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E-LEARNING: CHALLENGES AND PERSPECTIVES

Concepts of e-learning and its usage for blended learning especially in distributed virtual learning environment are discussed. The authors' experience is summarized and future trends are outlined.

If we consult a dictionary, for example *Merriam-Webster Online Dictionary* [http://www.m-w.com], we find that *learning* means *"to gain knowledge or understanding of or skill in by study, instruction, or experience"*. Unfortunately **e-learning** does not possess such a precise and clear definition. The understanding of the e-learning phenomenon varies from *"training via the Internet"* according to the *Computer User High- Tech Dictionary* [http://www.computeruser.com] to a more extended definition as *"an approach to facilitate and enhance learning by means of personal computers, CDROMs and the Internet"* given in a self-published *Free Encyclopaedia Wikipedia* [http://en.wikipedia.org].

According to the authors' own experience the **enhancement** of learning is the main challenge for e-learning in any form. In this paper we will try to show which components of a study process can be enhanced through properly integrating e-learning facilities.

1. Digital or e-literacy

Traditional learning demands literacy. The prerequisites fore-learning make far stronger demands on all the actors playing on the e-learning stage. These additional demands are for computer or *digital literacy* at a rather high level. This is particularly so for teachers, who need to be able to make use of all digital advantages, and understand all nascent possibilities, in order to prepare creative study materials and manage processes of learning effectively. In fact, digital literacy is probably a greater challenge for teachers than for students. Nowadays, in the information society, the whole mode of life may change many times within the life of a single generation, in comparison to the former more stable life. That can decrease the confidence of teachers, who question whether their own experience and knowledge is still valid for the youth generation.

So teachers themselves need to be trained "digitally". In this context, it is remarkable to remember that as early as 1981 Prof. Andrey Ershov [1] proclaimed *Programming the second literacy*. That was a remarkable prophesy; even now, almost a quarter of a century later, not everybody from the older generation recognizes the truth of this prophesy. However we should recognise that our students have been born into the digital age, and that the digital divide can have not only a geographical but also an age/generation dimension, dividing teachers and students.

Many researchers use the term "information explosion" to emphasise the speed of information growth which we observe. However, this is not strictly helpful in this context; we are not dealing with an explosion that reaches its maximum, and then dies down. We do not believe that that is what will happen. The process under discussion is an "information crisis", and we cannot see or foretell where it will end. In this new age, digital sources become the main sources of actualised knowledge. It was shown in the Report [2] that the growth of information may be estimated as 68 % per year: the growth of paper media is 36 % and the growth of magnetic media is 87 %. Teachers urgently need assistance from (or need to themselves become) **cybrarians;** cybrarians are guides "to *the information available on the World Wide Web, who offer an information-gathering service using the Internet, or use the Internet as a resource tool"* according to *Encarta* [encarta.msn.com]. The web-based class room is a now a reality, even at a high school level.

2. E-learning components

E-learning has became a type of e-business in the last few years. This is particularly so in the USA, where there are many commercial e-learning providers; they promote the idea that e-learning suggests more powerful and less expensive training tools, which in turn increases the range of educational opportunities available to people without imposing any geographical constraints. However, in this paper, we will not consider the business side of e-learning, and will restrict our analysis to the academic use of e-learning in higher education. Moreover we will only consider the use of e-learning in the context of its integration into a process of study at campus based universities (not distant or virtual universities) . Our target groups are university teachers and students, e. g. those who create and provide e-learning materials, and correspondingly those who use them. Our objective is to show how virtual academic communities can be organised and coordinated on a national or even international level (given that the internet knows no boundaries).

The process of learning is usually assumed to involve communication between teacher(s) and students through their personal interaction. The process of learning in an e-learning environment is able to replace part of the personal interaction with virtual communications which may be either online or offline. Digital asynchronous communication tools are emails, discussions, FAQs, tests etc. Digital synchronous communication tools are teleconferences or even chats, and assume the participation of all the participants at the same time. Though distributed across the world, the teachers and students can share data and applications and mark up a common whiteboard at the same time.

An *e-learning Web portal* is able to provide students with network access to information covering all learning resources and services available to them. A short list of typical portal features contains the following components:

1) organisation:
   a) curricula,
   b) schedules,
   c) announcements,
   d) course programs,
   e) enrollment;
2) information and documentation:
   a) libraries,
   b) lecture scripts and notes,
   c) lecture accessories: texts, graphics, video and audio sequences,
   d) lecture presentations,
   e) next books,
   f) exercise books,
   g) home tasks,
   h) webfolio;
3) assessment:

a) grade books,
b) nests,
c) self-assessment,
d) exam samples;
4) communication:
a) whiteboard,
b) tutorial project (team-) development,
c) forums: dialog with a teacher, student discussions,
d) online communication tools: (webcast-) lectures, streaming video,
e) online seminars (webinars), webconferences.

3. E-learning platform

The **E-learning platform** is specialised software, sometimes referred to as the *virtual learning environment* or the *learning management system (LMS)*. This software should be capable of providing facilities for both the development and the delivery of e-learning courses. The LMS is usually a distributed online system connected to the Internet through the *e-learning Web portal*. Whilst there are also specialised Intranet and Extranet solutions, a Web interface is the most widely used solution. Offline CD-ROM solutions can also be used as a type of hybrid online-offline tool; in the context of the process of self-paced learning, they can offer an effective but simple substitute to access to remote resources.

E-learning serves now not only as a platform for a time bounded learning process, e. g. at the university, but also as a basis for life long learning support. In the context of life long learning, the challenge is how to create a personalised learning environment which is linked closely to the every day professional life of the student. In the future, the process of learning maybe represented as a collaboration of teaching and studying *agents* [4], each of them representing its owner in the global world learning environment. Agents operate with concrete LMS (for example at the University where a student is enrolled), and they track the whole consistent history of the student's study. This history includes a range of information covering all studying activities in which the student has participated, and all the study achievements of the student. The information is stored in electronic form, in the personal e-notebook, and the personal e-portfolio or *Webfolio* of the student. Impressive Webfolios are collected in [5].

Agents must be interoperable, and after graduating from a particular undergraduate program, the agent should be able to be switched to another LMS, to a masters program probably at another educational institution, as well as to other appropriate further educational activities. Interoperability of agents implies *interoperability* of e-learning platforms. In general *interoperability* is the ability of one software system to provide services to and accept services from other (remote) software systems, and to use the services so exchanged to enable them to operate effectively together. There are several ways to achieve interoperability within the e-learning context; one of them is standardisation of learning objects. The most promising interoperability solutions at present, are Open Standards, for example the Sharable Content Object Reference Model SCORM [www.adlnet.org].

This raises the further question of whether an e-learning platform should be Open Source (for definition see, e. g. Wikipedia)? *Open Source* means the openness of sources for examination and eventually for changes. Does Open Source support Open Standard, which leads to interoperability? If an Open Source e-learning platform is not Open Standard, and a user requires interoperability, the user can redevelop the original source code in this way. This might not be easy, but it is possible. Changes in the other direction are also possible. That raises some objections against Open Source. It was stated in [10] that commercial software seems more likely to be developed in an orderly way. This might be the case, but there are extremely effective examples of Open Source — Learning Platforms which support Open Standard as well.

The Open Source e-learning platform I LIAS (Integriertes Lern-, Informations- und ArbeitskooperationsSystem) [www.ilias.uni-koeln.de] is a good example. A total of 120 platforms were examined in an evaluation initiated by the Austrian Ministry of Education, Science and Culture [11]. The three stage examination rated the Open Source e-learning platform I LIAS as one of the 3 best platforms [12].

I LIAS has been used at the Hamburg Helmut Schmidt University (HSU-HH) [ilias.hsu-hh.de] since 2001. The e-learning portal at HSU H H not only provides a huge content repository, but also serves as the basis for the infrastructure which supports the processes of learning at the university as well as at partner institutions.

E-learning brings a new dimension to the process of study. According to an ancient Chinese proverb *"I hear and I forget, I see and I remember, I do and I understand",* and so learning by doing became more and more popular. With the introduction of e-learning, the process of study has become more practical and active, and less purely academic. In e-learning, the student is no longer just the recipient of tutor instructions; in e-learning the student be-

comes a member of many different educational development or research teams. All the activities are open to be monitored and evaluated by a wide academic and industrial community, including fellow students, teachers, future employers, etc. The monitoring activity is found to contribute to the quality enhancement of the whole process.

This complex vision of learning processes demands not just basic digital literacy but highly developed digital excellence. This digital excellence is a mandatory requirement if e-learning is to achieve its real potential in the future. The achievement of *digital excellence* must be an objective of every education institution, starting from primary school. The program *Learning Regions* [www.lernende-regionen.info] launched by the German Ministry of Education and Sciences is a good example of those Centres of Digital Excellence, established in different regions, which spread the idea horizontally across a country or vertically through levels of educational institutions. The establishment of a Centre of Digital Excellence is also a key objective of the Tempus-Tacis Joint European eMeReCU Project "Electronic Media Resource Centre, Ukraine" [www.media-resource.net], which is currently coordinated by a German-British-Ukrainian academic-industrial consortium. Centres of Digital Excellence are seen as a powerful tool for bridging the digital divide between nations, regions, educational institutions, etc. They are seen as being essential in facilitating the further penetration of technology in education.

4. Is content king?

E-learning has become the largest user of electronic publishing processes and electronic libraries. The electronic publishing processes are now supplying e-learning with educational content. Electronic libraries store this content, and allow widespread student access. Although electronic publishing itself is a major business area in its own right, mostly outside the e-learning context, the influence of electronic publishing on the whole academic and especially the educational field, is difficult to overestimate [6].

We will now concentrate on e-learning and e-publishing as a part of the public domain. The Open Source movement influenced another development, namely Open Content. There are Open Content libraries at many universities and other educational institution around the world. More important are the portals of educational communities, which provide access to a wide spectrum of Open Content educational resources. One of the best

e-learning oriented portals of this kind is *Multimedia Educational Resource for Learning and Online Teaching or MERLOT* [www.merlot.org].

On of the most significant developments within the Open Content movement in the last few years has been the announcement of the *Open Course Ware Program at Massachusetts Institute of Technology* or OCW M IT. By May 2004, there have been 701 courses published at OCW. Though OCW has been proclaimed as a free and open educational resource for faculty, students, and self-learners around the world, OCW MIT is more oriented towards teachers rather than students. According to Charles M. Vest, President of MIT, the aim of OCW was *"to inspire other institutions to openly share their course materials, creating a worldwide web of knowledge that will benefit mankind"* [ocw.mit.edu]. OCW M IT did not attempt to support any feedback processes from potential users back to M IT teaching staff, and this has caused some serious criticism of OCW MIT [8]. In this sense we agree with a point view stated in [13]: *"Content is king, but feedback is queen"*. For this reason we believe that OCW MIT cannot be considered as a comprehensive e-learning portal.

There still remain serious questions: Can an e-learning platform support the registration of external users? How can external user communities be organised? How can support from the staff of the hosting institution be ensured? These issues need technological and primary organisational support. The technological support is provided by many e-learning platforms. Any lack of organizational support is likely to cause problems, which in the case of OCW must be solved elsewhere. In effect, the success of OCW and other similar schemes will be measured by the skill of the local instructors who use the courseware as a professional resource. It is they who must build it appropriately into learning resources for their own populations of students, reflecting the cultures in their own institutions, and the specific curricula being studied at their own institutions [9].

5. E-learning context: presence vs. virtual

One of the most widespread mistakes that is made when considering e-learning, is to assume that e-learning is only necessary and is only effectively used, in distance universities. Of course, e-learning provides a powerful but not necessarily a unique tool in the teaching processes of distance universities. However, there are also instances where the teaching processes of distance universities are based on surface mailed written materials, and do not use e-learning at all. Equally, some distance universities put in

place regular contact sessions with their students each term. What is not in question is that the efficiency of distance learning will rise if digital communication tools are used.

One of the world's largest distance universities, The Open University UK, uses both presence and virtual education. The key difference between a campus-based and a distance university lies in the balance between personal and virtual contacts. Contact hours are very important as they provide direct flow of experience from teacher to students. Pure distance education (with no contact hours) is only effective if the students can then gain the necessary learning/training contact through their professional activities, and work colleagues.

This led to a new development, the concept of *blended learning which* combines a range of different delivery methods, e. g. contact and virtual [17] (the actual delivery methods may or may not include e-learning tools). In blended learning, the internet may *just in time* connect a presentation delivered during a contact lesson with any available location. Equally, the playback of a lesson stored on an e-learning server is digital technology *delivery on demand*. So on-line connections extend a class room in two dimensions: remote content can be presented to the audience *(virtual scene),* and a remote audience can take part in a lesson *(virtual audience)*. Considerable experience in using blended learning, has been amassed at the HSU HH, particularly by the second author [16], where a huge repository of learning materials has been put together.

The next question that arises is *what does the content for blended learning look like?* As Mr Jeremy Chappie, a recent Open University Senior Consultant said: *What is the world telling us at the OU? — It's important to get the media balance right —. ..and do NOT forget paper* [15]. The issue is not to make

all students read textbooks from the computer screen. The challenge is to provide students with the most suitable type of content for the particular learning needs. If a university library possesses sufficient copies of a book, it just may be a reference to this book. If not, it might be a reference to *Amazon,* or copies of couple of selected pages, or it might be a PowerPoint or Acrobat presentation delivered on the lesson, or its pdf-script. The greater challenge is how to find ways to assist a student through the use of self-assessment tools, how to provide e-content with keys, and how to develop tests which can help students when they come to take their examinations.

6. Organizational frame work

The strategy of how to develop e-learning skills, and how to introduce them into the process of education must be the subject of step by step development. There are many didactical, organisational, psychological, and technical problems, which need to be solved, but not all at once. Even the choice of an e-learning platform cannot be made hurriedly. There are many factors that should be taken into account when choosing the platform. Three key issues are stability, interoperability, and feedback support. The question of stability can best be proved in practice, by the extent of usage (by 2004 there were 4500 users, including 400 users from abroad).

The Hamburg experience clearly makes the point that special organisational frameworks are needed in order to achieve the effectiveness promised by e-learning. E-learning requires particular e-management and a special infrastructure. The management is particularly time constrained. That is why besides objects which represent *entities* (courses, course elements, etc) *and persons* (students, teachers, course developers, administrators),

Table 1.

	Students (consumers)		Teachers (suppliers)	
	percentage	ranking	percentage	ranking
Sharing materials with students	53	1	62	2
Track grades	48	2	51	4
Faculty feedback on assignment	43	3	27	8
Sample exam online	42	4	38	6
Online readings	38	5	76	1
Syllabus	27	6	61	3
Online quizzes	26	7	33	7
Online discussions	22	8	48	5

time objects which represent relations between subject objects are necessary to make the management consistent. Another Open Source system OpenUSS [www.openuss.org], developed at the Munster University, suggests an approach in this direction.

A business approach to education quickly leads to the recognition that in the context of education as a market, students are the consumers. Even within a pure academic approach, their votes should be taken into account.

According to [14] students prefer blended learning. Hybrid courses are in use at 40 % of universities surveyed in his research, and the number of offerings is growing by more than 10 % per year, usually much more. That corresponds to students' preferences: 2.9 % of interviewed students voted for no IT to be used in education, 2.2 % voted for an entirely online approach. The overwhelming majority of 94.9 % supported the use of information technology in education (22.7 % of them on a limited, and 30.8 % on an extensive level).

The inquiries at two German universities were not as clear: 36 % of students at RWTH Aachen University, and 61 % at Hamburg Helmut Schmidt University, preferred traditional ways of teaching, while 60 % at RWTH and 38 % at HSU-HH voted for blended learning.

The following table, also taken from [14], shows the ranking of different e-learning components from a "consumer" and a "supplier" point of view.

Another questionnaire was designed on an alternative principle. Students at two German universities (HSU-HH, and RWTH) assessed a range of different e-learning components on a scale of 1 (minimum) to 5 (maximum) (table 2),

In fact both questionnaires show that students voted for communication; they preferred to be in-

formed at the proper time and obtain full access to the information needed for the course.

7. Academic communities in the Bologna context

The final serious challenge is how to organise proper cooperation between universities themselves. Using e-learning access, students from one university may be integrated into a study process at another university. If both universities use some e-learning platforms, it would be essential that the platforms are interoperable.

Interoperability should provide the possibility of collaboration at different levels. The lowest level would be the import/export of learning contents; the highest should ensure the collaboration of learning agents registered on different e-learning servers based on different platforms. As far as feedback is concerned there must be a reasonable combination of student — teacher and student — student collaboration. This is particularly relevant when a teacher's interaction is restricted or impossible. Students' forums, mailing lists, blackboards, chats, and FAQs are examples of students' self-collaboration (the highest level of collaboration is video conferences and white boards [7] which normally requires the participation of a teacher who delivers the lecture, or who moderates the learning event). Assessment and self-assessments tools should be used to provide (self-) evaluation criteria.

Another problem is the establishment and support of teacher communities. As noticed in [3] *teachers must be supported by a network of content-area colleagues who will challenge us to grow*. These communities will control quality and volume of learning objects. This will be most effective if the e-learning platforms contain interoperable authoring and course management tools, including a broad spectrum of plug-ins for multimedia components.

Table 2.

	HSU-HH		RWTH	
Sample exam	4.36	1	4.72	1
Script downloads	3.43	2	3.98	2
FAQs to syllabi	3.35	3	3.65	3
Pictures	3.05	4	3.28	5
Online quizzes	3.04	5	3.64	4
3D animation	2.98	6	3.17	6
PowerPoint presentations	2.88	7	2.98	7
Video sequences	2.57	8	2.70	8
Audio sequences	1.97	9	2.08	9

Altogether, student - student, student - teacher, and university — university cooperation must move e-learning towards the Bologna process. Bologna implies that students during their study spend a part of it (semester or semesters) at another university abroad, and that credit points are transferable. E-learning makes this even more important. Students are likely to obtain increasing amounts of information on content, and choice of institution to study at. Furthermore, they can study as remote students using an e-learning platform. They will also be able to continue their education virtually, after they return to their "home" university.

E-learning in the Bologna context leads to widespread quality assessment and the dissemination of best practice. The content of courses that can be accessed on the Internet, will become a subject of broad discussion at a national or even international level. The best of these courses will be reviewed and accepted as de facto standards by competent academic consortia. The best didactic solutions will also be quickly recognised and widely adopted, (e. g. three windows technology developed at HSU HH [16]).

This whole movement will result in the development of a worldwide open bank of learning content developed that can be accessed on the internet. This learning content will have been developed to the highest world standards, and will come with (self-) assessment tools and other course accessories. The first steps in this direction may be the development of undergraduate courses, recognised under international standards.

There are at least three crucial areas were Bologna objectives may be more easily achieved with the assistance of e-learning. These three areas are the introduction of joint degrees; the introduction of credit transfer systems, and student mobility.

The Master of Science in Information Systems is a working example of a joint Masters program, comprising 21 professors from 15 different universities and research institutions. Furthermore, the program is supported by case studies and seminars carried out by industry experts from leading enterprises [www.winfoline.de].

If a university offers a virtual course, then a student from another university should be able to participate and obtain "real" credits which will be recorded in the students "grade book". There certainly remain some issues surrounding examinations, and these must be solved in a reasonable way (for example a virtual exam in a special examination room at the student's "home" university, with the "home" university responsible for student identification).

Student mobility also gets a new impulse. As suggested in [19], students will be able to watch on video a lecture given by foreign professors, before making a course offer choice as a consumer. The student can then take part in a webinar, or connect to a selected professor with any other possible communication tool. After that, a physical visit to the host university may be arranged for a duration which might be reasonable shorter a semester but produces a comparable result. In this way, the student has a cost efficient approach to mobility and the gaining international experience.

8. Summary

In addition to the Bologna objectives there are also opportunities for e-learning activities in the context of e-villages. The program of e-learning development should also therefore include the establishment of regional, national and international subject oriented learning communities. A working example of a regional community, is a community on *standardization and technical drawing,* coordinated by Hamburg Helmut Schmidt University, Aachen University, and Bremen University of Applied Sciences. The regional community is now likely to enlarge and become a national community, with about ten other German universities joining the community. An international enlargement has also been launched in the last year within the framework of the EU Asia-Link Program. An international consortium was established for developing e-curricula standards. The consortium consists of China JiLiang University, Institute of Technology Bandung (Indonesia), University of Moratuwa (Sri Lanka), Erasmus University Rotterdam (Netherlands), National Economics University (Vietnam) and is headed by Hamburg Helmut Schmidt University [http://www.asia-link-standardisation.de/ project.htm].

Since 1998 a community of Kyiv-Mohyla Academy has been established, consisting of 12 high schools and 4 universities. The aim of the community was to introduce throughout Ukraine ideas of liberal art education; the community also sought to find the best way to prepare school-leavers for university entry. The experience of local school communities, mentioned above [www.lernende-regionen.info], in the Leipzig region [neuseenland.de], together with the Polish national program Interklasa [18], all demonstrate ways of transforming the community of Kyiv-Mohyla Academy into an e-learning community. This community would be open to every institution to joint, and each member of the community would benefit from the joint de-

velopment efforts. This community will promote and put into practice in the Ukraine, the idea that the *Digital future of a nation grows at school* (Graży-na Staniszewska, Member of Parliament, Poland). This will be the core objective of the E-Community of Kyiv-Mohyla Academy.

An international dimension to these developments started with a sequence of Tempus-Tacis projects; the consortia involved in the projects included Oxford Brookes University (United Kingdom), and Leipzig University of Applied Sciences (Germany), and led to the establishment of a German-Ukrainian Centre for Interdisciplinary Studies at Kyiv-Mohyla Academy, together with Bielefeld University (Germany). With technological support from eMeReCU, this community will develop into an International Institute for Informatics, and will be joined by Munster University (Germany), Technical University of Opole and To run University (both Poland). The Community will remain open, and other academic institutions who wish to join will be welcome. The main direction of the joint activities of the community will be an international collaborative study of e-learning.

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ЕЛЕКТРОННЕ НАВЧАННЯ: ЗАПИТИ І ПЕРСПЕКТИВИ

У статті розглянуто можливості підвищення якості освіти, в першу чергу вищої, шляхом упровадження і розвитку засобів інформаційних і телекомунікаційних технологій, які зазвичай об'єднують у платформу електронної освіти (e-learning). Електронна освіта розширює коло учасників, послаблює залежність від їх місцеперебування. Ідея електронного віртуального середовища полягає в заміні тієї чи іншої частини особистісного спілкування студентів із викладачем і між собою віртуальним спілкуванням, яке може бути як синхронним, так і асинхронним.