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C@mpus+ 2005

Scenarios for future learning environments involving the University of Twente

A report prepared for the *Adviesgroep Innovatie*, University of Twente

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Summary

This report is submitted by the Advice Group Innovation (Adviesgroep Innovatie) of the University of Twente to the Steering Committee for Learning Environments (Stuurgroep Leeromgevingen) of the same university as a stimulus for decision making about the future development of technology-based learning systems. The idea of "C@mpus+ 2005" was used as the identification of the study, although the target of 2005 is not meant to be taken literally. Although the study is ultimately focused on advice concerning future technology-related learning environments, tools and systems, the major focus of the work became the potential settings for those environments, in terms of educational models and learner targets likely to be of impact. The study considered of several stages, using interviews, desk research, and group discussions and feedback. Based on these results, four key profiles relating to learning environments were identified, based on the dimensions "Local vs Global" and "Programme or Individualised quality control". The four profiles were related to three generic types of learners: Entry level, transitional, and professional level. It was concluded that different combinations of the profiles were needed for the different types of learners. Finally, two major scenarios were identified to capture these profile-learner combinations: *Stretching the Mold* and *New Economy*.

Following the elaboration of these scenarios, the technological implications of the scenarios were analysed. Migration routes toward realisation of the scenarios were considered and two paths studied in more detail. These paths were identified as evolutionary and interventionary. It was hypothesised that the evolutionary path was likely to lead to the Stretching the Mold scenario, but not the New Economy, while the interventionist path was more likely to lead to both. A series of strategic questions were identified for the University of Twente relative to these scenarios and migration paths, and suggestions for further research presented.

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Chapter 1. Introduction to *C@mpus+ 2005*

In the summer of 1999, the University of Twente decided to implement *TeleTOP*, a course management system developed by the faculty of Educational Science and Technology, into all faculties and courses of the university and gave the task of this multi-year implementation to the DINKEL Institute. During the 1999-2000 academic year, a plan for a more-general digital learner-support environment to include the TeleTOP system but extend it with other services was formulated (Koppen, Mouthaan, Roosendaal, Ruijter, van Tongeren, & Verhagen, 1999) and the task of realising the plan given to the DINKEL Institute. This digital learner-support environment is being called *C@mpus+*.[1]

The main points of the DINKEL Institute's current *C@mpus+* plan are:

a. to develop an integral, comprehensive digital learning environment for the University of Twente, being an integration of the course management system TeleTOP, an electronic study guide (VIST), assessment administration, a virtual library, and other yet-to-be defined features,
b. to have all courses from all faculties implemented into this integrated learning environment by 2002

To guide and stimulate the C@mpus+ development and implementation process, several groups have been formed as shown in Figure 1:

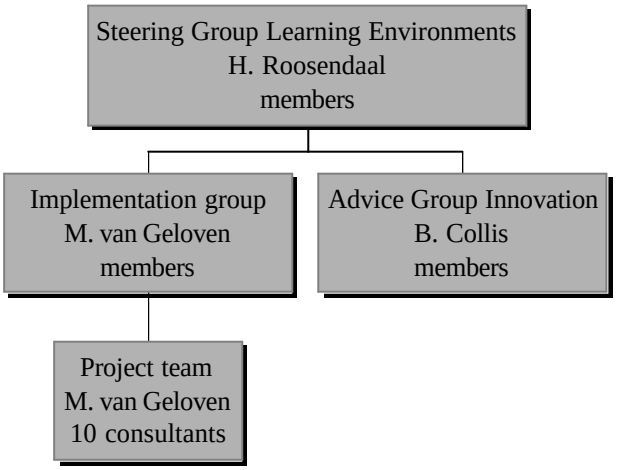


Figure 1. Groups involved with the design, development, and implementation of the C@mpus+ system at the University of Twente, (DINKEL, 1999)

The *Steering Group* is responsible for overall policy relating to the C@mpus+ system. This group meets once per month, and receives reports at each meeting from the Implementation Group and the Advice Group Innovation. The *Implementation Group* is responsible for the current implementation of the C@mpus+ system throughout the university. The (implementation*) Project Team* consists of TeleTOP consultants from the DINKEL institute that give support to instructors while implementing their courses into TeleTOP. The *Advice Group*

[1] The use of the term *C@mpus+* by the DINKEL Institute for describing an integrated learning-support system that includes the course-management system *TeleTOP* is different from the original use of the term C@mpus+ by the Faculty of Educational Science and Technology since 1997. In the faculty case, the term C@mpus+ has been used to describe an educational philosophy. In the university context since 1999, the term is being used in the broader sense.

Innovation group has the task of advising the Steering Group on future developments important for the evolution of the C@mpus+ system. The Steering Group must decide on the basis of this advice what instructions to give to the Implementation Group as well as what policy to suggest to the central administration.

In this context, the Steering Group has given the Advice Group Innovation the task of presenting alternative situation descriptions concerning the learning environment(s) with which the University of Twente will be involved in the middle-range future. Although the *year 2005* is being used as a convenient frame of reference, it is not the intention that exactly five years in the future is involved. The term is used more in a metaphoric sense, to represent the middle-range future. Stimulated by discussion of these future views, the evolution of the current C@mpus+ system itself and also the broader learning environment of which the descendants of the C@mpus+ system will form a part can be considered. Through the presentation of these alternative future descriptions (which can be called *scenarios*) and their possible consequences for the future of the University of Twente, the Steering Group Learning Environments can be stimulated to make decisions relating to how to move forward to realise, or avoid, the alternative situations.

It should be noted that the future descriptions involve more than only a single digital system, such as the current version of the C@mpus+. Other aspects of the learning environment that will have a relation to the future C@mpus+ system, such as the physical and virtual environments in which students learn and perform other actions relating to learning, will also be considered. Thus *learning environment* will be seen in a broad sense--digital, analogue, face-to-face, print, new-style lecture halls, virtual libraries, etc.,--and involving many different actors. For convenience in this report we call this complex system in its middle-range form, *C@mpus+ 2005.*

Thus the purpose of this report is:

- to assist thinking, planning and decision making in the *Steering Group Learning Environments* about learning environments in which the university is or shortly may be involved. This will be done by identifying future alternatives for post-secondary teaching and learning that are likely to have meaning for the University of Twente

- to do this via *scenarios* that present these alternative situations and express them around key dimensions, actors, and trends

The report is organised as follows:

In Chapter 2 the problem domain is clarified. In Chapter 3, the methodology used for the development of the scenarios is described. This is an exploratory methodology using the *profile-of-the-future approach* (Cole, Gershuny, & Miles, 1978; Miles, 2000). In Chapters 4 and 5, the results of an exploratory study of current developments relative to the problem domain, based on experience, a literature review, and interviews with a sample of informants are given. In these results, key actors and key factors involved with the domain starting at the present time and projecting toward the future are compiled and elements of emerging contexts identified. These inputs lead to the identification of a set of contrasting images of the future, called *profiles,* based on two key emergent dimensions. The profiles are discussed in Chapter 6. In Chapter 7, a second round of expert comments this time focused on the profiles, with the intention of assessing the reasonableness and applicability of the profiles and of "fleshing out

the profile into a fuller picture of future circumstances" (Miles, 2000; p. 5) is reported. The results of this round of expert comment will be used to derive a set of scenarios, described in Chapter 8. In this Chapter, technology requirements for the resulting scenarios will be discussed and in Chapter 10 we conclude the report by suggesting two paths to a C@mpus+ 2005 platform to support these scenarios.

Chapter 2. The problem domain

Learning environments

The focus in this report are the future learning environments with which the University of Twente may come to be associated. Many definitions of *learning environment* can be found. A learning environment can be thought of as a digital platform with communication and information tools; it can be taken to mean the physical environment (classroom, library, desk in residence, etc.) in which the learner learns; or it could refer to the many different social and cultural systems that surround a learning experience for an individual. For this report, we will maintain an ultimate focus *on aspects of learning environments related to technology*, as the work of the Steering Committee currently is restricted to these aspects.

However, technologies are not considered without their application contexts. The analyses that will result in alternative scenarios for learning environments in which the University of Twente may come to be involved in the middle-term future will also include variables associated with the broader sense of *learning environment*. Thus while one aim of this document is to assist decision making and planning of the Steering Committee for the technical aspects of future learning environments, the other aim is to sharpen awareness of the many interrelated factors that influence the use and meaning of technology-related learning environments now and in the future.

Technology-related learning environments

For the technology-related aspects of learning environments there are at least three aggregation layers:

a. The *layer related to software* with content-specific as well as general software entities, a software platform, applications, tools, resources
b. The *layer of the technical infrastructure*, containing network facilities, computers and associated technologies (printers, modems, etc.), and the software related to network and server maintenance and functioning. Wireless networks will soon join fixed-location networks as standard components of institutional network infrastructures.
c. The *layer of the physical environment of learning relating to technology access*, containing computer laboratories, study areas with computer and network access, and meeting rooms of various sizes for different forms of face-to-face contact and outfitted with networked computers and display devices or with stations for wireless access to networks.

In simple terms we could say: (a) *technology products*, referring to specific tools, applications, resources, and software-based systems; (b) computer- and network-related *infrastructures and related services*; and (c) *facilities* related to technology access. Categorisations can vary, particularly from the perspectives of persons coming from different professional backgrounds.

In this report we will use the term *telematics* on an on-going basis particularly for (a) and (b) but also related to (c). We define *telematics* as the *combination of telecommunications, information technologies (computing) and their combined services*. While common in some parts of Europe including The Netherlands, the

term telematics is used differently or not used at all in many other parts of the world.

Table 1 gives an overview of examples of some of the sorts of entities that are included in the category *technology products* in (a) above (Collis, 1999). The table shows existing types of products, categorised around six basic learning-related uses.

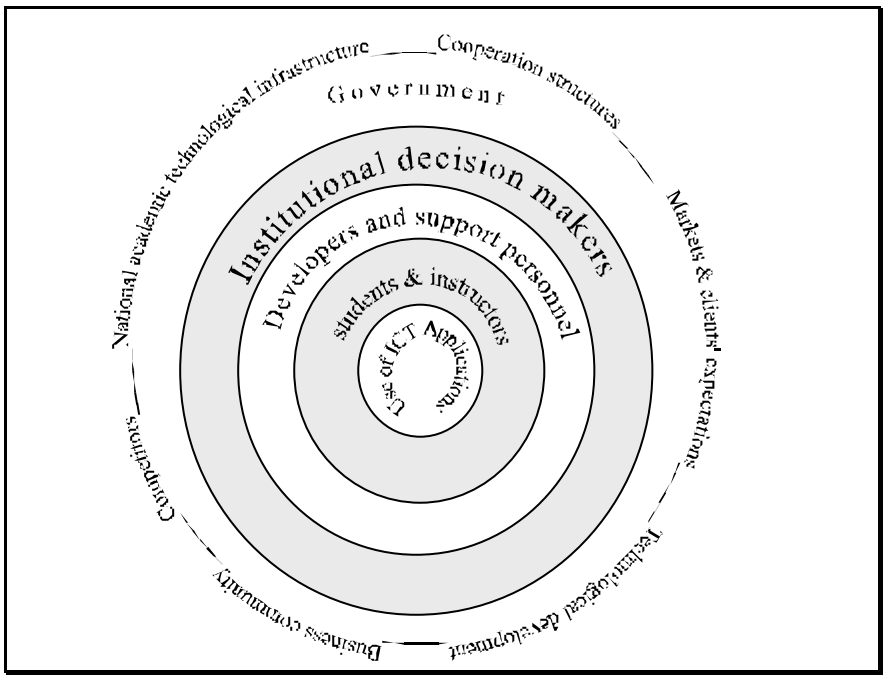
Table 1. Examples of technology products related to learning support in higher education (Collis, 1999)

Major educational use	Examples of technology products
1. Publication, information dissemination	Word processing software; HTML editors; WWW sites and the browsers to access them, WWW sites associated with database environments; software to facilitate file transfer and document attachments to e-mail; tools for cross-application format retention (i.e., pdf).
2. Communication	E-mail systems, computer-conferencing tools, including WWW boards and other forms of WWW-based conferencing; WWW sites offering communication options for the direct sending of e-mail and forms for structured communication; software for Internet telephony; software environments for audio-video desktop conferencing, for voice-email, for creating video attachments for e-mail; software systems for text-based chat.
3. Collaboration (groupwork) support	Groupware, which includes application-sharing software, shared workspaces, WWW-based shared workspaces, WWW-based application sharing, workflow tools; WWW sites designed for collaboration support; tools to allow collaborative writing on documents that are then commonly available to a group.
4. Information & resource handling	CD-ROMs with resource collections, which may or may not be linked with a WWW site; WWW -based search engines; distributed database systems (WWW- and proprietary); WWW sites designed for information organisation, access and sometimes creation; tools to retrieve and display distributed multimedia resources stored as digitised audio and video (including streaming audio and video).
5. Specific for teaching & learning purposes	Stand-alone software for tutorials, simulations, electronic workbenches, demonstrations of processes, collections of resources; interactive software (such as tutorials, quizzes, simulations) stand alone or accessible via WWW sites; computer-based testing systems; video-capture tools for lecture or presentation capture; video-conferencing (point-to-point and multicasting) for lecture participation; WWW-based pages or environments
6. For course integration and integration with other information systems	WWW-based course-support (or management) systems; database-driven WWW-based systems

The broader context

The broader context of technology-related learning environments includes the actors, factors, and developments that affect the technology that is chosen and used. The broader context of technology-related learning environments includes layers related to the institutions in which learning occurs or which are associated with the learning process, layers related to the entities that regulate or legitimise learning experiences in terms of translating them into socially accepted diplomas or degrees, layers related to the social and cultural contexts in which learning occurs, and layers related to those who support or supply the learning process. Figure 2 shows one conceptualisation of these interrelated layers. The figure was used to interpret international trends with respect to technology use in higher education for the Ministry of Education, Culture, and Science and the Ministry of Economic Affairs in a study carried out in 1999 (Collis & van der Wende, 1999). In the figure, the term *ICT applications* was used instead of technology-related learning environments.

Figure 2. Actors involved in the use of ICT in higher education (from Collis & van der Wende, 1999, p. 116)



This broader context is the framework for the scenarios. In Chapter 4, a new visualisation of the actors involved in the domain will be given, based on the results of the first phase of the study. The function of the scenarios involving the broader context will be to assist the Steering Committee in its decision making and planning about the more-specific domain of technology-related learning environments.

In the next chapter, the methodology for deriving and validating the scenarios will be described.

Chapter 3 Methodology

Goal of the methodology

Generally speaking, the goal of scenario-analysis methods is "to assist thinking about the future, so as to inform decision-making in the present" (Miles, 2000, p. 4). This are different conceptual backgrounds for these methods, many different technical approaches for scenario generation and validation, and many ways of carrying out the technical approaches. One example is the *Océlot Approach*, (Bergs, de Bruin, Engelsman, Geffen, van, Heeren, & Wit, 2000) recently used by the Telematics Institute to inform planning for office automation. Another example is the *SUNA* (Scenario Based Need Analysis) approach of British Telecom now being used in the *CANDLE Project* (Collaborative and Network Distributed Learning Environments) in which the University of Twente is involved. SUNA is based on USTM methodology (Hutt, Donnelly, Macaulay, Fowler, & Twigger, 1987) and USE case descriptions (Wasserman, Pircher, Shewmaker, & Kersten, 1985). Although such methodologies vary in their specifics, they all involve the generation of scenarios.

Scenarios

The term *scenario* can have different meanings. Miles distinguishes two basic categories: an *image of the future* and a *future history*. In the first category, the intention is "to present a rich description of a set of circumstances at some point in the future"; thus an emphasis on how the future might appear to someone within it if that person could wake up tomorrow and be in that future. The second category extends the first. While a description of the future is still needed, the emphasis is on describing the process by which those involved got to that future, "a specification of a sequence of developments, often highlighting key events, decisions, or turning points" (Miles, p. 4).

While the scenario generation that forms the major task of this study is of the image-of-the-future type, the last phase of the work will make a preliminary attempt to extrapolate a *future history* for each scenario (Chapter 9).

Key dimensions

The scenario-development process can be organised around *key dimensions* both within and outside of such environments that can influence their impact. One task of the study therefore will be to identify a productive set of such defining dimensions in which to position the scenarios. These dimensions are derived in Chapter 5.

Methodological approaches

Methodologies for approaching the future can be categorised in two broad ways (Ringland, 1999): *Exploratory* methods that start from the present and ask "What if…?" questions to project possible futures, and *normative* methods that start with a point in the future and ask "How do we get here?" questions. For this study, we will use an exploratory approach in order to avoid premature decisions about the conditions in that point in the future.

As a way to carry out an exploratory approach, Cole, Gershuny, and Miles (1978) suggest what they call the *profile of the future approach* in which:

1. A collection of highly limited sketches (*profiles*) of a small number of contrasting images of the future is developed, based on "What if?" questions from trends emerging in the present.
2. These profiles are used as vehicles to stimulate experts to speculate on the images and the possible courses of events that could have led to those profiles.
3. In turn this speculation leads to a fuller image and eventually, to a scenario of the future.

Steps 2 and 3 can be carried out in any number of iterations. Step 2 involves both basic categories of scenarios, image-of-the-future and future-history. The value of Cole, Gershuny, and Miles' approach for this study is that it suggests a concrete way to get started with the scenario-generation process: As a result of an exploratory period derive and sketch some initial profiles and use these as discussion stimuli. This *profile of the future approach* will therefore be used in this study as a general guide to methodology.

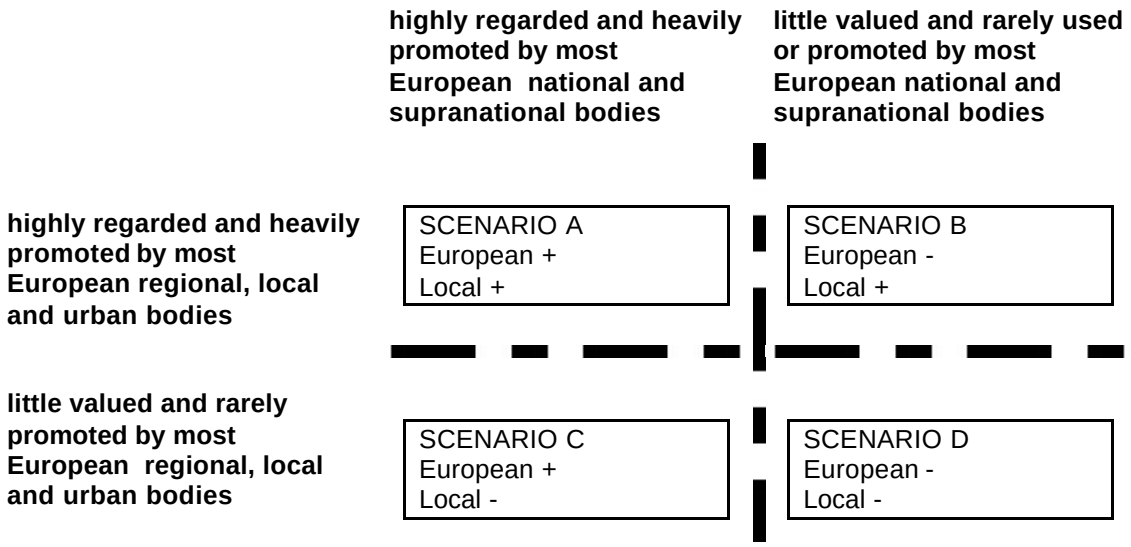
Initial profiles

An issue in the profile-of-the-future approach is the source of the initial set of profiles. Basically there are three possibilities: the analysts doing the study generate the profiles based on their experience and research; expert informants contacted by the analysts contribute ideas in various ways such as via free-form discussions, interviews, Delphi procedures, workshops, or other techniques; or a combination of both analyst and informant input. The latter is the approach chosen for this study. A series of free-form interviews with expert informants from the University of Twente was also used to help shape the initial profiles (Chapter 4 and Appendix 1). In addition, the analysts used the first six months of the study to systematically gather and categorise a substantial amount of information about current developments affecting learning environments (Chapter 5 and Appendices 2 & 3). The combination of these two sets of input was used in the study for generation of the initial profiles (Chapter 6).

Miles (2000) suggests a technique for structuring the initial set of profiles. This technique involves an analysis of the emerging contexts identified in the exploratory studies to select two aspects of surrounding conditions which are highly likely to have a future impact on the domain, and also which could plausibly vary in the future in terms of high or low extremes. For example, in his study of conditions that are likely to influence the future impact of telematics projects in Europe, the two surrounding conditions he selected related to two sets of policy makers, (those at the European or national level, and those at the regional or local level), and the extent to which they would value and promote future applications of telematics (high or low). The four profiles thus generated are shown in Figure 3.

Figure 3. Example of profiles based on two key dimensions (from Miles, 2000, p. 10)

Profiles of the Future in which Applications of Telematics will be:



In the diagram, "European " refers to the supranational and national governing bodies; "local" to subnational authorities

In Miles' diagram, the profiles are already called scenarios. However, in the profile-of-the-future approach, this migration to scenario status would not occur so directly.

From profiles to scenarios

Once a set of profiles is articulated, a transformation process must occur in order to migrate the profiles into scenarios. Miles (2000) used an interview approach with his set of four profiles, in which he asked his informants to indicate in their opinions which profile was most desirable and which profile was least desirable. For these two profiles he asked a number of other interview questions. Informants were asked to indicate five categories of actors which would be likely to be most involved in each profile. From lists of potential critical factors generated during the previous exploratory phase and grouped into four main categories (economic issues, employment issues, organisational-innovation issues, and social and environmental issues) informants were asked to indicate which five of the factors they predicted would be most important in the most-desirable and least-desirable profiles and then in a more free-flowing way to envision how those actors and factors chosen would be most likely to be interacting and thus what the impact would be on the domain at the focus of the study. An exploratory, "What if?" approach was used.

After synthesising the interview data, Miles determined that the informants found the profiles to be meaningful and plausible but that two in particular seemed most differentiated and stimulated the most response from the informants.

This systematic approach used by Miles and his colleagues identifies a procedure to carry out Steps 2 and 3 of the profile-of-the future approach of Cole, Gershuny, & Miles; it will be used in the current study. The interviews based on the initial profiles are reported upon in Chapter 7 and the profile-to-scenario steps in Chapters 8 and 9.

Summary of methodology

In summary, the methodology for study will be a combination of Cole, Gershuny, & Miles' profiles-of-the-future approach and Miles' profile-generation and interview techniques. The steps will be:

1. Define the domain of focus for the study (technology-related learning environments, see Chapter 2)
2. Using a combination of informant interviews and analyst research, use exploratory methods to start from the present and develop (a) a list of actors involved with the domain, and (b) a list of factors having a potential impact on the domain, and broad categories in which to group these (Chapter 4 and Appendices 1-3)
3. From these, (c) translate the input into overviews of current developments that point toward emerging contexts for learning environments, (d) ask "What if?" questions to identify two main sets of conditions whose high and low values would be most likely to influence future scenarios, and (e) sketch a set of four profiles representing these combinations of conditions (see Chapters 5 and 6)
4. Using the profiles, carry out a series of structured interviews in which informants choose a most- and least-desirable profile, and then indicate which actors and factors or trends are likely to be most involved in those profiles as well as what future images of these profiles might be. These interviews lead to a validation of the profiles in terms of meaningful and plausibility, and are the basis for choosing which profiles will be retained for the migration from profile to scenario. Initial *image-of-the-future* descriptive scenarios based on the most viable of the profiles are then written. (see Chapters 7 and 8)
5. Using these scenarios, speculate on the processes that might have occurred in order to reach these future situations. State these processes in terms of key events and decisions, thus generating future-history scenarios at the same time as refining the image-of-the-future scenarios (See Chapter 9).

Given the time and resources available for this study, the interviews in the above steps will be limited to key figures at the University of Twente. Analyst input and experience will also be of particular importance in Steps 2 and 3. Steps 1-3 have occurred in the period April-August 2000. Step 4 will occur in September 2000 and Step 5 in October and November 2000. The report will be completed in January 2000.

Chapter 4 Key actors and factors

To evolve profiles which can be used for scenario development, an exploratory approach was used to start with the present and move toward the future. We started by identifying actors and factors that are relevant to the problem area that are relevant to the problem domain of technology-related learning environments. Actors and factors are described as follows:

- Actors: Individuals, institutes or organisations with certain interests regarding technology-related learning environments and their broader contexts
- Factors: Circumstances that influence technology-related learning environments and their broader contexts, directly or indirectly.

Method

To generate these lists of actors and factors relevant to the research area, a group of seven experts was used and a three-step process occurred. All experts were persons directly associated with the *TeleTOP* and C@mpus+ technology-related learning environments at the University of Twente. (Appendix 1 gives the names and work descriptions of those involved).

First, individual interviews were conducted with each of the experts The topic of the research area, technology-related learning environments, was discussed with them and they were asked which actors and factors they perceived as most relevant to the research area.

Second, the research area and the list of actors and factors resulting from the interview were again discussed, this time in a plenary session with the experts.

After this plenary session, the definition of the problem domain was sharpened to what now appears in Chapter 2, and revised lists of actors and factors were identified.

Actors

The revised list of actors having a current or potential relationship with technology-related learning environments is presented in Table 2.

Table 2. *List of actors resulting from the interviews and plenary session*

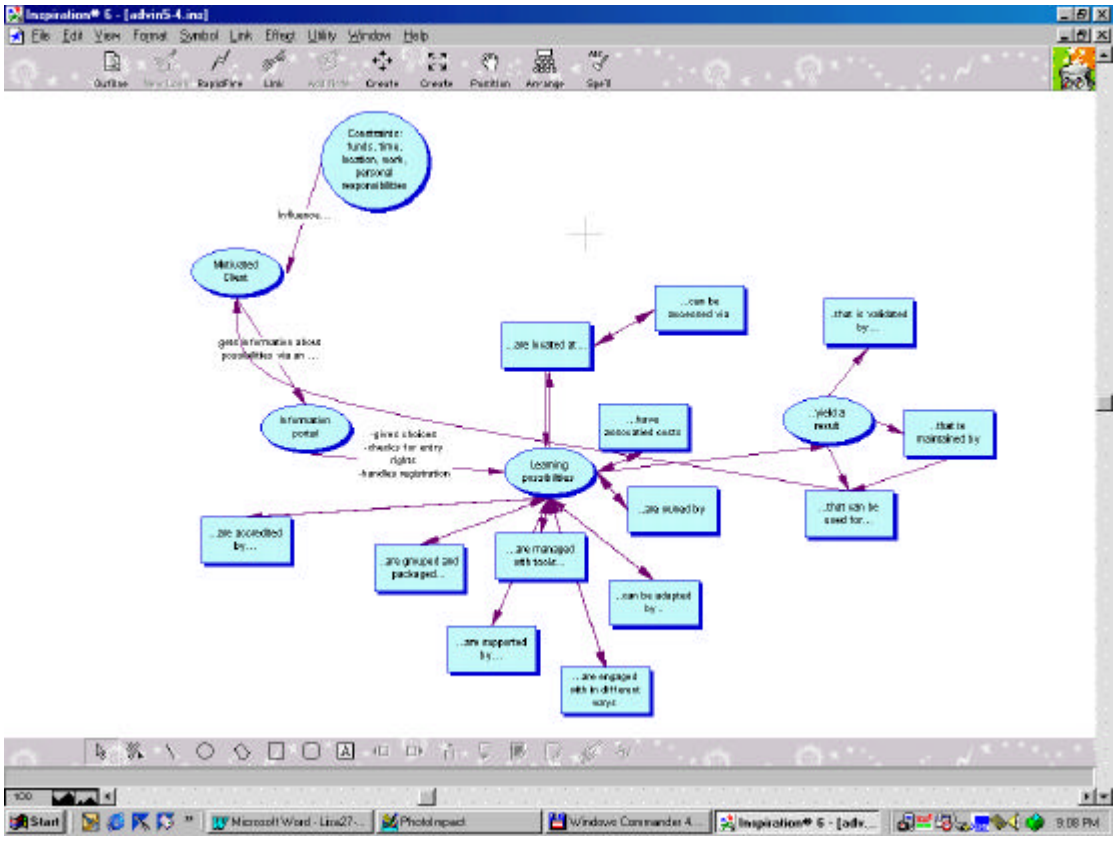
Actors:
Students / learners
Potential students (clients)
Parents
Educational providers (administrators / policy makers)
Administrators from other institutions
Providers of learning materials (creators)
Instructors / people guiding learning processes
Instructors from other institutions
Providers of learning materials (providing access to …)
Providers of software, tools and resources (non-content specific)
Designers / developers of software, tools and resources
Network service providers, infrastructure providers
Hardware providers
Technical support unit (e.g. CIV)
Educational support unit (e.g. DINKEL institute)
"Portal" personnel (e.g. BOZ)
Companies (financier, partner / client)
Government (legislation / study-financing, certification)
European bodies
Partner-universities / strategic alliances
Secondary education (provider of learners / employer)
Labour unions
Alumni of educational institutions using technology-related learning environments
Aggregators, persons who assemble packets of study materials from different sources
Archives (persons who store, ,maintain and make available study materials
Agents (educational brokers)

Potential relationship among actors

In order to visualise some of the relationships that could occur among these actors, a concept map was created to show one possible relationship. This relationship also involved the identification of a process, in this case the process of a potential client-learner deciding she wishes a particular sort of learning experience, taking steps to get information about how she could meet her need, registering and participating in the learning experience, and completing it to a standard about which a notation is then added to her personal records so that she is ready for her next cycle.

Figure 4 shows this concept map. Its purpose was not to prematurely generate a scenario but rather to help stimulate communication about the actors and factors. The map was used as a preliminary report to the Steering Committee in April 2000 of the results of the actor-naming activities.

Figure 4. Preliminary idea about relationships among actors in a learning environment.



Factors

Table 3 gives the list of factors identified by the informants as influencing the current or potential use and impact of technology-related learning environments.

Table 3. Factors predicted by informants to influence technology-related learning environments

Factors
-Forms of (educational) offerings: programs, courses, modules, units of leaning materials (ULMs), etc.
-Student characteristics; motivation, location, need for flexibility, etc.
-Types of support services; available services for education
-Technical developments;
-Educational developments (didactics): workforms, educational activities, theories, etc.
-Context; general IT, government, etc.
-Costs or finances
-(Traffic)mobility
-State of the art in world-wide network infrastructure
-State of the economy (labour market)
-Fashion trends (e.g. mobile phones)
-State of the environment (costs of electricity / paper)
-Study time
-Market developments
-Attitudes
-Innovative climate
-Organisational form of the university
-Tele-working

Literature- and current-practice review

Parallel to the interview sessions, the analysts over a period of several months assembled a collection of news items, reports, and articles relating to current developments in the broader context of learning environments in post-secondary education. Over 400 elements were extracted, each focusing on a single development. In Appendix 2 a list of some of the sources that were regularly scanned is given.

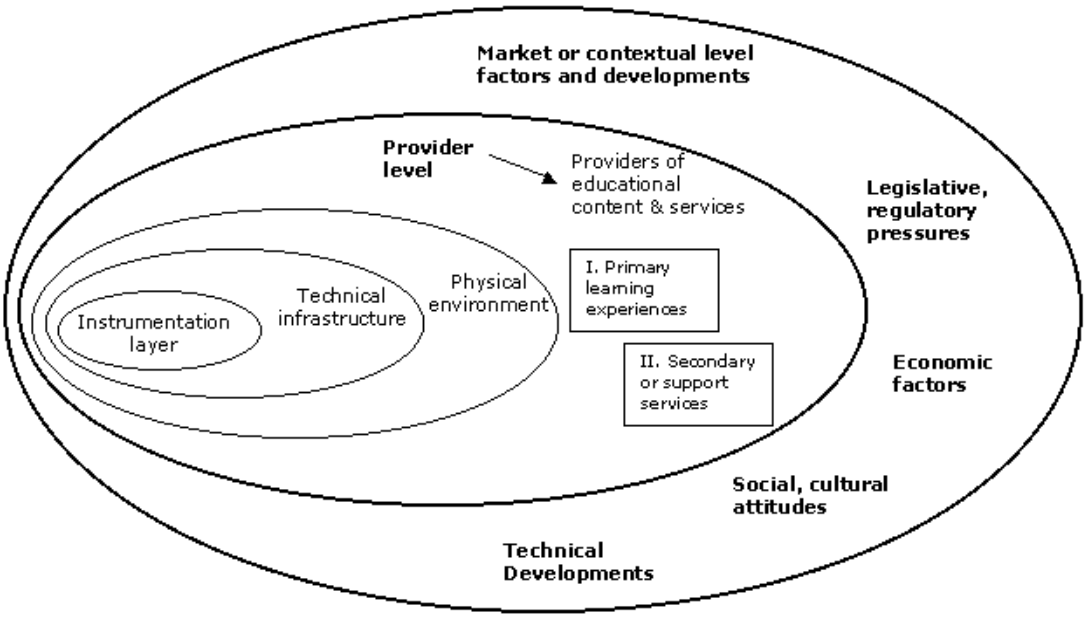
Categorisations of emerging developments

These resource elements were stored as separate records and sorted by the analysts until consensus was reached as to emerging Categorisations. The categorisations that evolved were compared with categorisations related to the actors and factors identified by the informants to come to a final set of four main groupings of developments:

> *Changes in context*
> Developments in society in general: legislation, social values, economy, experience with Internet, computer literacy, expectations for education, increase of use of technology throughout society, etc.
>
> *Organisation & didactics (primary processes)*
> Developments related to the providers of primary learning experiences (content, primarily organised into courses), such as universities but also other new players and forms of consortia, and the ways in which teaching and learning processes at educational institutions are being organised and made available.
>
> *Services (secondary processes)*
> Developments related to the provision of secondary educational services, not directly involving teaching and learning, but supporting and facilitating it (educational brokers, e-commerce applications, on-line textbook buying, on-line counselling services, etc)
>
> *Technology*
> Developments in hard- and software related to learning environments.

Appendix 3 contains key texts from the reports and articles assembled by the analysts, grouped according to these four main categories. Figure 5 gives an overview of the categories and their relationship to each other.

Figure 5. Categories of investigation



Thus the first round of interviews and the information-collection activities of the analysts elicited many ideas, not so much about the domain of technology-related learning environments in itself but about circumstances that surround the uptake and use of technology-related learning environments in practice. The outputs of the exploratory phase were then synthesised to express emerging contexts and developments. These are identified in the next chapter.

Chapter 5 Developments and emerging contexts

Methodology

Exploratory methods for scenario development involve starting from the present and posing "What if?" questions about emerging developments and contexts (Miles, 2000). In this chapter, these emerging developments and contexts are summarised under the four main groupings shown in Figure 5 and various "What if?" questions are posed.

Contexts

Many trends can be identified in developments in the broader context that relates to technology and learning environments. One of these major contextual trends is *virtualisation*. People are becoming more comfortable with Internet technology as an everyday tool. Professionals may already be spending as much one third of a workday behind the computer. It is estimated that in the USA, 47% of the 16-22 age group are Internet users although account for only 10% of the population. Even children in the 2-to-5 year old age group in the USA are using the Internet an average of three hours a week, and more than 5 million children below the age of 12 are regular Internet users. Internet-mediated shopping, e-commerce, is becoming an enormous market, with the USA, Germany and the UK the world leaders.

The economic aspects of using the Internet are also being rapidly discussed by major businesses in relation to their training programmes. "E-learning has arrived at the plant floor", in that it is seen as cutting costs and promoting efficiency. If the current trends continue, by 2005, at least 50% of the IT for companies will take place online. The e-line market for training is expected to jump from $1 billion in 1999 to $11.4 billion in 2003 in the USA. This relates to a second major contextual trend--*life-long learning*. New forms of corporate training programs are being seen as necessary because of fast-paced technological developments.

All of this public use of the Internet also has an impact on its presence in education. For the school sector, many countries are launching new waves of initiatives to connect all schools to the Internet. These waves are like those of a decade ago, with respect to computers. The same main frustration is being expressed now as then: Teachers do not respond or are not trained enough to respond. Most seriously, they may not see a reason to respond, as the impact of technology on learning is still not clear. In the university sector, more and more courses and educational materials and services are being offered online (see the next two sections). Being wired is becoming a criterion for evaluation of institutions. Relating to this, universities are increasingly facing new forms of problems, such as with students violating copyrights through easy downloading of resources from the WWW.

New student demographics are also part of the context. An overall raise in student enrolment in post-secondary education can be expected because of a larger cohort of young people, but more so because of an increase in what are still seen as *non-regular* students participating in education, such as part-timers, adult learners, life-long learners. These people can either be sent by companies or enrol on their own initiative. A trend is that non-regular students may soon outnumber regular students at educational institutions.

Because of these new groups of learners, there is also a need to make education more *flexible* and customer orientated (or *individualised*). These adult and part-time learners will have more need for time- and place independent education, to be able to choose different courses or even modules from different institutions, etc. Traditional structures of education, such as diploma granting, authority, state and local accreditation, etc., will find it difficult to coincide with increasingly flexible education.

But the trend toward virtualisation and flexibility in education may be slowed by a variety of factors, starting with the lack of willingness or capacity of instructional staff be work with new forms of learning environments. Some of the these constraints include governmental regulations that lag behind trends toward virtualisation, economic factors related to technology use and Internet access, and fears and perceptions such as expressed in the that spending more time online will decrease the time students spend interacting with fellow-students, teachers, and friends and thus causing social isolation. Also, economic issues can slow the trend toward virtualisation and flexibility. Universities are already spending considerable amounts of their budgets on technology (approximately 15% in the USA) and indicate they would need more if they were going to be trying to offer high-speed networks, for example for video, or subsidised access especially to remote students. Institutions are already having difficulties in funding technology expenses; 71% of state universities in the USA already use increased student fees or tuition add-ons to shift costs to the students.

This flexibility will be enhanced by a fourth trend in society: *globalisation & internationalisation.* Throughout the world, business is more and more taking place as a combination of local and international. People still go to local shops, even as they shop online. Businesses are forming alliances with each other to take advantage of each other's local markets and to have the combined resources to operate internationally.

From all these trends, a number of questions are regularly being expressed:

-Will everyone be using the Internet? What if most people use it, but some remain outside? What are the social and ethical implications if some cannot because of circumstances related to income or living and working conditions?
-Should the Internet become primarily a medium for business transactions, or for personal communication and expression? What if there is no control over what occurs on the Internet? Will those not able themselves to judge quality be endangered by making contacts that are not good for them or investments that are not wise?
-Who should monitor quality? What if people more and more are using the Internet for communication and contact? Will social development change or suffer?
-To what extent should governments regulate and subsidise Internet connectivity, particularly to the educational sector? What if a substantial amount of money is spent on connecting institutions and individuals to the Internet, and then little use is made of this for teaching and learning?
-Who should pay? What if it costs more to participate in education because of technology costs, and students cannot or will not pay?

These questions suggest two main lines of development. One is the line relating to *quality control*: Who does it, by what criteria, using what forms of control interventions? On one extreme, the Internet can be seen as a free channel, allowing anyone to access and contact anyone else. On the other extreme, the Internet can be seen as needing to be ordered; made secure; made a place to do business with consumer confidence; made a place to go for entertainment, with

confidence that one's norms will not be offended. A second line of development relates *to local vs global* aspect: Will one shop at the corner store or via a virtual portal whose server may be continents away? Where will one go to meet friends and socialise? What language will be spoken? How expensive is each alternative?

Given the unstoppable surge of use of the Internet throughout society, these questions will effect all sectors, including higher education.

Organisation of teaching and learning in higher education

Pressures for change

Changes occurring in the primary processes of higher education--courses and degree granting--are closely related to the contextual trends of virtualisation, internationalisation, life-long learning, and customer orientation that are part of society in general. There is a strong message appearing in the popular media as well as in professional circles: "Traditional universities and colleges face a bleak future unless they significantly alter their instructional methods to keep pace with developments spurred by the Internet. In order to survive, these institutions must examine the educational undertakings of such companies as Dell Computer and Sun Microsystems, understand their own strengths and reputation among the public, and customise their teaching methods to the different age groups of students" (Financial Times, Business Education, 3 April 2000). As institutions are more and more trying to reach students who do not fit the standard residential degree program, individual courses or even entire degree programmes are being offered via the Internet, which is perceived as saving both universities and students money and time. Instead of planning around credit hours, "talk at top campuses these days is about 'bytes of delivery'. The goal is to develop Internet courses, filling the coffers without cheapening the school's name" (U.S. News & World Report, 24 January 2000, p. 45). Also, "many cybereducators hope to get rich in the process" (Newsweek, 24 April 2000, p. 56). Flexibility is seen as the key idea, and flexibility requires technology.

There are many forms of flexibility, not only time and distance (Collis & Moonen, 2000). Learning environments of the future are being envisioned, to include many other aspects of flexibility, such as flexibility in the student's choice of modules to combine together to meet course- and degree requirements (Ben-Jacob, Levin, & Ben-Jacob, 2000). More and more courses or entire degrees are being offered online, which is perceived as saving both universities and students money and time. Many different players are looking to more-flexible and new forms of course delivery to reflect these trends of student diversity, the need for flexibility, and the use of the Internet.

Models

There are many ways that this flexibility increase is being realised. The individual institution can become more-flexible in its own practices, can join with other universities in a variety of models, or can join with other partners in a variety of models. Also, new players, both related to traditional universities and not, are also becoming providers.

The individual university is responding in a number of ways. Some are setting up for-profit ventures, sometimes calling them a *virtual university*, sometimes to try to sell to individual students, other times to target to corporate employers. At Columbia University in the USA, the goal is to put the university's core content on the Internet and charge users a fee for it. Stanford University has been using the

Internet and television for several years to broadcast some of its engineering courses to working engineers, currently 1,500 participants. Lectures are captured on video at Stanford as they normally occur and made available via the Internet to registered parties. (see http://www.scpd.stanford.edu and http://www.stanford-online.stanford.edu) . Finally, many traditional universities are joining the traditional distance-education universities in making courses available to students at a distance. WWW environments become the portal through which course registration occurs, course materials are obtained, course interactions and communication occurs, and course examinations or final projects are managed.

Another way that the individual university is responding is not necessary to offer courses at a distance, but to make the course-participation process more flexible in other ways. The University of Twente is seen as a leader to examples of on-campus use of telematics to diversify instruction, but many other institutions now are developing such ideas. The goal of Wharton Direct, a WWW environment at Wharton Business School in the USA, is to enrich education via offering students highly innovative multimedia learning experiences. This approach stressing quality improvement is hoped to draw students to the home campus and program (http://www.wharton.upenn.edu). The Pew Learning and Technology Program Newsletter (http://www.center.rpi/edu/PewHome.html) reports monthly on examples of *redesigned learning environments using technology.* It is frequently noted that the instructor's role is changing along with the use of such re-designed environments, toward a consultant or moderator, as students have increasing access to external resources (media-based and human). At the learner level, many developments can be seen. (Digital) portfolios are being used more and more in education for progress monitoring and assessment. By keeping a portfolio, students take responsibility for their own learning processes. Students taking a more-active role in their courses is a major trend. The use of WWW-based course-management systems provides a convenient platform for these new forms of learning activities, such as students submitting additional resources or case materials to a course WWW site, students working together with the support of groupware available via their course WWW sites on the communal production of course materials, students giving each other peer feedback via being able to view each other's submissions in the course WWW environment, students engaging in activities with students in other countries or making contact with experts via use of WWW and other Internet technologies.

In addition to the traditional university becoming more flexible on its own, a number of other types of models can be identified

- new alliances such as *university networks or consortia* and *international educational consortia* (and variations of these with non-university partners)
- *corporate universities* (companies now offering on-site training programs for their employees are moving to online variations),
- *mega-universities* spanning national boundaries (moving from earlier technologies of print and local tutors to the use of the WWW)
- *virtual universities* that operate entirely online and may offer an entirely Internet-based degree.

A major development is the emergence of new groupings of institutions, coming together to apparently find a more potent way of market penetration than if they continued to operate only on their own. These can be seen in different forms: international education consortia which may or may not involve commercialisation, corporate universities where a major player is a multinational company, university networks of various sorts, and start-up ventures with

technology companies (Brockhaus, Emrich, & Mei-Pochtler, 2000). This gives students more options to choose from and an international offer of educational programs. At the same time, this will increase the competition between universities and enhance the need of universities to position themselves on the educational market.

There are many permutations, some involving new forms of broker agencies. The Pensare Consortium is a profit-making operation, where tailor-made courses are developed for business with the help of partner universities as content providers (http://www.pensare.com). The UNext.com (or *Next Generation University*) involves a for-profit broker company that invests in both private companies developing course materials as well as universities, in order to offer integrated offerings, primarily to companies (http://www.unext.com). The universities involved provide course materials and lecture videos from their "leading instructors". It is interesting that a variant of this broker idea is taking place in a secondary school in the state of Florida in the USA, where students still attend the physical school setting for socialisation, sports, contacts with contacts with other students and with councillors and resource teachers, but do all their "course work" via the Internet using course materials supplied elsewhere. The task of explaining these materials when needed, or of motivating students to stay on task or to see applications of the materials in the local settings is the role of the new-style teachers in the physical school environment. Thus course emerge as a model in higher education: that actual courses are chosen from expert instructors around the world, with the local institution providing the personalised support and application settings.

Other partnerships are taking place among universities themselves, without broker services. These can include partnerships where smaller universities identify courses offered by some that are not available at the others, and then arrange for students to participate, via the Internet, in courses that are not available at the home institution. Other times a partnership occurs among several universities that have some or pragmatic connection with each other.
An example is the Singapore-MIT Alliance (http://www-cases.mit.edu/). Or the partners may share a common professional base, such as the arrangement whereby MBA students at three USA universities will be able to take classes at each other's institution using technologies such as chat and videoconferencing as well as the WWW.

Yet another model is the formation, usually at the governmental level, of an new entity, which integrates in some way the course offerings of some number of institutions in its jurisdiction, and often offers some extra added-services. In May 2000, the Prime Minister of France announced the creation of an Internet University, which will build on the resources of existing universities, research centres, and businesses in France
(http://chronicle.com'free'2000'05'20000051702t.htm).
The newly announced Digitale Universiteit in The Netherlands is another example. The Western Governors University, involving 18 states in the USA has captured much attention from the media (and generated by itself) but so far has not attracted many students.

Perhaps one of the major new players in terms of course delivery are the so-called corporate universities. Having in-house training is nothing new, but the use of the Internet and intranet systems has now stimulated corporate universities to also aim at a broader public as well as their own employees. Motorola University has 130,000 students, with a mixture of face-to-face and online activities, and also now partnerships with some universities

(http://mu.motorola.com/aboutMU.htm) Currently, 1,600 corporate universities exist in the USA alone, and 40% of Fortune 500 companies have such "universities". Many are now moving to offer traditional degrees, often by partnerships with conventional universities.

And other sorts of non-traditional partners are becoming involved with course delivery. A textbook published, *Harcourt General*, plans to offer accredited degrees; the *Jones International University* sells online courses and tools to traditional universities as customers (http://www.jonesknowledge.com); IBM and its subsidiary Lotus Development have formed a e-learning business unit. The CEO of Lotus was quoted as saying "It is my intention to have Lotus established as the franchise player in the knowledge management and distributed learning space" (Information Week, 15 May, 2000).

Thus the options for new forms of course delivery and course origination are many, with new possibilities emerging with every scan of the Internet. Many universities are now involved in a number of different partnerships; there is not yet any sense of shakedown as to what model is most viable for a particular university. Partnerships are often formed at a strategic level, without a clear operational plan. How they will settle into a sustainable form is still to emerge in most cases.

Questions

Despite the waves of activity, some questions are being raised, such as:

> Does the online degree have the same value as the traditional degree?
> How can students in online courses be kept interested to prevent high dropout rates?
> Who should an institution partner with, in what ways?
> How can instructors overcome the lack of time, training, and support that they need to integrate technology into their instructional practices effectively and to develop new didactics for student engagement and interactivity?
> Will online courses have academic vigour, or will they be seen *as digital diploma mills*, offering subpar education?
> Will they threaten the viability of tradition campus-based institutions?
> Will online universities differentiate among instructors, a handful of popular content experts who write the curriculum and are viewed internationally, and armies in instructional-support faculty who actually implement the courses at the local level? (Newsweek, 24 April 2000)
> Will instructors be exploited? Will they be able to handle these new forms of teaching and new technologies?
> Will there be an even wider gap between digital *haves and have nots*, in society given more and more online courses?
> Who owns the course materials? The instructor, the broker, the home institution, the partner institution, the student (who may contributed to them substantially)?

Looking at these questions, two main lines of development can be noticed. One relates to the local vs global issue. Strengthen the home base or move toward a future in a multinational partnership? What if the individual decides to go it alone? Can it compete? Will the big partnerships dominate client attention? Or will a swing back to the basics occur, as a backlash against failed attempts at globalisation if these should occur?

A second line of development relates to the program and content to be offered. How should this be obtained, and offered to clients? As total programs? As individual courses? As portions of courses (modules, or learning events of different types) which can be combined in different ways? What if the *choose-your-own-combination* idea takes root, stimulated by competition for fee-paying professional clients? Can the local institution handle this sort of individualisation itself? What if an institution wishes to maintain the integrity of its program and feels that courses of a partner may not really be good substitutes for its own courses? Once partnership arrangements are institutionalised, they can become difficult to fine-tune and change.

Services

At least two major trends can be spotted in the category of secondary services. The first one is the *commercialisation* of education as an online market. The second relates to the emergence of portals and brokers, such of which may also be commercial enterprises.

Commercial enterprises

Online commercial companies have discovered the educational market and are targeting on both students and instructors. *EduCommerce* for example, combines online course offerings with advertising content. These and other vendors have discovered a new markets; over 500 higher-education institutions have agreed to have advertising on their intranet pages in return for the vendor supplying the intranet or WWWW site. As the cost for building and maintaining a intranet and external WWW site is estimated to be $2 million for a middle-sized US institution, and since institutional WWW sites are now a major way for students to obtain information about an institution, the burden of tolerating advertising does not seem so great. Other kinds of services include online note services where students can buy and sell college notes, tests and abstracts; or e-commerce sites that supply students and teachers with items such as study materials, pens and classroom equipment. In competing with each other, these online service centres for students offer a wide range of possibilities including chat sessions with instructors, movie tickets, course registration, and online book ordering. These campus pipeline services are seen as leading advertisers to a demographic goldmine: students" (EDUPAGE, 3 June 1999). The key idea is physical space is no longer a limiting factor for doing business.

Educational institutions are beginning to try to share in this profitable market by offering academic products and knowledge for profit on the Internet.

Portals and brokerships

The second major trend are those of portals and *educational brokerships*. Portals at their simplest are lists of links, but most now offer added value of various sorts. Libraries are moving toward electronic portal roles for their institutions. Some portal services are moving toward brokerage and added-value enterprises. There are educational or commercial institutions that do not offer any teaching themselves, but operate as intermediaries (*infomediaries*) in the offer and demand for education. A good example of this is the *Regents College*. This institution can be characterised as a global community. Regents College offers all educational services except direct teaching, for example: assessment, educational brokering, academic advising, credentialing, etc. This organisation operates at a distance, using the Internet (with online library and bookstore) rather than having physical facilities to which students come. Students from all over the world

can register and take courses with materials and teachers from all over the world. The Fathom joint venture involves universities and museums in several countries and via its portal site offers a directory of all online courses offered by the partner institutions, but also the e-commerce aspects so that prospective students can register and pay directly through the site. The portal also offers books, CD-ROMs and other items for sale, and hosts forums lead by researchers and museum curators.

A major portal enterprise has been proposed in Europe (June 23, 2000) as the result of a workshop on European Virtual Universities (EvU). The workshop was funded by the European Union. It recommended that the Commission "develop a genuine Internet portal to European online learning provision" that would also have the function of being an "inclusive instrument bringing together stakeholders involve in e-learning,..and serving as the main window on the evolving e-learning initiatives throughout Europe" (Aslaksen, 2000). EvU institutions would agree to a "common meta-data description of courses and services". The recommendations also suggested that this portal could be launched at the Wiring the Ivory Towers", to be held in France on 28 September 2000.

Questions

The many new permutations of services relating to more-flexible learning suggest some major issues. *One is quality control*:

> Who controls what is available via portals, or what is chosen in enterprise services?
> What if there is no assurance of quality; to whom does the purchaser turn?

Another issue relates to the *location and management* of these services:

> What if all is done online?
> Can the sort of help that is needed be obtained by typing questions or pointing and clicking at alternatives on a WWW site?
> What if questions about education all were filtered via electronic questionnaires: Isn't there sometimes a need for trained human contract with which a troubled student can have a private and face-to-face counselling session?
> Which services are best done locally by personally known and trusted supporters, and which can benefit by economy of scale?

These examples show the sort of overlap that is now occurring between primary educational processes and secondary services. In all cases, technology is essential.

Technology

Network and access

Many trends can be identified in the technology of learning environments. Network developments such as ADSL and Internet 2 will make access to the Internet much faster and give more possibilities for its use, for example for more use of video on demand and multicasting in education. Where video-related applications have been often avoided because of low speed or quality, in the near future, this will no longer be a problem for a wide audience. Also new access possibilities via TV or stereo will simplify access. Server farms will become a

major new commodity and will bring back some of the strengths and vulnerabilities of older mainframe, terminal systems.

Another major development (that is also related to developments in Internet connectivity) is *wireless* or mobile computing. Wireless Internet connections, handhelds and Internet telephones are getting more and more popular and the first experiments on using this technology in traditional education institutions have already started. The University of Twente is one of the pioneers, starting its own *wireless campus* project.

Products and tools

Laptops are becoming very small. Handheld devices also are a new type of interface. Thus mobility is increasing. Electronic books and electronic magazines are new products that are moving from the R&D stage to the market. *E-books* are becoming available and some educational institutions have made contracts with publishers in order to make electronic access to journals and databases available for all of their students.

Also, educational materials are increasingly being offered in digital form. This can take many forms: via a Website, on DVD, etc. Students no longer have to carry around physical stacks of books. One problem which is emerging is how to store and reuse these digital educational materials. Standards and metadata are major topics of discussion as competing consortia strive to capture the market. An educational variant of XML is being developed to address this reuse problem.

A related problem to reuse is copyright. Once intellectual property is put on the Web, anyone can copy or print it, and strict regulations about this have not been standardised or internationally accepted. An alternative solution is being provided software tools to protect information on the Web from being copied without permission.

Pervasive computing is possibility the next breakthrough technology area (as was WWW technology in the early 1990s). Pervasive computing is essentially an environment where people interact with various portable or invisible computers. New forms of collaboration and eclectic networking are being studied.

With regard to WWW-based course-management systems, the market is growing quickly. Major players have emerged in the commercial market and compete with each other via auxiliary services (user support) more than via differentiation of their products. Proprietary approaches are still a major limitation for interoperability, metadata, and reuse of resources. The role of the bricoleur, who picks and choices a selection of resources from a database and assembles them into a new course environment is being studied carefully. Will this be the instructor? Or someone in a new sort of professional category?

Questions

While there is no doubt that technological change will continue, there are several major questions that are emerging.

-Are we becoming too vulnerable on ubiquitous networks and (emerging) pervasive computing?
-What if servers are overloaded or fail for other reasons?
-What if new technologies offer many different possibilities and are smaller, lighter, and more powerful, but keep changing so fast that users cannot settle down to a dependable habit of use?

-What if costs do not go down?
-What if standards are not agreed about, for example for learning resources?

These questions represent two lines of concern. One is that technology is rapidly changing, but is it moving to a point where it is too exotic for the average user? Does the average instructor want to plan educational uses of virtual reality rooms or pervasive 3-D settings? Will there be a backlash? The dimension is one of less technology- more technology.

A second dimension relates to the vulnerability that comes from depending on a server, and system (such as a WWW-based course-management system) and network for so many important transactions. What if these systems crash?

Choosing dimensions

This has only been a brief summary of what is now an explosive growth area: post-secondary education as a vast market and technology as the lever to open this market. Many different ways could be found to zoom in on key aspects of these developments and emerging contexts. In each of the sets of summaries above we have concluded with some "What if?" questions and an identification of two major dimensions that seem now to be particularly important for the future evolution of learning environments. Table 4 summarises these analyses.

Table 4. Summary of major aspects affecting the evolution and use of technology-related learning environments

	Key aspect	Directions for influence
Context	Quality control: Individual vs expert	A. The Internet as an open system; the user takes responsibility B. Intranets or controlled WWW sites as closed systems; expert responsibility for quality
	Local vs Global	A. Personal, local transactions, context specific B. Transactions via the network, context neutral
Primary processes	Local vs Global	A. Based in home institution B. Can be distributed among many different settings
	Programme vs self-choice	A. Expert determines programme B. Learner determines choices
Support	Quality control: Individual vs expert	A. User takes responsibility for choice and consequences B. Trusted agency or institution provides the services
	Local vs global	A. Support takes place locally, face-to-face, and in context B. Support takes place via the Internet
Technology	Backlash vs pervasive	A. Become less dependent on technology B. Become more dependent on technology
	Vulnerability: Local vs distance	A. If technical problems occur, a local helpdesk B. If technical problems occur, remote or non-available support

Combining all of these into a final set of two dimensions to use for the profiles, the following are chosen:

Location: Local vs global Quality control: Individual or expert

To talk further about these dimensions, some re-expressions may be helpful. *Location: Local vs Global* can also be expressed as *Place and Form of Transactions* in order to also capture the idea of interactions as well as location. *Quality control: Individual or expert* can also be expressed as *Individualisation of consumer choice* to indicate more specifically the idea of learner choice for just what he or she wants compared to specialist identification of a set programme or curriculum. The new terms are also those being commonly used in discussions of the *new economy* (Kelly, 1998). Expressed in these terms, the chosen dimensions can also be related to the eventual effect that the new economy might have on the educational market (Moonen, 1999).

We conclude this chapter with a reflection on the dimensions in terms of the focus for this study.

Place and form of transactions

Transactions have traditionally most often been carried out on a face-to-face basis, and most often via a local agent. A major change that is now occurring throughout the world is that of globalisation rather than local, and network mediated rather than face-to-face. But not all transactions are being carried out by networks with international dot.coms. Local stores and services still have an important role. Thus in the future a major tension for post-secondary education will be to find the balance between *local-and-direct*, and *global-and-via networks*. Blends of the two will be the norm. What if there are two distinct groups of students registered at an institution: Those who are present on the local campus and those who never are present? One response is to develop dual-mode delivery, two parallel forms of courses, two parallel but different series of instructional transactions. But if staff numbers stay the same, does this mean teaching load doubles? There are already many examples of institutions, for example in Australia, that have this sort of organisation, making heavy use of a WWW environment for the distant students and little or no use of this sort of learning environment for the local students. At the University of Twente, a different approach has been chosen: One course environment, with different views for different cohorts of students, and thus only parallel aspects within the course rather than two separate versions of the course.

Individualisation of consumer choice

The second major aspect of changes in society relates to the tendency toward consumer choice and individualisation. Personalised television is being seen as a major consumer growth area. Services tailored to the individual and available on his demand are growing in importance. But not all services can be offered in this manner. There is still the importance of social and group experiences, ranging from sports events to church services. In education, finding a balance between *learner choice* and *well planned curriculum* will be a major tension. A major task confronting educational institutions will be on one hand, to try to offer a tailored learning experience for the individual learner, and on the other hand to offer a quality and cohesive programme where pre-requisite skills and knowledge are gradually built up. Institutions may try to do both, or some combination of both, or decide to profile themselves around one or the other. Traditionally, it has almost always been the structured programme choice rather than the client-responsiveness approach which has been the method of operation in higher education. To what extent will this be augmented by or even replaced by the

learner-choice approach? What if an increasing number of students only want one or two courses, or portions of courses? While partly this is an issue for the procedures of the institution (How to charge fees? How to determine if pre-requisite experience is adequate?, etc.), it also has a strong relationship with the technology used. How can these individualised experiences be may available and managed? A learning environment with mechanisms for secure transactions and that is an interface to a well organised database of units of learning materials that can be packaged in response to the request of the client is required.

While each of the two dimensions in themselves presents a starting point for "What if?" questions about the future, it is their combination which is most productive. We will use these two dimensions to identify four profiles in the following chapter.

Chapter 6 Four profiles

Two critical conditions

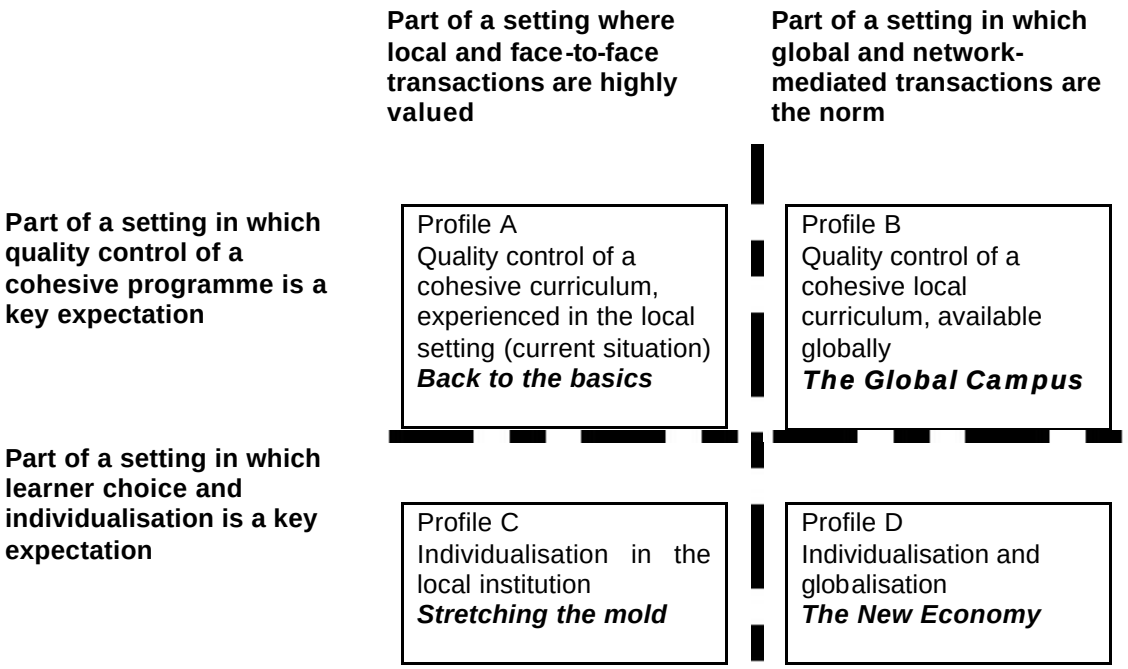
Not only relating to education, but society in general, two major dimensions were identified in Chapter 5 that can be important in projecting the future as it will related to technology-related learning environments. One of these is a dimension relating to place and form of transactions: local vs global. The other is a dimension relating to consumer choice vs quality control by an expert.

The profiles

Combining these two dimensions, the four profiles shown in Figure 4 can be seen.

Figure 4. Four profiles (approach from Miles, 2000, p. 10)

Profiles of the future in which technology-related learning environments will be:



The profiles have been given names to capture their flavours. For example:

Profile A. *Back to Basics*
Profile B. *The Global Campus*
Profile C. *Stretching the Mold*
Profile D. *The New Economy*

Profile A is the current dominant situation for many post-secondary institutions, including the University of Twente. In the future it may also become a reponse to a pendulum-swing, away from increased virtuality and commercialism in education, and back to *what universities are really about*. Many traditional universities are now moving toward some forms of Profile C, by offering more flexibility within their pre-set programmes (an example of this is the

accommodation of part-time students in the Faculty TO). What if this becomes the dominant mode in the future? It is also the case that many universities are starting to experiment with distance participation in their established programmes. What if pursuing and serving these off-campus students becomes the dominant mode (as is already happening in several Australian universities)? Profile D is the most radical; a systematic example of it does not yet seem to be available at the University of Twente. What if it became the dominant setting in the middle-range future? For all of these "What if?" questions, what are the implications for the different actors identified in Table 2?

Following are sparse sketches of the profiles.

Profile A. Back to Basics

What if students still prefer to come to a local institution, to have face-to-face contacts with their fellow students and to relate to their instructors in familiar and, to their perception, effective ways? *Virtual this and that* are seen as just hype; real learning takes place in a fine campus setting with its library, computer labs, instructors with office hours, students to interact with. What if students still prefer to leave the task of choosing courses and organising requirements for a degree to the institution? Experts in the institution are in a better position than the student to indicate what courses are useful and the order in which they are taken. How can the student decide this when he is just being introduced to the field and doesn't have a basis for these decisions? Technology appears here in sensible ways; using word processors, using email and WWW browsers, getting course information via WWW environments. WWW sites are good for extra course resources and to make communication easier. But the basics are still what matter: a well planned curriculum and regular face-to-face courses.

Profile B. The Global Campus

What if students want to study in a well-planned program, but they want to stay in their own locations and continue their own lives at the same time as they are studying? Then they are able to participate online in the program of an university, even if they don't physically ever come to that university (or only come once or a few times). Technology here becomes very important. Perhaps the student needed to use technology to find out about the programme of the university that she has chosen? Perhaps she needs to use the technology to register for the programme? She will certainly need the technology for stable access to all the course materials, and her assignments. She communicates and interacts primarily via the WWW site.

Profile C. Stretching the Mold

What if the student has no particular interest in being involved in a program or course at a distance, but would appreciate more flexibility in his local study setting? Perhaps he would like to substitute some courses from outside the home institution for courses in his own program? Or maybe he would appreciate some variety of the types of assignment that he is required to do, or some flexibility in the resources he reads or the type of didactic approach that he participates in (face-to-face groups; vs individual). For all of these technology is an important if not essential condition.

Profile D. The New Economy

What if the student wishes to make his own decisions? He is a working professional, and has a good idea of the types of courses that would be useful to his work setting. He looks to an advisory person (via the WWW) to help him better define what he wants, and then when he gets some hints, he goes to the WWW site to search for himself (or use a portal) to locate where, how and when he can do the sort of learning he wants. He doesn't mind where the course is coming from; it does matter to him that he can stay near his home and work for at least the majority of his participation. It also doesn't matter to him about the whole curriculum; he knows what he needs to know and doesn't have the time or interest to take a structured set of courses. Often, he will not want to commit himself to an entire course, but only portions.

Thus, what if these are four starting points for thinking about the future? What different images of the future evolve? This is the focus of the interviews summarised in the next chapter.

Chapter 7 Validating the profiles

To validate the profiles stated in chapter 6, A group of informants from the University of Twente was interviewed to extract their responses to the four profiles. The interview methodology used by Miles (2000) was followed. A first result of the process will be a decision about the desirability or non-desirability of the profiles and their reasonableness and potential use as the basis for scenarios. In this chapter the interviewing method and the questions for the interviews are described. Then, a short analysis of the interview data is given, leading to the idea of the different learner types in chapter 8.

Method

Each respondent is given time to become familiar with the four profiles and then asked to select the one which is in his opinion, most desirable for the future, and the one that is least desirable for the future.

For each of these profiles, show the informant the list of actors from Table 2 and ask him to select five categories of actors from that list that are most likely to be associated with the most-desirable, and then the least-desirable profiles.

For each of these profiles, show the list of factors in Table 3 and repeat the above procedure.

Then ask the informant to respond to each of the following questions, thinking first about the most-desirable profile, and then the least-desirable profile.

Questions for the interviews:

A sample will be selected from the following:

Context

- Will everyone be using the Internet? What if most people use it, but some remain outside? What are the social and ethical implications if some cannot because of circumstances related to income or living and working conditions?
- What if there is no control over what occurs when using the Internet? Will those not able themselves to judge quality be endangered by making contacts that are not good for them or investments that are not wise?
- Who should monitor quality? What if people more and more are using the Internet for communication and contact? Will social development change or suffer?
- To what extent should governments regulate and subsidise Internet connectivity, particularly to the educational sector? What if a substantial amount of money is spent on connecting institutions and individuals to the Internet, and then little use is made of this for teaching and learning?
- Who should pay? What if it costs more to participate in education because of technology costs, and students cannot or will not pay?

Organisation for teaching and learning

- Does the online degree have the same value as the traditional degree?
- How can students in online courses be kept interested to prevent high dropout rates?
- Who should an institution partner with, in what ways?
- How can instructors overcome the lack of time, training, and support that they need to integrate technology into their instructional practices effectively and to develop new didactics for student engagement and interactivity?
- Will online courses have academic vigour, or will they be seen *as digital diploma mills*, offering sub-par education?
- Will they threaten the viability of tradition campus-based institutions?
- Will online universities differentiate among instructors, a handful of popular content experts who write the curriculum and are viewed internationally, and armies in instructional-support faculty who actually implement the courses at the local level? (Newsweek, 24 April 2000)
- Will instructors be exploited? Will they be able to handle these new forms of teaching and new technologies?
- Will there be an even wider gap between digital *haves and have nots*, in society given more and more online courses?
- Who owns the course materials? The instructor, the broker, the home institution, the partner institution, the student (who may contributed to them substantially)?

Services

- Who controls what is available via portals, or what is chosen in enterprise services?
- What if there is no assurance of quality; to whom does the purchaser turn?
- What if all is done online?
- Can the sort of help that is needed be obtained by typing questions or pointing and clicking at alternatives on a WWW site?
- What if questions about education all were filtered via electronic questionnaires: Isn't there sometimes a need for trained human contract with which a troubled student can have a private and face-to-face counselling session?
- Which services are best done locally by personally known and trusted supporters, and which can benefit by economy of scale?

Technology

- Are we becoming too vulnerable on ubiquitous networks and (emerging) pervasive computing?
- What if servers are overloaded or fail for other reasons?
- What if new technologies offer many different possibilities and are smaller, lighter, and more powerful, but keep changing so fast that users cannot settle down to a dependable habit of use?
- What if costs do not go down?
- What if standards are not agreed about, for example for learning resources?

Analysis

During the interviews, it became clear, that is was very difficult for the respondents to choose a most and least desirable profile, without making a difference between two types of students; regular and masters or postgraduates. Most respondents chose very different profiles for these two groups. To clarify the difference, the interview results were separated in two categories. Table 5 shows the results for regular students:

Table 5. Choice of most and least desirable profile for regular students

Respondent	Most desirable	Least desirable
1	C (Stretching the mold)	B (Global Campus)
2	C	A (Back to Basics)
3	D *(via B of C)*	A
4	C	D (The new economy)
5	A *(toward B)*	D
6	C	A
7	B *(or C)*	D
8	D	A
9	D *(most probably B)*	A
10	D	C

In figure 5, this information is shown in a graphical manner, which clearly indicate the widespread distribution of respondent choices among the four profiles.

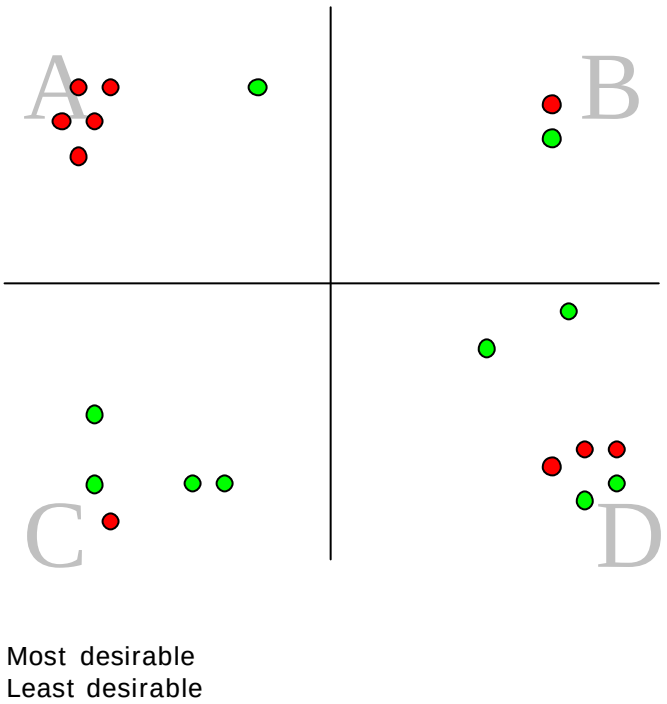


Figure 5. Choice of most and least desirable profile for regular students

What we can see in table 5 and figure 5 is, that opinions about what is the most and the least desirable profile vary greatly for regular students. Many of the respondents think profile A (Back to the Basics) is a non-desirable perspective for the future, because this is the current situation and the possibilities we have now should not be left unused.

Some people think profile D (The New Economy) is the least desirable profile, because is offers students too little structure and contact with instructors and fellow students.

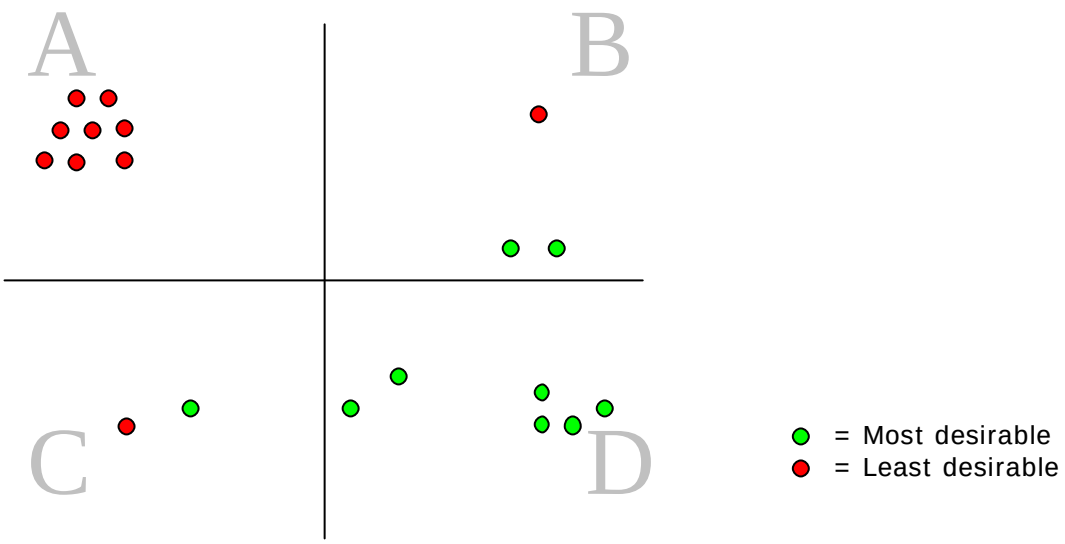
As an alternative, some respondents choose profile C (Stretching the Mold), in which regular students have a lot of freedom in selecting their curriculum, but work in a local setting.

Three respondents do choose Profile D as most desirable, whereas one person thinks more of a combination between B (The Global Campus) and D. When we look at the results for the non-regular students (masters and post-graduates) in table 6, we see a movement of this picture. Almost all respondents now choose profile D (The New Economy), some more and some less in the direction of profile B (The Global Campus) and C (Stretching the mold). Profile A (Back to Basics) is seen by almost everyone as the least desirable profile for this group of students.

Table 6. Choice of most and least desirable profile for regular students

Respondent	Most desirable	Least desirable
1	C (Stretching the mold)	B (Global Campus)
2	D *(toward C)*	A (Back to Basics)
3	D (New Economy)	A
4	D (with elements of C)	A
5	D	A
6	D	A
7	D *(with elements of B)*	A
8	D	A
9	D *(toward B)*	A
10	D	C

Figure 6, shows that for non-regular students, respondent's choices for the most and least desirable profile are grouped together around profile D (most desirable) and profile A (least desirable).



Chapter 8 From profiles to scenarios

For profiles which are judged to be good candidates for further development, the analysts will build scenario descriptions. These descriptions will be of the image-of-the-future sort (Miles, 2000; see Chapter 3).

Relating the profiles to each other

In the interviews it became clear that a single profile would not be present in isolation but instead all four profiles in different degrees would be present and interrelated. The interrelationships are expressed in the sense of a migration from one profile to another, where the earlier profile still remains but in a less-dominant form.

Profile A is the current dominant situation for many traditional post-secondary institutions. In the future **Profile A** may also become a response to a pendulum-swing, away from increased *virtuality* and commercialism in education, and back to what universities are "really about". However, it is also the case that many universities are starting to experiment with distance participation in their established programmes. This can lead from **Profile A** to **Profile B**. What if pursuing and serving these off-campus students becomes the dominant mode (as is already happening in several Australian universities) in the institution?

The migration from **Profile A** can also be to **Profile C**, where the latter relates to flexibility extension within the institution: More flexibility within courses and sometimes the opportunity to participate in some courses outside of the institution and outside of the chosen study programme can be made available for the student. Many traditional universities are now moving toward some forms of **Profile C**, by offering more flexibility for participation within their pre-set programmes.

Profile B and **Profile C** are already evolving, in often an overlapping way for many universities (Collis, 1999; see also the full report, Collis & Gommer, 2000). At the same time as programmes are becoming available to students at a distance, new flexibilities are being integrated into both local and distance courses. The idea of distance is already beginning to fade in meaningfulness, as students make an increasing number of choices about where, when, what, and how to study. The course WWW environment is becoming the technology for interaction and communication for much of the learning experience; the core technology. Other communication and interactions experiences that may occur (such as face-to-face contacts) are complementary to this core, and thus differ in their value for different students.

Profile D is the most radical; a systematic example of **Profile D** does not yet seem to be available in most traditional universities. It is most likely to be an migration from **Profile C**. What if this learner choice / global and network mediated profile became the dominant setting in the middle-range future? Will it lead to a new economy in education in the future?

Profile D is particularly relevant to learners who are in a work situation in which tailoring learning to their own contexts is essential. As more and more flexibility is offered to the learner in terms of choices in content, sequences, types of learning experiences, and original of courses or modules, the migration from **Profile C** to **Profile D** will occur. However, it will be difficult to scale up the sorts of organisational arrangements that are likely to characterise **Profile C** and **Profile D** developments unless institutional change occurs. The migration from **Profile A** to **B** and **C** can occur as an evolution within existing institution structures, but the Migration to **Profile D** will at some point require a deep change in organisational procedures.

Figure 2 represents the progression toward a new economy in education in terms of the four profiles.

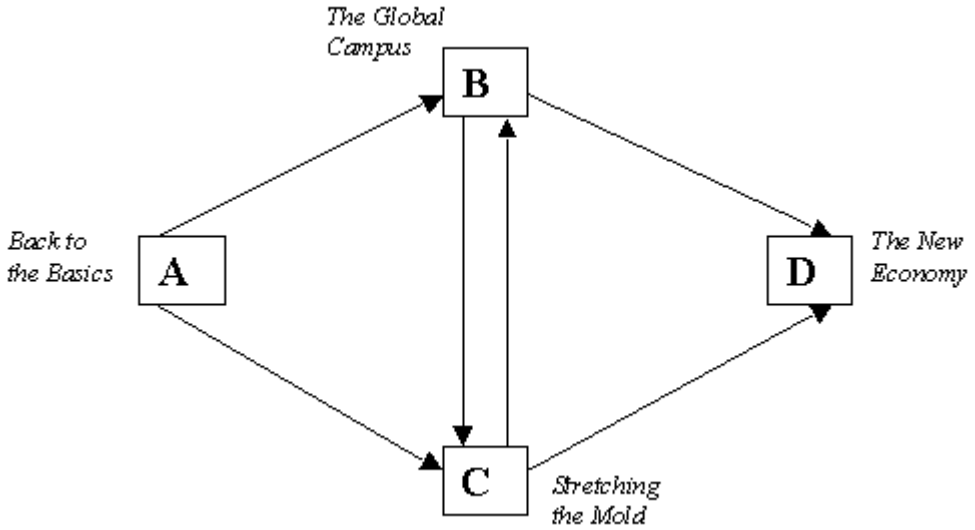


Figure 2. Evolution toward the new economy in higher education (Roosendaal, cited in Collis & Gommer, 2000; p.)

Relating types of learners and profiles

In the interviews it became clear that the desirability of individual profiles depends on the type of student involved. It may be that at the same time as **Profile D *The New Economy*** evolves as an extension of ***The Global Campus*** and ***Stretching the Mold*** for some learners, an institution may be supporting different blends of the profiles for other types of learners. In this section, different balances among the profiles are shown that may all be present at the same institution, to cater to three different categories of learners.

The first type of learner we define as the *Entry-level learner* :

> These entry-level learners can be characterized as learners who probably do not have much professional experience and/or also lack the experience to self-select and self-motivate their learning situations. They need and want a well-planned curriculum and clear expectations as to what and how to learn and what is expected of them. They expect these decisions to have been made for them by the experts within the institution. Also, because of their lack of experience as learners, they appreciate regular face-to-face sessions and guidance. Examples of such learners could be first-year students that come directly from secondary school or international students enrolling in a Masters programme for which they have limited backgrounds. This does not mean however, that these

learners do not appreciate some flexibility. Although most of their needs fit into Profile A, they will also probably call for some possibilities for choice within their fixed curriculum and some possibilities for more flexibility of time, place, resources, institutional approaches, assignments, etc., by taking some of their courses online. Figure 3 shows the blend of profiles an institution could offer to support entry-level learners, expressed in terms of the four profiles:

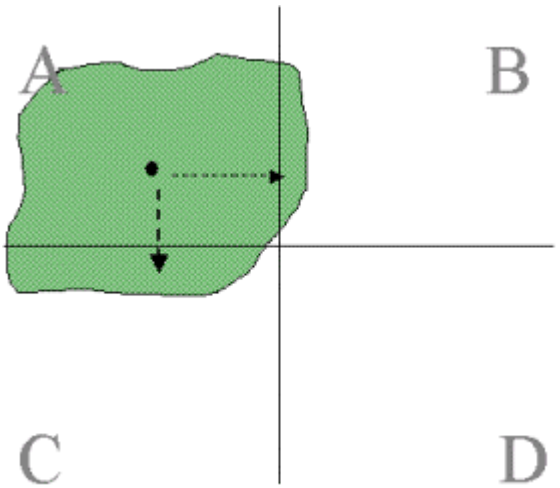


Figure 4. Profile blend for entry-level learners.

The second type of learner is the *Transitional-level learner* :

As learners get more experienced, such as during the latter period of their bachelors' phases, the emphasis of their needs moves more and more to Profile C. Students still appreciate a planned programme, but as they get more experienced, the need for more flexibility within a planned programme increases. Also, the need for face-to-face guidance decreases as students gain more capacity for self-guidance and students can take a larger part of their curriculum online. A small part of their curriculum (perhaps as a component of a local course) may actually be done according to Profile D. Figure 4 shows the blend of profiles an institution could offer to support transitional-level learners:

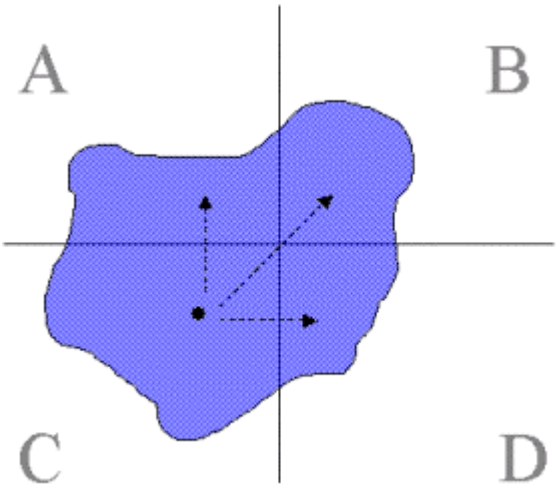


Figure 5. Profile blend for learner in transition between entry level and professional level

The third type of learner is the *professional-level learner* :

> These learners are more mature and can relate their learning to professional and life experiences. This group, that can for example consist of masters students with work affiliations in the areas in which they are studying, post graduates and life-long learners, is more experienced in learning and has to divide its time between learning and other activities as work, family and professional commitments. These learners have a need to select their own curriculum, according to their specific interests or needs. Also, professional-level learners need a high level of flexibility of time, space, content, types of study materials and assignments. For this group, the emphasis shifts from Profile C to D. Figure 6 shows this situation.

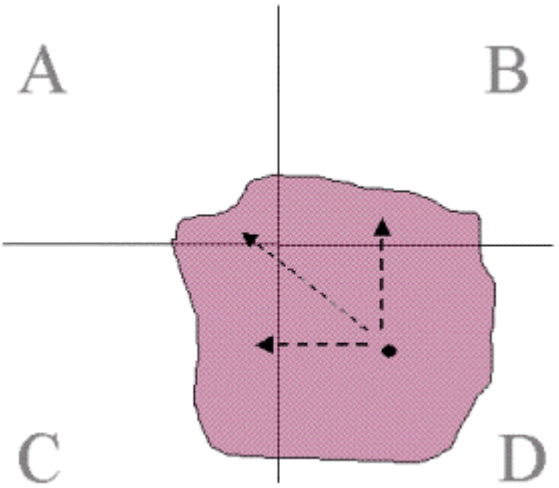


Figure 6. Profile blend for experienced or professional learners

From learners and profile blends to scenarios

Each institution should develop a strategic plan relating to the relative importance to the institution of these three types of learners in the post 2005 period. In The Netherlands, higher-education has been traditionally oriented around the entry-level learner evolving to an transitional level while within the system. "International Masters" programmes have been emerging as service to transitional learners (although some require entry-level support), and when the Bachelor-Masters structure becomes formalised the organisational door will be opened to more Profile A, B, and C blends. In several other countries, such as Canada and Australia, the orientation of the system has already shifted to an equal or even predominant focus on transitional or experienced learners. The "elite universities" in the United States and Australia make their reputations based on their "graduate schools", representing their focuses on experienced learners. In these countries, among others, the predominant profile blend is already a mixture of A, B and C. If Profile D occurs it is via individual contracts between a fee-paying client (an employer for some group of employees), usually negotiated by an office with a name such as *Continuing Education*. These activities are generally not seen as part of the general organisational or financial streams of the institution, but are periphery activities. They are not represented in its mainstream organisational procedures.

While the blend of profiles may moving toward a similar mix in different institutions, there is one important distinction. This is what we can call the *organisational basis* for the profile blends. Is the institution organised around programmes and courses which it offers in increasingly flexible ways; or is the institution organised like a library, department store, or cafeteria, in which basic **knowledge units** can be selected, mixed or matched to the client's needs? We can contrast these as a *programme*-based approach and a *knowledge-unit* based approach. In a knowledge-unit approach, a client may wish to select a full course or programme, but may also wish to order an adaptation of a course or a portion of a course, or even a finer granularity. (Perhaps a one-hour consultation with an expert?).

These two basic organisational bases can be used to define two scenarios for the C@mpus+ 2005 context. The names used for Profiles C and D are also expressive for these scenarios. Table 3 contrasts the **Stretching the Mold Scenario** and the **New Economy Scenario** in terms of the learner-client perspective.

Table 3. The learner perspective for the Stretching the Mold and New Economy scenarios

Learner activity	**Stretching the Mold scenario**	**New Economy scenario: Same as Stretching the Mold, but also:**
Makes initial choice	Chooses an institution and programme, some variation of choice within programme	Chooses programme, course, module, other knowledge unit; may pick and mix among institutions
Requests tailoring within the initial choice	Requests, to the extent allowed by the institution, variations in programme requirements Requests flexibility within a course (to the extent the institution allows and the instructor agrees)	Requests options within a module or other knowledge unit (to the extent the institution allows and the instructor agrees) Via "Beads and String" approach (Stephenson, 2000) learner or instructor may string together different knowledge units, even from different institutions, to suit the learner's needs
Manages the costs	Generally pays a fixed fee per full-time enrollment, to the home institution;(fee generally paid by government or employer, or in many non-European countries, paid by the learner himself)	Pays by knowledge unit, with vouchers or personally or via employer
Expects accreditation	Earns accreditation by following the structure of the home institution (a	May not be oriented toward a pre-specified degree, but rather just-

	pre-set number of credit units or study points needed to receive degree. Some flexibility allowed by the home institution)	in-time learning; validation of the learning comes from being able to use it in one's problem setting. May negotiate for degree-level recognition of accumulated competencies May shop around via the Internet until finding a base institution that will be flexible enough to meet his needs with respect to accreditation
Learns via some sort of instructional pattern	Accepts the pattern organised around the schedule of the institution (lectures and examinations on certain days set by the institution) although occasionally requests exceptions to this pattern; Accepts the instructional approach used within the course which is generally determined by the instructor,	Chooses either a pre-set instructional pattern or selects a combination of knowledge units from a combination of institutions and brokers to fit his wishes about instructional approach (i.e., may prefer problem-oriented learning, so shops around until he finds a problem-learning approach for the content he desires)
Expects the institution and instructor to offer:	Flexibility support within the course, can involve re-usable knowledge objects	Re-usable knowledge objects and tools to "string" the knowledge objects together

Table 3 has highlighted some differences in the two scenarios from the learner perspective. In Section 3, the implications of the two scenarios for the technology in the institution is the focus.

Chapter 9 Technologies for the scenarios

In this chapter, technology requirements for the Stretching the Mold and New Economy scenarios will be discussed, beginning at the most comprehensive level, then zooming into technology platforms for the learning aspects of the scenarios, and finishing with individual tools for learning. In the first section, the implications of the scenarios for the various information systems of the institution are compared. Following this, visualisations of differences in the core technological architectures needed to underlie the two scenarios are presented. In the third section, some key tools and functionalities likely to be of value to both scenarios are suggested, and special needs for the New Economy scenario are identified.

Integrated information systems

Every higher-education institution now has a number of complex information systems running on different technical platforms, many with legacy applications that have been hand-coded for the institution over years (Serban & Malone, 2000). The Stretching the Mold scenario may be able to evolve with only evolutionary changes to most of these existing information systems. In contrast, the New Economy scenario, if operating as an institutional approach, will require a comprehensive overhaul of these separate systems so that at least some sharing of data and replication of updates can occur. Table 4 contrasts the Stretching the Mold Scenario and the New Economy scenarios in terms of the basic information systems in the institution.

Table 4. Institutional information systems and the two scenarios

System	Stretching-the-Mold Scenario	New-Economy Scenario
Core systems: Facilities, scheduling	May not have to change much from current approach (organised around programmes and pre-scheduled courses, courses with similar scheduling patterns (# of lectures, similar lengths of courses; examinations in a set period, etc); departments decide staff load in advance). However, systems will have to be re-tuned to accept flexibility within programmes.	Might need to redesign key aspects. For example, time-tabling may have to become responsive and dynamic: Contact sessions of various types scheduled when demand is adequate, with the system then communicating to potential attendees if the requested session will occur, and if yes, when and where. New system aspects will have to be designed to match expert availability with client demand; perhaps agendas will have to searchable centrally
Finance systems: Purchasing, budgets, income records, accounts payable	Might not have to change much from current practices	Changes might be needed depending on new sorts of services that may be needed such as new sorts of technology provision
Human resources systems: Personnel and payroll	May not have to change much from current practices (Academic personnel paid fixed salary; salary and promotion based on time and academic (research-oriented)	Deep changes may become necessary: How to quantify instructor time for providing tailored services? Academic personnel may be (partly) paid *on commission*, based on demand for their knowledge units; promotion based (partially) on demand for one's knowledge units. New systems (and institutional

	variables) but financial incentives for willingness to incorporate learners with different pre-requisites and requests may be needed as a stimulus. These may cause some tuning of existing systems.	procedures and culture) will be needed for these sorts of data-management tasks.
Student systems: Financial aid, accounts receivable, communication management, registrar, degree audit/advisement, student affairs/housing, admissions, records	There will be need for interfaculty coordination, as learners may choose courses in different programmes. Centrally available data about student status will be necessary.	Deep changes will be needed. Via a business plan and policy the costs of different forms of knowledge units (with variables, such as certain "star" instructors who have a higher rate than others) will have to be decided by the institution and managed by an integrated business-information system with e-commerce aspects. accommodated by Integrated systems and databases will be critical; records will need to be kept of all clients having transactions, not just well-defined cohorts
Instruction-related systems: Prior performance of learners, learner profiles, learner portfolios, exceptions tracking	The current system (records typically kept of final marks in a course, not component marks) may have to change; Some sort of learner-portfolio needs to be centrally available for an instructor to get insight into a learner's past performance when this learner has not followed a standard path in a programme; systems will be needed to manage records related to learning experiences from other institutions	Deep changes should occur. Learner preferences and characteristics should be stored so that mentors, instructors, and even personalised *software agents* can support the individual learner effectively; learners need access to an electronic portfolio of their learning history portable across institutions; Learners will need search and preview tools as well as decision-support help in order to make choices; the underlying system might need to be re-designed. Instructors need tools for re-use and "beads & string" approaches to knowledge-unit assemblage (Stephenson, 2000; *stringing together* appropriate combinations of learning resources and activities given client wishes); institutional policies with respect to copyright and access privileges will have to be supported by the learning-related system
Contact development systems: Major prospects, alumni, activities and events, institutional information, gift and pledge processing	The current evolution to use of public WWW sites as information sources about the institution and its up-coming events will continue. New systems should evolve to link inquiries from the WWW sites directly to different databases of the organisation.	This may be able to evolve but at a certain point will need to be integrated with other systems. Potential clients must be located and contacted in a professional manner. Marketing will become international; therefore the language for transactions needs to be standardised within the organization.

What are key differences in the Stretching the Mold and New Economy scenarios in terms of the information systems in Table 3? The Stretching the Mold scenario can continue with its existing systems, but this will at some point curtail the amount that the system can stretch and bring increasing frustration to all in the enterprise (Edirisooriya, 2000). Also, "there is abundant evidence concerning the ad-hoc manner in which information management systems evolved within higher education institutions…each unit has developed or purchased an individual system to suit its own needs" (pp. 44-45). Gradually what will be needed is a move toward an integrated educational information management system as well as institutional-wide systems for access rights and control to learning resources and environments. A single log-in system where the user's log-in id is linked not only to course-access rights but also to secondary services such as printing and costs for network access will emerge.

The latter is the starting point for a New Economy scenario. The key concept is boundary crossing, with the gradual elimination of shadow systems and discouragement of duplicate or add-on systems. This is not only a technical question but also involves organisational and human issues. Cross-department discussions of workflow and shared decision making need to occur but under strong coordination and project management (Serban & Malone, 2000). Costs in terms of the information systems involved for offering a knowledge-unit approach in a comprehensive manner may be more than the home institution itself can finance; consortia or third-party services may take increasingly important roles (Ryan & Miller, 2000). The business-management aspects of the New Economy scenario may increasingly come under the management of outside, professional brokers. Institutions will provide services as coordinated by the broker, and thus internal information systems will have to change to match the dataflows needed by the broker.

Technology requirements and architectures

While the previous section focused on information systems of all sorts at the institutional level, the systems involved with the actual support of learning need further discussion. A key difference in the two scenarios relates to the nature of the content-related unit or commodity, the knowledge unit, which is being offered to learners. In the Stretching the Mold scenario, the unit is the programme, with possibilities for tailoring within this unit. In the New Economy scenario, the unit is an object in a (distributed) database of knowledge objects. Courses will continue as a familiar type of knowledge unit, but also portions of courses, and other sorts of knowledge units that may or may not have been originally part of a course entity, will be available via a knowledge-unit database. Although most of the knowledge units will originate in a learning context (i.e., made for a course setting), an increasing number of knowledge units will come directly from the knowledge base of the institution itself, and from sources outside the institution, such as professional portal sites on the WWW. Knowledge units can also be defined in terms of communication possibilities rather than specific content. For example, experienced learners may wish to have an opportunity for interaction with a particular more than they are concerned about pre-specified content. Figure 7 shows a general architecture of the Stretching the Mold scenario. Figure 8 shows a general architecture of the New Economy scenario. The figures are based on De Boer, 2000.

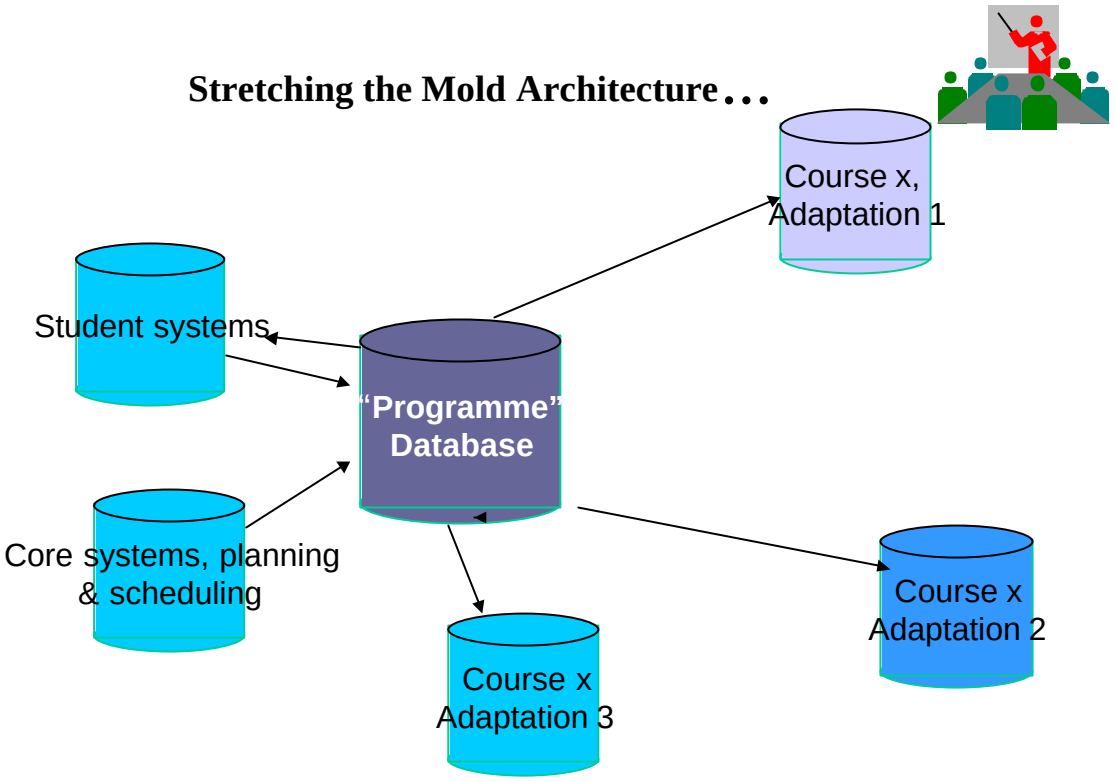


Figure 7. Architecture for the Stretching the Mold scenario

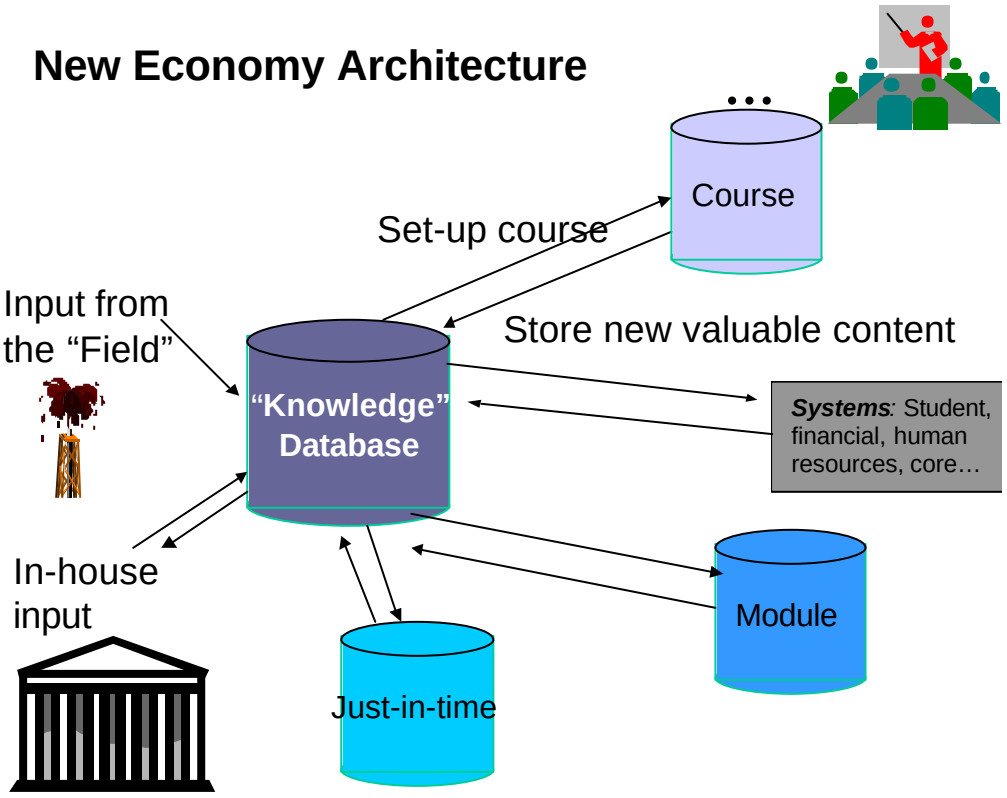


Figure 8. Architecture for a New Economy scenario

There are several key variations in the two architectures. In the Stretching the Mold architecture the programme database may need to be no more than pointers to the separate databases of individual courses. New entries to the database will only take place in a systematic way, via the institution, when a new course or programme change occurs. Issues such as metadata and change of privileges for a knowledge unit in a re-use context are not likely to occur. However, the databases for the courses will be under strain, as more calls for individualisation come from the learners. Tools so that views of a course environment can be easily tailored for different cohorts of learners (for example, variations in assignments or rows of a course roster for different cohorts or even individual learners) will only be feasible if the systems used can handle view flexibility.

In contrast, in the New Economy architecture, the knowledge base is more dynamic as well as no longer constrained to only courses and programmes. Learners can contribute to this knowledge base themselves, especially experienced learners who can develop, for example, case reports in the context of participation in a knowledge unit and then allow the copying of these reports into the knowledge base as new knowledge units for re-use by others. Resources of different granularities will come into the database, from different origins and of different data types. There are substantial implications for the organisation of the database in these sorts of fluid conditions. The indexing of a dynamic flow of (multimedia) objects into the database will be a major challenge as well the management of access privileges per knowledge unit. When costing and use tracking needs to be associated with knowledge unit, the complexity increases even more. An institution would be wise to model the processes involved and validate them in a simulated business system of some sort before any sort of public role out.

Tools and functionalities

View flexibility is an example of a technical issue that involves both system architecture and user tools and functionalities. In this section we look at some emerging tools and functionalities that are likely to be of value to both the scenarios, and then look at some special requirements for the New Economy scenario.

Web-based course-management systems.
For both scenarios, current developments in tools and functionalities will continue and become increasingly powerful, flexible, and user friendly.. Microsoft, for example
(http://www.microsoft.com/education/planning/online/wpaper_cc.asp, 2000) indicates that

> "the online learning system must be a container of robust interactive, communications, network and knowledge database functionalities, "smart" courseware templates and open-standards Internet technologies which, together, form a resource-rich virtual classroom and remote certification platform."

In particular, this will require much more complex tools and support than are currently available, for:

- Re-use on demand of re-recorded streaming multimedia, also for mobile access
- Whiteboards, application sharing, and multi-media conferencing, also for mobile access
- New search facilities, such as for non-text objects (simulations, applets, animations, images, segments of stored audio and video, etc), also for mobile access. New input possibilities such as voice or symbol for searching
- Ability to set and pre-test competency criteria, as learners increasing will come from different streams and backgrounds into a course or knowledge-unit activities; direct branching to appropriate remediation materials for those missing some required background
- Tools to tailor and manage assignments, monitoring of learners, and different forms of intervention and feedback . New feedback and communication tools, such as audio-feedback
- Progress-tracking tools with views for learners, instructors, and mentors
- Workflow tools and other tools for management and monitoring, particularly of groups

Knowledge-management tools

The need for learners to organise and manage their knowledge units and learning activities will grow rapidly, in both scenarios. The capacity for personalisation of Web-based portals has only begun. There is a rapid evolution occurring from bookmark collections to agent-maintained knowledge collections (Jensen, 2000). . Access to portals can be via various input approaches including audio. Knowledge portals will be multimedia collections including audio, video (streaming), symbols, interactive resources, and text. Mobile access will be a normal occurance.

Tools to organise, visualise and share knowledge, such as the current tool called "The Brain" http://www.thebrain.com/ will be useful in the Stretching the Mold scenario and almost necessary in the New Economy scenario. These sorts of tool can help users instructors seeking items for re-use and learners seeking knowledge units to move through large datasets in a way that is tailored to the user's own approach to combining concepts. Figure 9 shows an example from the use of *The Brain*.

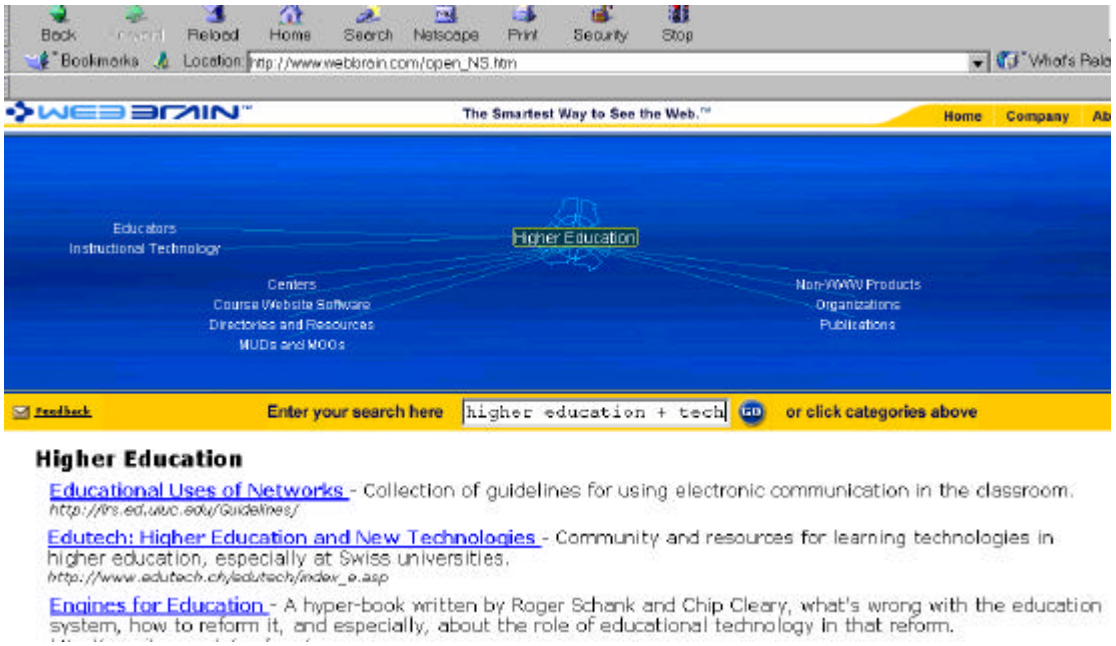


Figure 9. Result of a search for the terms "higher education" + "technology" using *The Brain* for knowledge representation. Each link can be further expanded into a grouped listing of URLs.

The existing tool shown in Figure 9 is only at the beginning of sophistication in terms of knowledge-management tools. Learners will be able in the future to design new combinations of learning resources or knowledge units using such tools and "order" their combinations directly via the tools. Agent technology will become increasingly powerful, to remember the knowledge-related profiles of the learner and manage knowledge collections accordingly. The interfaces provided by the tools will have to link to the information systems of the institutions providing knowledge-unit services.

Integrated tools and functionalities

To anticipate the New Economy scenario as well as to optimise the Stretching the Mold scenario, various user requirements can be identified for which integrated tools and functionalities to meet those requirements will be needed (see for example, Hochstettler, McFarland, Martin, & Watters, 2000). The knowledge-management tools discussed above are in this category, but many others can be anticipated. In Table 5 a mapping is made between user needs in the New Economy scenario and technology requirements. Some of the user needs and also present in the Stretching the Mold scenario.

Table 5. User requirements, tools and functionalities for the New Economy scenario (Collis & Moonen, 2001)

User actions and requirements	**Technology requirements**
Access & privileges: A professional community shares access to a common database or interconnected distributed databases and evolves a procedure for certain categories of resources into the database for communal use.	Privileges for distributed users, allowing differentiated read and write access
Entry & labeling of objects: When entering a resource into the shared database, a simple to use check-list process allows the addition of metadata tags to the resource. The least number of tags for use in practice is the goal as instructors will not take the time to make more than a few key indications.	Granularity will be expressed in terms of what can be entered as a single file or linked to from a single-view overview. Tools for users to easily add or adapt metadata tags and add new ones if necessary must be available. Views of the objects in the database selected around any given set of tags or other key categories can be called up in which the associated objects can be listed in terms of frequency of access. Rules can move objects to an archival status after a designated period of non-access.
Instructor support: To create a course-support environment, tools are present in the system leading the instructor through the steps in setting up a course environment, in terms of general organisational features, communication features, a device such as the TeleTOP Roster which presents an integrated overview of study materials and activity instructions and support, groupware features, resource-management features, and special features such as quiz tools. This is also needed for Stretching the Mold.	The course-management system should be integrated with an instructor-support tool to lead the instructor through options associated with the organisation of his course. The tool should directly generate a new database associated with the underlying database.
Re-use tools: The instructor should be able to sort and choose from resources from the associated database (the general database and other databases created in relation to this) and copy whatever resources she wishes to the new site and also move the objects from a completed version of the course that she wants to re-use in other settings back to the main database. This is also needed for Stretching the Mold.	A sort and copy tool relating to all databases to which the user has access is needed to facilitate the copying of resources. Copying allows new privileges to be assigned to the resources, privileges that may be different in different data bases.
Learner-contribution tools: Learners studying with the new course environment not only use the selected resources provided by the instructor (both from other courses or from non-course related sources) but also enter new resources into	The system must handle student submissions as ordinary objects, and should provide a tool for the instructor to easily designate which student submissions should be copied for possible re-use.

the course database. The instructor can indicate with a simple click which of these learner-contributed resources are candidates for re-use and thus transfer to the master database or to a new copy of the course database adapted for a different learner population. This may also be desirable for Stretching the Mold.	
View options: Different views of the database can identify different categories of objects, different patterns and dates of access, and different authors, among other possibilities. Members of the community can also attach comments and rating codes to objects. This is also needed for Stretching the Mold.	The system should allow user-tailored views and the adding of notes or additional codes to objects. Tools such as concept-mapping tools can show different clusters and categories.
Ownership: The knowledge community itself decides on procedures for maintenance of the database, for updating categories, and assigning read and write privileges.	Tools in the shared workspace should support these activities.

All of the technology tools discussed in this section are already emerging but there are much to be done before they can be used to scale up a Stretching the Mold or New Economy scenario to rollout use. How to plan a path from today's C@mpus+ to the future scenarios? In Section 4 we consider two development lines from the current state of C@mpus+, including TeleTOP, to a C@mpus+ 2005 for the Stretching the Mold and New Economy scenarios.

Chapter 10 From scenarios to processes

In this section we conclude the report by suggesting two paths to a C@mpus+ 2005 platform to support the Stretching the Mold and New Economy scenarios. One path is evolutionary, the other is interventionist.

The evolutionary path is one of continuing current trends toward Profiles B and C, with courses become increasing flexible, such as when both regular- and part-time students are accommodated in the same courses. The use of a well-designed corse-management system can support and even stimulate flexibility within courses, especially when tools are used to allow easy tailoring of different views of the roster (course organiser), news, and course information areas to different user-defined groups. Flexibility within courses can evolve at the instructor's pace. Instructors can continue to think in terms of courses and the institution in terms of programmes. All that has to change is the instructor's willingness to offer options within the course, and the tool options to make different views easily available in the same course environment. Re-use of existing resources can gradually grow as well, as instructors see the value of such re-use, first within their own courses from year to year, and then later between courses.

The interventionist path is one of stimulating a change in thinking and in work habits in the institution. Instead of only thinking of one's course, the idea in the interventionist path is to stimulate colleagues in the same discipline to think of a common knowledge base into which all instructors occasionally contribute and from which all occasionally select re-usable knowledge units. These units can be objects created previously for a particular course (such as a PowerPoint presentation), objects contributed by students in a particular course (such as a model example of student work), objects coming out of the professional activities of the instructors such as papers and conference presentations, objects representing "showcase" examples of student work such as final-project reports or dissertations, and objects from external sources. Placing knowledge units in the communal knowledge base makes them available for re-use and re-combination. Such a way of thinking involves a perspective a level higher than one's own course and thus coordination at the programme level. It involves policy with respect to ownership and conditions for use by others than the intellectual owner. It also requires a technical platform that makes the movement between one's own course environment and the common knowledge environment as simple as possible.

The evolutionary and interventionist paths could share a number of characteristics as they evolve over the next several years, but work out those characteristics in different ways. Also, there are clear differences in conceptual bases of the paths, and perhaps in the results. Figure 10 shows key aspects of the paths. The prediction in the figure is that an evolutionary path is not likely to end in the New Economy scenario within the "2005" timeline. In contrast it is predicted that an interventionist approach can lead to both the Stretching the Mold and New Economy scenarios, but at a cost and speed that the institution may not be able to bare.

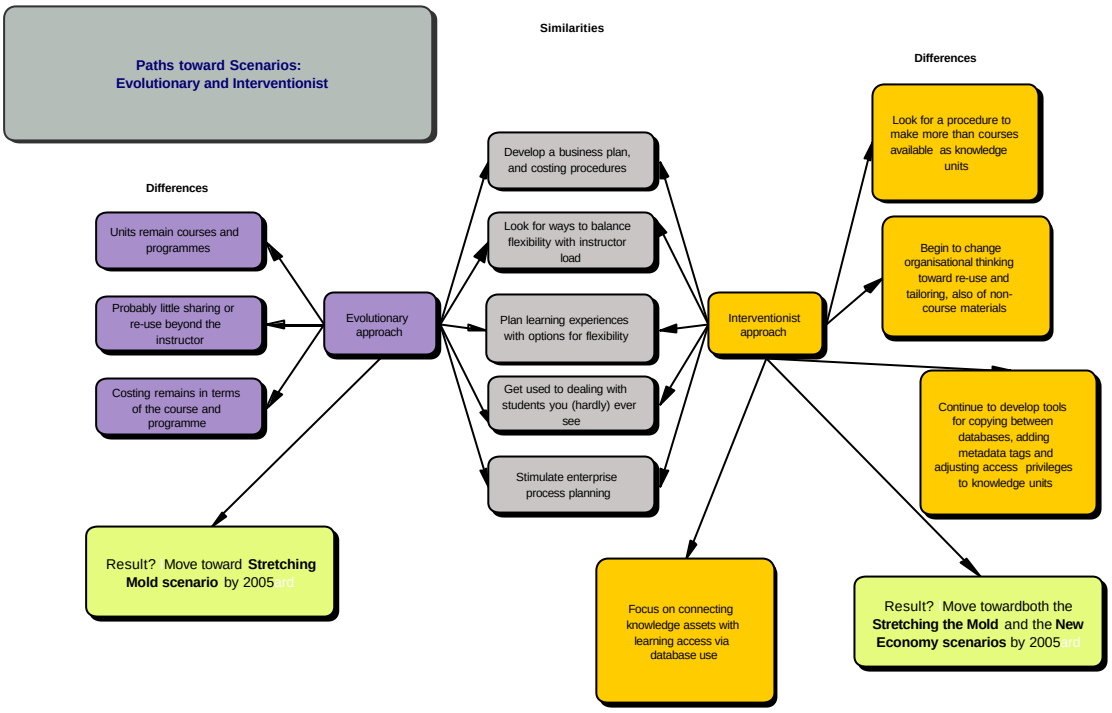


Figure 10. Evolutionary path, leading to the Stretching the Mold scenario, and interventionist path, leading to both the Stretching the Mold and New Economy scenarios

Figure 10 shows the prediction that an evolutionary path is not likely to lead to scaling up of a New Economy scenario for 2005+. This is because organisationally, mentally, and technically, the continuation of procedures based on pre-set programmes and pre-defined courses, even with increased flexibility within them, is not conducive to a library or cafeteria approach, where one client can metaphorically choose only a small "starter" while another wishes a three-course meal. The ability to re-use knowledge units not only originating as course material but also including resources from the knowledge base of the professionals and experienced learners involved also has another important aspect. It is a way to better integrate the intellectual assets of an institution with the for-learning materials and processes. In companies, this is becoming an urgent need, as in-house expertise can take a great deal of time to move through the "course-production" processes and become available as learning materials in the company. Links--organisational, human, and technical--between knowledge-management systems in knowledge institutions and training systems are difficult to realise or exploit. The "knowledge base-flexible learning" intervention appears a way to move forward. The evolutionary path, however, is manageable and realisable. The decision to move toward the New Economy via an intervention path would not to be the strategic choice of the entire university, with policy and funding to match. However, preliminary modeling for the New Economy can and should take place at the same time as support for Stretching the Mold occurs.

Strategic questions for the University of Twente

A number of strategic considerations need attention if the University of Twente is to maintain its national and international profile with regard to learning environments. For each of these, strategic visions and policies need to be put into place, followed by modelling and implementation cycles.

What are the major goals?

Without a common sense of goal, the University runs the risk of drifting; sponsoring or tolerating a series of incentives but not moving to a clear target around which decisions can be made. Is the goal more students? More research? More multidisciplinarity? More return on investment? A more well-defined profile? More differentiation from other universities? More collaboration with other universities? Competencies or course objectives? *Academische vorming* or learning on demand? Depth or breadth? The answer cannot be that the goal is everything; some sort of priorisation should occur.

Which types of learners?

The University of Twente is organised at present around a **Profile A** approach and an expectation that the mainstream cohorts of students are entry-level. At the same time, efforts to attract these entry-level cohorts from traditional intakes are not very successful for many faculties. Where is the growth potential in terms of student intake for the University? Modelling of different combinations of entry-level, transitional-level, and professional-level learners should occur. Should we move toward being an institution that focuses its reputation on its "graduate school" (Masters and PhDs, as is the case with many of the elite universities in North America)? If the University continues to organise itself around a Profile A and an entry-level approach (i.e., its Bachelor's programme), then the likelihood of also attracting substantial numbers of professional-level clients in its Masters or an eventual Graduate School must be questioned. A return-on-investment analysis for simulated cohorts of the three types of learners could identify where the growth potential lies.

Which types of pedagogical approaches?

Flexibility involves more than time and location; flexibility in terms of pedagogy and learning organisation (group work vs individual projects; project-based vs expository; practicum-based vs simulations or self-study of examples; communication oriented vs resource oriented are only some of the bipolar options). Instructors need guidance and tools to offer a choice to learners. Also, the institution should perhaps not try to offer a carte blanche selection but instead profile itself around several instructional alternatives and develop pedagogical models and templates for TeleTOP that support those models. Universities such as Maastricht (with problem-based learning), Aalborg (with project-based learning), Harvard (with case-based learning) have taken the step to profile themselves with a certain pedagogical model and thus mold institutional procedures around such a model. For efficiencies and scalability, the University of Twente should consider some well-defined pedagogical profiles for itself, and optimise delivery of those profiles. The de facto profile in many faculties, (colleges & groep opdrachten & tentamen) has been long institutionalised. New pedagogical profiles now need to be studied in terms of their operational procedures. Modelling again is needed.

Might we need to move toward different categories of instructors?

There is no explicit differentiation of instructors at the University of Twente; salary is based on level and time of service, not differentiation with regard to the contribution of an individual to the learner intake of the organisation. In some models of the *New Economy*, the suggestion has been made that learners will choose "star" instructors for core aspects of a learning experience and turn to a different cadre of instructors for mentoring and support and feedback on learner work. A *Stretching the Mold* approach could for example mean that a re-usable collection of "star" resources (and presenters) particularly for content that occurs in different disciplines could become the core learning materials with faculty or programme level tutoring for feedback and application. In a *New Economy* approach, learners could choose this "star" material from other institutions, and choose UTwente as the base for local tutoring. The model moves then toward that of the Open Universities. To what extent, and with what incentives and recognition, are we willing to move toward this approach? It is possible that each faculty could eventually have a few star instructors who could bring in a large number of transitional- and professional-level learners. What are the implications?

How does our knowledge become a commodity?

Many implications arise when or if we move toward a systemic commodisation of our knowledge. What are the knowledge units? How does selection, maintenance, and responsiveness to client demand occur? Who owns a knowledge unit? What quantification, fee for access, and accreditation standards apply? How is the balance between university and local decision making and control maintained? What are the implications for units rarely chosen as commodities? How can TeleTOP handle handle a reusable knowledge-unit approach?

A unique profile, or partnerships?

The University of Twente is active in many consortia and partnerships relating to new forms of educational delivery. To what extent can it continue to commit to these and at the same time develop and maintain its own profile and approach and its own technical system? The risk is that, for most of these collaborations, only a relatively few are involved and no systemic input on the University as a whole will occur. Should we define our own model more clearly before attempting to blend with others? What happens when the goals of a partnership involve a different model than our own approaches, as is already the case in consortia in which for example the University is involved in which course-management systems different than TeleTOP are involved? Should we be content if partnerships represent niche associations? Is the return on investment warranted? Are partnerships such as EUNITE and ECIU more likely to become operationally meaningful in a *Stretching the Mold* or *New Economy* scenario?

Who should model the new value chain for the University?

Many players are involved; both research and operational considerations need attention. Under what sort of construction should partners such as the DINKEL, CTIT, CHEPS, TO, BSK, T & M, and other faculties with research expertise relevant to the *New Economy* and its operationalisation be organised? Which unit should take the lead? Who on the new CvB is the key innovation leader?

Recommendations for the University of Twente

The following recommendations for the Steering Group Learning Environments reflect the analysis in this report:

1. *Set the target*: At the policy level, take a decision as to the priorisation of types of learners for the next decade at the University of Twente. Base this decision with input from a modelling exercise. Stimulate a wide discussion of the two scenarios; articulate a vision for the institution relating to the scenarios (or alternatives).
2. *Become more systematic about Stretching the Mold*: Continue the current process of migration to a *Stretching the Mold* scenario that is already underway at the University of Twente, by developing a business plan related to the learner-type priorisation in Step 1. Parallel to this, model and plan for the integration of information systems that will be needed for both the *Stretching the Mold* and *New Economy* scenarios (see Table 4). Stimulate the development of decision-support tools for instructors to guide them in terms of strategies for "stretching the mold" of their courses, particularly the ideas of re-use and tailoring of views for different learner characteristics.
3. *Stimulate new tools*: Stimulate targeted R&D projects on technical innovations for tools as described in Chapter 3 and also for their integration into future releases of TeleTOP (and TeleTOP powered by Lotus):
   - -Re-use on demand of pre-recorded streaming multimedia, also for mobile access
   - -White boards, application sharing, and multi-media conferencing, also for mobile access
   - -New search facilities, such as for non-text objects (simulations, applets, animations, images, segments of stored audio and video, etc), also for mobile access. New input possibilities such as voice or symbol for searching
   - -Ability to set and pre-test competency criteria, as learners increasingly will come from different streams and backgrounds into a course or knowledge-unit activities; direct branching to appropriate remediation materials for those missing some required background
   - -Tools to tailor and manage assignments, monitoring of learners, and different forms of intervention and feedback. New feedback and communication tools, such as audio-feedback
   - -Progress-tracking tools with views for learners, instructors, and mentors
   - -Workflow tools and other tools for management and monitoring, particularly of groups
   - -Knowledge-unit management tools
   - -Other tools as listed in Table 5 that relate to the *New Economy* scenario.

4. *Develop expertise in aspects of a knowledge-unit approach*: Begin a pilot plan for a migration to the *New Economy* scenario via an interventionist path:
   - -Call for a study of a business plan for this approach and model the implications for system integration that would be needed to implement the plan
   - -Stimulate research relating to metadata and re-use aspects of knowledge units and their relationship to multimedia databases, to support tools for instructors, to appropriate pedagogies for a knowledge-unit approach, and to knowledge-unit management options for learners (see Table 5). Call for R&D work for future versions of the UT version (and the commercial, TeleTOP powered by Lotus, version) of TeleTOP that focus on the knowledge-base and re-use chain architecture and functionalities (see Figure 8 and Table 5).

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Appendix 1: Informants in first and second round of interviews

First round of interviews

Prof. Dr. H.E. Roosendaal (DINKEL, Advice Group Campus+)

Dr. H. Alblas (INF, Advice Group Campus+)

Dr. M.C. van der Wende (CHEPS, Advice Group Campus+)

Dr. E. Heeren (???,Advice Group Campus+)

Drs. P.H.G. Fisser (EdTe, Advice Group Campus+)

Second round of interviews

Prof. Dr. J.M. Pieters (EdTe)

Prof.Dr.Ir. A.J. Mouthaan (EL)

Ir. M.P. van Geloven (DINKEL)

Drs. A.B.M. Koppen (CIV)

S.J. van Tongeren (BCvB)

Prof. Dr. H.E. Roosendaal (DINKEL, Advice Group Campus+)

Dr. H. Alblas (INF, Advice Group Campus+)

Dr. M.C. van der Wende (CHEPS, Advice Group Campus+)

Dr. E. Heeren (???,Advice Group Campus+)

Drs. P.H.G. Fisser (EdTe, Advice Group Campus+)

Appendix 2: Literature and sources used in analysis of developments and emerging contexts

- *EDUPAGE*, a weekly electronic newsletter produced by EDUCAUSE, summarising news releases from around the world related to "transforming education through information technologies". Past issues are available at http://www.educase.edu/pub/edupage/edupage.html
- Other listservs including *The Learning Marketplace* (http://www.center.rpi.edu/Lforum/LdfLM.html) and *the Pew Learning and Technology Program Newsletter* (http://www.center.rpi.edu/PewHome.html)
- Newspaper articles from local (*UT-nieuws*), regional, national and international newspapers
- English-language news magazines including *Time, U.S. News and World Report* and *Newsweek*
- Dutch magazines including *Computable, Telewerken* and *Intermediair*
- WWW sites from consortia related to "virtual universities", from commercial and non-commercial educational services, relating to European workshops and taskforces, associated with conferences relating to higher education, and WWW sites of specific universities and consortia. (For one collection of these WWW sites, see http://education2.edte.utwente.nl/ictho.nsf/framesform
- Project, advisory, and commission reports (see in particular: Brockhau, Emrich, & Mei-Pochtler, 2000; Collis & van der Wende, 1999; Encarnaçao, Leidhold, & Reuter, 2000)
- Books and journal articles (see in particular, Ben-Jacob, Levin, & Ben-Jacob, 2000; and Hardin & Ziebarth, 2000)

Appendix 3: Overview of news items and reports assembled during the exploratory phase

In each item below, the title of a news or magazine item, press release or short report, or a summary sentence from a short press release or report is given. The actual wording is used, to most directly capture the flavour of current reporting. To improve readability, quotation marks are not added here, but should be assumed as surrounding (most of) the items. Some items are paraphrases of the actual titles. Full references for each item can be supplied but are not listed separately in this report.

Context

Socio-cultural:

- People are becoming more comfortable with Internet technology as an everyday-tool.
- Worldwide Internet use to reach 130,6 million in 2000 and 350 million in 2003.
- The US earns a share of every e-commerce dollar, with Germany and the UK following next.
- City kids more likely to be wired: Children in the 2-to-5 year age bracket average three hours a week on the Internet…More than 5 million kids below the age of 12 are Internet users. (USA)
- Young Web users reshaping consumer demands
- Employees spend one third of a workday behind the computer.
- People spend more time online and less time interacting with family and friends.
- De Nieuwe Economie, een nieuwe revolutie staat voor de deur.

Business-training trends:

- Corporate training programs are necessary because of fast-paced technological developments and also encourage workers to remain loyal to their employers.
- E-learning has arrived on the plant floor…E-learning is the latest tool companies are using to cut costs, boost efficiency, and maintain a highly trained workforce.
- Just-in-time learning: By offering substantial time and money savings, as well as the most current content, e-learning training programs are becoming increasingly popular
- The electronic, just-in-time learning market is expected to reach $11.4 billion in 2003, up from over $1 billion in 1999.
- The evolution of online learning: By 2005, at least 50% of IT training will happen online

General aspects relating to education:

- The coming of the new millennium encourages a new vision in education
- States get serious about educational technology
- FCC gives approval for $1 billion to link schools to Internet (USA)
- As computers idle in classrooms, training for teachers is the next challenge
- The learner of the 21st century…academically independent and a life-long learner
- Is there a new economy in education?
- Lack of reliable scientific support for the assertion that ICT is beneficial to learning.

General aspects relating to higher education:

- Universities spend large parts of their budgets on ICT
- Wired on campus e-life: 60% of college students go online daily and 85% own their own computers (USA)
- A computer in every room: PCs become standard issue (USA)
- University students will spend $700 million online during 2000 and over $4 billion online annually by 2002 (USA).
- Universities master Web-based administration
- Push for higher education computer literacy test: All students to be computer literate before graduation (USA)
- America's 100 most wired colleges: Undergraduates are as interested in a college's Net resources as in its curriculum or social life…
- State regulations are slowing the growth of online education.
- Universities are increasingly facing problems with students violating copyrights, selling lecture notes to companies.
- Ivory tower open source: Software allows academic authors to post their papers online to solicit outside reviews
- Web-based education models affect traditional structures of education, such as diploma granting, authority, state and local accreditation, etc.
- Study-financing gets more flexible. Students can stop and start study financing every month and take a break from their studies. Dutch government is responding to different needs.
- Light raise in student enrolment expected because of a larger group of young people.
- Dimensions of change in the area of online education: virtualisation, globalisation, lifelong learning, customer orientation

Organisation and didactics of teaching and learning (primary processes)

General changes relating to course delivery

- Internationalisation of education; universities are starting up international alliances and students will be more and more able to do part of their study in another country.
- More competition between universities enhances the need of universities to position themselves on the educational market.
- Because of the increasing need of life-long learning, universities can expect a new group of non-regular students participating in education (part-timers, adult learners, etc,) either sent by companies or on own initiative.
- Learning is getting more flexible and individualised
- Online teaching to save universities and students money and time.
- U.S. colleges offer more and more accredited degrees online.
- *Collaborative network learning* will be the learning environment of the future
- Fusing modules together to form the desired course will become the norm
- State U is quietly morphing into College.com (USA)
- Millions of adults are dialling up for diplomas…the "typical" college student--18 to 22 years, living in dorms, studying full time--makes up only 16% of enrolments today (USA)
- Study any time! College has never been more convenient
- In one year, remote enrolment has more than tripled (USA)
- Savvy e-learners drive revolution in education
- Traditional universities and colleges face a bleak future
- Online education may be the next big thing

- Education is becoming a life-long activity and the Internet is the most efficient means of delivering this product
- Traditional residential higher education to be obsolete within 30 years

Providers and models

- More co-operation between universities such as with joint educational programs.
- Universities start-up ventures with technology companies.
- Four types of educational institutions: traditional college, corporate universities (on-site training programs from companies), mega-universities without national boundaries and virtual universities that operate entirely online.
- E-universities are created in the UK, leading to an entirely internet-based degree.
- American business schools offer online and offline possibilities for students to study e-commerce.

New didactic possibilities

- (Digital) portfolios are being used more and more in education for progress monitoring and assessment. By keeping a portfolio, students take responsibility for their own learning process.
- Students taking a more-active role in their courses is a major trend.

Issues

- Questions are raised; does the online degree have the same value as the traditional degree?
- Teachers lack time, training and help to integrate technology into the classroom effectively and make learning interactive
- Online courses have higher dropout rates than traditional courses. The challenge is to keep students interested.
- Distance learning is no substitute for real-world education
- Traditional college life can't be replicated online

Services supporting teaching and learning

Enterprises

- *EduCommerce* combines online course offerings with advertising content
- New profits for professors; universities offer knowledge online for profit.
- Online note services are offered to students on commercial websites. Teachers worry about how this will affect their classrooms.
- Services offer help to instructors designing online courses
- The market for abstracts, old tests, and college notes is flourishing.
- E-commerce sites supply students and educators with everything from study-materials, pens, college notes, etc.
- Making new markets: The dynamics of space have given way to the economics of attention
- E-tailers grab part of college textbook trade; bookstores counter by beginning their own online services
- The global community: Regents College is an example of college that only offers secondary provision. It offers all services except teaching. Services offered are: assessment, educational brokering, academic advising,

credentialing, etc. They operate on a distance, using the Internet (online library and bookstore).
- From Ivory Tower to open source: New tools stimulate professors to share their writing on the WWW
- Data mining afforded by e-registration can enhance recruiting efforts
- Institutions can have their WWW sites developed for free-with advertising
- The library as the latest Web venture

Portals
- Portal services offer online catalogues where prospective students can find information on existing programmes
- Research universities team up to create a portal
- Collaborative portals provide students with most of the sorts of services that they need
- Partners aim to create global library on the Web
- Museums, universities, and libraries form knowledge portal
- Medical school develops a portal for cutting-edge medical data
- Portal services allow matchmaking

Technology

Network and access

- Next generation Internet 2 will improve the performance of traditional internet (high speed, possibilities for video and multicasting)
- Apple, RealNetworks join to broadcast audio, video over Internet
- Rush of high speed services
- Enter the fast lane to get access to the Web
- Internet services for stereos and home televisions
- DSL makes high speed internet connection possible.
- Wired for success
- The market for wireless Internet services is exploding. But before wireless gets wide-spread, Internet speed must increase, Internet phones must be more user friendly, etc.
- The market for handhelds (palm pilots) is growing.
- Plans for wireless campus
- The future is at hand: Wireless technology has introduced the age of the handheld device
- More campuses go wireless
- Always connected, anywhere: Mobile Internet
- User is identifiable and characterised
- Server farms now appearing
- Harmonisation of national regulation and policies at the European level is needed
- Improvement of access network diffusion and speed for end users is critical
- Decrease in operative costs of ICT networks needed for education

Products: Software and hardware

- More Canadian colleges go laptop
- Ultra-thin laptops measure less than an inch in thickness
- Apple offers IMAC's laptop offspring: The IBoook with innovative wireless features

- Electronic books are becoming more and more a reality. A market for digital texts appears. However, e-books won't replace paper books anytime soon. The first e-books are already available.
- Xerox in manufacturing pact for electronic paper
- SIM (secure card for transaction applications)
- Most of Web is beyond scope of search sites
- Peer-to-peer computing is the next big thing
- Protocols such as XML or EduML support reuse of educational materials.
- New software prevents intellectual property from being printed or saved without the Website's permission.
- Software being developed to let users annotate Web sites
- I know how you feel: Affective computers can detect a user's emotional state and modify its reactions to suit individual preferences
- So many megabytes, so little space: Goal is gizmo to store all digital data
- Dataquest: Storage management software market to explode
- George Washington U. tries to sell software it created to put courses online
- WW-based course management systems need to integrate with campus-management systems

Wider-area technologies

- 3-D images that you can step into the wireless virtual reality theater at Iowa State University (USA) surrounds visitors with computer-generated images that are projected onto the walls, floor, and ceiling
- Get serious about educational technology: Develop a collaborative environment that supports e-mail, videoconferencing and Web hosting, and portable group computing platforms which combine Internet, TV, and personal computing.
- Pervasive computing: The next big thing?