

NCEC - Network-Training Collaboration in Europe and China:

Developing the Infrastructure

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1. Introduction

In this paper we describe a project, *Network-Training Collaboration in Europe and China (NCEC)*¹, aiming at designing and developing network-based course production, delivery and presentation systems for China. One of the main objectives is to enable cost-efficient and effective continuing education and training. The project will contribute to, and aim at making use of the results of parallel European and Chinese projects, in which the partners are involved. The NCEC will improve the utilisation of the Internet in China, such as the China Educational & Research Network (CERNET) for continuing education and ChinaNet for professional training. At the first stage the project will focus on training, supporting conventional education, manufacturing and commerce. The specific objectives include:

- ?? Developing methods and an integrated set of *tools for cost-effective production of electronic course materials*. The tool set is designed in accordance with the principles of courseware engineering to enhance the productivity and maintainability of the course materials. In particular, course material reuse and customisation will be supported by adopting the new international (EU and IEEE) standards for course material description. The courseware production and delivery systems adopted will enable the production and use of Chinese electronic learning materials.
- ?? Carrying out experiments by describing a set of training exercises and delivering *pilot courses* within the network-based learning environment. The first courses will be in the areas of information and communication technology and management, reflecting the current perceived needs of China.
- ?? Implementing a pilot of the *network-based collaborative learning environment* for training, teaching, tutoring, assessment, and for providing feedback to the learners. The environment will be accessible to the users (trainees, trainers and tutors) via appropriate Internet connection, and some of the project partners are in the position of providing such connections in China.

¹ NCEC project is a project funded by the EC/Directorate General XIII, Telecommunications, Information Market and Exploitation of Research, Cooperation with Third Countries and International Organisations, Scientific and Technological Cooperation with Developing Countries. The project will run from December 1998 until December 2000.

?? Developing a set of *training needs templates*, which will allow us to *assess the trainee needs in the NCEC environment* in order to support trainee profiling for customized production and delivery. This set of training profiles will also allow us to test the pedagogic and production model. The *outcome* of trainee needs assessment will be a set of *training programs to realise these needs*.

Our basic model for the NCEC system is to develop an environment which will allow NCEC system to support development of relationships between suppliers of training and users of training over networks with supply being demand led as shown in Figure 1.

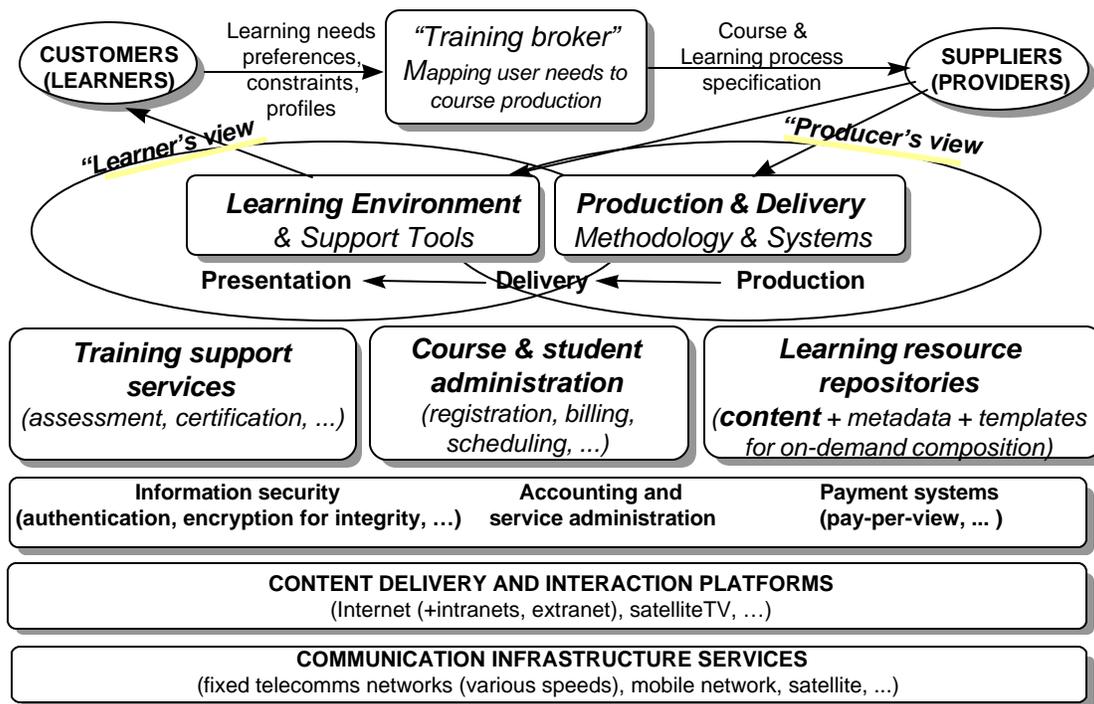


Figure 1. The Elements of Course Production, Delivery and Presentation

2. Developing Internet-Based Education and Training in China

While several delivery platforms and interaction methods are available to support distance education, such as TV, radio and CD-ROM, we have chosen the Internet to underpin the research and development of the NCEC system. However, the system may later utilize a combination of technologies, including satellite TV, mobile telecommunication systems, and Internet-based environments.

The Internet has developed and expanded exponentially in China both in the corporate and in the academic environment, as well as become widely available to the public. The China the Ministry of Information Infrastructure, MII (previously the Ministry of Post and Telecommunications, MPT) has developed ChinaNet for corporate and public use, and Tsinghua University's Network Research Center has been in charge of the development of China Education and Research Network, CERNET. Both of these networks are represented in the project to ensure platform for large scale deployment and use of the results.

Since 1994 the Internet has been growing very fast in China. Currently, there are four major Internet networks operated country-wide. ChinaNet, constructed by MII since 1994 is the leading commercial Internet in China. CERNET, headed by Tsinghua Network Research Center, has been built up since 1994, connecting thousands of universities and research institutions in China. ChinaGBN (China Golden Bridge Network) is the outcome of Golden Bridge Project launched in 1995 to serve government organizations. CSTNET, the network for China Science and Technology, is based on the pioneer effort by IHEP, connecting to the research institutes of China's Science Academy, and the CEInet of the State Information Centre.

The use of the Internet in China is rapidly growing, but there is a need for useful content and applications, such as education and training. The Internet user population has exceeded one million this year according to China Network Digest (CND). The quality and informativeness of China's web servers have been greatly improved in the last few years and China now has much better Internet connection to outside world than before.

In addition to basic Internet services, such as email and Web servers for content publishing, some new applications, such as e-commerce, are already in large scale use in China, including web-based stock trading and retailing. Internet-based application research has reached high quality, including network traffic control, network security and distance education platform development.

When appropriate, the Internet can be complemented with other media, such as ISDN-based videoconferencing. Internet connectivity provided by MII can be complemented by that of the China Education and Research Network (CERNET) and the satellite transmissions, to provide a basis for the development of a virtual education system for training. The production, delivery and presentation

system will be based on common Internet tools allowing for delivery over various data communication facilities.

The NCEC will be an on-line education system that provides courses both in English and in Chinese. This is not only a difference in language, but also in cultural and educational aspects. Considering the huge population in China and the type of the students, one of the major strategies is to switch educational patterns from conventional paper and classroom-based delivery to computer and network-based delivery of courses. The on-going China Internet constructions will provide a supportive environment for this effort. On the other hand, continuing and distance education will become one of the major services adding value to the network infrastructure.

3. Related Projects

The NCEC project will link to a number of ongoing projects, and provide a platform for more extensive testing and exploitation of their results. These include the ARIADNE project (in which University of Paisley and EVITech have been as partners), a research and technology development project in the "Telematics for Education and Training" sector of the 4th Framework Programme for RT&D of the European Union. Its objective is to develop tools and methodologies for producing, managing and reusing computer-based pedagogical elements and telematics supported training curricula based on the notion of shared "knowledge pools" of reusable elements, where the elements and components will be stored in standard format and appropriately marked-up for pedagogical content. The NCEC project will complement the development of the broker based "University for Industry" of the UK as well as the broker systems being developed in some other EU funded projects (such as INCO-COP KNIXMAS project) in which the European partners are intimately involved. NCEC may also utilise and adopt results from other European and Chinese projects in which the partners are involved, that provide the basic research results to be deployed in NCEC. These include GTN - Glasgow Telecollege Network (an ERDF funded project); DUCK - Designers Using Collaborative Knowledge (an EPSRC funded project) and TOPILOT (project to evaluate systems for training of Occupational Travellers).

The infrastructure and basic standards for the NCEC will be based on the developments in the ARIADNE, IMS, CEDMA and the IEEE projects leading to international standards for training

products. The NCEC project partners have links to all of these projects. In this way NCEC will be developed in a parallel manner with other projects, leading to the creation of a seamless market for training products between China and Europe.

4. Structure of the NCEC System

NCEC system consists of course production, delivery and collaboration environments as illustrated in figure 2:

- ?? Courseware Authoring and Production System (CAPS)
- ?? Network-Based Learning Environment (NBLE)
- ?? Network-Based Collaboration Environment (NBCE)

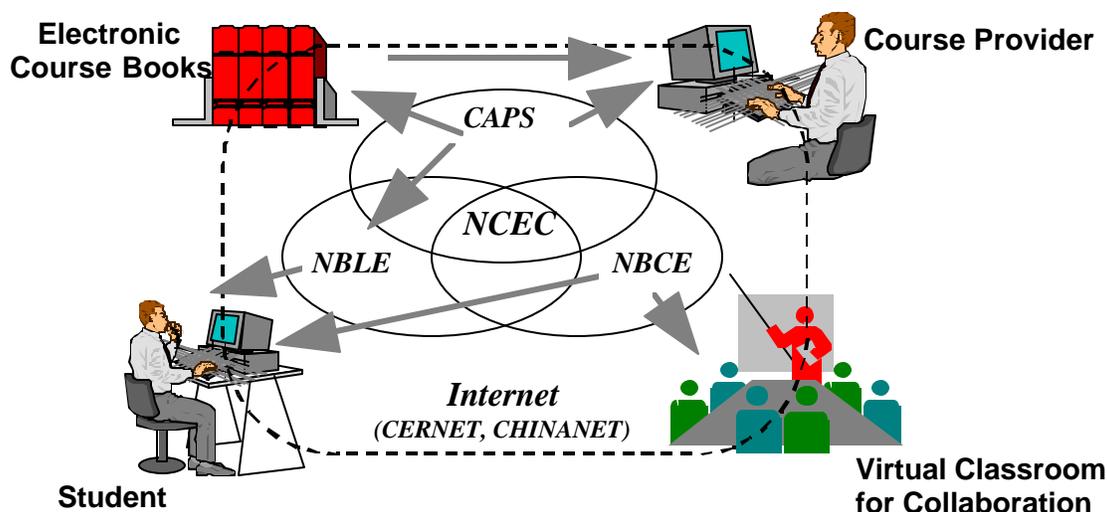


Figure 2. Structure of the NCEC System

Courseware Authoring and Production System (CAPS) will support the authoring and production process illustrated in figure 2. It will provide users with a set of tools for authoring and producing courseware on NCEC. The tool kit will be capable of supporting courseware development tasks, such as electronic textbook authoring, courseware updating, maintenance of course element repository, and complimentary elements.

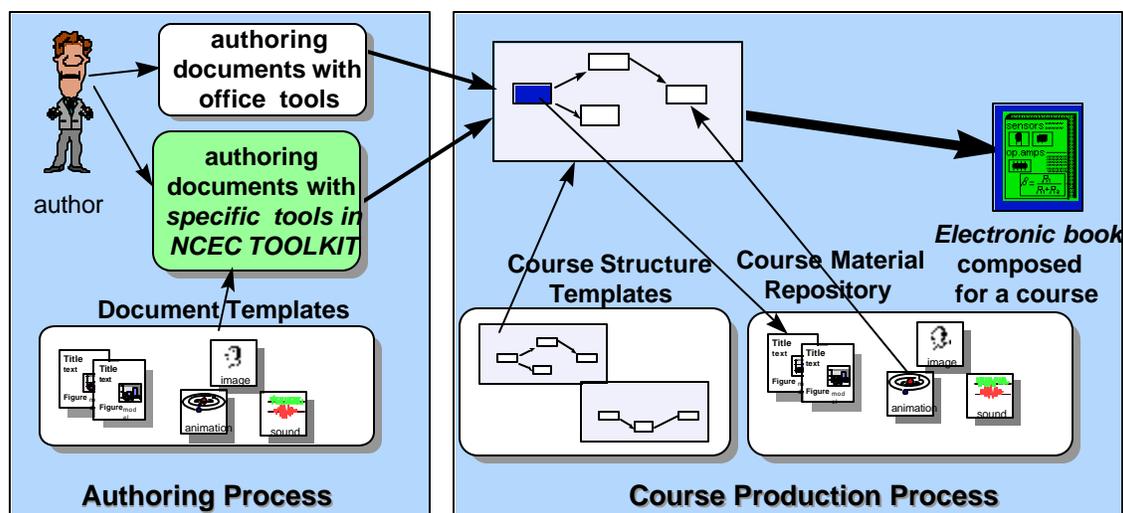


Figure 2. The Authoring and Production Process

The elements are authored with office tools and other common tools and NCEC specific authoring tools will be developed only when necessary. Document structure templates for each tool will be used to ensure consistency of materials. Courses are produced according to selected structure templates (workflow or pedagogic sequences) by using elements in the repository (and possibly new authored elements).

This component will apply the results of complementary research in related projects, as detailed in section 3, where the model is based on the development of course material repositories of reusable elements, accessible via the network. The databases may be distributed on different servers and partially duplicated for local use. The special techniques for Chinese information processing will be utilised for search and retrieval, including Chinese word separation, automatic indexing of Chinese information, and Chinese information storage, transmission and display.

Network-Based Learning Environment (NBLE), illustrated in Figure 3, makes full use of the hypermedia features of the WWW, providing a good environment to present users with a versatile interface and content. The learning resources are presented as *electronic books*, which can be annotated and shared by groups of students and tutors on the network, and a *virtual library*. The electronic books contain course materials, such as texts and learning tools, available either locally or remotely, and customized to the needs of groups of trainees. The virtual library contains relevant external/internal information resources linked to electronic books. In addition there are *assessment and feedback tools* for self-evaluation as well as for instructor assessment and feedback. It is

important to note, that the system supports individualized electronic books to delivered to the learner based on their actual needs, that may be determined using pre-exams to tailor the content.

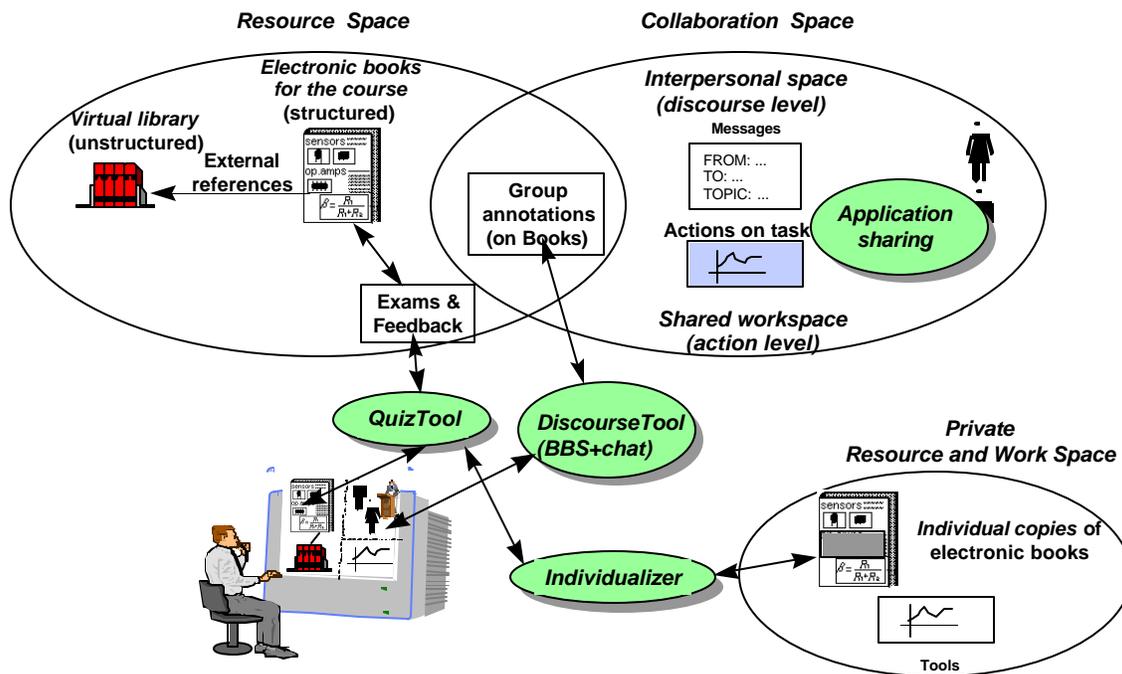


Figure 3. The Network-based Learning Environment

Network-Based Collaboration Environment (NBCE) will provide the users with an integrated network-based collaborative work space. This includes: electronic conference (in English and Chinese), virtual classroom, tutoring facility, and collaboration support. Currently, the collaboration facilities available on the Internet include e-mail, audio- and videoconferencing and whiteboard, IRC, interactive Web-systems (annotations) and similar allowing users to communicate using voice, image, video and text. The NCEC research group will analyse the basic requirements for the training in sharing and exchanging information, and NBCE will be designed in accordance with a set of interactive scenarios for the activities. The NBCE will be based on the KWAFU system developed by Tsinghua University.

5. Pilot Courses and the Bootstrap Model

A number of pilot courses are being developed both for verification of the NCEC methods and tools and for helping the Chinese partners acquiring skills in the new methods for the production, delivery and presentation of electronic courses. The pilot courses are carried out as training experiments

where both the cost-efficiency of the production methods and the effectiveness of learning in terms of learning outcomes will be assessed. Some of the courses will be provided for training the employees of European-Chinese joint venture companies. The end user courses could be in the areas of engineering and information technology.

?? Introduction to Telecommunications Networks

?? Internet Technology

?? Electronic Documents and Network Publishing

The telecommunications course will provide competencies and skills required for both fixed and mobile telecommunications networks and the functions of different network elements. The objective of the Electronic Documents and Network Publishing course is to provide knowledge and skills for the production, publishing and management of electronic documents on the network. This will provide a basic underpinning of the development of Chinese based electronic courses on the NCEC system. The above programmes will form the basis of the training experimentation of NCEC. The experimental techniques will be based on those developed within other EU and China projects, with evaluation being carried out as established in other EU projects.

However we do have to consider how to develop the learning capability of the new target population. This implies that we have to develop a hierarchy of skills delivery. The programmes to be presented in China will therefore be delivered in a rather structured manner. We will first of all deliver a set of enabling courses which can be used to build up the community of trainers and learners enabled by the new technologies. We are calling this approach the *bootstrap model*. We therefore can classify our programmes according to the hierarchy given in the Table 1 below.

6. Project Quality Control and Internal Assessment

The partnership experience has allowed it to develop and implement authoring standards and forms for the didactic analysis of learning objects. Tools have been designed to assist in the implementation of non-generic learning objects to enhance lesson quality. The quality management system for development, production and delivery of course materials has been designed and implemented by University of Paisley. A set of evaluation methods and standards have been built in complementary

European Projects (DUCK, ARIADNE) and they will be applied to ensure that the project proceeds with due diligence and care. Also, Tongji University has a long experience in delivering continuing education courses.

Level	Activity	Courses	Domain	Technical support
Application Specific	Data brokering e-commerce e-trading	Entrepreneurship Data Business - Call Centre	Information Technology Technology Support Areas BioTechnology	HIGH BANDWIDTH
Content Development	Electronic Network Publishing	Learning Applications Development	Quality Processes for Learning	MEDIUM BANDWIDTH
Basic Level, Enabling Knowledge & Skills	Language and authoring Costing	Network use Introduction to Internet	Use of Internet in Education	LOW BANDWIDTH

Table 1. The Bootstrap Model

7. Conclusions

For educational institutions, as well as for European and Chinese companies, such network-based training systems form an excellent basis for the development of joint courses, training systems for industries (both competence development and customer training). Also, they can effectively be used as a basis for collaboration in research and development projects. The collaborative project between European and Chinese institutions enables all the partners to contribute and share their expertise required to address the specific issues of Chinese information processing and the telecommunications and computing environments.

The research will address training infrastructure issues by allowing the Universities of China to develop an infrastructure for the delivery of training programmes to the emergent companies of China and the joint ventures between Chinese and European companies. The research will allow the

conversion of European learning programmes to a Chinese context by encouraging the collaboration of European and Chinese academics and technicians. The exploitation plan places emphasis on the following aspects:

- ?? Extending NCEC system to other distance education programmes in China.
- ?? Setting up joint distance education programmes between European and Chinese universities. These joint programmes can be a transfer of the programmes in one partner country to another. The applications are also transferable to other countries.

Within the NCEC project, there is provision for the development and delivery of a number of pilot courses to trainees in China. This will provide a test and experimentation capability which will allow us to establish the needs of the final users of NCEC. This will also give us the opportunity to measure the effectiveness of delivery in China from the EU. By providing a focused research and development effort on network-based methods and tools in continuing and distance education in China, we view the NCEC project as being potentially one of the relevant contributors, in areas significant to the rapid development of the Chinese economy.

8. References

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