standards for examinations).

Also, visions are not necessarily restricted to technological developments. They can also be about new learning concepts (e.g. individualised learning support, multi-disciplinary learning, different forms of testing) or what we learn (e.g. more practical and job-oriented, new subjects like time-management, technology ethics or assessing the reliability of sources) and learning environments (e.g. hierarchies, classroom design, ecological considerations).

The development of visions will also stay related to the DESTEP analysis conducted in the initial phase of the project.

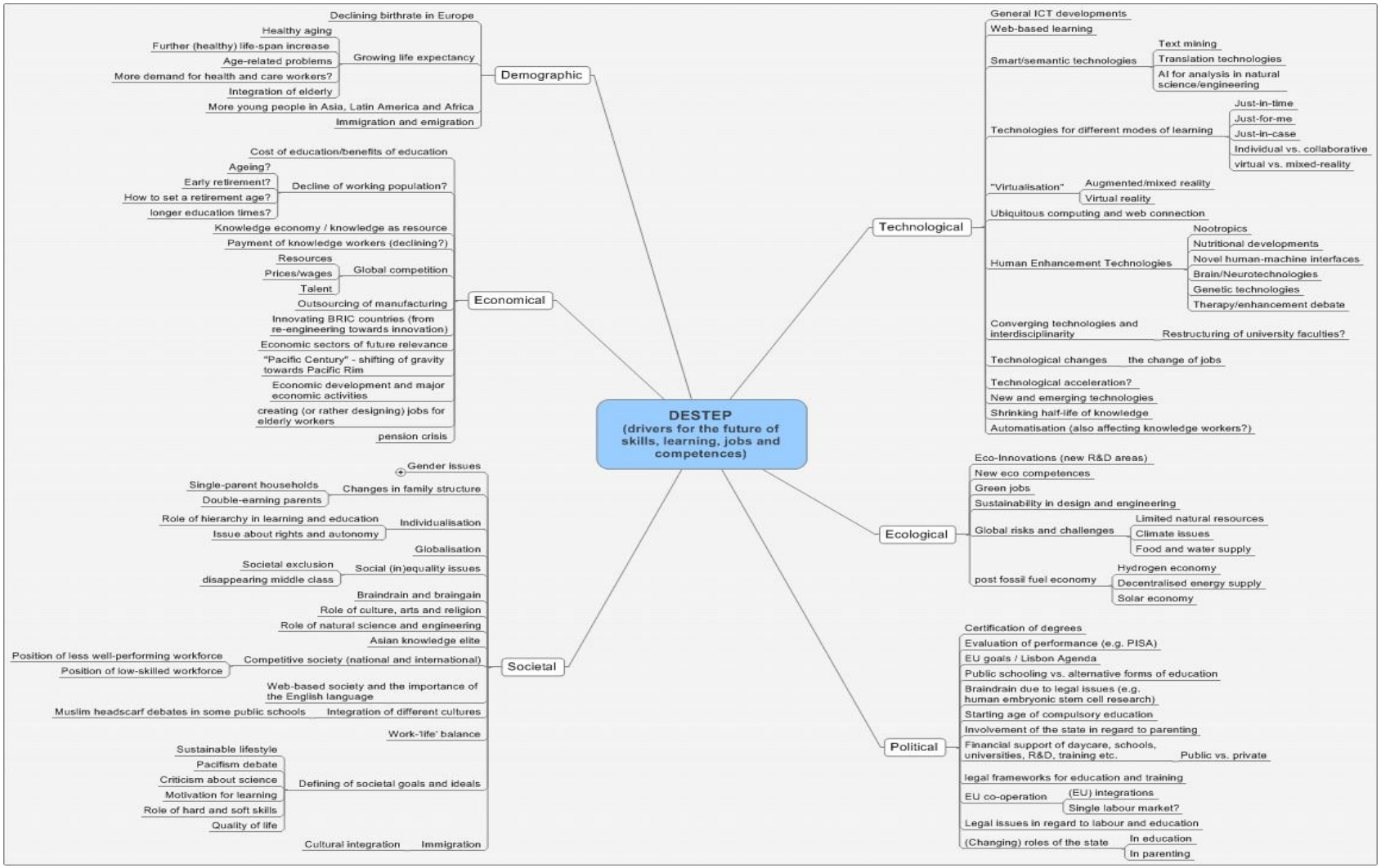
I. 2.2.4 Development of personas

On basis of the visions, different "personas" (i.e. characters) will be developed that represent different people within different learning phases (e.g. primary education, university, job training, "life-long-learning") with their experiences in the future. The personas will also be portrayed in short films to be published on our website (www.futureoflearning.eu) to provide a picture of the "Future of Learning" based on the methodology used within the project.

I. 3. Networking and expert groups

Within the project, a network of experts and people working in the area of education, learning, human resources and similar areas has been set up via a LinkedIn Group (cf. resources). Also a facebook group has been set up targeted more at the pupil and student community. The project is also present at Youtube and has a project website where all information will be posted, presented and connected at: www.futureoflearning.eu.

DESTEP Analysis



Part II: Thoughts About the Future of Learning and Education

II. 1 Current and future developments

As the foresight studies as well as observations within other projects seem to reveal, the following socio-technological developments look to be especially relevant for the future of society and education and may call for general systemic changes in education systems, processes and procedures as well as attitudes:

- Decreasing half-life of knowledge
- (Need for) growing interdisciplinarity
- Rising life expectancy
- Growing complexity and expectations

II.1.1 Decreasing half-life of knowledge

New scientific discoveries, technological developments as well as changes in lifestyle and culture seem to occur within ever shorter intervals especially since the 20th Century and even more since the widespread of computing and internet technologies. If comparing the 1990 with 2010 – which is the same time-span than from 2010 to 2030 – so many things have been developed, changed and discovered within this time frame that were non-existent for all the previous millions of years of human history. For many previous generations until a few hundred years ago not much substantial changes happed within their lifetimes (and thousands of years ago not much has changed even over many generations). But especially the generations that experienced the pre and now the post digital age are being confronted with many technological as well as societal changes that happened within decades.

Although the concept of technological acceleration as it is being used by some foresighters (e.g. Ray Kurzweil) is disputed, it is a fact that nearly all of the concepts, technologies; knowledge and ideas I am working with today in my job have never been mentioned as I was still in school and (mid 1980s to mid 1990s) and have also not been standard issues on my university curriculum (social and political sciences from the mid 1990s to mid 2000s at a highly rated German university). Much that has been considered science fiction as I was still in school is now reality.

I am talking about things like genetic engineering, regenerative medicine, synthetic biology, service and military robots, advanced applications of nanotechnology (not the manufacture of car tires or dairy emulsions), advanced medical engineering and prosthetics, neuro-sciences and technology, new ICT applications, smart phones, increasingly complicated CAPTCHAs (these distorted images of letters or numbers one often has solve when signing up for something on the internet which get increasingly challenging to solve for humans because Artificial Intelligence is also improving), brain-computer interfacing, life-extension research, human enhancement technologies and all the new political, legal, social and ethical challenges associated with these developments. And within most of these areas, improvements rates are fast, for example if comparing prices and abilities of digital devices, smart phones and computers from 2000 to 2010 or the costs and required time for full human genome sequencing over the last 10 years.

Consequently, I obtained most of my knowledge and competencies I use today not at school or university but through self education and learning within global expert communities by using ICT. But what does this say about the usefulness of compulsory and university education?

Thus, what you may learn when entering education may be outdated when you have finished your formal education a few years later. This of course represents a challenge for the structure of educational systems but also in regard to the question which contents are fundamental and which ones updateable and how to design learning and education in such a way that fundamental basics (e.g. fundamental concepts of mathematics, physical laws, logic etc.) and findings prone to potentially fast changes (e.g. latest technologies, procedures, cultural trends and scientific discoveries) can both be dealt with adequately by the individual. So how to deal with a situation when the things you learned when entering university or higher education are outdated when you finished your studies? Also society and laws seem to find it increasingly difficult to deal with new scientific and technological developments where there is often no useful precedence cases to serve as a basis. Examples could be stem cell research, the definition of life and death in face of biotechnology and advanced medicine, privacy concepts, reliability issues within complex human-technology systems and animal rights issues.

In the future there may also be new kinds of jobs that are unknown today (the same as many ICT and internet-related jobs were unknown 20 years ago).

The UK Fast Future Research has already provided a list of possible future jobs[1]:

- Body part maker
- Nano-medic
- Farmer of genetically engineered crops and livestock
- Vertical farmers
- Memory augmentation surgeon
- 'New science' ethicist
- Space pilots, tour guides and architects
- Climate change reversal specialist
- Virtual lawyer
- Avatar manager / devotees / virtual teachers
- Time broker / Time bank trader
- Waste data handler

II.1.2 (Need for) growing interdisciplinarity

Although there seems to be more talk than actual action about interdisciplinarity, it has already become clear that it is necessary for different scientific areas to co-operate. New and emerging research areas like nanosciences, bioinformatics, biomedical engineering, robotics, bionics, bioethtics, technology assessment, environmental sciences and future studies are proof of this necessity. However, school and university curricula are still mostly structured around single subjects taught in isolation to each other. At universities there even often seems to be a tendency of fierce competition (instead of co-operation) between different faculties

[1] http://fastfuture.com/wp-content/uploads/2010/01/future_jobs_sheet.pdf

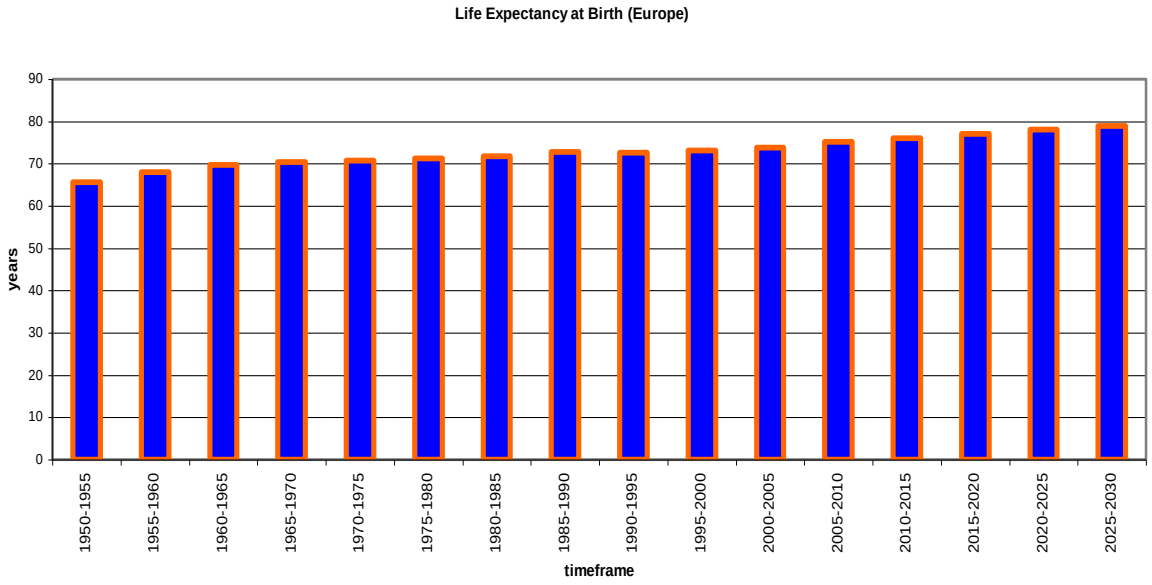
and departments. Especially the co-operation between humanities and social sciences on the one hand and natural sciences and engineering on the other still seems to be suboptimal and insufficient, e.g. for areas like constructive technology assessment or innovation policy.

To deal with current and future challenges, interdisciplinary co-operation and insights as well as broad-picture capabilities are necessary as the example of environmental innovations, sciences and technologies show. In regard to environmental practices, different dimensions like science and technology, funding, political and financial incentives, human life styles, attitudes and habits, geopolitical issues and media competencies are required to achieve an overall result, e.g. in regard to decreasing energy use or encouraging the use of renewable technologies.

Since many subjects are interrelated by their nature (e.g. music, world culture, history and physics or sports, physics and biology) designing interdisciplinary curricula should not be too difficult and could make learning even more interesting. The question will be how to bridge the gap between currently common educational practice and the growing requirements for being aware of connections between different issues (i.e. interdsiciplinarity) can be bridged.

II.1.3 Rising life expectancy

Within so-called post-industrialised countries like those within the European Union, the life expectancy has risen over significantly over the last century. Even from the time span of 1950 to 2010 the average life expectancy at birth (both sexes) has risen in Europe from 65.6 years in 1950 to 75.1 years in 2010 and is expected to reach 78.9 years in 2030 (UN population statistics)[2].



Source: UN Population Statistics

[2] http://esa.un.org/unpp/

This means that – if healthy – people may be required to extend their work-life in the future. Of course the extension of working years would have a positive effect for the economy and social insurance (decline in people living on pensions and increase in workforce), but this also necessitates a workforce that is sufficiently capable of dealing with the requirements of the future time. Therefore a constant updating of ones knowledge (which also includes forgetting things that have turned out to be wrong) is needed and this in such a way that the person possesses the right skills and has not focussed ones attention towards subjects that are not required. This of course could provide a conflict between market necessity and creativity and from a humanly point of view, educating and training people to function as 'means' for fulfilling duties for business and the economy would contradict the ideal of personal development and freedom.

Another tendency is that today's people are changing their jobs more often. According to a Eurobarometer Statistics from 2009, 9% of EU-27 respondents have changed their job 6 to 10 times and 60% at least 1 to 5 times and 73% of EU-27 respondents thinks that one job for lifetime is a thing of the past (Eurobarometer, 2009)[3]. This has also consequences on requirements for skills and education since the training one got for one specific occupation may become less useful within a couple of years. If above this, people are also generally working more years within their lifetimes, the number of different professions could even increase. Therefore the question has to be asked, in how far standard educational practices like well structured and single subject-oriented university curricula are suitable for such (future) biographies. Rising life-expectancy makes life-long-learning even more crucial, but how to encourage people to follow this path, especially within societal contexts that tend towards easy and fast consumption and shallow entertainment.

II.1.4 Growing complexity and expectations

The complexity of our world as well as the expectations people have about technologies as well as about the performance of people are growing. If looking at standard computer programs like Microsoft Windows, "the internet", a modern airplane or power plant only very few people – if any – are able to understand the whole system. Therefore the tendency of specialisation (and over specialisation) is growing. On the other hand, as mentioned above, the need for interdisciplinary co-operation is also growing, thus asking for how these two seemingly contradicting requirements could be brought together. Isolated over-specialisation also bears the dangers of loosing the overall context which could endanger the whole system. On the other hand, it would be extremely difficult - if not impossible – for a human to be competent in everything at the same time.

Consumer-orientation and easy interfaces also contribute to people forgetting the real complexity behind the systems and technologies they are using and could provide a false picture of an easy and uncomplicated world. The people's expectations towards the technologies and devices they using is rising and smallest delays and flaws are causing annoyance, whereas actually if looking at the complexity of a system (say a computer program) it actually should be surprising that it works as good as it does. Therefore, doing things yourself (e.g. writing computer programs, building small-scaled technical systems, simulating a country's administration, developing concepts to ensure data security) could

[3] http://ec.europa.eu/public_opinion/archives/ebs/ebs_316_fact_at_de.pdf

become even more important within a growingly complex world to get a look behind the black boxes of usability.

But also the expectations about human performance are rising. Within complex systems, even smallest errors can have profound consequences and in the context of complex systems where humans and technology are greatly interwoven (e.g. flight control) reliability issues increasingly become a challenge (e.g. in case of aircraft accidents). But also issues about work-life balance, job and family and assigned responsibilities of employees and societal competition are getting more and more challenging. As more and more people are opting for higher education and university degrees, an increasing number of highly educated people are likely to be expected to end up in jobs below their qualification profile or even unemployed.

Also interesting in this context could be the question if education and learning needs to be coupled to the job market and its requirements or if knowledge and education could also serve just an individual satisfaction?

II.1.5 Emerging needs for a future society

Out of these the following future needs for skills and competences could be deducted:

- Solving complex (information) problems due to the increasing complexity of theories, technologies and societies
- Need to continuously update (technical) skills due to the decreasing half-life of knowledge
- Increasing relevance of social / soft and (inter)cultural skills within a global and increasingly anonymous society
- Self-Management / Regulation Skills / time management due to the accelerating pace of society, business (24 hour economy) and higher expectations
- Responsibility / Accountability within an increasingly complex and “anonymous” world with complex interrelations between technology and human action

II.2 Chances and challenges of ICT

Most foresight studies focus on the further development of ICT-related innovations and their application in the education context, mainly naming web 2.0, virtual education and learning environments and the use of gaming and simulations.

II.2.1 Web 2.0 and the internet

Web 2.0, the internet and sophisticated and specialised search engines (e.g. WolframAlpha) are making it increasingly easy to obtain information and get in contact with (people claiming to be) experts in a specific area. One can principally get instant answers to a very wide spectrum of questions whenever and wherever wanted. What might have taken days if not weeks of searches 20 years ago can be obtained on the push of a button. However just

obtaining data does not necessarily mean understanding it or being able to find out if the information is reliable and trustworthy. Someone could obtain the results for an engineering calculation by using a computer program or doing searches on the internet, but only if one knows how the calculation works and what should be calculated can also assess if the result reliable (e.g. within an expected range) or if the data has been unreliable or an error has occurred.

Thus the possibilities of the internet encourage fast and just-in-time results that can be very useful and helpful, especially if time is short, but also bears the danger of an evolving superficial and "copy-paste" mentality, where people use results without understanding them.

Other challenges of internet-based information acquisition involve the reliability of data, i.e. how to tell if the information being provided is based on solid research, methodologies and facts or just being made up?, as well as the possibility to find what one is searching for.

Although mass-rating systems can be useful, e.g. if wanting to evaluate the quality of a service or institution, they could also be problematic if the judgement of the masses is based on errors or if ratings are not independent from each other.

So, one important requirement within these new possibilities would be the ability to assess the reliability and quality of information found on the internet. This is of course increasingly difficult if the person does not have sufficient knowledge about the topic. Also through the interconnectivity of different information on the internet, independent cross referencing can be difficult. On the other hand, many people are using the internet for self-education purposes to acquire knowledge about new areas. Therefore it is important to develop individual competences as well as technological solutions to improve this challenge.

One major advantage of internet-based information access is that everybody can be a student and teacher at the same time, depending on ones fields of expertise. It would also encourage and foster interdisciplinary co-operation, global exchange of ideas and counter possible discriminations due to origin, gender or age.

II.2.2 Web-based education

There can already be found advertisements for online college courses for a 99 US dollar tuition fee per month plus 39 US dollar per course (StraighterLine)[4] and the so-called "eSingularity" movement has the goal of enabling to "learn anything, anyplace, anywhere[5]" and "to mold existing technology into a vessel through which learning is made freely accessible to everyone in the world[6]". Also the usage of virtual worlds has already been explored for educational purposes, however still with mixed reactions (especially in regard to second life and its usage of avatars as well as technical shortcomings). Also universities are already placing lectures onto the internet.

Of course these developments can reduce costs and provide many advantages for individual time planning and scheduling (e.g. for working students) and also enable people from around the world to view the lectures (if digital rights management allows). These developments lead

[4] http://www.straighterline.com/
[5] http://e3o.posterous.com/posterous-re-laaa-learn-anything-anyplace-any
[6] http://www.esingularity.org/

to the question about the future role of 'classic' educational institutions that are expensive and location-bound. One possible scenario could be that "education for the masses" would be free and via the web, whereas education for the elite would be the expensive traditional presence boarding school, college and university which would come up with new curricula and procedures to distinguish themselves from the cheap and web-based institutions. Another challenge coming with web-based education is the assessment and certification of what students ought to have learned as well as praxis-tests.

II.2.3 Virtual and augmented reality, simulations and games

Virtual reality and simulations have already found many applications in training. What started within the context of military and than civilian aviation has now spread to architecture, city planning, engineering, medicine, physics, ecology, social sciences and arts and entertainment as well as other areas of professional training. The advantage of these technologies is that the work within nearly real-life settings can be practiced without endangering the learner or the equipment.

Augmented reality technologies provide a virtual projection of digital information onto the real physical environment, thus supplementing it with additional data. An engineer using an augmented reality system could get relevant technical data virtually projected onto a specific part of the construction or a biologist could get additional information about the plant s/he is looking at. This kind of technology could also be valuable for learning purposes, e.g. getting historical information about the buildings in a city or artefacts in a museum.

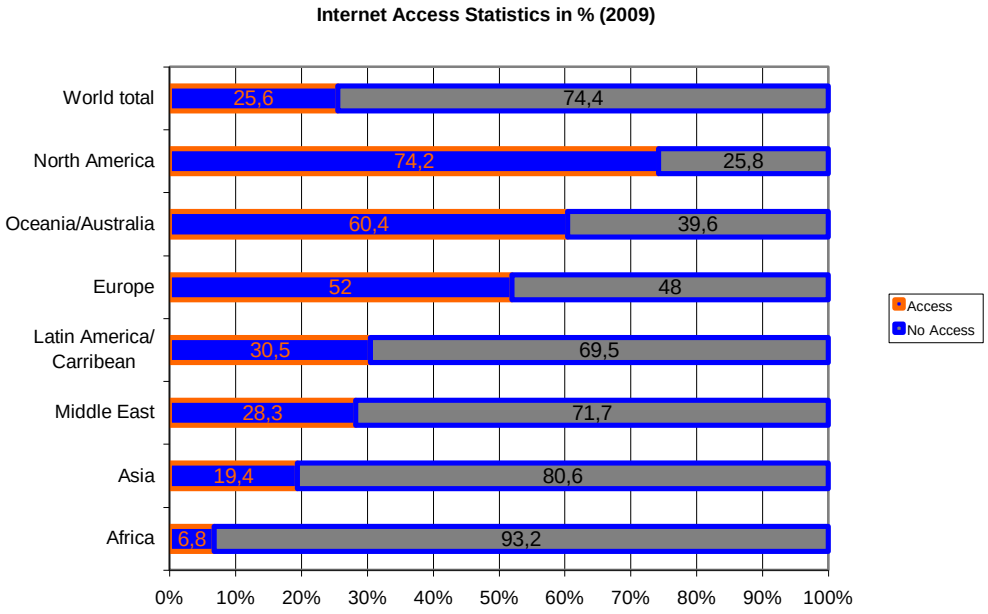
Although simulations are very valuable because of the aspects mentioned above, it should not be forgotten than there is still a difference between virtuality and simulations and physical reality, at least when it comes to consequences. Whereas an error within a simulation or game does not have real consequences, it could lead to real dangers within physical reality. Therefore simulations are very useful for training people to avoid these errors, but they should not lead to an attitude of people thinking that they also have "3 lives" in reality.

Gaming is also regarded by many as a promising way for future learning and has also been mentioned in many of the foresight studies. One of the major aspects has been that through gaming the fun aspect of learning could be better integrated and thus leading to higher encouragement. Although improving the encouragement and interest in learning is a very important goal and would also spark the interest in life-long-learning, the usefulness of gaming has to be assessed and games need to be carefully designed for this purpose. It has also to be evaluated what kinds of knowledge, competences and skills can be learned through different kinds of games and if the focus of current 'average' gamers lies in learning and if, what kinds of skills 'average' gamers have that non-gamers (or different gamers) lack. Especially it has to be kept in mind that life is not a game and every action in the physical environment has physical (i.e. "real") consequences. The other question to ask would be in how far learning should be "fun" and what is meant by "fun".

In conclusion the following challenges of ICT-based learning can be listed:

- Digital divide is still a reality (only 52% of Europeans have Internet Access as of 2009)
- Accessing is not necessarily understanding (e.g. JIT learning, using search engines, copy-paste mentality)
- The usage of technology has to be learned → Digital Skills (e.g. data access, privacy protection, detecting fraud, IPR, dealing with anonymity etc.)
- Ability to evaluate information (what and whom to trust)
- New pedagogical skills and motivation for learn

Whereas technological developments play an important role and could open up new and unprecedented opportunities, technology alone can not ensure a successful future, for life-long-learning and that we really learn what we need to know.



Source: Internet World Statistics (2009) http://www.internetworldstats.com/stats.htm

II.3 Visions for the future

Although the visions development of our FORLIC study has just been started, this final chapter will outline some ideas that could be considered as elements for future visions:

- Universal access to good quality learning opportunities

  Regardless how the future education system and practices will be structured (web-based, presence based, blended learning etc.) the major goal should be that every person has the equal opportunity to access good quality and suitable education and that students will not

enter into disadvantages within their later life because they visited this and not another learning institution.

- Customised learning opportunities and methods

The abilities and learning styles of every person is different and many of the currently used standard educational and testing practices do not foster and measure the real abilities and interests of the learning subject. Therefore it would be a good idea if educational methods could be customised to get the best out of every individual. Here computer/ICT-based and assisted practices could help (e.g. in assessing individual interests, learning methods and preferences and skills) to make such procedures affordable and programs customised.

- Balance between education in technical and natural science subjects as well as culture, arts and humanities

The "war" between humanities and natural sciences may also be based in the practiced proposal of to different educational cultures and underlying philosophies. In order to improve scientific and technological development to be in line with humans and societal needs, both fields have to be focussed on in balance and in relation to each other.

- Emphasis on learning to take responsibility

Especially in an global, complex and anonymous world, taking responsibility or knowing ones responsibilities for ones activities becomes even more important. The current setting of complex and interwoven information streams and the vastness of the world wide web could encourage people to delegate responsibilities to others or the technology.

- Trustworthy technology

Technology and information obtained through ICT and computer systems should be trustworthy or at least trustworthy information should be identifiable as such. Otherwise the success self-learning could also be jeopardised if ones acquired knowledge is based on faulty sources.

- Goal-oriented application of technology for human needs

Technologies for learning, education and training are to be designed for the human and to better assist humans with their needs. Therefore the question should be about what technologies could improve the learning situation of humans or even individuals and not how can existing technologies be equipped with some learning features.

- Better motivation for (life-long) learning

Life-long-learning requires motivation, especially if external pressure (e.g. examinations with penalties) is not in place. Actually it could be said that principally everybody is learning constantly. The question is, however, how to assess these learning results and how to make use of them within society. In principal there are also two directions how the application of life-long-learning can be viewed: either one derives from a demand side and looks if the person has acquired the needed skills and competences or one can look at

what the individual has to offer through ones personal experience and life-learning and find a way to put this at use.

II.4 Conclusion

It is very likely that the future will hold new possibilities and challenges for which we need to be prepared in order to grasp the opportunities and divert negative effects. Scientific and technological progress seems to become faster with more new discoveries, ideas, products, philosophies, attitudes and life styles entering our society within shorter time intervals. Global interconnectivity of persons, technologies and socio-technical systems is increasing and ideas as well as technologies, theories and devices are getting increasingly complex and unmanageable by sole individual humans. Research areas and ideas are becoming more interwoven with each other – biology is combined with engineering, social studies and philosophy with technology, computer technology with neuro sciences – thus calling for a growing need of interdisciplinary co-operation and knowledge.

Therefore the classical curriculum and subject-distinction as it is currently still practiced in many schools and universities may not be sufficient for preparing the coming generation for the requirements ahead. Besides a core of basic and "universal" knowledge (e.g. basic physical laws, mathematics and logic), there is a wide array of subjects and knowledge prone to (possibly rapid) changes.

Technology, especially ICT and internet applications are very helpful to get instant information about nearly every subject wherever and whenever needed and therefore leads to time efficiency and makes self-motivated learning easier. Online communities are already forming around specific topics and some interest communities can also be regarded as (informal) learning communities. However the vastness of data obtainable within the internet also leads to challenges in regard to assessing the reliability and quality of information and finding what one is looking for. Fast and just-in-time solutions that are encouraged through the internet and specialised search engines could also lead to a very superficial "knowledge society" that can provide answers without understanding them.

Games and simulation are valuable tools for training and education because they provide a safe environment where errors have no real consequences. However, when acting in the real physical environment, it has to be clear that there errors indeed have consequences and that second chances and second lives often do not exist. Thus, the gaming and simulation generation could run danger of confusing the safe virtual reality with the potentially dangerous real physical environment.

As a conclusion it should be said that the future of learning includes more dimensions than just technological progress and developments, faster internet, realistic games and augmented reality. The future also includes people with their different abilities and preferences, laws, regulations and the need for financing, time and resources. From this perspective it is even easier to predict the purely technological innovations available by 2030 given sufficient means, resources and support, but changing institutional settings, laws and harmonising different and conflicting interests could take much longer. This discrepancy between technological progress and societal adaptation may also increase the *perception* of accelerating progress.

Resources

Eduit (2009) "laaa" learn anything, anyplace, anywhere... The eSingularity Initiative (http://e3o.posterous.com/posterous-re-laaa-learn-anything-anyplace-any)

eSingularity project page (http://www.esingularity.org)
Eurobarometer (2009) Europäische Beschäftigungs und Sozialpolitik (http://ec.europa.eu/public_opinion/archives/ebs/ebs_316_fact_at_de.pdf)

Fast Future Research (2010) Shape of Jobs to Come (http://fastfuture.com/wp-content/uploads/2010/01/future_jobs_sheet.pdf)

Internet World Stats (http://www.internetworldstats.com/stats.htm)

StraighterLine Online Courses (http://www.straighterline.com/)

UN Population Statistics (http://esa.un.org/unpp/index.asp)

* All internet sources retrieved in February 2010

FORLIC Project

FORLIC Project Page: www.futureoflearning.eu
LinkedIn Group: http://www.linkedin.com/groups?gid=2266966&trk=myg_ugrp_ovr
Facebook Group: http://www.facebook.com/home.php?#/group.php?gid=176371588344

Selected Foresight Studies

Cedefop (2009) Future skill supply in Europe. Medium-term forecast up to 2020: synthesis report
http://www.cedefop.europa.eu/etv/Upload/Information_resources/Bookshop/546/4086_en.pdf

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[7] Note: the synthesis report of the 16 sector studies will be available in mid November 2009. The present summary will be updated based on the findings of the synthesis report.