BETTY COLLIS

SHELL PROFESSOR OF NETWORKED LEARNING, UNIVERSITY OF TWENTE, THE NETHERLANDS

Professor Betty Collis, Ph.D.

Vital: PhD (University of Victoria, Canada), Masters (Stanford); undergraduate Mathematics (University of Michigan). Presently Senior Full Professor (University of Twente, The Netherlands) involved in the design, development and application of Web-based tools and systems for learning and the implementation of change strategy for the University.

Contribution: She is a researcher, evaluator, designer and developer in the innovative use of technology for learning support. In addition to her position at Twente University, The Netherlands, she partners with Shell International Exploration and Production in developing and designing e-learning and blended learning programs to support technical and leadership development training. The TeleTOP system for design of and delivery of new forms of technology-supported learning was one that she and her team developed at the University of Twente.. This system provides an environment where professors and program directors can design and carry out effective "blended learning" programs that engage the learner through technology, peer-to-peer interaction, and faculty-to-student coaching. Working with Shell (Noordwijkerhout, The Netherlands) the 'blended learning' approach now in place utilizes her expertise in scientific and practical development. She is now the Shell Professor of Networked Learning at the University of Twente, in a chair established by Shell to anchor the collaboration between the two organizations. r. She is the author of three successful textbooks and more than 600 other publications. Her attributes include, writing, speaking, leadership, research, teaching, mentoring, consulting, support, design, and innovation. She works extensively with her graduate students, both Masters and PhDs, and enjoys mentoring them through the evolution from students to professional colleagues. All of these attributes are fully utilized in universities, professional organizations, administration, governments and large corporations, often utilizing educational software that she and her team have designed and developed. . Describing her, terms like 'change leader' and 'combination' come to mind.

CV OVERVIEW, PROF. DR. BETTY COLLIS

2 March 2002

For my full CV, see http://users.edte.utwente.nl/collis/
Also see the attached summary of CV entries from 2000-2001, as an example of my yearly productivity
(also available at http://users.edte.utwente.nl/collis/homepage/01-02sum.htm)

SUMMARY OF EXPERIENCE:

1988- ***University of Twente (UT), Faculty of Educational Science & Technology (TO)***

Major points:

UHD (Associate Professor): 1988-1997

- Professor of Tele-Learning: 1997-2001
- Leader of TeleTOP (http://teletop.edte.utwente.nl) initiative, leading to the successful development and implementation of the TeleTOP Web-based course-management system, now in use throughout the university and in other institutions: 1997-
- Department Chair, ISM, and member of the Management Team, TO: 1999-2001
- Member of the Management Team and Area Leader, Education & Training, CTIT (Centre for Telematics and Information Training (multifaculty research institute), UT: 1996-
- Voted by the students "Instructor of the Year": For the faculty, 1996, 1997; for the university 1997
-

2002– ***Shell Professor of Networked Learning***
(still within the University of Twente)

Leader of Shell-UT Collaborative Project

- Project, which began in 2001, now involves support for three AIOs (PhD candidates), five students doing Master's-level projects, as well as for my professorship
- Responsible for leading the change process to "blended learning, Shell style", using the TeleTOP system for technical professionals in Shell International Exploration and Production
- Associated PhD research which I supervise involves (a) organisational learning and technology, (b) blended learning as pedagogy and technology, and (c) tools for re-usability and sharing of learning objects
-

1974-1988 ***Faculty of Education, University of Victoria,***
Victoria, BC, Canada

Major points:

- Assistant professor, 1976-1982; Associate professor: 1982-1988
- Introduced computers in education (1979-) as research area, as focus of courses, and as actual tools within the Faculty of Education, leading to being part of university-wide change process (as member of Vice-President's Committee on the Use of Computers in University Teaching, 1986-1988)
- Member of many national and international projects involving computers in education, such as the IBM Canada-University of Victoria Cooperative Project (1984-1987)
-

1967-1974 ***High school mathematics teacher,***
Los Gatos, California and Victoria, BC, Canada

EDUCATION

1983 *University of Victoria* Victoria, BC, Canada
PhD, Measurement and Evaluation of Computer Applications in Education

- Study funded by University of Victoria scholarship award
- Dissertation awarded "dissertation of the year" by the Canadian Association for Educational Psychology, and "outstanding dissertation, Western USA and Canada" by the professional organisation Phi Delta Kappa

1966 *Stanford University* Palo Alto, California
Master of Science, Mathematics Teaching and Curriculum

- Study funded by Shell Oil, via Paul deHart Hurt Award for Mathematics

1963 *University of Michigan* Ann Arbor, Michigan
B.A. in Mathematics

- Graduated Magna Cum Laude (with high distinction) from Honours' Programme
- Study funded by National Merit Scholarship award
- Also obtained teaching certificate, mathematics

RESEARCH SUMMARY
(SEE HTTP://USERS.EDTE.UTWENTE.NL/COLLIS/HOMEPAGE/NEWRES.HTM FOR COMPLETE DESCRIPTIONS)

1980- ***Participation in 67 funded research projects, all relating to computer-related technology in education***

Research relating to implementation, effects, and attitudes: 18 projects

- Examples: The 4-E Model, TeleSCOPIA, ITEC, Gender differences in attitudes towards computers

Research relating to technology design, development, and attributes: 15 projects

- Examples: TeleTOP, Metadata and Reuse, IDYLLE

Research relating to pedagogical aspects: 11 projects

- Examples: Blended learning at Shell, Dimensions of E-Learning

Research relating to organisational or national levels: 9 projects

- Examples: ICT in Higher Education, Impact of the Internet

Evaluation research: 14 projects

- Examples: IBM/Europace, POCO, RDISAT, Saanich School District

PUBLICATIONS
(FOR A COMPLETE LISTING, SEE
HTTP://USERS.UTWENTE.NL/COLLIS/PUBS.HTM/PUBS.HTM)

1980- ***Author or co-author or co-editor of 15 books, author or co-author of 48 chapters in edited books, editor or guest editor of 9 special issues of scientific journals, author or co-author of 109 articles in refereed scientific journals: all relating to computer-related technology in education***

Key books:

- Collis, B., & Moonen, J. (2001). *Flexible learning in a digital world: Experiences and expectations.* London: Kogan Page. ISBN Hardback: 07494 33728, Softback 07494 3371X
- Adelsberger, H., Collis, B., & Pawlowski, J. (Eds.). (2001). *Handbook of information technology for education and training.* Berlin: Springer Verlag. (41 chapters, 950 pp). ISBN 3-540-67803-4.
- Collis, B. (1996).*Tele-learning in a digital world: The future of distance learning.* London: International Thomson Publications. ISBN 1-85032-157-4 (648 pp.).
- Collis, B. (1988). *Computers, curriculum, and whole-class instruction.* Belmont, CA: Wadsworth. (with Instructors Manual and accompanying software). (412 pp. in book). ISBN 0-534-08460-5

Examples of book chapters and articles in scientific journals:

Relating to implementation, effects, and attitudes: 55 publications

- Collis, B., Peters, O., & Pals, N. (2001). A model for predicting the educational use of information and communication technologies. *Instructional Science, 29*, 95-125 ISSN 0020-4277
- Collis, B., Winnips, K., & Moonen, J. (2000). Structured support versus learner choice via the World Wide Web (WWW): Where is the payoff? *Journal of Interactive Learning Research, 11*(2), 163-196. ISSN 1093-023X
- Collis, B., & Messing, J. (2001). Usage, attitudes and workload implications for a Web-based learning environment. *Journal of Advanced Learning Technologies 9* (1), 17-25. ISSN 0968-7769

Relating to technology design, development, and attributes: 46 publications

- Collis, B. (1999). Design, development and implementation of a WWW-based course-support system. In G. Cumming, T. Okamoto, & L. Gomez (Eds.), *Advanced research in computers and communications in education.* Vol 1, (pp. 11-20). Amsterdam: IOS Press. ISBN 158 603 0272
- Collis, B. (1999). Applications of computer communications in education. An overview. Invited lead article for Special Feature on Telelearning. *IEEE Communications, 37*(3), 82-86. ISSN 0613-6804/99
- Collis, B. (Ed). (1999). Systems for WWW-based course support: Technical, Pedagogical, and Organizational Perspectives. Special Issue of the *International*

Journal of Educational Telecommunications, 5(4). ISBN 1077-9124. 11 articles and Preface.

- Collis, B. (1996). The evolution of educational software portability. In D. Ely & B. B. Minor (Eds), *Media and Technology Yearbook 1995/1996* (pp. 76-97). Englewood, CO: Libraries Unlimited. ISBN 1-56308-359-0

Relating to pedagogical aspects: 48 publications

- Collis, B. (1994). Cooperative learning and CSCW: Research perspectives for internetworked educational environments. In R. Lewis & P. Mendelsohn (Eds.), *Lessons from learning*, (pp. 81-104). Amsterdam: Elsevier Science B.V. (North Holland). ISBN 0 444 81832 4
- Collis, B. (1999). Designing for differences: Cultural issues in the design of WWW-based course-support sites. *British Journal of Educational Technology, 30*(3), 201-216. ISSN 0007-1013
- Collis, B. (1998). New didactics for university instruction: Why and how, *computers & Education, 31*(4), 373-395. ISSN 0360-1315
- Collis, B., & Smith, C. (1997). Desktop multimedia environments to support collaborative distance learning. *Instructional Science, 25,*, 433-462.

Relating to organisational or national levels, change & policy: 21 publications

- Collis, B., & Winnips, K.. (2002). Two scenarios for productive learning environments in the workplace. *British Journal of Educational Technology, 33* (2), 133-148. ISSN 0007-1013
- Collis, B., & Gommer, E. M. (2001). Stretching the Mold or a New Economy? Part 1: Scenarios for the university in 2005. *Educational Technology, XLI*(3), 5-18. Part 2: Realizing the scenarios for the university in 2005. *Educational Technology, XLI* (4), 5-19 ISSN 0013-1962
- Collis, B. (1999). Telematics supported education for traditional universities in Europe. *Performance Improvement Quarterly, 12*(2), 36-65. ISSN 0898-5952

Relating to evaluation research or research methodology: 18 publications

- Collis, B. (1998). Building evaluation of collaborative learning into a WWW-based course: Pedagogical and technical experiences. Invited paper, Special Issue on Networked and Collaborative Learning, *Indian Journal of Open Learning, 7*(1), 69-80. ISSN 0971-2690
- Collis, B. (1993). Evaluating instructional applications of telecommunications in distance education. *Educational Training and Technology International, 30*(3), 266-274.
- Collis, B. (1993). Telecommunications applications in education: A research taxonomy. *Australian Educational Computing Journal. 8*(2), 1-11. ISSN 0816-9020.

1974- ***In addition, 91 papers published in refereed conference Proceedings, 97 reports/deliverables for funders of research projects, and 167 other professional publications***

PRESENTATIONS

(FOR A COMPLETE LISTING, SEE http://users.utwente.nl/COLLIS/homepage/newpres.htm)

1978- ***35 keynote or major invited presentations, 119 presentations at other international conferences or meetings, and approximately 415 other presentations***

Invited presentations given in 34 countries.

Recent examples of the 35 keynotes include:

Collis, B. (2001, 6 June). *Stretching the mold, or a new economy? Changes in the conceptual framework of distance education for traditional universities.* Keynote presentation at the 10th Annual EDEN Conference (European Distance Education Network), Stockholm.

Collis, B. (2002, 5 March). *Blended learning and organisational change.* Keynote presentation at Online Learning Europe 2002, London. (http://www.vnuonlinelearning.co.uk).

Collis, B. (2000, November 7). *New forms of teaching, new technologies.* Keynote presentation, SOMECE 2000 (8th International Symposium for Computers in Education), (national conference for computers in education in Mexico), Monterrey, Nuevo Leone, Mexico.

Collis, B. (2000, 21 January). *Getting larger, getting smaller: The future of educational software.* Presentation while assuming the IBM International Chair in Computer Science, Faculty of Science, University of Gent, Belgium.

Collis, B. (1999, 5 November). *Design, development and implementation of a WWW-based course-support system.* Keynote presentation, ICCE '99 (International Conference for Computers in Education), Asian-Pacific AACE, Kazusa, Japan. (Also published in the proceedings)

Collis, B. (1998, 15 December). *Implementing change throughout the faculty: Combining educational principles, strategy, and technology.* Keynote presentation given at the conference "Flexibility: The next wave", the 15th Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education, Wollongong, Australia. (Also published in the proceedings)

SUPERVISION OF GRADUATE STUDENTS

(FOR A COMPLETE LISTING, SEE http://users.edte.utwente.nl/collis/homepage/newgrads.htm)

At the University of Twente:

Supervision of 13 Phd candidates (8 successfully completed, five in progress); Member of the examining committee of 23 others

Supervision of 66 Masters' candidates (56 successfully completed, 10 in progress; Member of the supervisory committee for 6 others
(Data no longer available for supervision while at the University of Victoria, but the amounts were comparable)

TEACHING

(FOR A FULL OVERVIEW, SEE http://users.edte.utwente.n/collis/homepage/teach.htm)

Web-based courses:

I have designed, developed, and been the instructor for 24 Web-based courses and am a pioneer in this area.

Teaching overview:

Over the years I have taught 39 different courses, most of them for several iterations. The majority of the courses were also designed and developed by me, and featured innovative use of learning technology.

Note:

In 1996 and 1997, I was chosen "teacher of the year" by the students in our faculty and in 1997 "teacher of the year" for the university

PROFESSIONAL ACTIVITIES

(FOR A FULL LISTING, SEE http://users.edte.utwente.nl/collis/homepage/newpro.htm)

Member of editorial board or reviewer for scientific journals: In total: 28. Currently, 16

Services to professional associations: In total 18 associations, including periods on executive boards, leadership of working groups, etc.

Member of steering committee or programme committee of international scientific conferences: In total: 49 conferences. Currently, 1

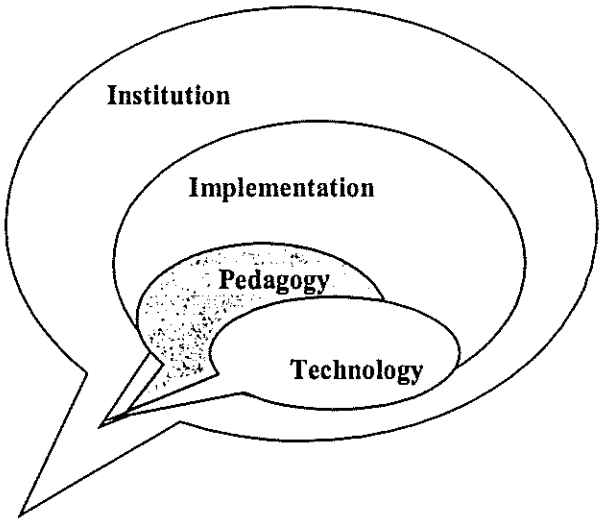
Member of Advisory Boards, external adviser, or consultant to international organisations (World Bank, UNESCO, ILO, etc): In total: 49. Currently 5

Service to the University: Department chair and member of the Management Team for the faculy, until 2002. Many committee chairs. Remain member of the Management Team of the CTIT (Centre for Telematics and Information Technology) (multifaculty research institute).

Chapter 8: Practicing What We Preach:

Keeping going

Chapter 8 from: Collis, B., & Moonen, J. (2001). *Flexible learning in a digital world: Experiences and expectations*. London: Kogan Page. ISBN Hardback: 07494 33728, Softback 07494 3371X



Flexible learning in higher education

In Chapter 7 we showed how a successful initiation process involving more-flexible learning and technology took place in our faculty during the academic year 1997-1998. By the end of the first year of the TeleTOP initiative, an implementation strategy based on the ideas of the active student (Chapter 5), flexibility (Chapters 1, 4, and 5), and the 4-E Model (Chapter 3) and involving a specially developed WWW-based course management system (Chapter 4) were all made concrete. We were ready to open the doors to a new first-year group of students, some of whom would be regularly on campus and others of whom, working people, physically would only come once every two weeks. In this chapter we tell more of this story. We look at the subsequent implementation process, not only in our own faculties but in other faculties at our university and beyond. We also look at a transition that not many institutions have yet gone through: the move from implementation to institutionalisation. In this chapter we also tell about the institutionalisation of TeleTOP and what this means now to our current work. Throughout the chapter we refer to various of the lessons.

THE IMPLEMENTATION PHASE: YEAR 2 OF TELETOP, 1998-1999

This section gives highlights of the second year of the TeleTOP Project. This summary involves a general overview of the implementation process, instructor choices, results of evaluation studies of TeleTOP, transfer to other institutions, and the mixture of implementation with new aspects of pioneering work.

Results of the overall implementation process:

Lesson 16: *Get a measuring stick*

To sum up Year 2 briefly, TeleTOP's primary tasks—to prepare the faculty so that the new educational approach could be fully in operation at the start of September 1998 and would run smoothly throughout the year incorporating new forms of student activity and flexibility into all of its first-year courses—were successfully executed. The entire first-year programme in our faculty, (21 courses or independent portions of courses), as well as four additional courses at the second- and third-year levels, ran during the September 1998-June 1999 period using TeleTOP-based course-support environments and reflecting in different ways a move towards the U approach (Chapter 5) and new forms of student activity. There were as many working students attending physically only once per two weeks as there were the traditional on-campus students. All of the TeleTOP-supported courses operated under the "one course, adapt within approach". There was little drop out among the working students, a strong difference from the faculty's earlier attempts at offering an evening- and Saturday version of its programme as an approach to dealing with working students who needed time flexibility (Van Rennes, 1998). Thus our specific goals of making our programme ready for the new cohort of students via more-flexible courses but without the instructors having to teach the same course twice were met.

Lesson 9: *After the core, choose more*

No disruptive technical problems involving the TeleTOP system occurred. Instructors as well as students in both the part-time and full-time variants of the program made extensive use of the TeleTOP system, with about two-thirds of the use occurring on weekdays and the other third on weekends, a reflection of the flexible use of the system in terms of time. The system was visited by instructors and students approximately 500,000 times in the first eight months. The average session length for students was 11:07 minutes, several times a day. This shows that students were using the course environments not as the primary study source for content material, but as support for short interactions and communications. In terms of our goal of a blend of core and complementary technologies, we were not using the system to replace books and readers but to support more interaction and communication in a flexible way supported by the TeleTOP system. Thus, in regard to content TeleTOP was primarily a complementary medium, with textbooks and readers as the core (see Chapter 4). For other aspects of the learning experience, those related to the active, contribution-oriented student, the TeleTOP-based course environments became the core technologies.

Instructor use of options

Lesson 11: ***Offer something for everyone***

Lesson 14: ***Aim for activity***

To study how instructors made use of the features in TeleTOP that they chose for new forms of contact with and among their students the course environments and the instructors were involved in a one-year evaluation study (Bloemen, 1999). In addition, there were on-going interviews with instructors and students as sources of data (see the evaluation results in the next section). Given many options (60 specific options and others that could be tailored on request) to choose from using the TeleTOP Decision Support Tool (see Chapter 7), what did our instructors actually use? Figure 8-2 shows an overview (Collis & DeBoer, 1999).

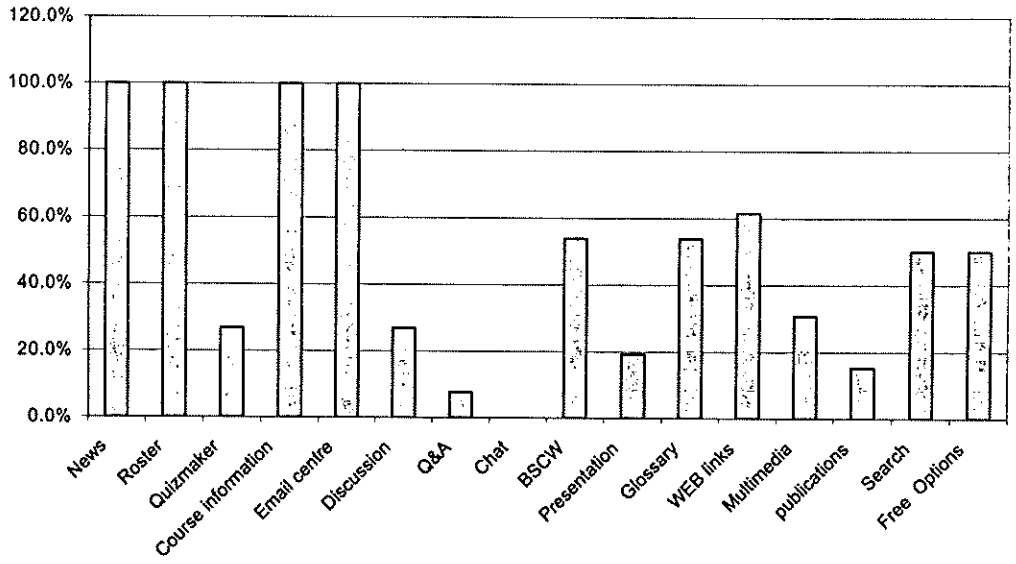


Figure 8-2. Choices made by instructors of 25 courses in our faculty offered between Sept. 98 and April 99 from options suggested in the TeleTOP Decision Support Tool

All instructors chose the *News* option, with 84% using it often and 16% using it marginally. The *Course Information* option was another popular option with 92% of the courses using this option to give an extensive overview of the course and the remaining 8% used it minimally. All but one, (96%), of the courses used the *E-mail Center* to have efficient access to the e-mail addresses of all course participants as well as the instructor(s) of a course. Some used the group option in the *E-mail* area to e-mail different messages to different groups of students, small but useful indicators of increased flexibility and efficiency.

The *Roster* became one of the most important options in the TeleTOP system. Every instructor chose to use the roster as an organisational structure. Table 8-1 gives an overview of various ways in which the instructors made use of the roster in 25 courses supported by TeleTOP during the 1998-1999 academic year.

Table 8-1. **Use of the Roster in 25 re-designed courses during Sept 98-April 99 (first implementation year of TeleTOP)**

New forms of contact supported in the Roster:	Yes	Minimal or no use
To provide instructor-produced material for self-study	52%	48%
To provide instructor-produced materials for a face-to-face session (and for use by the part-time students after the session)	64%	38%
To provide instructor-created PowerPoint slides	80%	20%
To provide instructor-selected links to external resources	20%	80%
For student submission of results of small activities during face-to-face sessions in our combination lecture-room/computer room (or after the session for part-time students)	56%	44%
For student submission of work via the course site	72%	28%
For re-use of student work submitted in the course site as study materials for others in the course	18%	82%

The Roster was used by 92% of the instructors for access to some kind of study material including (PowerPoint) slides, assignments during and after face-to-face sessions or relating to particular topics, and the provision of WWW links to related topics. Two instructors integrated video segments of portions of their presentations and of student presentations in the roster for review and discussion via the WWW site. These are examples of flexibilities and efficiencies afforded by the TeleTOP system as well the beginning of the U approach in many of the courses (Chapter 5; see also Dijkstra, Collis, & Eseryl, 1999).

Lesson 14: ***Aim for activity***

In addition to these sorts of uses of the system for increased flexibility, examples of increased levels of student activity began to emerge. When contact sessions were held for on-campus students, some of the instructors began to structure these not as lectures, but as guided-activity sessions, so that students who were not present could do the same activity later and submit the results via the course site. The average number of assignments submitted via the Roster was about five per (8- 12-week) course per student. For many courses, there had not been any such "small" assignments previous to TeleTOP; the emphasis had been on reading the textbook, attending lectures, perhaps doing a major course project or essay, and a final examination. Thus the switch from lectures with marginal feedback to a series of small assignments with personal feedback as part of the *U-Turn* had begun.

There were also a number of interesting examples of contribution-oriented learning. For example, one instructor made extensive use of multiple-choice questions produced by the students themselves relating to major topics in the course and submitted within the Roster. Each row of the Roster was organised around a topic in the course (covered as a chapter in the course textbook); contained cells via which the instructor added some brief motivational comment related to the chapter to be studied; made available his PowerPoint slides from previous years relating to the topic as a background resource (the instructor no longer lectured, but did meet three

times with the students focusing on motivation and discussion of examples and applications of course theory); and provided a link to an external WWW site that illustrated some aspect of the topic in process. Each row also contained a cell describing the assignment for the topic, (the creation of the two multiple-choice items), a link to the quiz tool that the students could use to produce those items, and the *submit* function via which they uploaded their questions and responses to the site. The questions of the students were thus directly linked to the same row of the matrix as contained the other study materials about the topic. The students studied each others' questions as preparation for the final examination.

In another example of students as contributors to a course learning resources, students in a required second-year course worked together in groups of three (often with some of the group members in a different physical location from one another) to create supplementary study resources for each topic in the course. These were made available via the TeleTOP course site, were assigned reading for the other students in the course, and were included in the material required to study for the final examination.

Lesson 12:
Watch the speed limit

Thus although the data in Table 8-1 show that the majority of uses of the Roster was for making aspects of instruction more flexible or efficient, use of the Roster as a tool for contribution-oriented pedagogy also began to emerge. This progression is what we expected: The instructors were going at a comfortable speed in terms of change, with the first step primarily toward Quadrant III in the Flexibility-Activity Framework of Chapters 1 and 5, as indicated by more-flexible learning and an increase in student activities. But the increase in student activities was leading the way to a contribution orientation, and thus toward Quadrant IV. It was enough for the first cycle of experience that the instructors made use of the system for more flexibility and efficiency as well as more student activity.

Evaluation results.

The first-year courses were extensively evaluated during the entire academic year via three information streams (see Table 8-2). An evaluation team of six persons carried out portions of the evaluation with the remainder of the evaluation informed by expert input and by the on-going data collection of the TeleTOP team itself (Bloemen, 1999; Maslowski, Visscher, Collis, & Bloemen, 2000).

Table 8-2 Information streams for formative evaluation of the TeleTOP WWW-based course-mangement system (abbreviated here as a "W-CMS")

Information stream	Major instruments	Major focus	Evaluation type (Sweeney, Maguire, & Shackel, 1993)
1. Instructor choices and behaviors	(a)Decision Support Tools (DST) and interviews in which the DSTs are used; (b) Options for instructors to choose from in W-CMS and data about choices made	What do instructors choose when using a W-CMS? Why? How do they think about their courses and what are their instructional conditions, and how can these be reflected in the W-CMS?	User-based; Theory-based
2. State-of-the-art inventory and analysis	(a) On-going contacts with others using W-CMSs and with literature and research about W-	What are the major international and national trends with respect to W-CMSs and their	Expert-based; Theory-based

	CMSs (b) Participation in national studies about W-CMSs	implementation? What implementation model is most appropriate?	
3. Field reactions (in addition to input related to Instructor Choices and Behaviors, #1 above)	(a) Questionnaires and interviews, instructors and students; (b) Reactions from implementation teams in other faculties making use of the TeleTOP W-CMS; (c) Reactions given during demonstrations to persons from other institutions	What are opinions about the implementation process as it is being carried out? What aspects of the W-CMS are most important in the local context? How well are instructors making use of the W-CMS? What are the major differences in TeleTOP and other W-CMSs with which persons are familiar? How should TeleTOP be revised?	User-based; Expert-based

(Maslowski, Visscher, Collis, & Bloemen, 2000, p. 12)

Evaluation in relation to the 4-Es

Lesson 5:
Watch the 4-Es

The results of the evaluation (Bloemen, 1999; Maslowski, Visscher, Collis, & Bloemen, 2000) showed no significant difference between the regular and part-time students in achievement and in their appreciation of the courses. For courses in which there were comparative data from earlier versions, there were also no significant difference between the 1998-99 TeleTOP version of the course and previous versions in terms of student performance and attitudes. Thus, replacing lectures with TeleTOP-supported activity did not lead to measurable declines in learning, as had been feared by some (see Table 7-5 in Chapter 7), but it did not lead to measurable increases either. Among the results of the evaluations relating to instructor and student reactions and expressed in terms of the 4-Es were:

- *Ease of use*: The user friendliness of the TeleTOP system was evaluated by the instructors and students as good.
- *Effectiveness:* Students made considerable use of the system and indicated that it was for them the most important resource (not necessarily as content providor, but as a stimulus and guide for activities) for their courses.

Thus, with the Environment "E" so strong in the faculty, the fit with the instructors' chosen ways of working also good (relating to the development of a sense of Engagement as well as the perception of Educational Effectiveness), the fact that the new flexibility allowed us to double our number of students (Educational Effectiveness, long-term payoff) and the above two "Es", the 4-E combination our first implementation year can be seen as shown in Figure 8-3. Likelihood of use was 100%.

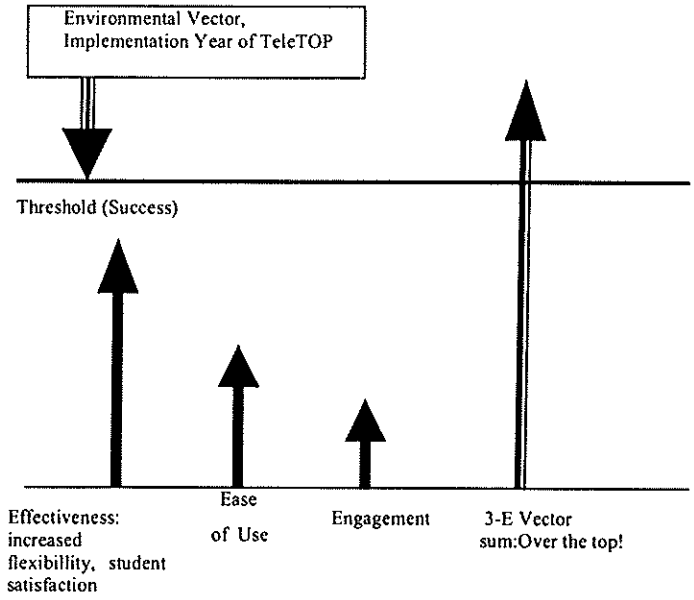


Figure 8-3. The 4-E Model, in terms of the implementation year of TeleTOP

In addition to helping guide us to our implementation process, the 4-Es also helped us categorise areas for further improvement that had been clarified by the evaluations. These included:

- *Ease of use*: Students need a clearer way to get an overview of what it expected of them in all their courses, not just in each course separately (this was subsequently done in the third version of TeleTOP)
- *Effectiveness, short-term payoff*: Instructors were concerned about the higher time investments that they perceived were needed on their parts, not only for direct student contacts but also for the preparation and management aspects of using a WWW-based learning environment. (Attention to this was a major focus of Year 3 and continues in Year 4)
- *Effectiveness, short-term payoff:* The giving of feedback was identified as a problem area: instructors felt that they were spending large amounts of time in giving personalised feedback, while at the same time students did not always perceive the feedback as helpful or timely enough. (Attention to this was a major focus of Year 3 and continues in Year 4)
- *Effectiveness, long-term payoff:* Instructors need to continue to develop their ideas about how to use the TeleTOP system for added value educationally (This will be on an-going task, with a new decision support tool based on activities for the U approach being developed in Year 4).

Evaluation of the TeleTOP system

Lesson 11: ***Offer something for everyone***

We also were regularly involved in the systematic evaluation of the TeleTOP system itself. In Year 2 we used our 12 criteria for a WWW-based course-management system (see Chapter 7 and Tielemans & Collis, 1999) as a framework for evaluating our progress so far with

the TeleTOP system. Table 8-3 reviews those criteria and the results of the implementation-year evaluation of the TeleTOP system in reference to those criteria.

Table 8-3 Dimensions for formative evaluation of the TeleTOP system

Requirements	Type of dimension	Standards and performance indicators	(On-going) results of the formative evaluation
1. Threshold of use as low as possible	Usability	Measured by the skills needed, those of using a word processor, file handling, using a Web browser	Minor revisions in editing/typing-in procedures based on observations of use and expert analysis
2. Only an ordinary Web browser is needed	Usability	Measured by the extent to which all system functions can be accessed via only a Web browser regardless of location and computer used to access	System in itself succeeds; some problems with network capacity and access especially for video
3. Instructor makes choices about features to include	Utility, scientific basis, usability	Measured by the extent to which instructors' wishes can be accommodated	In most cases, successful, but on-going enhancements occur; Difficulty in accommodating changes in user interface
4. Extend, not replace, books and lectures	Utility, usability, effectiveness	Measured by quantitative and qualitative measures of use of the roster	Data (see Table 8-1 and Figure 8-2) show the functionalities are being used; more attention now needs to be given to how the functionalities are used
5. Tools to support any instructional approach must be available	Utility, scientific basis, usability	Measured by ability to supply whatever instructors request, and by instructors being able to make use of what is supplied	Supply has been successful; Usability is being improved for some tools, such as the quiz tool and shared workspace
6. Expansion to include any produce accessible via the Web	Utility	Measured by ability to call up any Web product requested by instructors	Difficulties with student products involving multiple files in folders, such as projects involving Web sites
7. Uploading and downloading must be simple	Usability	Measured by the problems encountered by users	Some revisions to uploading and downloading have occurred
8. Instructor can organize communication streams	Usability, effectiveness	Measured by usage, instructor and student satisfaction	Complaints by students most related to deficiencies in instructors' practice, such as slowness in responding, unclear responses, etc.
9. Access organized around log-in data	Utility, effectiveness	Measured by accuracy of access, based on user characteristics	Revisions needed for external users, persons having different roles
10. Maintain-ability	Utility (system perspective)	Measured by opinion of system master	Hand entry of registration, individual templates were most time-consuming; extensive upgrade occurred
11. Multimedia data needs to be handled in the same way as text data	Utility, usability	Performance indicators: speed, quality	Full compatibility with video server; network access problems for persons outside of Netherlands
12. Instructors and students are using the system	Usability, utility	Measured by usage and robustness	All first- and second-year courses, as well as others; no technical crashes or slowdowns, but continual improvements in back-up and other back-office features

From: Maslowski, Visscher, Collis, & Bloemen, 2000, p. 17.

Thus, while the TeleTOP system was clearly off to a good start, it was far from a finished system. This was by design: We wanted to continue to shape the system, based on input from our users. Thus the technology of the TeleTOP course-support system continued to evolve during 1998-99. Continuing with its combination of Domino database technology and HTTP server technology, TeleTOP evolved from Version 1 to Version 2 during the 1998-99 academic year without any disruption to instructors or students. Version 2 was primarily more features added to Version 1 based on instructors' comments and experiences and on-going improvements in the ease of use. Of particular importance were improvements in the ease with which the instructor could modify portions of the Roster and could modify the choices of tools in the environment as a whole. Also, workspace tools were simplified and made more flexible.

Institutional support: The TeleTOP PC Plan

From an ease-of-use perspective, a major activity during 1998-99 was the implementation of the *TeleTOP PC* plan. All first-year students were given the chance, at a highly favourable rate (and via a loan which they do not have to pay back if they maintain good grades), to obtain a powerful personal computer with fully installed applications and tool software to support all of the courses in the first year, and other features such as a writeable CD-ROM drive, choice of an ISDN, modem or network connection, and audio and video-handling capabilities. The PC offer was highly attractive to students, with almost all of the students using TeleTOP (regular and working cohort) taking advantage of the offer. Because of demand, the TeleTOP PC Plan was also made available to other students in the faculty and to instructors and staff. Connectivity for students from anywhere in The Netherlands to the university network (and thus to TeleTOP as well as the Internet) was subsidised by the university and cost home users no more than a local phone charge. Our faculty also subsidised this home ISDN connectivity for our instructors, so that they could work on TeleTOP from home with minimal personal cost. In terms of the 4-Es, these are *environmental* and *ease-of-use* factors that we believe offered a good return on investment (ROI, see Chapter 6), in that without them barriers and frustrations for use of TeleTOP would certainly have occurred for many instructors and students.

Transfer to other institutions.

Lesson 8: ***Get out of the niche***

A major activity for TeleTOP in 1998-99 was the generalisation of the TeleTOP Method to other groups and settings. Was TeleTOP going to be a niche product (Chapter 4), fitting its own context but not likely to be useful in others? In particular, would TeleTOP's roots in a faculty with educational-technology expertise transfer to a technical faculty? The first tests of this occurred in Year 2 with a new curriculum in the computer science faculty of our university and in a law faculty in another university. The new curriculum in the computer science faculty was in the area of telematics (applications of network technology from a technical perspective). The motive of the new Telematics Department to want to use TeleTOP was that they felt that it was valuable to the profile of their programme to be able to indicate that they were using a state-of-the-art telematics platform (the TeleTOP system) in their courses. During Year 2, the TeleTOP team thus also focused on a method for moving TeleTOP out of its niche in our own faculty (Collis & DeBoer, 1999a). The general approach developed by TeleTOP for the transfer of the TeleTOP Method to other faculties, based on the experiences in the first half of 1999 with the Telematics Department and the Law Faculty adaptations, has the timeline shown in Table 8-4. The time periods can be different for any particular case; they depend on the level of readiness and organisation in the target institution, and the persons involved.

Table 8-4. Timeline for transfer of TeleTOP to another institution

Time period	Activities (Collaboration between TeleTOP team member and local team)
Months 1-3:	Define target group, analyse context in terms of 4-Es, set concrete goals, make planning, appoint at least two implementation-team members (technical and educational), decide on technical infrastructure, build awareness in target group
Month 2	Set up the technical infrastructure
Months 2-3	Train the implementation-team members
Months 2-on-going	Put into place technical support, helpdesk
Months 3-4	Instructor sessions, focused on re-design of their own courses
Months 3 - on-going	Re-design of courses, use of decision-support tool with instructors for design of their course-support environments
Month 4	Student orientation session
Month 4 - on-going	Start first courses, put into place on-going educational support, begin internal evaluation
Month 5	End of support by the TeleTOP team

Using the method indicated in Table 8-4, the TeleTOP team supported the re-design of all of the first-year courses for the 1999-2000 academic year in the Telematics Department, and an evaluation study was carried out among the telematics instructors as to their expectations and initial impressions relating to working with TeleTOP. In general, the telematics instructors had similar expectations and concerns as our instructors had had one year earlier: that a major problem would be the time management for instructors particularly in the handling of feedback for an increased number of student assignments (Fisser, Van der Kamp, & Slot, 1999). Perhaps because they are a technical faculty or because the experience in the Faculty of Educational Science and Technology was well known, there was no expression of concern among telematics instructors or students about too much computer

dependency or loss of contact between instructors and students. The time needed for instructors to be comfortable with using the system was also quicker than had been the case on our faculty, probably because many of them had already been using technology in a variety of ways to support their teaching.

The transfer to the Telematics Department went so well that discussions began about the systematic implementation of TeleTOP throughout the entire university. This would be under the responsibility not of ourselves in a faculty but with the central teaching-support centre called the DINKEL Institute. Considerable time was spent in 1998-99 in discussions with the DINKEL as to the generalisability of the TeleTOP Method to the rest of the university. The TeleTOP system was extensively studied by a work group (of which we were not members), and recommended for university-wide adoption. Proposals were submitted independently of this decision for collaborative activities with TeleTOP from two other faculties (electrical engineering and applied mathematics). Much interest was coming in from other institutions and much time was spend on demonstration sessions and meetings with parties interested in potential collaborations.

Pioneering work

TeleTOP was funded as an implementation project. But we, and other pioneers, also saw TeleTOP as a testbed for new ideas, research, and experimentation even while implementation was just beginning. This led to new, small-scale cycles of initiation and implementation within the larger overall implementation progression and several research-oriented experiments (Collis, Winnips, & Moonen, 2000) . Major new pionering interests during Year 2 were student portfolios as part of the TeleTOP system, and investigation of the use of video on demand within TeleTOP. The practical reason for the interest in video on demand was to provide students who are not regularly present at the faculty with access to the experiences available to students who are present. Doing this as other than as a "talking head" capture of instructor presentations began to be one of our interests in TeleTOP. Also, the use of video explanations or demonstrations in reusable units of learning material in course sites was seen as a growth area for TeleTOP and preliminary work was done (Collis & Peters, 1999).

Preparing for Year 3, 1999-2000

Lesson 4: ***Don't forget the road map***

In addition to the courses successfully offered during the 1998-1999 academic year, the TeleTOP team was busy throughout 1998-99 with preparation for more than 50 courses for the academic year starting in August 1999, in particular the revision of the second-year courses to begin in September 1999, and not previously planned, the courses in our Masters programme.

A major and unexpected event affected our planning. The university decided to adopt a new approach called the Major-Minor system, which meant that much of the third year of each faculty's programme had to be made free so that students could take a minor in another faculty. This led to the decision in our faculty to not only reconsider the third year, but the entire curriculum. Consequently, much time was

taken up with curriculum review, with TeleTOP and pedagogical change moving out from the central point of attention in the faculty.

In some ways this turned out for the good: TeleTOP was moving quickly to being accepted as ordinary procedure in the faculty replaced by a newer innovation in instructors' attention, and thus stimulated less debate compared to the initiation year. Instructors just got on with it. Also, the instructors could see that TeleTOP would allow them to tailor versions of their courses for students from other faculties taking the courses as part of their minors, and thus a new long-range benefit for TeleTOP became clear. As a direct consequence of the time being spent on curriculum-change activities in the faculty, our rapid-prototyping method (see Table 7-3) was abbreviated (although still including the decision support tool sessions) and only a few workshop sessions relating to pedagogy and TeleTOP were held. There was a risk of forgetting the pedagogical roadmap.

Thus Year 2 tested the strength of TeleTOP's approach in two major ways: to move TeleTOP (perhaps prematurely) into the start of institutionalisation in our own faculty, and to successfully move TeleTOP out of its niche in our faculty into other settings. Both appeared to be succeeding although it would have been better for pedagogical change to have had another year of attention to pedagogy in the faculty. Instead, the flexibility aspects of TeleTOP became the major focus, in terms of re-design of courses for the new curriculum and student groups.

FROM IMPLEMENTATION TO INSTITUTIONALISATION: YEAR 3 OF TELETOP, 1999-2000

In Year 3 of TeleTOP the major focuses were course re-design, instructor support and pedagogical analysis, time and effort costs of TeleTOP for instructors, transfer of TeleTOP to other settings, and the institutionalisation of TeleTOP within our faculty.

Continued course re-design

All courses in the first and second year of our programme were re-redesigned in TeleTOP to reflect the new curriculum, and TeleTOP was used without technical problems to support the two cohorts of regular and working students. A number of third- and fourth-year courses were also redesigned. And a number of courses in different variants of our masters programme were redesigned in TeleTOP and offered via TeleTOP, including all the courses in the totally-at-a-distance variant. The remainder of the courses in the old curriculum and the majority of the remaining courses for the masters programme were in the process of re-design for the 2000-2001 academic year. Over 80 courses were supported in the TeleTOP database for our faculty during the third year of TeleTOP. Thus the implementation process in our faculty, in terms of the redesign of courses for more-flexible participation using the TeleTOP system, was nearly complete. The re-design of pedagogy for the U Approach (Chapter 5) will be a longer process. In addition, all of the first-year courses in the Telematics Department ran using TeleTOP.

Evaluation, instructors in two faculties

Lesson 14: ***Aim for activity***

An evaluation was carried out at the end of the academic year 1999-2000 with 22 of the instructors in our faculty (in their second year of actually using TeleTOP and in their third year of contact with TeleTOP) and 13 of the instructors in the Telematics Department (in their first year of using TeleTOP) relating to their experiences with TeleTOP during the 1999-2000 academic year (Messing, 2000; Collis & Messing, 2000). Among the focuses in the evaluation, instructors were asked what was new in their teaching as a result of using TeleTOP.

The majority of the open-ended responses to this questions focused on improved opportunities for feedback provision, both qualitatively in terms of new ways of providing feedback (for example, peer evaluation) and also procedurally (faster, via the course site, with feedback available in the course site, feedback to groups via the site). Other new teaching aspects included (in the words of the instructors):

- "Reuse of student work as models'
- "The rich supply of links and attached files is very handy and beneficial for students' learning"
- "Change in teaching style (more interaction) has been forced - I am less an information giver, more a problem solver"
- "Via the Roster I was able to organise the background information for each week"
- "Improved presentation including of feedback"
- "The possibility to answer student's questions and have these answers available to all students"
- "More flexibility and up-to-date teaching"
- "More personal communication"
- "Easy to provide the students with relevant information"
- "You learn as a teacher to prepare lessons for students more thoroughly"
- "Providing a more encompassing database (not only texts but also web links, glossary of concepts) to students"

Despite their different amounts of experience with TeleTOP and their different subject-matter backgrounds, there were no particular differences in the responses of the educational science & technology instructors and the telematics instructors.

Both groups of instructors also noted that their use of TeleTOP resulted in "more activity and instruction of students" accompanied by "a better overview of the tempo of the learning and level of participation." Students are "stimulated to react / comment more intensely" with new options added to the learning process, for example "giving students the opportunity to exchange information - greater student interaction". The course becomes "more personal for students".

Thus the instructors in both faculties were moving toward an approach more focused on student activity than had been the case before using TeleTOP. In addition, two-thirds of the instructors felt that their courses were now a better learning

experience for their students. Of the one-third who felt that the learning experience was no different than before (no one felt it was worse), almost all admitted that they were only making marginal use of TeleTOP, predominately using the system for flexible provision of course information.

Lesson 17: ***Be aware of the price tag.***

The majority of the instructors also noted efficiency gains by using TeleTOP. Some of their comments were:

- "All materials are handy and reusable"
- "More materials (WWW-based) are available and better access to the materials"
- "Overcomes the hassle of having readers in stock, etc."
- "Students have a uniform interface to courses (saves time; avoids confusion)"
- "Helps organise the communication with students"
- "Its provides a uniform user-interface with helpful features which can be easily reused"
- "I can let students work and hand in assignments that force them to process the literature studied. I can provide them feedback on their work more flexibly".

In terms of the features chosen by instructors to use within the TeleTOP system, there were more similarities than differences between the two groups of instructors. Figure 8-4 compares the features chosen and used from in these two samples of instructors in our faculty and the less-experienced telematics-department instructors (Messing, 2000).

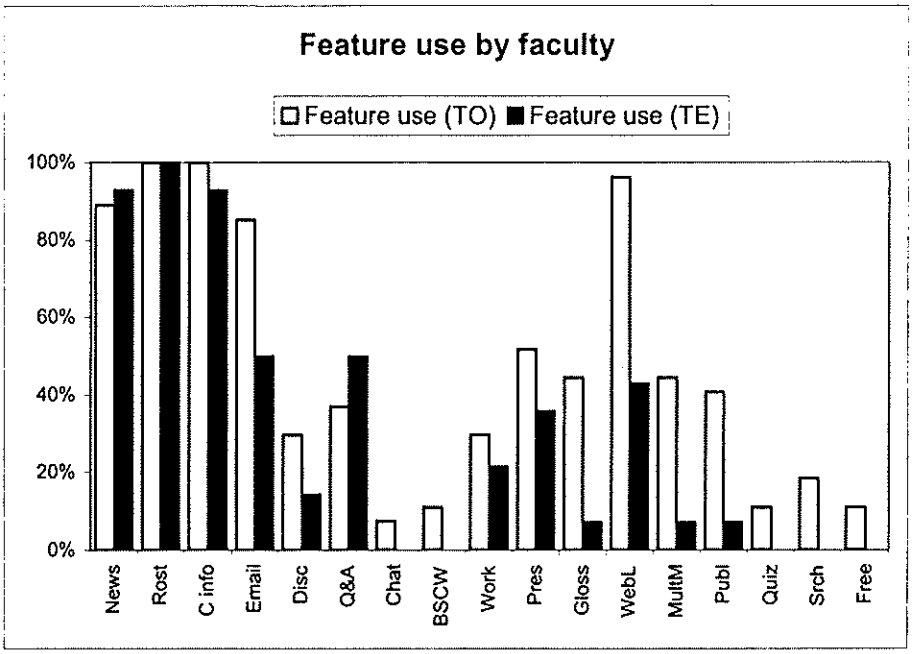


Figure 8-4. Use of TeleTOP features, by faculty (Note: "TO" is the Faculty of Educational Science and Technology, in its third year of involvement with TeleTOP; "TE" is the Telematics Department, in its second year of involvement)

Note: *BSCW* and *Work* refer to two different groupware tools. *Pres* is *Presentation area* (where highlights of student work can be presented). *Gloss*, *WebL, MultM, Publ*, and *Srch* are *Glossary, WebLinks, Multimedia, and Publications* areas (in all of these, both instructors and students can make entries), and *Search* is a collection of search tools for inside the TeleTOP database as well as externally.

Lesson 12: ***Watch the speed limit***
Lesson 11: ***Offer something for everyone***

Analysis of the reasons provided for choosing or not choosing a particular feature revealed that the decisions about the use of a tool were based largely on the current practices of the instructors. While comments were made which indicated that the TeleTOP implementation was an opportunity to redesign the teaching strategy, instructors still largely tried to adapt existing practices to TeleTOP so that these practices become more flexible and efficient. Instructors are most likely to begin by choosing aspects of a system that reflect their current ways of teaching, and then gradually move to new instructional approaches and new features. A system should be flexible enough so that instructors can find a comfortable starting point, but are stimulated rather than constrained by the system in moving beyond that starting point. TeleTOP appears to offer these characteristics.

Instructor support and pedagogical analysis

For just-in-time support, a TeleTOP environment was created as a support resource for instructors. It continued a variety of hints, examples, resources documents, and

links to course sites illustrating new approaches to flexibility and to student contributions. In particular, ideas relating to the use of TeleTOP to support new forms of assignments and feedback, which as a topic was given particular attention during the year, were also supported in the TeleTOP instructors environment. The time and effort costs for instructors of new forms of student activities became a topic of considerable interest.

Lesson 15: ***Design for activity***

To support the instructors with respect to assignments and feedback, that is, to help them "design for activity", we first made an inventory of what they were currently doing with respect to learn activities, particularly in terms of assignments. Table 8-5 shows the types of assignments and feedback in 31 of the courses in our faculty during the 1999-2000 academic year. The table is not exhaustive; it only indicates the major approach per course, not the number of assignments. Also, if more than one approach was used in a course, the table only reflects the approach used most often or given most emphasis.

Table 8-5 **Forms of assignments and feedback, Faculty of Educational Science and Technology, a sample of 1999-2000 courses (n=31)**

Type of Feedback Type of assignment	Instructor gives personal feedback	Model answer provided	Students give peer feedback	No feed-back via TeleTOP	Computer-generated feedback	Total
Searching for new information	5		1			6
Case studies	3	1				4
Roll play		1				1
Reports	1					1
Production of multimedia products	2		1	3		6
Assignments related to theory	6			2		8
Skill practice	1			3		4
Testing, quiz					1	1
Total	*18*	*2*	*2*	*8*	*1*	*31*

Van der Veen, DeBoer, & Collis, 2000

In the TeleTOP instructor site, examples from existing courses were used to show how different instructors were managing different types of assignments and feedback. Also, Table 8-5 was available in hyperlinked form in the support site that we made available for instructors within the TeleTOP environment, so that they could examine examples in their own time and just-in-time.

Also available for instructors was a set of guidelines for handling assignments, but also for other aspects of designing and managing their TeleTOP environments (Remmers & Collis, 2000). The guidelines mix pedagogy and efficiency aspects and each includes a hyperlink to an example from one of our own courses, so that instructors can see what is meant as made concrete by a colleague. For example, some of the guidelines relating to feedback are:

Give the students via the WWW-site:

- personal feedback when they have to carry out personalised variations of the same assignment.
- public feedback when you want them to learn from each other's answers or maybe use each other's answers for a new assignment.
- group feedback when the numbers of students of the course is large and could not be handled with personal feedback with regard to time constraints
- one answer key to all students when many students make the same mistakes in their answers.
- peer feedback when you want to guide the students in learning how to evaluate and give feedback

As can be seen in Table 8-5, the majority of instructors were using the most time-consuming form of feedback, individualised comments to each student entered via the course environment. A goal for TeleTOP in its fourth year became helping instructors further on the pedagogy of student activity, particularly focused on making that pedagogy manageable for the instructors as well as the students. It is interesting that in Year 3, there was one complaint being voiced by the students, not the fears from Year 1 about depersonalised education, but rather the opposite. Students complained that they were being expected to be too active, that it was costing them too much time to carry out all these activities, certainly more time than they had spent on their courses in the previous lecture orientations (although no more than they were meant to be spending on the courses according to the number of credit hours involved). The *contribution approach* is not as time-efficient for students as the previous acquisition approach. It is also more time-consuming for instructors.

Time and effort costs of TeleTOP for instructors

Lesson 17: ***Be aware of the price tag***

Particular attention was paid during Year 3 of TeleTOP to the time and effort costs for instructors, not only for assignment and feedback management, but also other aspects of course re-design and delivery using TeleTOP. In the evaluation carried out by Messing (2000), the instructors who were interviewed, from both our faculty and the Telematics Department, were asked to estimate their time expenditures for course preparation and delivery. Because the issue of time demands is so important as a potentially negative effect of using TeleTOP (Lesson 5: *Watch the 4-Es*), these time estimates are reproduced in Table 8-6. Unfortunately, we do not have comparative data for non-TeleTOP time investment in course preparation and delivery.

Table 8-6. **Preparation/delivery workload, estimated by instructors, comparing first- and second-year users of TeleTOP** (Messing & Collis, 2000)

First-year users of TeleTOP (n=18)		Second-year users of TeleTOP (n=14)	
Preparation	***Delivery ****	***Preparation***	***Delivery***
0.5 weeks = 13	0.5 weeks = 5	0.5 weeks = 8	0.5 week = 3
1 week = 3	1 week = 4	1 week = 2	1 week = 3
1.5 weeks = 0	1.5 weeks = 2	1.5 weeks = 3	1.5 weeks = 2
2 weeks = 2	2 weeks = 0	2 weeks = 0	2 weeks = 2
More than 2 weeks = 0	More than two weeks = 2	More than 2 weeks = 1	More than 2 weeks = 4

* Several courses were still in progress at the time of the interview.

All instructors indicated great difficulty in estimating their time investments and gave their perceptions rather than specific data. However, two observations are still useful. First, the four second-year users estimating that they spent more than 80 hours (two weeks) in the delivery of their courses were also all pioneers in terms of doing innovative things in with their teaching. They were likely to be spending considerable time on their courses, with or without TeleTOP. For the majority of instructors, it cannot be said that their estimated time involvement is excessive, but in the perception of many it was excessive. A number of instructors indicated that they only gave the time that they felt they had available: if this meant that they didn't give feedback, that was just the way it had to be. Thus there seems to be a natural ceiling on time and energy investment, based on the willingness of the instructor to make these expenditures in teaching. But this has always been the case, well before TeleTOP.

While overall time spent on a course is important, the ways that time is spent within a course making use of TeleTOP to support more-flexible learning and some forms of student contributions to the course learning environment also was studied. Figure 8-5 shows one instructor's estimates of the percentages of time he spends on different aspects of the course preparation and delivery process with TeleTOP.

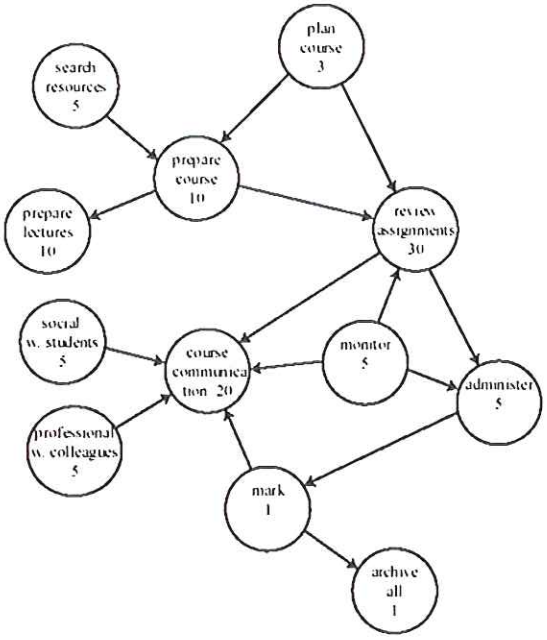


Figure 8-5. Estimated percentage of instructor time spent on various categories of course-related tasks (Collis & Gervedink Nijhuis, 2000)

Some of the main management problems encountered by our instructors and the main responses that they have found helpful include (Collis & Gervedink Nijhuis, 2000):

- Preparations becomes less time consuming because there are many resources that can be reused, and instructors know better what to do or to leave out. However, it still takes time to find good references on the WWW because there are so many sites and pages. Quality control of what students find, and submit to the course WWW site, is a new and major time concern. Making WWW site selection and evaluation an assignment for the students saves us considerable time and also considerably enlarges our own resource collections.
- Communications among students and between instructor and students is no longer a technical problem, but how to handle and archive communication in an efficient and effective way is still a problem. It is useful to try to avoid unnecessary communication by writing instructions clearly so that students do not have to send messages to ask for clarification. Another good idea is to structure the communication that is to occur via the use of forms.
- Assignments and feedback still take much time, although it is foreseen that using techniques such as *Frequently Asked Questions* and standardised feedback will help to decrease the burden for instructors (Van der Veen, DeBoer, & Collis, 2000). (Well-structured) peer feedback can help so that the instructor does not have to provide all feedback, but instead only needs to respond to the feedback given by others (Winnips, 2000).
- Monitoring group work still needs attention, firstly to be able to handle the progress of activities and secondly to be able to signal problems within a group before the problems escalate (Van der Veen, 2000). It is valuable if each member in a group has a specific task, and if progress on these tasks is easy to monitor via the TeleTOP site.

- Keeping student records is becoming an even greater burden for instructors as individualisation and diverse types of students call for more and more exceptions in course planning. It is useful to keep records of all agreements with students about exceptions to assignments, changes in dates, etc., archived in the course TeleTOP site for immediate reference when needed.

In order to get some quantitative measures about the impact of TeleTOP on the main actors of a faculty, a simplified ROI approach (Chapter 6) was applied to one of the courses using TeleTOP in the Telematics Department. Actors that provided data were (a) the education manager of the faculty representing the institutional perspective, (b) the instructor of the course, and (c) a sample of 60 students. Simplified ROI tables (as the example in table 6-3) were used for economic, qualitative and efficiency aspects. In table 8-7 the results of the analysis for the efficiency aspects are given.

Table 8.7 Simplied ROI with respect to efficiency, for a specific course running in TeleTOP (adapted from Mombarg, 2000, p. 13)

Actors:	Institution (Education Dean)		Instructor		Students (n=60)	
Aspects:	Weight	Score	Weight	Score	Weight	Score
Flexibility	1.0	+5 ("Can serve students at a distance")	0.6	+2 ("Can work on the course at home or when travelling")	1.0	+3 ("Time can be used more efficiently, don't have to come to lectures, but you need to work at a computer")
Studying course content via TeleTOP					0.6	-2 ("What's there is not important, only the textbook")
Efficiency in terms of student results	1.0	+5 ("Students stay on tempo, finish the course on time")	1.0	-4 ("Costs much more time to look at & give feedback on all the extra assignments, handle e-mail, etc")		
Finding information & literature on line	0.8	+2 ("Useful for final projects")	0.8	+2 ("Information, also via WWW, always available, but students can waste time and find irrelevant info on the WWW")	0.6	+2 ("Glad to have the lecture notes, but don't make much use of extra information")
Doing and submitting assignments					1.0	+1 ("Saves time and is handy, but there are more assignments now, and you have to use a computer")
Assessing assignments and giving feedback			0.8	-3 ("Easier & faster to give feedback with a red pen, directly on paper")		
Feedback on assignments via TeleTOP			1.0	+1 ("Despite above, it is handy to give feedback directly onto the WWW site")	0.8	+1 ("Good that you can read feedback, even at home, as soon as the instructor puts it there, but the instructor is slow at entering the feedback")
Communication	0.8	-3 ("Not flowing as expected")	0.8	-1 ("Good possibilities for streamlining communication but students don't use them")	0.8	-2 ("Options (i.e., Q&A, are sensible, but we just don't use them")
Support of group work			0.8	-2 ("Much better if students do it face to face")	0.6	-2 ("Easier to get together face to face")

General information about the course available via TeleTOP	0.8	+1 ("Handy, also handy that integrated with the university news")	0.8	+1 ("The News is handy, but students don't look at other information")	0.8	+2 ("Always up to date and handy")
Technology skills and competencies	0.8	+2 ("Everyone will benefit from having more technolgy experience")	0.8	+2 ("Has gotten much more handy with the computer since using TeleTOP")	0.8	+2 ("Improves your skills at using the Internet, stimulates you to get your own computer")
ROI : Efficiency	+11.6 ≅ +12		-2.6 ≅ -3		+5.2 ≅ +5	

In this Table 8-7 a number of relevant items with respect to efficiency are mentioned in the first column. The following columns represent the points of view of the education dean, the instructor, and the students. Furthermore, a weight factor is mentioned in order to represent the importance of each aspect as reliable as possible. The data in the cells (on a scale from –5 to +5) represent the relative amount of loss or gain that was perceived by the respective actors in the new situation using TeleTOP in comparison with the original situation. For instance, +5 in the first cell means that the education dean has the opinion that from the perspective of efficiency, the flexibility provided by the TeleTOP system had really made a difference.
The last row gives the weighted sum of the data in the respective colums and can be interpreted as the simplified ROI with respect to the efficiency category from each of the actors' perspectives. As has been said in Chapter 6, the importance of this simple calculation is not to get absolute results, but to come to comparative results between the main actors. In this example, it became clear that the institution and the students got a relative good ROI from the TeleTOP investment, while the instructors are not that lucky. This empirical result confirms the conclusions brought forward at the end of Chapter 6. Of course, this result is influenced by the choice of items that were selected in the first column. But again, as has been said in Chapter 6, selecting those items of which the expectation is that they will make a difference is an essential part of the discussion. The simplified ROI leads to more explicit thinking about return-on-investment that should take place in order to come to valid decisions.

Transfer of TeleTOP to other settings

As Messing's (2000) survey data show, the transfer of TeleTOP to a technical faculty has proceeded smoothly, with results similar to our own experiences. During Year 3 of TeleTOP several other transfer activities absorbed much of the team's time. These included transfer to two other universities and well as transfer to the remaining faculties in our own institution.

Lesson 6: ***Follow the leader***

A major event for TeleTOP in Year 3 was the official transfer of TeleTOP as a technical system and an implementation and pedagogical method to the DINKEL Institute (the institute for teaching and learning support at the university level). The board of the university decided during 1999 to support TeleTOP as the common course management system to be used throughout the university in order to provide a consistent and common environment for all students. The transfer took place in January 2000. Since then, the

DINKEL Institute is assuming all responsibility for implementation of TeleTOP within the faculties of the University of Twente (including, eventually, for support of our own faculty), and also for licensing of TeleTOP by external parties. The DINKEL also has the task of commercialisation of the TeleTOP system, a task that culminated in September 2000 with the signing of a agreement between the University and IBM that TeleTOP will be marketed and supported internationally by IBM under the name *TeleTOP powered by Lotus*. For the TeleTOP team, this year of transition to the DINKEL has meant continual interaction and collaboration with the DINKEL in a variety of ways. This transition will still continue in 2000-2001.

Institutionalisation of TeleTOP

Throughout the year additions to the TeleTOP system were developed to reflect wishes of instructors and students. Considerable time has been spent in Year 3 by TeleTOP on designing and developing a TeleTOP-based support environment for the educational-affairs office of the faculty to handle student registrations, the making of student accounts, and other administrative functions. Also TeleTOP began working with others at the university level on the integration of TeleTOP with other administrative information systems supported by the faculty and university. These activities have had little or nothing to do with pedagogy, but rather have been primarily information-systems tasks relating to efficiency.

As a complementary process to the transfer of implementation responsibility to the university level, within our own faculty TeleTOP was also moving to institutional status. We discuss this more in the next section, relating to the academic year 2000-2001. Procedural issues relating to the transfer to institutionalisation took up much time. While this is the price of success there are also few models to guide us, as not many implementation projects of the scope of TeleTOP (technology, new pedagogies, flexibility) have made it to the institutionalisation level in such a short time.

INSTITUTIONALISATION: 2000 AND BEYOND

This section is relatively short, as at the time of preparation of this book, the academic year 2000-2001 had only just begun. Thus the illustration here is of the planning and anticipation of issues for the completion of the institutionalisation of TeleTOP rather than a description of what has already occurred. The main points in our institutionalisation year relate to stimulating the continual development of flexibility and contribution-oriented activity within an institutionalised process, further developing the U Approach, and more generally blending innovation with stability.

Two major focuses are underway in 2000-2001 to continue the development of systematic methods for pedagogical change and more flexibility. One focus is on a different way of thinking about a course, as a view of a database with reusable objects. A second is on new support tools for instructors. One of these tools will be to help them consider ideas for new forms of contribution-oriented student activities as

well as see examples of how to implement the activities within TeleTOP and manage the support and feedback process for the activities. A second tool relates to tailoring a new environment and copying objects from one environment to another.

A major focus in 2000-2001 is to design a systematic way for instructors to build a database of resources and components related to a subject domain, and then have simple-to-use tools within TeleTOP to designate various alternative views (i.e., different course environments) for different categories of students, such as regular students, working students, different variants of our Masters' programmes, and other possibilities. We are developing this approach for all the instructors in a programme, bringing new opportunities for collaboration and sharing of resources, and new challenges for instructors used to developing their courses in relative isolation from other courses. A new tool for copying objects from one database to another makes it easy to list all the resources in the underlying database in a variety of orders, and then select the components for reuse in the new view. This will enhance the efficiency for instructors of tailoring variations of a course for different groups of students, an on-going goal of flexible learning. Strategies for tagging objects in the underlying database to designate their key attributes are being developed (Strijker, 2000), coupling international standards such as IMS with locally relevant attributes.

Lesson 14: ***Aim for activity***

A second focus in 2000-2001 is on support for instructors for assignments and feedback, not only to move toward new forms of contribution-oriented learning but also to improve the efficiency and thus time demands of assignment management. Based on the inventory done in Year 3 of types of assignments and feedback currently being used by instructors (see Table 8-5), we are developing and testing a new decision-support tool, this one to focus on helping the instructor systematically consider different types of learning activities and types of feedback and see examples of how these types are being or can be carried out within TeleTOP. This new TeleTOP DST will be a complement to the first TeleTOP DST (see Chapter 7); the first one most appropriate for instructors at the transition between initiation and implementation phases and the new one most appropriate for instructors with some experience, at the transition between the implementation and institutionalisation phases. In addition, we are also planning to adapt both decision-support tools for corporate-university environments, to study similarities and differences between the needs of instructors in those settings compared to university instructors.

SUMMING UP

In this chapter, we have continued our illustration of how we apply our lessons in our own practice. All the lessons have been represented explicitly or implicitly in Chapters 7 and 8: we do practice what we preach. And we are continually evolving the lessons, based on new rounds of experience

How we will combine institutionalisation with new rounds of pioneering will be one of our challenges for the year 2000 and beyond. The transition to institutionalisation and the gradual mainstreaming of the approach and system for maximal involvement and ownership are critical, and after a point a special team and project can be a barrier to this transition. So, the time has come for us as the TeleTOP

team to phase out. We will continue as researchers, and probably as always, as pioneers ourselves in the use of technology in our own learning settings.
We can also have a role as visionaries. In Chapter 9, we look at some future developments for flexible learning and technology which show that this combination of innovation and stability will be critical.

Submitted for publication in the *British Journal of Educational Technology*, May 2001; accepted for publication, October 2001

Two Scenarios for Productive Learning Environments in the Workplace

Betty Collis and Koos Winnips

Prof. dr. Betty Collis has been Professor of Tele-Learning in the Faculty of Educational Science and Technology at the University of Twente in The Netherlands since 1997. Recently she has assumed the newly created chair "Shell Professor of Networked Learning", reflecting her work with the Shell Learning Centre in establishing the scenarios for productive learning described in this paper as models for blended learning at Shell. Her research interests include Web-based learning-support systems, factors that influence use of telematics applications in education and training and new models for professional learning. e-mail: collis@edte.utwente.nl, http://users.edte.utwente.nl/Collis/

Dr. Koos Winnips is an assistant professor in technology applications for learning in the Faculty of Educational Science and Technology, University of Twente, The Netherlands. His research interests include scaffolding and learner support via the WWW. After writing his dissertation on this topic he proceeds this work, focusing more on application areas in training, such as workplace learning via performance support systems. Address for correspondence: Faculty of Educational Science and Technology, University of Twente, Postbus 217, 7500 AE Enschede, The Netherlands. Fax: 31-53-4894580, e-mail: winnips@edte.utwente.nl, http://scaffolding.edte.utwente.nl.

Abstract

Productive learning is defined as learning that can be reused, in application to new problem situations in an organisation or for assimilation and reflection in structured learning situations such as courses. An important but underexploited form of productive learning relates to the capture and reuse of the tacit knowledge of members of an organisation. Two approaches for this reuse of tacit knowledge are discussed, along with instructional strategies and technologies to support the knowledge capture and reuse process within each of the approaches. In one of the illustrated approaches the emphasis is on how those in mentor or supervisor positions can more systematically support the diffusion of their own tacit knowledge to those of their mentees and in the process create new knowledge for reuse in other situations. In the second illustration, a change in orientation from knowledge transfer to knowledge creation and sharing in the formal training prgrammes of the organisation is the focus. An underlying database as well as easy-to-use tools for resource entry and indexing are key elements in facilitating the reuse of experience-based resources within and across both informal and formal learning.

Introduction: Increasing the productivity of tacit knowledge in the workplace

Learning occurs in various ways in the workplace. Often learning occurs as part of a process of endogenous growth (Trentin, 2001), via mechanisms such as trial and error, problem sharing and solving, and informal contacts with peers. Mentoring relationships are important opportunities for learning in the workplace, but generally occur without any reference to a conceptual framework for learning support. Another major way in which learning occurs in the workplace is via traditional training programmes, usually offered in the form of a few days or weeks of classroom-type courses. Increasingly, classroom sessions are being paralleled or supplanted by e-learning variants, offering content via a Web-based system in a time- and place-independent manner. What is often missing in traditional training (and now, many of the e-learning variants) is an explicit orientation toward learning from the experiences of others in the organisation more generally or the course participants more specifically. The focus is on the transmission of pre-determined content. Experiences may be shared in

classroom discussions, but are ephemeral; lost except perhaps in the memories of some of the participants. Experiences may also be shared via electronic discussion fora but most often entries are sporadic, unstructured and not further exploited for current or future learning. In both informal and formal learning, the productivity of what has already been learned by others in the organisation is far from being optimised.

This is particularly the case with tacit knowledge, knowledge that is difficult to see and express, personal, and involves subjective perception, intuition, and foresight (Nonaka & Konno, 1999; Takeuchi, 1998; Trentin, 2001). Trentin describe two dimensions of tacit knowledge, a technical dimension involving "tricks of the trade that are hard to define and are usually covered by the term "know-how" and a cognitive dimension involving convictions and mental models that "delineate a way of viewing the world" (p. 10). Explicit knowledge, in contrast to tacit knowledge, can be expressed in words, numbers and other resources such as handbooks and thick binders of printed course materials in predefined and prestructured ways. In informal workplace learning, it is more often the tacit knowledge that is diffused; in formal training settings, it is more often the explicit knowledge.

Productivity of learning, both explicit and tacit, can be defined in several ways. One measure can be the frequency or impact with which that which is learned can be applied to a new situation in the workplace. Another measure is the extent to which that which has been learned can be reused for the learning of others. The transfer of explicit knowledge has been long studied, by instructional designers, publishers, librarians and knowledge management professionals. The productivity of explicit knowledge can be increased by increasing access to the databases or repositories in which the knowledge is stored, or by increasing distribution of the knowledge via multiple channels and modalities. However, increasing the productivity of tacit knowledge is a more complex task. Key issues are how tacit knowledge can be efficiently extracted, expressed in a concrete form, communicated in an effective way, codified for reuse and retrieved and reused in subsequent learning situations.

In this paper we discuss two scenarios for involving the productivity of tacit knowledge in the organisation that relate to these key issues. The two scenarios involve not only learning concepts but also technology and operational strategies. The scenarios are currently being studied in five different research projects in which we are currently participating, each involving multinational workplace situations. The scenarios have already been developed and extensively tested in practice in the university setting (see Collis & Moonen, 2001; Winnips, 2001). However, their application in the workplace and company learning settings requires adaptations in terms of strategies that work in the university context. We are currently involved in the pilot testing of these adaptations in the company settings. In this article, we give the conceptual bases for the scenarios. We plan subsequent reports in 2002 documenting the results of the pilots that are now running in the workplace settings.

The first scenario relates to informal learning opportunities that occur in mentoring situations in the workplace, particularly when a worker with less experience than his supervisor or mentor is confronted with a complex task. A key idea is appropriate *scaffolding* strategies and tools to increase the productivity of the tacit knowledge of the mentor or supervisor. The second scenario relates to formal learning settings, classroom or Web-based. The key idea in this second scenario is to expand the orientation of training programmes from that of explicit knowledge transfer to one that also includes (and even emphasises) tacit knowledge contribution and reuse.

To illustrate the two scenarios, we will show examples from a graduate course in educational technology at our university. In this course, the participants are all educational professionals, some of whom attended the course entirely at a distance. The figures show screendumps from the course-management system (called TeleTOP; http://teletop.edte.utwente.nl) that serves as the integrating tool for the course.

Scenario 1: Increasing the productivity of mentoring and supervision

Mentoring situations may offer the opportunity to structure the sensitive communication process that is needed for the transfer of tacit knowledge from mentor to mentee. This can be helped by building up a situation where responses to the problem around which the mentee's task revolves are for some part modeled by the mentor, and frequent contact between mentor and mentee is possible. But this frequent contact may not always be possible, or desired. A mentor will probably not wish to be present continuously for mentoring tasks, as his time-investment will be too high. Further, from the mentee standpoint, it is desireable to become self-reliant in performing a task as soon as possible, and to learn to perform the task without support from the mentor. To foster this development of self-reliance, the gradual fading of support is needed, a process which is called scaffolding (Winnips, 2001).

Scaffolding principles can be operationalised in the mentor-mentee relationship by the mentor suggesting that the task of the mentee be divided around a number of subproducts. These subproducts will lead to a final product that the mentee has produced in an increasingly self-reliant manner. The subproducts and final product are shared between the mentor and mentee (or a group of mentees working on a similar task) within shared workspace tools available via an in-house learning-support environment. Via this environment, support on the subproducts is also given by the mentor or other mentees. The main advantage of this approach is that the mentee can work in an increasingly self-reliant way on these subproducts, while the mentor can use each of the succession of subproducts as a way to receive enough information to monitor the ongoing work. As the mentees do their part of producing the products self-reliantly, the mentor adds to this process the support that is needed to finish the subproducts and in so doing transfers his tacit knowledge. This does not always have to occur via discussions; uploading an example from the mentor's own work that shows how he has dealt with a similar problem becomes a major tool for the tacit-knowledge transfer. Figure 1 visualises the conceptual model underlying this scaffolding process

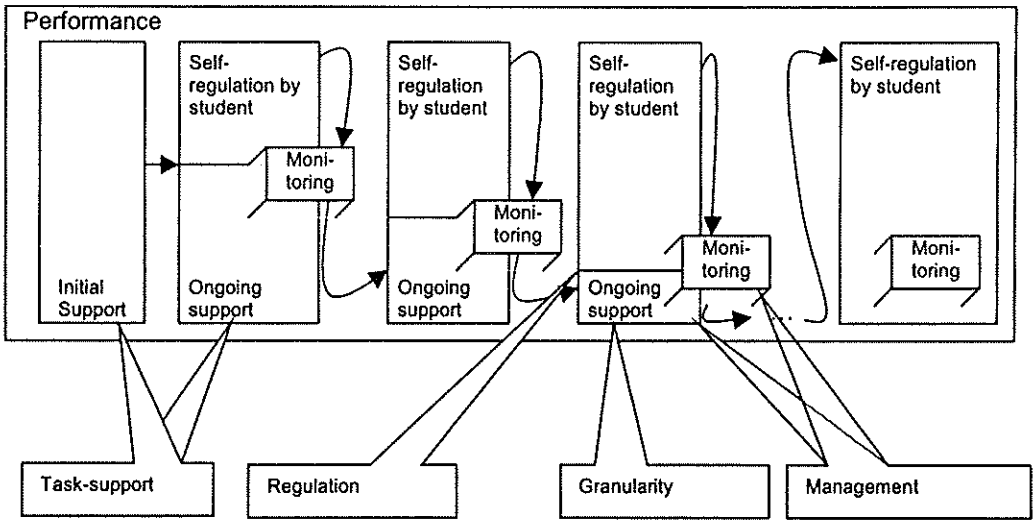


Figure 1. The *Scaffolding-by-Design Model* and related decision aspects (Winnips, 2001).

The basis for this model is performance and the setting up of a communication process between mentor and mentee to support this sharing and monitoring of performance. The model has its theoretical backgrounds in cognitive-apprenticeship theory, where learners are supported by experts while working on a task (Collins, Brown & Newman, 1989). At the beginning of the task, initial support is needed to help persons get started on the task. It is support that can be included in a Web-based environment beforehand. This can take the form of Web links, videos of expert practitioners, design templates, or a proposed sequence of activities. Subproducts are delivered by the mentees a number of times during their activities, in order to systematically give the mentor an indication of the mentees' progress. Examples of subproducts can be a process report, a prototype, or a digitised video segment

of an in-house presentation accompanied by a PowerPoint file. Based on monitoring, the amount of ongoing support to be given by the mentor is decided on for each subproduct. Ongoing support is support that is provided during the learning process, usually feedback on the performed task, suggestions for improvement or making available example reports or presentations from the mentor's own experience. In the ongoing support process the mentor articulates some of his tacit knowlegde, explaining how he might have performed the task, linking to previous experiences, and giving hints based on his own experience of how the task might be efficiently performed. An example of ongoing support in the form of final presentations that are made available to all learners is given in Figure 2.

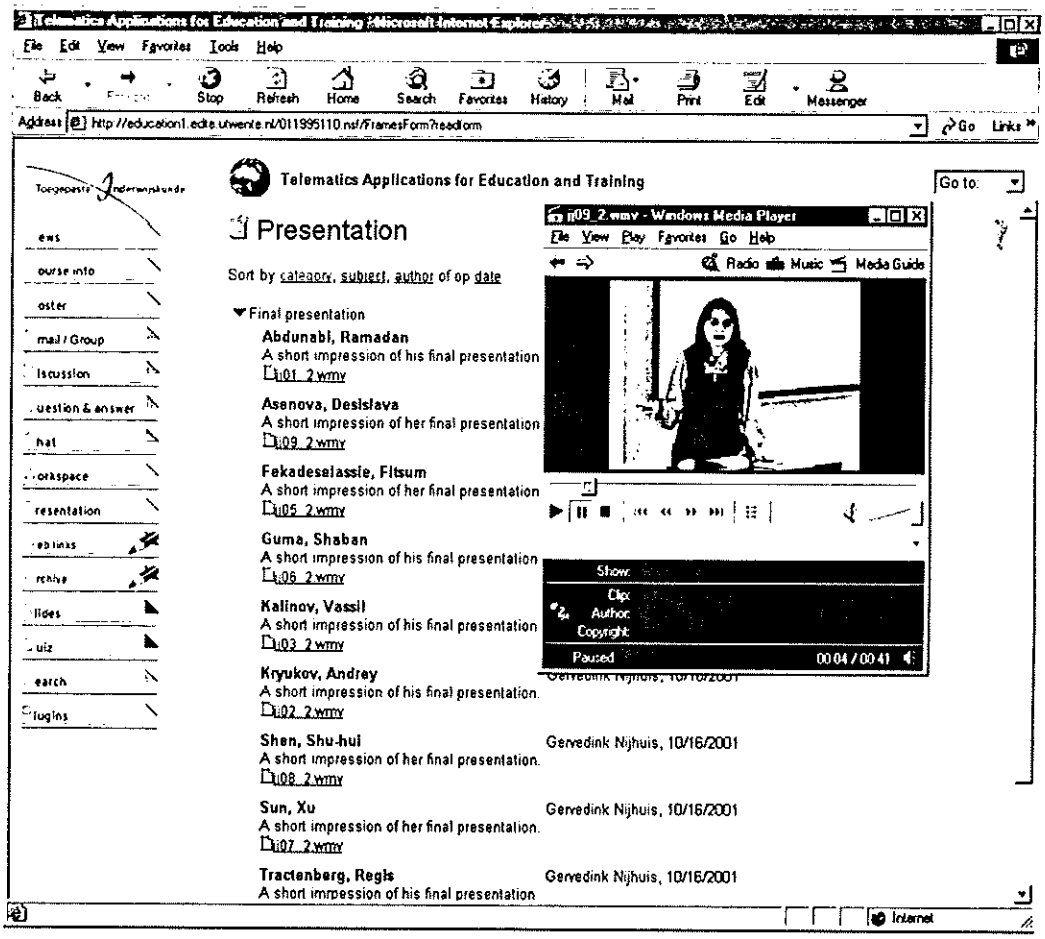


Figure 2. Ongoing support included in a course environment. Final presentations made available as support for learners that could not be present.

Within this process, the amount of mentee self-regulation increases during task execution and the amount of ongoing support (from the mentor or from peers) decreases, based on the principle of scaffolding. All this takes place so that finally the mentee can self-reliantly perform the task, producing a final product that is not only submitted as required in the workplace but also included in a database related to the in-house learning-support environment. This means the final product has become more productive in that it can be re-used as an example performance for other mentees.

To help mentors apply this model in their day-to-day workplace practice, four decision aspects related to this scaffolding model should be brought to the mentor's attention. These aspects can be used to structure the mentor's decision making on certain key aspects of the mentoring process. They are indicated by the lower set of rectangles in Figure 1.

Task support relates to decisions about the nature of the support that is given to directly help performance on a task, and is thus linked to "initial" and "ongoing support" in the model. Within this aspect decisions are made about how much and what kinds of support are needed.

The *regulation* aspect relates to decisions as to who takes the initiative in providing support. This can be experts (mentors), the mentee, a computer, or peers. The regulation aspect is linked to the intersection of self-regulation and ongoing support and relates to decisions about how much support is should be provided, how often.

Granularity relates to the size and scope of the support offered, as well as decisions as to the division of the task and support materials into smaller components. Similar to the way that the vertical rectangles in Figure 1 represent decisions relating task defintion and the amount of support to be provided, granularity is linked to the width of the vertical boxes.

The *management* aspect relates to the efficiency of the learning process, in particular to those aspects of the process that could be facilitated by technology, such as monitoring and ongoing support. The management aspect is also the enabling (or constraining) factor for the three other aspects, as decisions on time investment play a role in support (how much time can be invested on support?), regulation (expert, peer, self, or computer regulation?), and granularity (how detailed should the granularity be?).

Systematic consideration of these decision aspects during the mentoring process can help the mentor structure decisions on what support to be include in the learning environment. In this way the learning environment is shaped to transfer appropriate elements of the tacit knowledge of the mentor to the mentee. The "design guidelines" given in Table 1 can be a further help to program managers or other mentors for the application of some of the support-related decisions in their workplace settings.

Table 1. Design guidelines for implementation of Web based learning support during the mentoring process in the workplace

Decision aspects	Design Guideline for Mentors	Explanation (Winnips, 2001)
Management	Stimulate groups of mentees for peer-support.	Peer-support is a mechanism for learning not only for the mentee who receives support but also for the peers who give it. Further, peer support reduces the time investment for the mentor.
	Invest time in moving mentees towards self and peer regulation.	Self- and peer regulation can help mentees to become "lifelong learners", increasing in their skills for finding their own support. Further, these strategies can reduce the time investment for the mentor.
	Provide as much initial support as practically possible.	When problems in task-performance are expected and known beforehand, place support for these problems in the learning environment, so that the learning environment instead of the mentor becoming the main source of just-in-time support.
	Plan to support only a part of the task.	As time-investment for closely monitoring the learning process was found to be quite high (Winnips, 2001), choose to support only a part of a task that proved problematic earlier.
Task-support	Use subproducts.	Via the use of subproducts deadlines are agreed on, and the performance on a task can be monitored via the learning-support environment.
	Provide initial, as well as ongoing support, particularly via sharing examples of the mentor's own work.	Different forms of support are needed, initial for "getting started" on a task and solving anticipated problems, ongoing for unanticipated problems and transfer of tacit knowledge.
	Provide criteria for the task in the learning environment.	Criteria help to structure the work, as well as provide a mechanism to structure discussion between mentor and mentee, and thus stimulate the transfer of tacit knowledge.
	Structure peer-feedback using Web based forms and checklists, structured along task criteria .	Via Web based forms mentees can directly check feedback and relate it to the criteria or examples. Checklist-type forms save time for the mentor as well.
Regulation	Structure regulation so that it gradually shifts from mentor to mentee.	According to the principle of scaffolding, mentees need expert regulation at first, and can then learn to self-regulate as support is faded.
Granularity	Plan to have subproducts in fixed time periods.	By fixing the time period to one or two weeks, clear expectations are met, and a habit of working and delivering subproducts can grow.

The final product that evolves delivered during this process is a collaborative effort of the mentee, mentor, and possibly peers. This final product can then be included in an "experiences database" as described in the next scenario so that they can be reused afterwards.

Scenario 2: Increasing the productivity of tacit knowledge in the structured learning setting

In contrast to mentorship relationships in which tacit knowledge is richly present but often not systematically maintained or reused, structured learning in organisations generally takes place in short courses in which explicit knowledge transfer is the major orientation. There are several key differences in the "learning from tacit knowledge" approach compared to the "learning from explicit content" approach. These are identified in Table 2 (Collis, 2001).

Table 2. Learning from explicit content approach compared to learning from tacit knowledge approach.

Learning from explicit content	Learning from tacit knowlegde
Content is preselected, prestructured, and delivered	Content is encountered from a variety of sources, and partially is contributed out of one's own experiences
Learning relates to hours of time spent on reading or listening or attending face-to-face sessions.	Learning relates to finding and interpreting examples from practice, seeing how they relate to important competencies and objectives, and contributing to the collective knowledge base.
The starting point of a course is its content, prepared by in advance by professionals, perhaps not even having any contact with the organization.	The starting point of a course is the activities that learners will do, resulting in bringing new resources into the learning setting.
To be time and distance independent, a course must be instructor independent; tutors need to be available to answer questions relating to the pre-defined study material. Perhaps a forum can be available if some wish to use it (must will not).	The good instructor should be extended over time and distance. His main task is to lead learners to making the connection between theory and practice, starting with their own practice. The instructor is not replaced, but extended.
Content and standards determine quality.	Building on and contributing to the learning resources and learning community of the organization determines quality.
Standards are necessary to make use of materials produced elsewhere, and to sell your own materials elsewhere.	Standards are necessary but need to be a combination of externally shared indices and also locally meaningful indices.
"Offering instructor-neutral courses on the Web" is the guiding theme.	Building on and using the experience base of the organisation is the guiding theme of learning activities.
Learning is completing courses.	Learning is becoming an active member of a professional community, knowing how to locate appropriate knowledge (also in human form) and apply it in one's work.
Learning is studying pre-written content.	Peer-to-peer learning is central; pre-written content is a resource, but may also sometimes by contributed by one's peers in the form of examples from their own experiences.

How do these principles involving learning from the tacit experiences of others in the organisation, even participants in one's own course, work in practice? They involve combinations of technology, pedagogy, and new ideas about instructional design (Collis & Moonen, 2001). An "experience management" architecture (Layton, 1999) is needed instead of a "course management system". Such an architecture, based on an object-oriented database, facilitates the acquisition of new records of in-house experience and also presents different views and combinations of the experiences for different learning settings. (De Boer, 2000).

How does this contribution-orientation happen in practice? We have been working in this direction in our own institution, the University of Twente, for several years and now also are implementing these ideas in various company settings. The following steps (Table 3) are the ones we are using; each is based on a considerable amount of literature and experience (see Collis & Moonen, 2001, Chapter 5; see also http://teletop.edte.utwente.nl).

Table 3. From content delivery to building on experience

Steps	Strategies and tools
1. Start where instructors are at; extend their strongest skills so that learners who are not present can also take advantage of these skills.	1. Begin by extending an existing course, not "creating" or "buying" a "Web-based course"
2. Shift the focus from content to activities	2. Assume you can go on, for awhile at least, with the existing textbook or course reader; don't start by trying to put it "on line". Focus instead on new forms of activities that will bring new resources into the course.
3. Plan activities around participant contributions, and learner (re)use of resources contributed from a variety of sources	3. Use a Web system that makes upload and download of resources easy, for both instructor and learners. Uploaded resources need to become objects in a database, indexed or managed on the fly to make them immediately available for re-use.
4. Plan activities so that particpants who are present in a face-to-face session create a base set of resources, which can be built upon by learners who are not present.	4. Use a Web system linked to a database; write activity descriptions that involve building upon the inputs of others; commenting, synthesizing, adding to, comparing to one's own ideas, etc.
5. Gradually add more self-study content materials, preferably based on the input of others in the organization.	5. Re-use good input; move toward an idea of a course site as a collection of resources, with the course itself focusing on structured use of and addition to those resources.
6. Make activities meaningful, and required.	6. Plan activities so that each participant's contribution is visible, valuable, and needed in order to continue with the learning activities. Activities are aimed at contributing to the learning resources, not individual practice exercises.
7. Assess via contributions	7. Assess the adequacy of course participation via what is submitted to the course Web environment. "Passing" a course is not a matter of only attending course sessions or completing an individual examination, but rather of showing that the participant can relate to, build upon, and add to, learning-related resources.
8. Aim for contribution flexibility, distance and time flexibility are not only or even major points.	8. With a contribution approach, learners can participate at locations of their choice and within certain time periods. The same learning resources can also be used for "just in time" and individual learning. Distance and time flexibility gradually and naturally increase.
9. Think of content as coming from a variety of sources.	9. Use the Web environment (based on a database) as a tool to bring together different views of a variety of content objects: those produced by professional instructional designers, those created by the instructor, those contributed by learners, and those documents found in house or on the Web which may not have been created as "learning objects" at all.
10. Be less concerned about the "perfection" of the content objects and more concerned about the contribution and re-use processes	10. Be very careful about how activities are described, about what is expected in sub-tasks, about how to monitor progress, about how to bring in peer interaction, about how to evaluate and determine completion. Re-use model contributions.

Figure 3 shows how the building process of a course can occur as the course progresses, with on-going input from both the instructor and other participants. In this approach, the course environment grows with each participant. The mechanisms of course participation stimulate additions to the knowledge and experience base not only of the couse itself but also of the organisation.

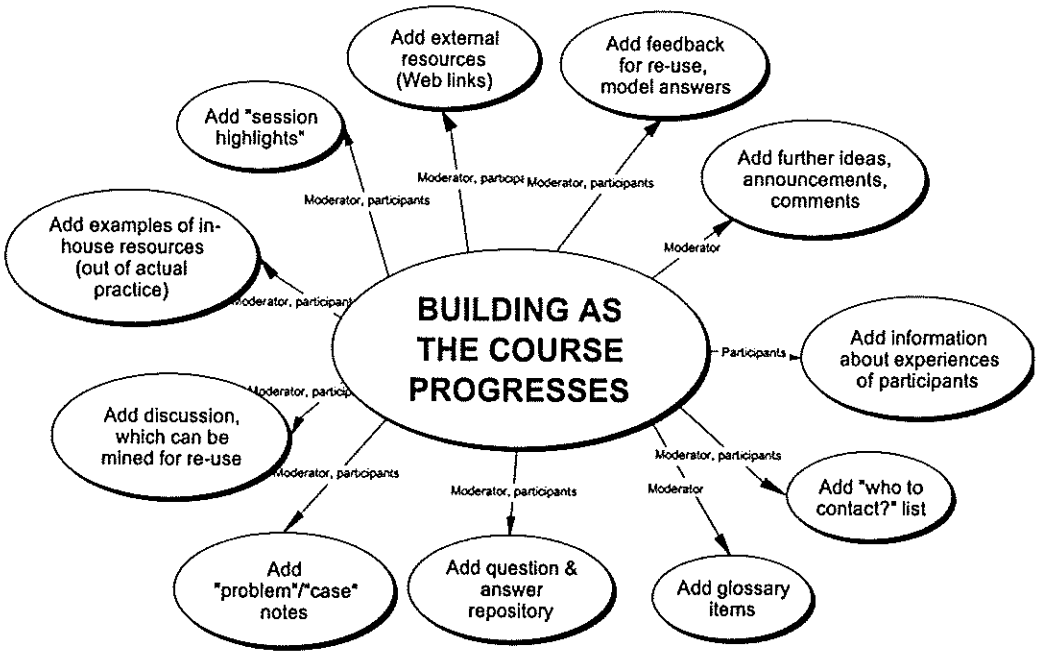


Figure 3. Building as the course progresses (Collis, 2001).

To illustrate the processes identified in Figure 3, we will show the roster from the course-management system called TeleTOP in Figure 4.

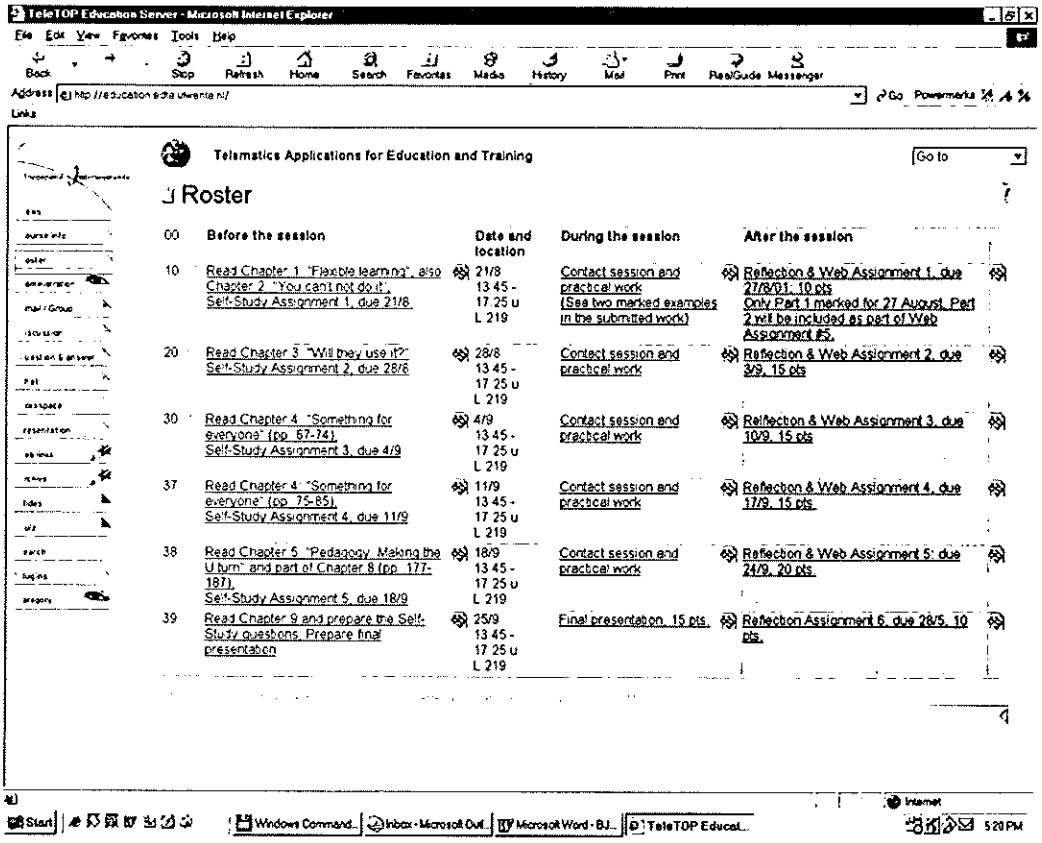


Figure 4. Roster showing integration of study materials with a variety of types of student contributions. Students who cannot physically attend the contact sessions make their contributions for in-class acitivities via the Roster.

During the regular self-study episodes (left column in the matrix), the participants read some common conceptual materials (available via the site) and then submitted brief reports on how the issues discussed in the conceptual materials are manifested in their own workplaces. Following up on these submissions, the participants compared their own experiences with those submitted by their classmates. This occurred in the subsequent face-to-face session, for those who were physically present, or via the Web site for those not able to be physically present. During the face-to-face sessions, participants did a variety of activities, such as working together to find good examples from the World Wide Web and entering these into the "WebLinks" portion of the course Web site. In each case, some product of the activity was entered into the course Web site. Participants who were not present at the contact session did the same or a related activity, usually making use of the submissions of those who were present. All submissions are available via the course Web site. Finally, the major project of the course consisted of each participant developing an electronic portfolio, analysising the situation in their home institutions with respect to the potential for flexible learning and developing a plan for implementation of some aspect of flexible learning in their own situations. These portfolios were developed over the period of the course in the "Workspace" area of the course environment, and were available to all participants, for peer feedback and comparisons among each other. The final products are available in the course site. Finally, for those who were present during the last contact session, video segments were made of each participant discussing his or her final project. These video segments are available for the students who were not present (as shown in Figure 2).

In the process of the course, involving 22 participants, over 500 submissions were made by the students into the course environment. All were re-used during the course itself, for comparisons, reflections, peer feedback, and other activities. At the close of the course, a

selection of approximately 50 of these submissions was made for re-use in further cycles of the course (or other courses). Each of these was given extra labelling, to facilitate its re-use.

The keys to this kind of productive learning are in the nature of the activities for the participants and in using a database-driven Web environment with appropriate functionalities to capture and enable the contributions for reuse. What these key functionalities are is discussed in the next section.

Key technologies

In the previous two scenarios, illustrations have been given of how tacit knowledge can be captured and expressed. In the mentoring and supervisory settings, this occurs through comments given to subproducts that include not only articulated reference to past experiences and intuitions but also links to examples and artifacts from the mentor's own background. The tacit knowledge of the mentee is also being captured, within the subproducts and final products themselves that the mentee is creating and submitting to the shared workspace. In the structured learning setting, tacit knowledge is elicited and expressed via appropriately designed and management learning activities. In both cases, In both cases, a key step toward learning productivity is the capturing and indexing of these various knowledge products for reuse beyond the particular learning setting. Otherwise, the productivity is limited to those directly involved in the sharing situation.

In both scenarios the technical key is an object-oriented database, in which mentors and mentees, trainers and course participants can all have access. The interface to this database requires a simple way to input objects of all data types, including zipped files, PowerPoint presentations, spreadsheets, images, even video segments (of an interview or discussion). Figure 5 shows how such an input process can occur, using a template associated with a database (in this case, the database that is part of the TeleTOP system at the University of Twente).

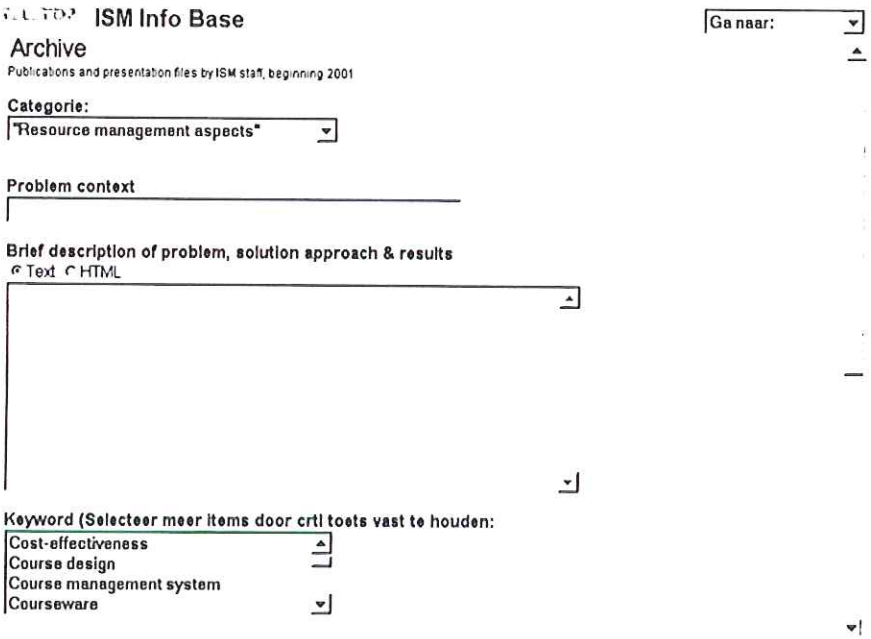


Figure 5. Easy and open entry and labelling of learning objects into a database, using a template orgamised around a problem orientation and using terminology meaningful for the organisation as part of its keyword and category systems.

In Figure 5, only a part of the TeleTOP template for object entry is shown (with some comments in Dutch). For "Category" any set of categories can be used that are appropriate

to the local situation. In the example shown in Figure 5, the categories relate to the areas of research in a faculty department called "ISM". Keywords also can be entered based on local relevance, such as competencies. As many keywords can be chosen as the uploader feels are appropriate, and can be easily edited, simply by clicking or unclicking. The insertion of locally relevant categories and keywords is important for subsequent retrieval and reuse of the saved resources. As much as possible, metadata indexing outside of categories and keywords should be automated, such as for the date, source, author, file characteristics, etc. For workplace situations where it is possible that certain items in the database may be shared as learning resources outside of the local settings, the choice of an internationally recognised standard for metadata indexing such as SCORM is useful. However, with a focus on in-company knowledge productivity, the intention is not so much to make a reusable knowledge item available to others outside the company as it is to strengthen the impact of the tacit knowledge of a company member within that company. Much of the value of the tacit knowledge stored in the database is its idiosyncraticity: of high value to the company and perhaps not so much otherwise. Items in the database should retain the local style of their contributors, not be edited to be "more professional" in format or expression. Most important is that contact can be made with the contributor, via an e-mail link or telephone number. The resources are thus not only reusable but extendable, via contact with their originators. This requires that the communication-support functionalities are directly integrated with the rest of the learning environment. This type of personal networking can extend outside company borders, but in terms of the knowledge productivity of the organisation, the first audience is in-house.

Conclusion: Cross-over productivity and issues

In this article we have described various strategies for making learning and learning environments more productive in workplace settings by noting practices that can grow and gradually become part of normal procedures. There is another aspect to making knowledge more productive that can also develop out of these approaches. This aspect relates to cross-over productivity, whereby tacit knowledge made explicit in a mentoring situation can also be reused in a structure training situation and vice versa. Once a common database is used for submissions and if appropriate copy functionalities are available so that submitted objects can be easily reused in different contexts, this cross-over productivity can occur. In this way the tacit knowledge of the mentor expressed during a mentoring situation can also be used by the instructor or moderator in the structured training setting, and the experiences captured during the structured training settings can be available for mentoring support. The more the objects originating in the tacit knowledge of members of the organisation are reused, the more productive they become.

The mentors and moderators or instructors of the described settings are key persons to stimulate this kind of personal networking via products in the database. While technically the database is the key to capturing the tacit knowledge that is produced in both learning settings the moderators and mentors are the social keys to capturing the learning experiences and ensuring transfer. The mentor can ensure that there will be transfer from the structured setting to the workplace. The moderator can ensure that the contributions to the structured setting will have enough realism so that they can be useful in practice. Thus the scenarios can work both ways.

Of course there are many issues facing the routine implementation of these knowledge-productivity scenarios. It is important that the ideas be feasible in practice; ordinarily busy professionals have no time or inclination to describe their experiences in a systematic way and enter them into a database. Through the strategies of focusing on two types of learning settings--the mentor/supervision relationship with a newer employee working on a specific task, and the course setting of the training department--we believe there can be natural opportunities for gradual filling of an experience database. Critical however are tools at one's fingertips that make the submission and labelling process something that can occur with little time investment and with minimal alteration in work procedures and workload. In some companies, a process has been set in place for the capturing of tacit knowledge, often within

a human resources development framework. At the Buckman Laboratories a team of subject specialists regularly screen additions to the organisation's very active electronic forums, looking for new objects for the database, pruning and labelling them and submiting them to the knowledge base environment of the company (Fullmer, 1999). As another example of an explicit procedure for capturing tacit knowledge, Takeuchi (1998) describes how "Hewlett-Packard has been embarking on a number of knowledge management initiatives to create a purposeful process for capturing, storing, sharing and leveraging what employees know. One of the outcomes of this initiative is the formation of *KnowledgeLinks*, (http://www.knowledgelinks.com) an on-line environment ...that enables managers to receive a screenful of documents, war stories and best practices on how others have dealt with key management issues in the past - such as decreasing time-to-market, outsourcing manufacturing, managing retail channels and others. The *KnowledgeLinks* web sites not only provide access to what others have done, but whom to contact as well". In both the Buckman and Hewlett-Packard examples, "people to people" connections (Hinrichs, Kelly, & Bakia, 2000) are critical. There is no indication however, in the Buckman Laboratories situation or in Takeuchi's discussions or in the Web sites of *KnowledgeLinks* or Hewlett Packard of any specific attempt to reuse these resources in their formal training programme, of cross-over productivity. This represents a loss of opportunity for the increased cross-over productivity of this tacit knowledge.

Most important is the need for some incentives for these new practices; the tacit knowledge database must be gradually seen by all as a valuable resource. This will not happen until a critical mass of usage and contents evolves, and that is turn will not happen without some form of organisational stimulus and support (Rumizen, 1998). Management can perhaps be stimulated to support such processes through arguments that relate to competitive benefits. "The only way to keep pace...is by rebuilding business processes to take advantage of the collective knowledge base" (Eckhouse, 1999). "The advantages in technology and changes in the organizational infrastructure have increased the significance of virtual knowledge sharing, knowledge refining, new knowledge building and virtual networked learning for professional development." (Vänskä 2001). "Potentially explicable knowledge that has not been articulated represents a lost opportunity to efficiently share and leverage that knowledge" (Zack, 1999). In our analysis, this process of making tacit knowledge explicit and more productive can occur via the convergence of training courses and professional development, of formal and informal learning. Re-usable learning products, elicited during scaffolding techniques applied to mentoring situations or via a contribution orientation in structured course settings, are a key for these processes. The processes also make for good learning experiences.

References

Collins, A., Brown, J. S., & Newman, S. E. (1989). Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L. B. Resnick (Ed.), *Knowing, learning, and instruction: Essays in honor of Robert Glaser* (pp. 453-494). Hillsdale NJ: Lawrence Erlbaum.

Collis, B. (2001, 29 June). *Linking organisational knowledge and learning.* Invited paper to be presented at ED-MEDIA '2001, Tampere, Finland.

Collis, B., & Moonen, J. (2001). *Flexible learning in a digital world: Experiences and expectations.* London: Kogan Page. [WWW resources available] http://education1.edte.utwente.nl/00FlexibleLearning.nsf/FramesForm?ReadForm (accessed 18 May, 2001)

De Boer, W. F. (2000). *Decision support for e-learning flexibility and enrichment.* Internal report, Faculty of Educational Science and Technology, University of Twente, Enschede, NL.

Eckhouse, J. (1999). Executive reports: Get creative with knowledge sharing. *Information Week Online News in Review.* [WWW document] http://www.informationweek.com/720/sharing.htm (accessed 19 March 2001)

Fullmer, W. (1999) *Buckman Laboratories.* Harvard Business School Report N9-899-175 [WWW document] http://www.knowledge-nurture.com/web/bulabdoc.nsf/whatsnew/8A906ABDAEFF6A6D8625680800520F59?OpenDocument (accessed 18 May, 2001)

Hinrichs, R., Kelly, H., & Bakia, M. (2000). *Report of a Workshop on a Proposed Learning Federation, National Science Foundation, November 28-29, 2000.* Internal report, The Learning Foundation, Washington, DC. [WWW document] http://www.thelearningfederation.org/documents/roadmap.pdf (Accessed 25 March 2001)

Layton, W. (1999). *Electronic performance support systems and knowledge management: The merging ground.* University of Brighton, UK. [WWW document] http://www.boyblue.freeserve.co.uk/wjlonline/dissertation2_files/content.html (Accessed 16 May 2001)

Nonaka, I., & Konno, N. (1999). The concept of "Ba": Building a foundation for knowledge creation. In J. W. Cortada & J. A. Woods (Eds.), *The knowledge management yearbook 1999-2000.* Boston: Butterworth-Heinemann.

Rumizen, M. (1998). How Buckman Laboratories' shared knowledge sparked a chain reaction. *The Journal for Quality and Participation,* July/August 1998. [WWW document] http://www.knowledge-nurture.com/web/bulabdoc.nsf/By+Title/CB95CBACE18737A586256675007371 8A/$FILE/AQP.PDF (accessed 18 May, 2001)

Takeuchi, H. (1998). *Beyond knowledge management: Lessons from Japan.* [WWW document] http://www.sveiby.com.au/LessonsJapan.htm (accessed 18 May, 2001)

Trentin, G. (2001). From formal training to communities of practice via network-based learning. *Educational Technology* 41(2) 5-14.

Vänskä, R. (2001, 27 June). *E-learning and M-learning in the corporate sector: Need for new concepts and a new mindset for learning, training and competence development.* Keynote presentation, ED-MEDIA 2001, Tampere, Finland.

Winnips, J. C. (2001). *Scaffolding-by-Design: A model for WWW-based learner support.* Doctoral dissertation, Faculty of Educational Science and Technology, University of Twente, Enschede, Netherlands. [Available via the WWW] http://scaffolding.edte.utwente.nl (accessed 30 May 2001)

Zack, M. H. (1999). Managing codified knowledge. *Sloan Management Review* 40(4) 80-97.

Uses of ICT in Teacher Education

Betty Collis
University of Twente, The Netherlands

Insung Jung
Ewha Womans University, South Korea

Introduction

The following chapter discusses the use of information and communication technologies (ICT) for teacher training. It starts by providing an overview of ICT applications and their functions for learning purposes and drawing a distinction between ICT applications as core or complementary to the learning process. Via a variety of examples, we show that ICT use is not only a matter of new possibilities but brings with it new implications and new challenges. We extract key factors that can stimulate or frustrate the use of ICT for teacher education and teachers' initial and on-going development. The chapter concludes with a discussion of key future developments in teacher training made possible by developments in ICT.

The evolving use of ICT in teacher education

'ICT' stands for 'information and communication technologies'. Information technologies involve computers. Communication technologies can include telephone and videoconferencing, but in the combination, 'ICT' is generally taken to mean technologies that support communication via computers. Currently, this implies the Internet or local networks, e-mail, and World Wide Web technologies. We begin with a brief historical perspective on the evolution of ICT in teacher training.

In the late 1970s a new wave of teacher training emerged, whose major focus was introducing teachers to microcomputers and programming. Students and teachers alike learned languages such as LOGO and BASIC. The LOGO language, and to a lesser extent, BASIC, were vehicles not only to create useful (small) programs, but also to learn how to program, to control the computer, to be 'ready for the information age'. Also, LOGO led the way in terms of intertwining information technology and a curriculum area, as LOGO programming was primarily used in the context of exploring mathematical ideas.

The focus on teaching teachers how to program faded during the 1980s as a number of regional and national initiatives in the UK, Sweden, The Netherlands, Australia, France, Mexico, the USA, Canada, Israel and other countries led the way to the professional development of educational software. Schools needed support staff to

select, license, and install the software packages and to train their teachers how to use such packages. Teacher training began to switch towards introductions to the use of these professionally made software packages, training which was sometimes provided by teacher training colleges or faculties of education, sometimes by support groups financed by ministries of education, and sometimes by representatives of computer companies. Also, the educational value of using computer software that was not necessarily developed for learning, particularly word processing and spreadsheet applications, became known, and teacher training began to routinely include courses on how to use and apply such generic applications in the classroom. A persistent concern was the growing divide between teachers in wealthier and less-wealthy countries due to differences in access to computers, appropriate teacher training, and (costly) educational software.

A major breakthrough in computer use in education came with the emergence of the Internet and the Web as technologies commonly available to individuals during the mid-1990s. A new phase of computer use began and is still continuing for teachers and teacher educators. In this phase, teachers are still making use of stand-alone computers, but are increasingly having online contact with other teachers, teacher trainers, and networked resources via the Internet or intranets. This has powerful implications for ICT in teacher training. Teacher education frequently focuses on how to make use of the Internet and the Web and teachers themselves are learning via the Internet and the Web.

Teacher training in HOW to use ICT

For *teacher training in HOW to use ICT*, the major types of ICT products currently being studied by teachers include: tutorial software and simulations for knowledge transfer and conceptual development, e-mail and conferencing software for communication support, groupware and other tools for collaborative learning, concept mapping and other tools for conceptual manipulation, software for access to educational databases, specialized computer-based tools for subject areas such as mathematics and technical drawing, software for testing and assessment, and different forms of Web-based resources (Collis, 2001). Video segments are increasingly a part of Web and CD-ROM resources. For all of these, the focus of

teacher training is how to use such products in the classroom of off-campus. Teachers face new roles with respect to using ICT, being called upon to:

(a) Select and use appropriate ICT tools and support students in the use of these tools.
(b) Think of new forms of student activity and determine how ICT can help support these.
(c) Learn how to set up and monitor ICT-related learning activities.
(d) Determine and communicate how learners will be evaluated in the new forms of ICT-related activities, particularly for group projects and peer evaluations.
(e) Monitor and intervene when there are problems with group work or using the technology.
(f) Manage contact with students, Web submissions, e-mail, discussions, and comments on each other's work.
(g) Develop new methods of grading student performance.
(h) Monitor the quality of what students find via the Web and share with others.
(j) Keep records of student participation and process for monitoring and grading.
(k) Manage incoming and outgoing e-mail and contacts with individual students

(from Collis & Moonen, p. 106)

Teacher education must help the teacher to use ICT in all of these activities.

Teacher training WITH ICT

For *teacher training WITH ICT,* the major ICT products are Web-based course management systems and other forms of database-driven Web systems, simpler Web environments, and e-mail and computer conferencing software (increasingly integrated within Web environments~~), and to a lesser degree, CD-ROM products~~. Web environments or systems offering an integrated range of tools to support learning and communication are becoming a major medium for learning in every

discipline, and thus also for teacher training. Table 1 provides an overview of how current Web environments can support teacher training with ICT, even if the teachers or trainee teachers are not in the same place at the same time.

Table 1. Web-based technologies to support teacher training courses (adapted from Collis & Moonen, 2001, pp. 83-85)

Course component	Increasing flexibility in participation	Supporting new ways of teaching and learning
1. General course organization	– Post all announcements about course procedures on a course Web site – Make a calendar of relevant dates and times available on the Web site	– Have teachers add links to Web-based resources and to the work and homepages of experts related to their courses and the subjects they will teach
2. Lectures and contact sessions	– Extend the lectures and contact sessions for persons who cannot always be present so that: ▪ the most relevant points are expressed in notes (PowerPoint, document files, images) available via the Web site ▪ discussions and presentations during the class session can be captured as digital audio and/or video and linked to the course Web site for later reference	– Extend the interactivity of the contact sessions by having teachers work in small groups and post the results of their discussions on the course Web site – Extend the impact of the contact sessions by having all teachers reflect on some aspect of the sessions and communicate with each other about the aspect with some form of structured comment via the Web page
3. Self-study and exercises; practical sessions	– Assemble a set of resources (text as well as images and video) which the teachers can refer to in terms of lesson planning or course materials. Teachers can compare their own experiences as teachers with resources in the collection (available via the course Web site or a CD-ROM) and also add information (text and images, and in special cases, video segments) about their own experiences	– Stimulate communication and interaction among the teachers via the Web site or e-mail. Teachers can build up a portfolio of instructional ideas or experiences, saving the files in a shared workplace environment that can be electronically accessed by other teachers – When student teachers are engaged in teaching practice or practical work in schools, invite regular reflective reports and stimulate e-mail contact among supervising teachers in the schools, staff in the teacher-training institutions and the teachers themselves. Web-based discussion boards are a good tool
4. Multi-session projects or activities	– Make available shared workspace tools along with other communication and reporting tools in the Web site to allow group members to work collaboratively on projects at one site or at different locations	– Use real-time communication tools via the Internet for teachers in different locations who wish to meet electronically and discuss their teaching experiences, to support action-research projects by teachers, and to make contact with subject specialists as individuals or via professional associations
5.Evaluation and assessment	– Use the Web environment to submit assignments electronically without having to come to a physical location. – Provide self-evaluation tools and guides for reflective practice	– Integrate new forms of assessment, such as teachers maintaining their own portfolios, within the course Web environment. Lead the teachers to comment on each other's portfolios
6. General communication	– Add a communication centre to a course Web site so that groups of teachers as well as individuals can be easily contacted via e-mail – Use real-time collaborative tools so that teachers can see and/or hear their instructor or each other during a fixed-time appointment, but without being face-to-face	– Add a Web board for discussion about course topics as a major activity in the course; have the teachers take responsibility for moderating the discussions, adding links to external resources to justify their comments when appropriate – -Involve experts from outside the course to join in or lead the discussions

ICT as core or complementary to the teacher training process

ICT may be the major or core technology in a learning setting, or a complement (Collis & Moonen, 2001). A core technology refers to the major way of organizing the learning experience; the component around which all other components are planned. In traditional teacher training, for example, the core technology is the face-to-face classroom session, led by the teacher trainer. Without the core technology more or less as planned, the learning experience is likely to be unable to continue. In contrast, complementary technologies are optional, serving a valuable function but able to be compensated for via the core technology if so needed, or dropped altogether if not functioning or feasible. When an ICT product is the core technology, all of those using it are vulnerable to problems of access, costs or breakdowns. When an ICT product is only a complement, it can be dropped from the learning setting if its use becomes a problem. In terms of *learning with ICT*, Web-based environments are frequently becoming core technologies, especially when some of the teachers or trainee teachers are participating at a distance. When ICT products are used as complementary technologies for teacher education, these products most typically include e-mail, Web resources, databases of electronic teaching resources, as well as individual computer-based learning resources.

Combining these two dimensions, learning HOW to use ICT and learning VIA ICT and ICT as core technology or complementary technology, gives the approach to analyzing ICT in teacher training shown in Figure 1.

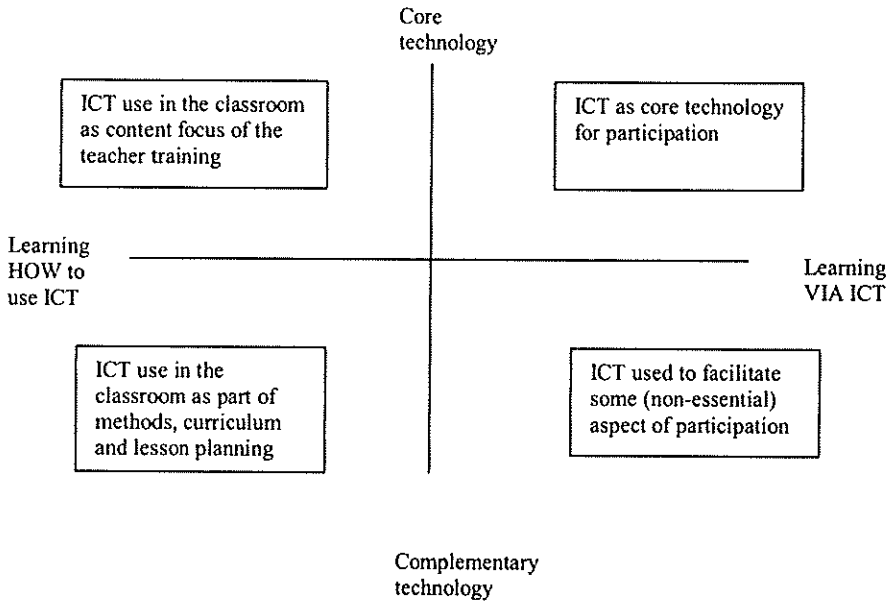


Figure 1. Categories for ICT in teacher training

The categories shown in Figure 1 can help position the examples of ICT used in teacher training discussed later in this chapter.

The upper-left quadrant 'ICT use as the content of teacher training' refers to helping teachers gain competence with ICT, for example, with specific software packages or the Internet. The lower-left quadrant includes courses in which ICT use (predominately subject-specific resources or general applications software) plays a part, but not the major part= for example, in courses where teachers learn the methodology of teaching in their subject areas or focus on students with certain learning characteristics or difficulties. The upper-right quadrant relates to ICT (predominately Web environments) as the tool used to support flexible learning for teachers and particularly for specialist or postgraduate school- or home-based study for teachers, *just-in-time* professional development including networking with other teachers, mentoring new teachers, and inter-regional or international collaboration. The online learning networks for teachers provided in many parts of the world and shown later in this chapter are examples of teacher learning via ICT as a core technology. The lower-right quadrant includes examples of ICT (predominately e-mail and Web) used to bridge theory and practice, support trainee or in-service teachers in their in-school activities, help teachers to manage student assignments,

student queries and feedback, facilitate access to resources, and support partnerships between schools, universities, and the larger community.

Applications: Training about ICT use and training via ICT use

ICT as a focus of initial teacher training: the Singapore experience

In1997, Singapore's Ministry of Education launched the Masterplan for IT in Education to ensure that all students have the knowledge, skills and confidence to compete in a constantly changing technological environment. This Masterplan aimed to train every teacher in the use of ICT for teaching, equip trainee teachers with core ICT teaching skills, and involve institutions of higher learning and industry as partners with schools.

Singapore's only pre-service teacher training institute, the National Institute of Education (NIE), was entrusted with integrating ICT into initial teacher training programmes. NIE developed and began implementing the new ICT plan in 1998, identifying four main areas needing change: curriculum, physical and technological infrastructure, human resource infrastructure, and R & D in the use of ICT in education. NIE's experience will be reported as one of nine case studies on the use of technology and teacher training supported by the World Bank's *infoDev* programme through a grant to the Institute for International Education. For the purposes of this chapter, we focus on how NIE has revised its curriculum to promote ICT use in the classroom by future teachers (Jung, 2001).

The curriculum was revised to include three kinds of ICT courses for student teachers: basic ICT-skill workshops, a 30-hour ICT foundation course, and a 26-hour elective course. In addition, 6 -12 hours of ICT integration into each curricular subject was recommended. The basic ICT skill workshops, which have to be paid for by students, are provided by external organizations and cover word processing, PowerPoint, Internet literacy, and other technical skills. The 30-hour ICT foundation course, Instructional Technology, is offered by the Division of Instructional Sciences (DIS) and covers: learning, thinking and the effective use of instructional technologies in the classroom; instructional planning models; selecting, creating,

evaluating, and integrating instructional technologies and resource materials; promoting creativity and complex thinking through IT project work activities; and organizing and managing instructional activities with appropriate IT resources in the classroom. The student teachers are required to prepare computer-based micro lessons and at the end of the course, the better lessons are selected, edited and published in CD-ROM and distributed to schools for use by teachers. The 26-hour elective, Message Design and Computer-Based Instruction, is provided by DIS and covers the design and production of computer-based instruction.

Besides taking these courses, the NIE Diploma in Education students have five weeks' practicum during the first year of their pre-service training and ten weeks during the second, during which time, depending on the school's ICT infrastructure, they are expected to use ICT in their teaching. When interviewed about the new teacher training curriculum, the student teachers agreed that the foundation course provided useful pedagogical strategies for the use of ICT in classroom teaching. In particular, they appreciated being able to download basic information and materials from the Internet. However, they reported that 30 hours of instruction was not enough time to gain ICT proficiency, and some wanted more ICT integration in the practicum.

ICT as part of teacher training methodology

Captured Wisdom (http://www.ncrel.org/cw/) is a US resource developed by the federally funded North Central Technology in Education Consortium for K-12 teachers, school administrators and adult literacy educators. It uses videotape and CD-ROM to help teachers see how technology can be integrated into their work. The *Captured Wisdom*™ CD-ROM Library is made up of stories about teachers making meaningful and creative uses of technology in their instruction. After viewing video descriptions and demonstrations in these CD-ROMs, teachers' focus groups then discuss the strategies and techniques of classroom management, assessment, etc.

The School Administrators' Technology Integration Resource (SATIR-RITAS) (www.satir-ritas.org) is a bilingual Canadian initiative providing tools and resources

to help school administrators successfully integrate the Internet and other ICT into their schools' curriculum. It includes the National Center for Technology Planning Clearinghouse of school district ICT plans, advice on how to provide technology, successful practice in introducing ICT, perspectives on staff development, and a beginners guide to the Internet.

The Korea National Open University (http://www.knou.ac.kr), with the support of the Korean government, created a 60-hour nationwide distance training programme for primary school teachers using Cable TV as the core technology and a self-study textbook and two-way videoconferencing as supplementary media. The programme has been delivered twice a year, each time with 1,000 primary school teachers, administrators and school principals participating. In 1999, a second distance training programme dealing with similar topics was delivered nationwide to secondary school teachers. Of these, 89% indicated that they felt the course was useful in improving their teaching and 78% enjoyed the live interaction with their instructors via videoconferencing. Integration of the Internet as a communication medium was recommended by the teachers.

The *Shoma Teacher Development Programme* (http://www.shoma.co.za/), a programme supported by various ICT companies and South Africa's National and Provincial Departments of Education, uses satellite TV, Internet technology and collaborative lesson planning to support in-service training for underqualified teachers in South Africa. Its primary foci are the South African Government's 2005 Outcomes Based Education programme, teaching methodologies and classroom assessment. Teachers have access to video materials, the Internet, and other learning support through eight training centres, each of which provides a broadcast room, a computer room, and a lesson development room.

ICT as a core technology in teacher education

The Virtual High School (VHS) (http://vhs.concord.org) is a US non-profit organization that facilitates a collaborative of participating secondary schools. Students and teachers are expected to attend their VHS NetCourse on a daily basis

(or, for students on block schedules, at least 3 times per week). Courses undergo rigorous evaluation before they are accepted, and are regularly monitored to ensure that they comply with VHS delivery standards. Participating schools must provide release time for their VHS teacher and a VHS site coordinator who acts as a contact for the VHS students and provides technical and administrative support to all local VHS participants. Site coordinators are trained in an eight week online Site Coordinators Orientation Program. VHS has developed two graduate-level online professional development courses for teachers, a 26-week Teachers Learning Conference (TLC), designed to enable teachers to become online course instructors and course developers and develop an effective online NetCourse for VHS, and a15-week Netcourse Instructional Methodologies (NIM) programme, designed to provide instruction on the pedagogy, methodology, and moderation skills required to teach an existing NetCourse of VHS. On both of these programmes, experienced VHS teachers are assigned to each TLC participant to help them access the correct learning resources and monitor their progress. Credits for these programmes are available through Fitchburg State College.

The *LearnLink* project (http://www.aed.org/learnlink) is funded by the Human Capacity Development Center in the USAID Global Bureau and other USAID bureaus, offices and missions. It is operated by the Academy for Educational Development (AED). supported by USAID and AED, and has implemented computer-mediated professional development programmes to improve training and support services for teachers in Guatemala, Morocco, Namibia, Uganda and Brazil (Fontaine, 2000).

The Guatemalan Proyecto 'Enlace Quiche' (Quiche Networking Project) uses ICT to train future teachers in Mayan languages to help strengthen cultural identity in indigenous communities. By enabling bilingual primary education in local languages, it is expected that many more Mayan children, once forced immediately into Spanish-speaking schools, will attend school. The project focuses on developing culturally appropriate Mayan language instructional materials, including an interactive multimedia system on CD-ROM, and improving teachers' competence in

Mayan languages, first and second language education, bilingual pedagogy, multigrade teaching methods, and developing cultural sensitivity among others Multimedia computer labs have been installed in four teacher training schools in the Quiche region and instructional materials developed for bilingual teacher preparation.

The Computer-Assisted Teacher Training Program (CATT) in Morocco has provided the pre-service teacher training colleges in five provinces with multimedia labs and training so that teacher trainers and trainee primary school teachers can learn about ICT and its application. AED/LearnLink-developed training modules guide the learners, and specially-trained Master Information Teachers run the labs. The project also aims to develop networks between teacher trainees, teacher trainers, and inspectors and much of the training and project monitoring is done via the Web and Internet-teleconferencing. The teacher trainees are using the Web for research and creating their own sites as well as accessing the bilingual (French and Arabic) primary project site at www.Ibtikar.ac.ma.

Namibia's Computer-Assisted Teacher Training (CATT) project is a part of a wider plan to improve teacher training nationwide. It is concerned with developing computer-assisted teacher training courses (improving educational quality through project-based learning and training in ICT applications is emphasized rather than technology training per se) and constructing a communications network through the Internet and other technologies. Teacher Resource Centres enable the educational community to draw on multimedia methods designed to network educators and strengthen the educational system through e-mail, listservs, chat messaging, web sites, discussion forums, file sharing, voice and video.

The Ugandan Connectivity for Educator Development (Connect-ED) project, supported by LearnLink, Ugandan governmental agencies, the Institute of Education Kyambogo, World Links for Development, and other organizations, is designed to improve subject knowledge among pre- and in-service primary school teachers through online training. It also aims to increase computer literacy among teachers, provide teacher training colleges with IT, and facilitate the integration of IT into the classroom. Multimedia teacher training laboratories in four teacher training colleges

provide access to computer assisted teacher training programme and digital library resources and the Internet.

The US-Brazil Learning Technologies Network (LTNet) is an Internet-based learning environment and clearinghouse on the role of ICT in education and promoting interactive collaboration between teachers in the two countries. LTNet's Web site includes a virtual library for teachers, a SchoolNet program, a help desk, and other interactive features such as email, threaded discussions and live chat, provides networking among teachers, and promotes collaborative projects via Virtual Exchange Environments.

LearnLink's teacher training activities differ in their target groups, scope, content, materials, methods, and national government involvement but they all partner with local education professionals, train teachers in ICT, establish multimedia centres for educators, build networks of Master Information Teachers, develop web sites and/or multimedia curriculum materials, and digitize educational resources for networking and knowledge transfer. These projects are still in their early days and the outcomes are not yet available but it is anticipated that they will increase collaboration and interaction among educators nationally or between countries, and provide institutionalized support for learning technology, greater ICT access for teachers and students, ICT-based curriculum reform, and enhanced pedagogy.

ICT used to facilitate professional development and networking

Virtual Workplace (http://education.qut.edu.au/vwl/), created by Queensland University of Technology, Australia, uses videoconferencing and Web-based technologies for synchronous and asynchronous interaction between pre- and in-service teachers. It aims to enhance pedagogy in teacher training, student teachers' learning in their undergraduate studies and teaching practice, and teachers' supervision or mentoring of the students.

The European Commission-supported *Telematics for Teacher Training - T3 Project* (http://telematics.ex.ac.uk/T3/), which ran from1996 until 1998, aimed to enhance primary and secondary teachers', teacher trainers' and librarians' professional development and encourage teacher trainers to adopt ICT across Europe. T3 was a consortium of seven European teacher training institutions, coordinated by the University of Exeter, UK. A Web site provided resources for teacher trainers and modelled best practice in site design. Participating universities developed courses on topics such as Telematics for Teachers of Mathematics, while others used telematics for school-based teacher training, tutoring teachers on an MEd programme, and developing a European Core Curriculum Framework for Telematics for Teacher Training. Evaluation showed that virtual learning communities and courses in areas such as science, maths, languages, and technology could be supported through such networks.

The *Virtual Teachers Centre* (http://vtc.ngfl.go.uk) is part of the UK National Grid for Learning/BECTA (www.ngfl.gov.uk) Teachers Online project, allowing teachers to link electronically to learn about others' work, create a virtual community of practice, sharing ideas through livechat, and access and share a variety of learning and teaching resources and links to other sites. 'Support Providers', for example, enables teachers to identify resources for professional development, for example, through the ICT Support Network Directory which provides easy access to ICT provision and training and the New Opportunities Fund (NOF), which provides ICT training for teachers and librarians. 'International Professional Development' helps teachers learn from and contribute to educational ideas and best practice throughout the world.

EduNet (http://www.edunet4u.net/teach/teacher.htm is an integrated educational Internet service for K-12 students and teachers managed by the Korea Education and Research Information Services (KERIS). It supports the introduction of virtual learning in primary and secondary schools, provides online teacher training, promotes teachers' networking and supports teachers' voluntary clubs by providing self-training materials and various online forums. There are thousands of voluntary teachers' clubs across Korea which aim to help teachers acquire the knowledge and skills needed for the effective use of ICT in teaching and learning. These clubs

provide their members with informal professional development opportunities using printed, Web and EduNet material and personal contacts.

TINTIN in The Netherlands was established and supported over a four-year period by a curriculum specialist and a specialist in online teacher networking. It provided two teachers' networks, one for teachers of German, the other for teachers of French. These networks used email, listservs and occasionally, face-to-face interaction. The teachers primarily used this network to share information – reflective exchanges occurred rarely – and it was shown that teacher anxiety decreased and productivity increased during the network experience. (Moonen & Voogt, 2001)

The US *Teachers Network* (http://www.teachnet.org) is a nationwide, non-profit educational organization that identifies and connects teachers exemplifying professionalism and creativity within public school systems, promotes collaboration among educators to improve teaching and student achievement, provides resources to support teachers in their own professional development, and disseminates the work of outstanding classroom teachers. Over 40,000 public school teachers have received Teachers Network grants and fellowships for work in curriculum, leadership, policy, and new media development.

TeacherNet UK (http://www.teachernetuk.org.uk) is an independent professional association for teachers and others in education who wish to make effective use of ICT in education. It promotes and supports teachers' professional development and national and international teacher networking, provides relevant resources, information and news on curriculum innovation projects, and encourages teachers' online discussions and forums.

SchoolNet SA (http://www.school.za) is a South African organization that supports educators and learners in transforming education through the application of ICT by providing knowledge and skills in the areas of Internet technologies, capacity building, and ICT-based curriculum management and development.

SchoolNet (www.schoolnet.ca) is a bilingual Canadian initiative providing online educators' forums to support teaching and learning and personal and professional growth, success stories of ICT use in the classroom, useful links, etc.

Singapore's Clearinghouse (http://www1.moe.edu.sg/iteducation/resources/welcome.htm) is a Web site created by the Ministry of Education to share ICT resources and lesson plans for among teachers.

Teachers Net (http://www.teachers.net) was created in 1996 by US teacher Tony Bott to help teachers share online resources and teaching ideas, learn about new ICT tools and Web pages, purchase classroom supplies, and communicate with other teachers. Affiliate networks include Australian teachers.net, Canadian teachers.net, and UK teachers.net.

The *National Geographic* Web site (http://www.nationalgeographic.com/education/teacher_community/) was developed by the National Geographic Society and provides lesson plans and resources related to the teaching of Geography and Science. Teachers can also share their practices and ideas through this newtwork.

Swedish Schoolnet (http://www.skolverket.se/skolnet/english/) was established in 1994 by the National Agency for Education and is a Web site for teachers, educators and students designed to stimulate the use of ICT in schools.

Project Lighthouse (http://el.www.media.mit.edu/logo-foundation/pubs/logoupdate/v7n1/v7n1-lighthouse.html) was designed to help Thai teachers and learners adapt to new technologies and change their traditional teaching and learning methods (Cavallo, 1998).

Red Escolar, or the *Mexican School Net*, (http://www.schoolnet.ca/magazine/pdf/fall-2000.pdf) is based on the Canadian

model and provides information for teachers and students, collaborative projects between schools, in-service training, etc.

Portugal's *NONIO Twenty-first Century Programme* (http://www.dapp.min-edu.pt/nonio/nonio.htm) provides support from universities, colleges of education, in-service training centres, teachers' associations, etc. for the application and development of ICT in schools.

European Schoolnet (http://www.eun.org/eun.org2/eun/en/index.html) is the framework for co-operation between the European Ministries of Education on ICT in education. Since 1998 it has offered online resources, workshops, training opportunities, forums, etc., for teachers across Europe.

International collaboration in teacher training and ICT

There are still many places in the world where limited resources and ICT infrastructure prohibit teachers from using ICT for their professional development. The following sites developed by international organizations aim to bridge this gap by collaboration in sharing resources and teachers' networking.

UNICEF's *Teachers Talking About Learning* (http://www.unicef.org/teachers/) was designed for international collaboration between teachers in developing countries using the Internet and television. It provides access to teacher training materials and useful links and promotes discussion among teachers.

UNESCO's *International Institute for Capacity Building in Africa* (http://www.unesco-iicba.org/) has developed an electronic library to support the improvement of mathematics and science teaching in primary schools. Designed for teachers, teacher trainers, curriculum developers and supervisors, this is available in CD-ROM and online.

The World Bank's *World Links for Development (WorLD) programme*

(http://www.worldbank.org/worldlinks/english/index.html) provides Internet connectivity and training in the use of ICT and other technologies in education for teachers, teacher trainers and students in developing countries. It also links secondary school students and teachers in developing countries with schools in industrialized countries for the purpose of collaborative learning via the Internet.

The *OECD Centre for Educational Research and Innovation* (http://www.oecd.org/cer/) has promoted educational research and innovation in OECD countries for nearly 30 years. Its activities aim to encourage better links between research, policy innovation and practice, enrich knowledge about educational trends internationally, and involve educational researchers, practitioners and government officials in cross-national discussions.

The USAID/AED *LearnLink* (http://www.aed.org/learnlink), as shown earlier, uses ICT to strengthen educational systems in support of socio-economic development in developing countries. It uses ICT for teacher training, to link teachers to teachers, and to improve teachers' capacity to access resources to meet their professional needs.

In an international survey of Web-based services for teachers, Lai-Kuen and Eastman (2001) identify the common ICT services appearing in all or most of these networks. These are: links to electronic resources, electronic discussion groups, e-mail services, provision of Internet search engines, electronic newsletters or magazines, online directories of links and mailing lists, provision of up-to-date news, promotion and facilitation of collaborative school projects, and online feedback mechanisms. While the examples of these applications above provide some idea of the potential of ICT for teacher training, we still lack firm understanding of its effectiveness in these areas. Therefore, it is important pay close attention to the impact of ICT use in various teacher training contexts to gain a better understanding of the factors influencing the effectiveness of ICT in teacher training.

ICT use for teacher training: the implications

Integration of national visions into ICT use for teacher training

The Singaporean National Institute of Education (NIE) successfully integrated the national vision for ICT use in its Masterplan for IT in Education and in the ICT-based environment created in Singapore's teacher training system. The USAID/AED LearnLink project in developing countries is being implemented in close collaboration with the national governments and integrates its activities with the various national educational policies. ICT teacher training programmes seeking to reflect national education policies should:

- Incorporate and reflect national visions for education in any ICT training plans for pre-service and in-service teachers.
- Include consideration of national policies for telecommunications and human development, and their impact on ICT costs and serving the number of pre-service and in-service teachers.
- Develop specific outcomes based on the national vision.
- Identify the appropriate means to achieve these outcomes.
- Collaborate with national policy makers in developing ICT plans for teacher training.

Implementing cost saving policies

Most nations have limited resources for teacher training and must make decisions based on cost-effectiveness. The experiences discussed in the preceding sections suggest several cost-saving strategies:

- Maximize use of computer facilities in training centres to lower user contact hour costs through efficient scheduling. Outside training hours, open computer labs to the public for a small fee (as Uganda has planned in the Connect-ED project).
- Share Web-based resources and training materials with other training institutions (Jung & Rha, 2000).
- Standardize on hardware and software and negotiate best prices with vendors. Complementary peripheral devices can mean savings in hardware costs and free,

public-domain software lowers costs. Some vendors include ICT skills training in the purchase price.

- Form partnerships across public and private sectors (inside and outside the country) to share the costs of innovation, infrastructure, and hardware and software systems, collaborate in the recruitment of students and share advanced technical skills.

Investment in teacher trainer training

Teacher trainers are unquestionably the key change agents behind adoption and utilization of ICT in pre- and in-service teacher training. The experiences of NIE, VHS, and LearnLink indicate the importance of providing a variety of formal and informal teacher trainer training so that the teacher trainers, teachers and trainee teachers can access those methods that suit them best. Experience shows that to enlist staff support and involvement, it is useful to:

- Employ a variety of teacher trainer training methods, ranging from face-to-face workshops to online self-study programmes.
- Integrate informal support into the formal teacher trainer training system so that the less experienced teacher trainers can obtain timely assistance.
- Provide multiple incentives such as workload reduction, recognition and reward in faculty evaluations, increased research allocations to encourage use of ICT in teaching, and compensation for those providing educational or technological assistance to others.

Implementing flexible teacher training policies

To promote ICT use for teacher training, flexible policies have to be institutionalized within conventional teacher training institutions in regard to access, curriculum, and teaching and learning processes. Experience in the use of ICT for teacher training suggests the following:

- Provide legal incentives and policies for teacher training institutions to restructure their programmes to include ICT-based teacher training (Jung, 2000).
- Reduce teachers' workloads and compensate them for their training time costs during ICT-based training programmes.
- Acknowledge the teachers' involvement in collaborative work during ICT-based training.

Development of outcomes-oriented, ICT-integrated training curricula

Teacher training courses must themselves model effective ICT-integrated instructional practices. In NIE' s Instructional Technology course, the student teachers must apply what they have learned by producing ICT-based micro lessons which may then be distributed to teachers on CD-ROM. The US VHS programme has developed Web-based teacher training courses to help teachers design and deliver Web-based courses. Teacher training institutions might consider these points in incorporating ICT into their curricula:

- Provide short, hands-on ICT foundation courses at the initial stages of pre-service teacher training, courses that relate ICT to the achievement of wider pedagogical objectives.
- Provide more advanced ICT courses as electives.
- Demonstrate ICT-integrated teaching and learning by using the technology in teacher training curricula.
- Provide opportunities for teachers to produce and disseminate ICT-based instructional materials.

Adopting a systems approach in the change process

In our experience, instructional technologies are not seen merely as complementary educational tools but part of a whole new teaching and learning environment. Reigeluth notes that 'piecemeal change leaves the structure of a system unchanged. In contrast, systemic changes entail modifying the structure of a system, usually in

response to new needs.' (Reigeluth, 1999, 16). Our recommendations for adopting a systematic approach to the change process are as follows:

- Identify problems and opportunities in ~~all~~ the functions and systems of teacher training in the country, state or province where ICT may be of help. These may include aspects of pre-service training, professional development, campus-based and off-campus support systems, research and development, and policy-making.
- Examine the specific needs for structural change in each of these and where ICT can help.
- Develop and implement strategies for meeting these needs.
- Build a coordinating body to support the implementation process and promote its goals.

Base implementation on factors influencing the success of ICT for teacher training

The factors that influence a teacher's or teacher educator's ability to make use of ICT in his or her classroom practice only partly relate to the training that the teacher receives. We use the 4-E Model (Collis & Pals, 1999; Collis & Moonen, 2001) to categorize the factors that influence the use of ICT in a teacher's daily practice. The 4-E Model shows that the likelihood of a teacher making use of an ICT application in his/her own teaching is a function of four clusters of variables. These are shown in Table 2.

Table 2. Factors influencing an individual's use of a technology innovation in learning-related practice (Collis & Pals, 1999; Collis & Moonen, 2001)

Cluster	Key subfactors and indicators
Environment The institution's profile with respect to technology use	***Organizational-context subfactor*** The vision, support, and actual level of use within the institution for technology use for learning-related purposes The readiness to change among the people in the institution when it comes to the use of technology in education
Educational Effectiveness Gain from the technology use	***Long-term payoff subfactor***: Likelihood of long-term tangible benefit for the institution or individual. ***Short-term payoff subfactor:*** Payoff such as efficiency gains, doing routine tasks associated with learning more quickly ***Learning effectiveness subfactor:*** New forms of valuable learning experiences, improved communication, improved capacity to individualize aspects of the learning experience, valuable support to the existing curriculum.
Ease of Use Ease or difficulty in making use of technology	***Hardware/network subfactor*** The network is convenient to access, adequate in terms of speed and bandwidth, and reliable. Computer and printer access are convenient. ***Software subfactor:*** Software associated with the technology is user-friendly, does what the user wishes, and is easy to learn.
Engagement Personal engagement about technology use for learning-related purposes	***Self-confidence subfactor:*** Personal orientation towards trying out new ways to carry out learning-related tasks, being interested in new technological developments, and sharing these interests with others. ***Pleasure with the Web subfactor:*** Particular interest in new technologies, currently the Web.

Some of these aspects can be directly influenced by teacher training; others not so, or only indirectly.

For the Environmental cluster, the readiness of teacher educators and teachers to change and utilize technology in education can be improved via effective teacher training and support. Support from those in leadership positions is likely to increase if some form of ICT training is also made available for them.

For the Educational Effectiveness cluster, teacher training should focus on examples of new forms of learning experience involving ICT, how ICT can support the curriculum, and how it can help the teachers or trainee teachers in their practicums and work in the schools.

For Ease of Use, teacher training can help teachers increase their computer and network literacy, thus improving their skills in handling ICT in the classroom.

For Engagement, teacher training needs to help the trainers and teachers become more self-confident as ICT-using educators, and develop a positive attitude towards managing change and particularly change relating to ICT. Well managed teacher networks can also help increase positive and self-confident attitudes.

The examples earlier in this chapter illustrate teacher training strategies relating to onr more of the 4-Es.

When teachers themselves are the learners, making use of ICT to access some or all of their training or professional experiences via an Internet-based teacher network or programme, many of the same factors can also be described in terms of the 4-E Model:

For the Environmental cluster, the teacher should feel supported within his or her professional activities and learning via the network by the school. Support in this case relates to recognition of the time and efforts made by the teacher, provision of technical and educational support, and release time for training.

For the Educational Effectiveness cluster, the Web site should offer resources and materials that are useful to the teacher, appropriately organized and described, and evaluated by other teachers.

For Ease of Use, the teacher needs convenient access to a computer with Internet connection at both school and home and with an adequate rate of network connectivity. The interface of any Web environment or other software must be designed for ease of use, being consistent, easy to learn and remember, easy to navigate, and an easy to find what one wants.

For Engagement, teachers can benefit from building a sense of professional community among their peers as they learn from each other.

The examples provided earlier illustrate these characteristics.

Future Developments

We conclude by discussing several lines of developments, some technical, some social, some institutional, that are likely to have a major impact on ICT for teacher training about technology or via technology.

Future developments related to convergence

A major current characteristic of ICT development is convergence. Convergence can be seen from the micro, meso and macro levels as well as within the technology itself (this section is summarized from Collis, 2001).

At the micro level, digital data involving a variety of signal types, such as text, audio, and video, are now handled within the same application. Also, the convergence of mass-media communication technologies (radio and television) with telephone technologies and data-network technologies is well underway. With regard to teacher training, such convergence of technologies will mean that ICT is increasingly ubiquitous in society, easier to access and use, and more of a complementary and even a core technology in teacher training contexts.

At the meso level, the convergence between ICT and curriculum in schools will also affect teacher training. ICT tools for learning mathematics, physics, language, environmental education, law, medicine, and other subjects are well established. ICT use will be so common throughout society that specific lessons on how to use the computer or the Internet will rapidly become unnecessary, for teachers and learners alike. What will still be needed is the skill and the wisdom to use ICT efficiently and wisely to enhance learning.

Another form of convergence at the meso level relates to the roles of teacher trainers, teachers and students. The students are increasingly engaged in activities that were previously the domain of the teacher educator or teacher; they can enter new resources into course Web environments, extend the study materials for courses, and

take on the role of peer evaluators, making use of Web-based tools such as shared workspaces. Teacher trainers' and teachers' roles are also changing and converging with those of the students. They must seek, sort through, and evaluate resources for their quality and appropriateness. Teacher trainers are also moving toward supporting and sharing in pre-service and in-service teacher training, rather than lecturing remote from the realities of the classroom.

Yet another convergence at the meso level relates to the learning resources. Increasing use of the Web does not necessarily mean that books will disappear in favour of digital libraries, but rather that they will be extended via their associated Web sites, by the addition of examples, links to contact persons, and links to the instructors' own resources via course Web sites. The convergence of real-time communication and video on demand is another technical convergence of high significance to teacher education. Teachers and trainee teachers will be able to review their teaching or other performance by accessing video segments via the Web site, and discuss these with their mentors or peers.

At the macro level, convergence is reflected in the ways that teacher development is increasingly provided flexibly, using various forms and mixes of delivery methods, locations and schedules. The convergence of local and more widely available learning experiences for teachers and teachers in training is only just beginning. Its impact is not yet great. But it will be.

Developments related to costs and access

Even though ICT is becoming more and more pervasive in society, this does not mean that all teachers have equal ease in accessing and using ICT in their teaching or professional development. Serious differences still exist between countries and regions in terms of computer-access ratios, costs and possibilities for Internet access, and help to support the use of ICT.

There are technological developments that offer promising new opportunities. For example, the use of satellites to transmit digital network data can allow countries with poor telephony infrastructures to leapfrog the need to first update those

infrastructures before Internet access can improve. All of the benefits of Web technology can be available via local area networks (intranets) where institutional access to the external Web is a problem for financial, cultural, or quality-control reasons.

Cost structures to help teachers with the affordability of ICT, for example, in preparing Internet-based lessons from their home computers, are slower to develop as they involve human and institutional change. In some countries and regions, teachers are gaining support for Internet access, but this is still the exception rather than the rule. Teacher educators and teachers will need the same support for home and school use of the networked computer as they expect with respect to the blackboard or overhead projector.

Future developments in teacher training

Teacher training itself will change in its forms and methods, due in part to ICT. The flexibility of ICT-learning will lead more and more teachers-in-training to expect flexibility in their courses and course provision. No longer will the local institution be the obvious and automatic choice for their training; they may choose from online generic and specialized courses from locations around the world. The only constraint will be accreditation, forcing the beginning teacher to fulfill some local requirements for teaching certification.

In the field of continuing professional development, we can expect to see a rapid development of what has already started: teachers using online networks to join and collaborate with communities of practice that best suit their development needs and educational visions and regardless of their location. Only language need stand in the way of worldwide virtual professional development communities. However, a common language and common points of reference will still be critical for many teachers and teacher educators, so teacher networks within the same country will also continue to grow in importance (Moonen, 2001).

References

Cavallo, D. (1998). Project Lighthouse in Thailand: Guiding pathways to powerful learning. *Logo Update Online*, *7*(1).

Collis, B. (2001). An overview of information technologies in education. In H. Adelsberger, B. Collis, & J. Pawlowski, (Eds.), *Handbook of information technology in education and training* (pp. 1-21). Berlin: Springer Verlag.

Collis, B., & Moonen, J. (2001). *Flexible learning in a digital world: experiences and expectations*. London: Kogan Page.

(see http://education1.edte.utwente.nl/00FlexibleLearnikng.nsf/framesform?Readform)

Collis, B., & Pals, N. (1999). A model for predicting an individual's use of a telematics application for a learning related purpose. *International Journal of Educational Telecommunications, 6*(1), 63-103.

Fontaine, M. (2000). Teacher training with technology: Experience in five country programs. *TechKnowLogia*, November/December, pp. 69-71.

Jung, I.S. (2001). Singapore's approach to preparing new teachers to use technology in the classroom. In J. Capper (Ed.), *Case studies of innovations in teacher training and technology* (in press). Washington, DC: The World Bank.

Jung, I. S. (2000). Korea's experiments with virtual education. *Technical notes series, 5*(2). Washington, DC: The World Bank.

Jung, I. S. & Rha, I. (2000). Effectiveness and cost-effectiveness of online education: A review of literature. *Education Technology,* July/August, pp. 57-60.

Lai-Kuen, K. & Eastham, T. R. (2001). Network services. In H. Adelsberger, B. Collis, & J. Pawlowski, (Eds.), *Handbook of information technology in education and training* (pp. 450-470). Berlin: Springer Verlag.

Moonen, B. H. (2001). *Using teacher networks to support the professional development of teachers.* PhD dissertation, Faculty of Educational Science and Technology, University of Twente, Enschede, NL.

Moonen, B. H., & Voogt, J. (2001). Teacher inservice training in networks: A strategy of ICT integration. In C. Morales, G. Knezek, R. Christensen, & P. Avila (Eds.), *Impact of new technologies on teaching and learning* (pp. 137-151). Mexico City: Instituto Latino Americano de la Comunicacion Educativa.

Reigeluth, C. (1999). What Is instructional-design theory and how is it changing? In C. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory* (V. II). (pp. 5-30). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

The authors:

Prof. dr. Betty Collis is Shell Professor of Network Learning, University of Twente, The Netherlands. collis@edte.utwente.nl

Dr. Insung Jung is Associate Professor, Department of Educational Technology and Director of the Multimedia Education Center, Ewha Womans University, South Korea. Isjung@ehwa.ac.kr

New Wine and Old Bottles?

Tele-Learning, Telematics and the University of Twente

mw. dr. Betty Collis
Faculteit Toegepaste Onderwijskunde, (Faculty of Educational Science and Technology)
Universiteit Twente (University of Twente)

collis@edte.utwente.nl
Homesite: http://www.to.utwente.nl/user/ism/Collis/home.htm
Site for this Diesrede: http://www.to.utwente.nl/prj/diesrede/

1. An Anniversary: Thoughts of new and old, of celebration and fine wine

Today is an anniversary celebration for the University of Twente. Anniversaries are happy affairs; among their many functions, they bring people together who share some common connection but represent different generations of contact with that common connection. The University of Twente, as our common connection, is not old as universities go, but as an institution it is certainly old enough to have old values, and old ways of going about its business. Today, I want to think about old and new. I want to reflect about the idea of "tele-learning" as something new at the University of Twente, and I want to speculate on what it might mean for our old values, our old ways of doing things at this university. And, because I am thinking in terms of an anniversary and of celebration, I want to use a metaphor that relates to celebrating: I want to frame my thoughts around the idea of wine: old and new, mature or still fermenting, I want to expand upon two apparently contradictory parables about wine, and draw messages from these for the University of Twente, telematics, and tele-learning.

2. But first, a definition is important

I am using the term "tele-learning" but I am quite sure that if we had a quiz right now, and each of you had to give a definition of what I mean by this term, there would be many different answers. Some of you would say: "distance education", and picture a scenario where a teacher, like me, is talking not only to the group in front of her, but also to a group clustered at a remote location, and watching the teacher via a room-sized videoconferencing system or television or even via a computer screen. The teacher pauses and asks a question--a student at the remote location, indicates by some technological procedure that he wishes to answer and then his voice and face come through a network or the ether into the monitor in the teacher's classroom.

But I imagine many others of you have a different idea: you picture a student, by herself, in her home, surrounded by piles of books and notepads, busily studying, perhaps for a course similar to those offered by the traditional open universities. She has the benefit of studying when and where she wants, but with the consequence that she looses the benefits of interacting with a skilled teacher in a class environment.

These were the two most popular images for tele-learning five years ago, but now there are other contenders. Perhaps you are picturing a situation in a basisschool (elementary school)

in your own neighbourhood: the teacher has one of the school computers in the classroom, a computer with a modem that connects to the networks needed to access the Internet. Within this classroom, with the teacher and pupils side by side, the class is able to bring in information about an event, such as the Mars landing as happened in the summer of 1997, taking place somewhere far away in the world (or even out of the world, as in the case of Mars and the Sojourner vehicle). The teacher and pupils not only access up-to-date information as it is occurring, but also are busy exchanging information and ideas with other classes, in different places, about the event, learning on the way about the solar system, distances in space, and geology.

Or perhaps you are picturing a secondary school, where students routinely check resources available in local, regional, national, or international collections, without paying much attention to the fact that one click of their mouse brings them to a computer in a library in Amsterdam, and another click brings them to the computer in a school in Australia where other students such as themselves have made available useful resources via a WWW site. Sometimes their teacher comes in the room as they search for appropriate resources, sometimes she doesn't.

But there are even more scenarios you might have thought of: perhaps you thought of someone like yourselves, no longer a student, but still someone involved in life-long learning. Not through taking courses in an institution, but by accessing information you need when you need it, sometimes by contacting appropriate persons, other times by reading journals or studying conference proceedings or accessing other sources of professional information. More and more, you are probably, like me, doing this via different World Wide Web sites, as well as by other means such as e-mail, telephone, and of course, reading printed text.

Each of the above scenarios I have described above, and a number of other scenarios[1], all are part of what I call "tele-learning". To encompass all these possibilities, my definition of tele-learning is:

Using telematics for learning-related purposes

Notice that this definition does not say anything about geographical distance, one way or the other. This is intentional, because with telematics when we make a connection with persons they may be in the next room or the next continent; when we connect to information with telematics tools, we maybe accumulating it from the hard drives of our own computers, from our own local servers or from computers on the other side of the world. The point is that with telematics, the distance between myself and the persons with whom I am communicating or between myself and the information with which I am working is not particularly relevant.

And there is another point to notice in the above scenarios. In all of them, a variety of ways of interacting, of learning, with a variety of media, and with a variety of communication methods, can be found. This is deliberate: in my definition, good "tele-learning" comes from knowing how and if and when telematics can support some aspect related to learning better than we do it without telematics, and how telematics can be combined with good pedagogy, good thinking, good debate, good books, good face-to-face interaction, and good working and learning habits to improve the quality of a learning experience. By "better", I mean more efficient, or more enriched, or more flexible.

Thus in the rest of these remarks, when I use the term "tele-learning" I mean simply, telematics used in some way related to the learning enterprise.

Now, back to the idea of a wine-related metaphor that I mentioned at the beginning of this talk: Is tele-learning our New Wine...? Or only some new packaging?

---

[1] I begin my 1996 book, "*Tele-learning in a digital world*", with a discussion of 11 such scenarios, and work these out in the subsequent chapters of the book.

3. Tele-learning at the UT, is anything really changing?

Previously I asked you to define "tele-learning" and I guessed that there would be many different definitions, with the "correct answer" being "all of the above". But I also imagine that some of you may have had some other sorts of thoughts. Perhaps when you saw the title "tele-learning" as the theme for this anniversary celebration, your deep-down reaction was that all of this "tele" business is something of a buzzword, a current "hype", similar to buzzwords such as the "information highway" or the "information superhighway" or the "virtual information superhighway" or the "virtual whatever". You may think of the World Wide Web as a fad, a bandwagon, more metaphor than substance, more noise than real impact. You may be thinking, "Yes, yes, lots of talk but nothing has really changed" in the university enterprise. In fact, this is the first of the wine-related metaphors that I want to use today, the Dutch phrase:

"Oude wijn in nieuwe zakken" (Old wine in new bottles)

Especially if you have gone through various waves of fascination with other technologies and their possibilities for education, particularly the computer itself, you may feel we should have learned our lessons already, that technologies come and go, but basically don't change the way we teach and learn and how we organise our courses and degree requirements and the way we fund persons to study; or the ways we work with our colleagues and our students. You may well be saying, "Please, no more hype".[2]

But I don't want to let the idea continue that tele-learning is some kind of new packaging, some kind of superficial add-on, to business as usual in the University. I want to turn the metaphor around, and instead argue the following: At the University of Twente, I see tele-learning not as a new packaging, but as new wine. I present a new metaphor:

New Wine and Old Bottles

But wait: Is this good or bad? If telematics is the "new wine" in the metaphor, then what are the "old bottles"?

I am going to look at the "old bottles" in two different ways. In the first way, the connotation of this new turned-around metaphor becomes positive, because the definition of "old bottles" that I will use is "old values". I will argue and demonstrate that telematics as a new wine is enhancing and enriching our old values at the University of Twente. In the second way of looking at the old bottles-metaphor, however, the message is a warning. I discuss this second way in Section 9.

4. "Old values" and the University

What are some of the old values that I believe most important to universities, not only Twente? There are many, but the ones I will focus upon today are the following four:

---

[2] I followed this line, comparing the response of educators and society to the possibilities of computers in education in the late 1970s with the response today with respect to the Internet and the WWW, in an analysis for UNESCO in 1996. An abridged version of this analysis is published in the journal *Educational Technology* (Collis, 1996b).

1. Values related to "academische vorming" (or what Prof. Van Vught, in his rede for the opening of the University year two months' previously, calls becoming an "intellectual expert")
2. Values relating to good teaching
3. Values related to the interaction of local and global perspectives; and
4. Values related to the university being a focal point of knowledge and expertise.

For each of these, I will show some examples from today, at the University of Twente, of how these old values are being strengthened and deepened by the use of tele-learning, rather than being diminished or threatened; not replacing what the University does well, but adding new dimensions to these old values. In the short time of this presentation, I will only be able to show a relatively few examples; in the WWW site I have prepared to support the demonstration, there will be links to other examples that those interested can study for as long as they wish. The address of this site is

http://www.to.utwente.nl/prj/diesrede/demo.htm

5. *Academische vorming* and tele-learning

The term "academische vorming" doesn't have an immediate parallel as a term in English[3] although certainly the idea has. However it is an idea that is increasingly under strain as it comes in association with other ideas about the university experience, such as those related to making the university more and more open. However, I agree with our Rector that *academische vorming* is an important, old value, for our young students. Van Vught (1997) uses the phrase "intellectual expert", which I like as a goal of *academische vorming*. I will expand on his definition by noting the following characteristics of an "intellectual expert": someone who is trained in a discipline at a scientific level; has developed into an independent and critical thinker (including being able to be constructively critical of himself); is an individual who can take responsibility and leadership in a problem situation in practical situations where his discipline is relevant and participate in designing and testing a solution; an individual who can speak the language of his intellectual community, who knows its manners and style, who feels at home in its "branches" where ever they might be geographically.

How does a student mature into an intellectual expert? Certainly by studying, but also by undergoing an intellectual apprenticeship, with certain key components. The intellectual apprentice must know the tools of his trade, must be able to articulate his perceptions in the language of his profession, and must understand when this language is used well and when it is misused. This partially comes from reading books and listening to lectures, but just as a child learns the ways of his family, not only by observing and studying but by a continual process of trying the language out himself and receiving supportive re-enforcement and correction as he comes to define himself by the norms. This is similarly the case with *academische vorming*, or intellectual development. I believe this development requires the opportunity to practice finding one's voice in a professional community, to realise genuine

---

[3] This is one of a number of terms that I find the Dutch language handles better than my native English; "vormgeving" is another.

success and failure in getting established in that community, and to have around one some persons who care enough to scaffold this process, giving opportunities, encouragement and criticism. For the fortunate student at a good university, this initiation process, scaffolded by a wise mentor, gradually takes place.

How can tele-learning enhance this process? I can see many ways, of which the following are only some examples, taken from my own courses here at the University:[4]

Aspect of Academische Vorming	**Example of Tele-Learning Enhancement**
Guided collaboration with external experts	Writing chapters collaboratively, via e-mail and the WWW; http://www.to.utwente.nl/ism/online/
Guided communication with an external expert	Asking questions about the expert's work and getting a response; http://www.to.utwente.nl/ism/ism1-96/wwwproj/STUDYCTR/Week40/Fdbk40.htm
Learning to learn; practicing the language	Using "design guidelines" as vocabulary throughout a WWW-based course; http://www.to.utwente.nl/ism/ism1-97/wwwproj/studyctr/lin.htm and http://www.to.utwente.nl/ism/ism1-97/wwwproj/prodctr/44eval.htm
Moving into a collegial relationship with external experts	Via the instructor's contacts, taking an active role in a professional on-line discussion; http://www.to.utwente.nl/prj/teled97/cwelcome.htm
Working with the instructor on professional projects; mentoring the student's initial public presentations about his work	Via cooperation with instructor on WWW-based projects and scientific writing and presentations about the projects; http://www.to.utwente.nl/ism/ism1-97/Edmedia/home.htm and http://www.utwente.nl/prj/teled97/present/sld001.htm
Maintaining close communication with the supervisor when on an outside final (afstudeer) project	Keeping in regular contact via the WWW; http://www.dipoli.hut.fi/~hquirijn/weekrapport/pages/

These are some of the types of professional experiences that differentiate *academische vorming* from taking a series of courses, in the way that the forest is more than the sum of the trees. Critical in these examples is the way that telematics can make it easier for a mentoring relationship between instructor and student to involve guided forays into real-world professional communities. Tele-learning techniques, used by the instructor interested in developing a mentor relationship with qualified students, can deepen and extend the

---

[4] I am using examples from my own courses simply because I know them best and can conveniently offer them as examples. There are, of course, many other examples of tele-learning in the University besides my own courses. For courses making substantial use of WWW environments in the Faculty of Educational Science and Technology, see http://to-www.to.utwente.nl/TO/project/teletop/examples.html

opportunities for the student to find his voice and identity in a professional community. Thus it is not a matter of *academische vorming* OR tele-learning; it is a matter of both.

6. Being a good teacher, and tele-learning

Here is perhaps where the greatest misconceptions appear about tele-learning. Many seem to assume that tele-learning means instructors no longer giving lectures, no longer being a "regular teacher", but moving to the background, even as in the Open University model, moving out of the picture entirely. I reject this. I feel the opposite. A good teacher who prepares good lectures and is effective in his class presentations should continue to exercise these skills, this craft, but can be even more effective with the addition of tele-learning techniques. To illustrate this, I will use the idea of the "Extended Lecture" that I use for all my lectures and also presentations.

An extended lecture is a lecture whose benefits begin before the lecture and last after the lecture, and where the actual lecture itself is improved, all through tele-learning techniques. Here are examples:

An Extended Lecture:	**Examples:**
Involves use of a WWW site to present the lecture notes, as interactive pages with links, before the class	http://www.to.utwente.nl/ism/telearn/schedule/schedul.htm and http://www.to.utwente.nl/ism/telearn/schedule/Week18/virt-uni/inter0.htm
During the lecture, involves using this same WWW site to illustrate points with multimedia examples from other sources. (And students who are not physically present at the lecture can interact with the same WWW site, either while hearing the instructor in real time, or via stored audio or video)	http://www.to.utwente.nl/user/ism/Collis/presents/Coimbra/index.htm http://www.to.utwente.nl/toprac1/telearn/www/group4/videosum/video/htm/home.htm
After the lecture, students interact individually with the links and resources in the lecture notes, for deeper study than possible in the lecture and with reflective communication added	http://www.to.utwente.nl/toprac1/telearn/www/group4/videosum/video/htm/opinion.htm
After the lecture, students can supplement the lecture resources by adding material to the WWW site	http://www.to.utwente.nl/ism/telearn/schedule/Week18/virt-uni/inter6.htm

All of these examples show how a good teacher, who invests much care in his lectures, can extend those lectures, in depth, in time, and over distance, via tele-learning.

There are many other aspects of being a good teacher, such as communicating personally with one's students, giving personal feedback, and keeping one's courses up to date and stimulating. For each of these points, I can show many examples of how tele-learning enhances good teaching, Here are just a few:

Aspects of being a good teacher:	Tele-learning support
Communicating personally with one's students	Via e-mail forms made handy within a course WWW site; http://www.to.utwente.nl/ism/telearn/communic/communic.htm
Providing regular feedback and models of good practice for assignments	Via model answers and links to examples of previous work of students, http://www.to.utwente.nl/ism/ism1-97/wwwproj/studyctr/Week44/Int44.htm
Keeping one's course up-to-date and stimulating	Via external links and new sorts of activities such as working collaboratively with students in another university; http://www.to.utwente.nl/ism/telearn/group/Grpp-wp.htm and http://www.to.utwente.nl/toprac1/telearn/www/Group3/home.htm

7. Live locally, think globally

Another of the important old values of the university is to provide an environment in which participants not only benefit from proximity to each other, but also are aware of larger issues and patterns, beyond the local boundaries, and even backwards and forward in time. Academics have always been aware of larger boundaries for their ideas than only the local setting, and of course have long nourished their own work and that of their home universities by participating in international activities, such as going to a professional conference or working with colleagues from other institutions and countries on professional activities. Students also benefit from mobility during their study[5]. But until recently, much of this mobility was limited by the realities of costs--time and financial. Going away to an international conference is a special opportunity, perhaps once a year for an academic and never for a student, and often depends on finding adequate funding. Working on cross-border projects presents immediate and costly problems of getting everyone together and maintaining the momentum of work over time and distance. Studying abroad is valuable, but costs time and effort to organise, and sometimes becomes disruptive to the student's mainstream academic career.

Tele-learning is making all of these professional international experiences not only more accessible to staff and student alike, but also adds a new dimension to them. Here are just a few examples:

[5] The conference, "Internationalisation and the University", co-sponsored by NUFFIC and the University of Twente in May 1997, provided an extended treatment of these points.

Internationalisation:	Tele-learning aspects:
Academics have new opportunities for collaborative projects with colleagues in other locations	Using a shared workspace via the WWW support collaborative research sponsored by the EU; http://bscw.dipoli.hut.fi/bscw/bscw.cgi (please note, this site requires a password to enter, but I will demonstrate it during the Rede)
Academics (and students) have new opportunities to publish and to extend the professional conference experience	WWW-extended conferences and video-conferencing at conferences add to the quality and quantity of participation; http://www.iste.org/conferences/teled97/webex/ and http://www.ieec.uned.es/~ifip97/
Guest visitors can be integrated into a lecture or a course or a project, via telematics	The external guest can lecture and interact in real time, and/or can make his work available for further study after the lecture or visit; http://itesm.cstudies.ubc.ca/ (please note that this site requires a password to enter, but I will demonstrate it during the Rede)

The opportunities already available to University staff (and students) with respect to moving outside the local situation for stimulation or study or professional interaction are now on another dimension because of tele-learning. One's inner circle of professional colleagues can be scattered throughout the world, and it can be easier to communicate with this circle, using various telematics tools, than to communicate with those in one's own building. Important however, is not only the thinking globally, but the ability to translate the relevance of the global experience to one's local situation. This leads to another of the important old values of the University.

8. And another old value: The University as expertise centre

Finally, the University values very much the service it can give to the community, the region, the country. By being acknowledged as a focal point of knowledge, as a centre of expertise, the University serves as a valuable partner in many different projects. Telematics makes these partnerships, at the very least, more efficient, as partners do not need to always travel to meetings and potential partners can find what the University offers and who to contact with support of different information channels, including those involving telematics and in particular WWW sites. Telematics is not only a channel but also a focal point for the University of Twente in many of its partnership activities. Increasingly, the local, regional, national, and international community look to us as a centre of excellence with respect to telematics and telematics applications (including tele-learning). Some of the many examples are shown below:

Focal Point:	Partnership
Telematics expertise nationally	The *Telematics Institute*; http://www.trc.nl/ttti/indextti.htm; the *MESH Project*, http://www.mesh.nl/extern/english.html
Tele-learning expertise within the University	The *CTIT-IDYLLE Project*; http://wwwctit.cs.utwente.nl/Docs/research/project/idylle/IDYLLE.htm
Tele-learning expertise internationally	The *European School Network (EUN)*, http://www.eun.org/

In all of these, telematics is being used in a learning-related context for responsive service and partnership with many different communities. The University of Twente continues to strengthen its international profile in this area; it has already become a focal point for knowledge and expertise with respect to telematics applications.

9. But, there is a second side to the metaphor

The last examples have focused on a positive message associated with the metaphor "New wine and old bottles". Tele-learning is the new wine, our old values are the old bottles, and the fermenting of the new wine in these old bottles brings a valuable result: the old values are strengthened.

But there is, unfortunately, another way to interpret the metaphor. This way comes as a warning. "New wine in old bottles" can lead to a sorry result. Many years ago a truly great teacher made the following observation:

> *"..no one pours new wine into old wineskins; else the new wine will burst the skins and will be split itself, and the skins ruined. New wine must be put into new wineskins, and then both will be saved" (Luke 5:37, Chalmers-Rheims Version, translation 1954)*

The metaphor here is striking: old wineskins in the Biblical time were brittle; new wine ferments, at a certain point the fermentation causes the old wineskins to burst. Both new and old are lost. There is also a message for us in this side of the metaphor. When the "old bottles" represent old procedures, old ways of doing things, that no longer are a good reflection of our old values, it is those old ways that must be replaced before, or after, the fermentation of the new wine of telematics applications bursts their seams.

10. Some old wineskins...

Two "old wineskins" are in particular danger from the fermentation of tele-learning in the university, not only our own university but worldwide[6]. The first of these is our "assembly line" approach to higher education ("Fordism")[7] and the second is intellectual parochialism.

In gradual response to the very positive motivation of providing quality-controlled and affordable university education to a maximal number of students, we have seen the development of a so-called "Fordism" or assembly line approach[8]. It is now assumed that a quality product will come off the assembly line after a set amount of courses, in a set amount of time, starting directly after secondary school, and this product will be road-ready, presumably forever, after this processing. Presumably forever, in terms of government funding policies, because there is no systematic provision for funding for study at the university after the end of this assembly-line period. Already many universities in other countries, particularly Canada and Australia, are breaking away from this Fordism approach, and investing as much systematic attention to what is often called "Continuing Education", or provision for life-long learning as they do to the first-phase learning[9]. Offering courses and programmes to professionals is not only motivated by a post-Fordist philosophy, but also by strong economic factors: the life-long learning market presents an important new client base for the University.

But re-tooling one's assembly line, to continue this metaphor, needs to be done at many different levels before the University of Twente can say it is truly responding to life-long learning. This will require not only the new wine of tele-learning, but will also inevitably result in the need for new ways, new procedures, new approaches to curriculum and academic programmes and funding and to staff time allocation and facility allocation throughout the University. The old ways will simply split at the seams as this fermentation continues.

And another old way that will split with change is what I call "intellectual parochialism". Self-enclosed thinking and teaching, self-feeding on its own work and ideas, will no longer be acceptable in the future university. The synergy between local and global will become so powerful in society as a whole, and the impact of telematics so pervasive and ubiquitous in all aspects of our commerce and culture, that the instructor who figuratively and literally lectures from old notes, who sees the world through his own research, who is bound within his own walls, will be as much of an anachronism as the candle, the horse-drawn carriage, the butter churn; nice for romantic occasions or for a sense of history but not tools to be funded by society.

Thus my use of the metaphor of "New Wine and Old Bottles" is deliberate for this rede, because it is a metaphor that captures both sides of tele-learning: When the old bottles are the old values of the University, these old values are not brittle wineskins vulnerable to bursting with the fermentation of the new wine, but elastic and flexible. Extending the

---

[6] For an on-going debate about the impact of telematics on the future university, the *Vision 2010 University* site maintained at the University of Michigan is a good source (http://www.si.umich.edu/V2010/). Also, the work of Tiffin and Rajasingham in New Zealand (via their 1995 book *In search of the virtual class* and the evolving *Global Virtual University* (http://206.154.197.130:80/VU/) which Tiffin is involved in founding) are useful to study.

[7] Volume 17(2), 1996, of the Austrialasian journal *Distance Education* (http://www.usq.edu.au/dec/decjourn/v17n296/issue.htm) discusses the evolution of Fordism in higher education at a particularly thoughtful level.

[8] I discuss this at some length in the final chapter of my *Tele-learning in a Digital World* book.

[9] See for example, the Life-Long Learning Institute at the Helsinki University of Technology, in Finland (http://www.dipoli.fi/eng/index.htm)

University experience beyond the confines of time, place, and person allows us--staff and students--to live locally and globally simultaneously, to magnify the opportunities we can scaffold for the professional initiation and the intellectual development of our students, and to strengthen our profile as a leader with respect to applications of telematics. But when the old bottles are old ways of doing things that no longer parallel the old values, then these are old wineskins such as the Bible warns about.

11. Some reflections on the New Wine...

In all these comments, I have been talking about tele-learning as a New Wine in a way that has not been very differentiating. It is important to note that just as "old bottles" can be seen in different ways, so can the "new wine" of tele-learning. To extend the wine metaphor even more:

Not every batch of new wine will mature into a great vintage

Not all forms of new wine will be valued over time

Some variants of new wine will achieve no more than local consumption

Some variants of new wine will not last long enough to even ferment

And, not everyone wants to drink wine...

I see much of my own work focused on these points (relating to learning, not wine, of course!). Which tele-learning applications will emerge as those gaining a critical mass of acceptance and impact in practice? Can we predict these now? I think so, but that is a story for another speech...

12. Our task at the University of Twente?

I see it as our job at the University of Twente to lead the way in "spotting the great vintages" in terms of telematics applications in society, and thus with respect to tele-learning. Once we spot these great vintages, we need to identify the ways their fermentation can be used to enhance our old values. But we also need to anticipate and reduce the painful impact of this fermentation on many of our old procedures, our old ways of doing things, even our old securities.

At the University of Twente, we have had a head start in pioneer work with applications of telematics in many different fields, including in education, and to this we owe much to the vision and strategy of our Board. The start of the *Centre for Telematics and Information Technology*, (http://wwwctit.cs.utwente.nl) for example, was an important strategic move for the telematics profile of the University. The decisions taken to supply all our students with good connections to the University network and the Internet was also bold and important to all of our subsequent tele-learning initiatives. The climate of encouragement as well as the real support provided by the Board for telematics initiatives is a critical factor in our success as pioneers in many different telematics-related areas.

But, the rest of the academic world is catching up on many of our pioneering ideas. The course "On-Line Learning" (see http://www.to.utwente.nl/ism/online/) was a pioneer in the use

of the WWW as a course environment in early 1994; now every university in the Western world uses the WWW in some way in relation to its courses (even if only for the conceptually simplest form of information dissemination). Our involvement, through CTIT, in multi-partner projects involving high-speed networking and its applications to different areas including education was more unique in 1995 when we began participation in the PLATINUM Project than it is now when many such collaborative explorations of ATM and other forms of high-speed, high bandwidth networking are occurring in countries throughout the world.

I believe we have reached a critical point: Even as we continue to strive for pioneering insights in our research and practice with respect to tele-learning, we need to turn our energy and expertise to a new challenge: implementation, or sustainable use throughout the institution.

There is a critical gap between the vision and energy of pioneers and the institutionalisation of this vision and energy into sustainable practice[10]. Sustainable practice is what I mean by implementation: Once we identify what aspects of tele-learning are potential "great vintages", how do we move to support their growth in as systematic and professional way as possible? There are many, many problems when change occurs in an educational institution; this is well known in the literature and in practice. Here is where I see our real potential for leadership in tele-learning now lies: How can we manage its acceptance into educational practice enough so that the fermentation reaches a critical mass of impact?

13. The new challenge: *TeleTOP* at the Faculty of Educational Science and Technology

I believe that my faculty, Toegepaste Onderwijskunde (T.O.), is again embarking on pioneer work with respect to tele-learning, but this time in the implementation aspect. Because of the range and depth of experience with tele-learning in our faculty, our own faculty Board has taken a visionary and strategic step. A major project has begun, called ***TeleTOP*** (the Tele-Learning at TO Project), which has as a concrete goal the systematic adaptation of approximately 15 of our courses, this year, to a more flexible form through the combination of new didactics and WWW-based environments. This more flexible form will be immediately put to test through its application with the many students who now participate in our Master of Science Programme in *Educational and Training Systems Design* (http://www.to.utwente.nl/masters/mscgen.htm) as well as new cohorts of part-time students for whom WWW-based course support can allow full participation in our education while continuing with their work. TeleTOP is both a top-down and bottom-up initiative: from top-down, we offer strong professional and technical support, guidance, and strategy, while from bottom-up we recognise the critical importance of faculty acceptance and buy-in and are seeking for each instructor the particular form and mix of tele-learning techniques with other aspects of instruction that will best fit his or her vision of good teaching. We invite everyone to visit the homesite of TeleTOP to follow our progress:

http://to-www.to.utwente.nl/TO/project/teletop/

Through TeleTOP, as well as other initiatives such as those in other faculties, those being supported by the *OC* (Onderwijskundig Centrum), and those within the framework of the *CTIT* (such as the *IDYLLE Project*) we will, again, move forward at the University of Twente as a leader in tele-learning, in the combination of new wine, old values and new methods that we celebrate today at this anniversary.

---

[10] I have made an analysis of this in a speech to be presented to representatives of all Dutch universities and hogeschools in December (see http://www.to.utwente.nl/user/ism/Collis/papers/suncoo.doc). In this speech, I identify three phases: pioneer, "1.000 flowers blooming", and managed change.

So, as we say in English at a birthday or anniversary celebration, "Many Happy Returns!" I suggest we use today as a benchmark, and look together again, in five years' time, to see what those returns, related to tele-learning, have been.

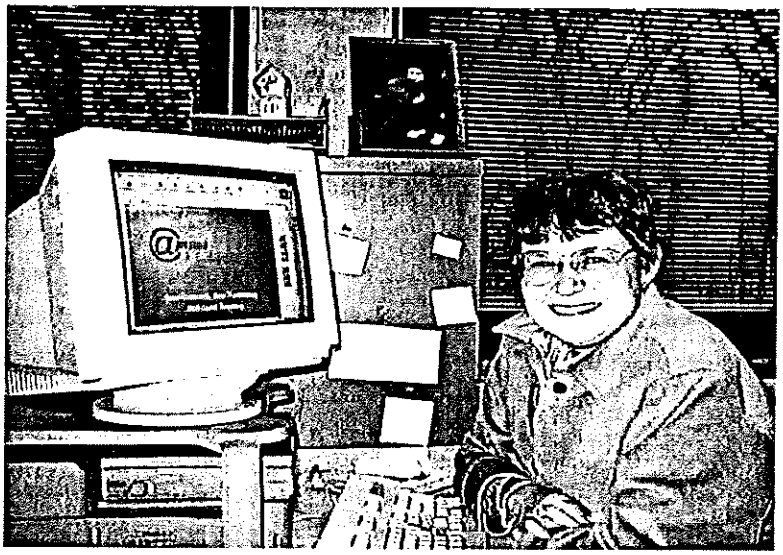
References

Collis, B. (1996a). *Tele-learning in a digital world: The future of distance learning.* London: International Thomson Publications.

Collis, B. (1996b). The Internet as an educational innovation: Lessons from experience with computer implementation. *Educational Technology, 36*(7), 21-30.

Tiffin, J., & Rajasingham, L. (1995). *In search of the virtual class: Education in an information age.* London: Routledge.

Van Vught, F. (1997). *Academische vorming: over experts en intellectuelen.* Rede, opening academsich jaar 1997/1998, Universiteit Twente, Enschede, NL.



Pioneering Academia and Business E-Learning Tools

Prof. Dr. Betty Collis

Shell Professor of Networked Learning

Faculty of Educational Science and Technology, University of Twente, Enschede, The Netherlands

Royal Dutch Shell Group
Shell People Services–Learning Americas

Professor Dr. Betty Collis

Pioneering Academia and Business E-Learning Tools

Shell Professor of Networked Learning

Vital: PhD(University of Victoria, Canada), undergraduate Mathematics(Stanford University). Presently Senior Full Professor (University of Twente, The Netherlands) involved in web-based course management system and implementation of changed strategy for the University.

Contribution: She is a **researcher, evaluator, designer** and **developer** in the innovative use of technology for learning support. In addition to her position at Twente University, The Netherlands, she partners with Royal Dutch Shell Group, Shell International Exploration and Production, in developing and designing e-learning programs to support technical and leadership development training. The Teletop system for design of e-learning modules was one that she developed at Twente University. This system creates a systematic environment where professors and program directors can design effective "blended learning" programs that engage the learner through technology, peer-to-peer interaction, and faculty-to-student coaching. Working with Shell (Noordwijkerhout, The Netherlands) , the 'blended learning' system utilizes her expertise in scientific and practical development. She is the **Shell Professor of Networked Learning Chair at the Shell Learning Center.** She is the **author** of four successful textbooks and more than 450 other publications. Her attributes include, **writing, speaking, leadership, research, teaching, mentoring, consulting, support, design, and innovation**. All of these attributes are fully utilized in universities, professional organizations, administration, governments and large corporations, even utilizing her own computer programming. **Describing her, terms like 'change leader' and 'combination' come to mind.**

A leader who practices everything BEFORE she preaches.

Professor Dr. Betty Collis

Pioneering Academia and Business E-Learning Tools

Personal Information

- She was born and grew up in Detroit, Michigan.
- Graduated with honors from University of Michigan, Stanford, University of Victoria (Canada).
- She is an American citizen, married to a Belgian, both of whom live and work in The Netherlands (she has been in The Netherlands for 14+ years).
- Besides being a wife, also a proud mother (son, a teacher, in Canada; daughter, a teacher and researcher, in Australia); daughter (mother in Detroit); and grandmother (Toby and Holly).

Professor Dr. Betty Collis

Pioneering Academia and Business E-Learning Tools

Academic Achievements

- Mathematics teacher, Michigan, California, British Columbia
- Faculty member for Educational Science and Technology, University of Twente, Enschede, The Netherlands
- **Pioneer** in the use of technology in "learning"

  1976 — teacher support for technology use

  1979—computers in education

  1979 — technology use in her own teaching

  1984 — network use in education

  1988 — technology and organizational change
- Designer, developer and teacher of 24 Web-based courses; voted "Instructor of the Year" in 1997 for Web-based work
- Collaborator in schools, in universities, with teachers, in companies; and with computer scientists and software developers internationally

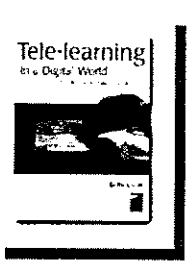
Royal Dutch Shell Group
Shell People Services–Learning Americas

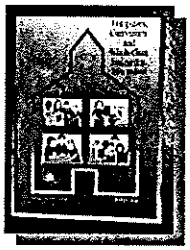
Professor Dr. Betty Collis

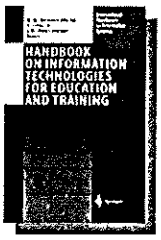
Pioneering Academia and Business E-Learning Tools

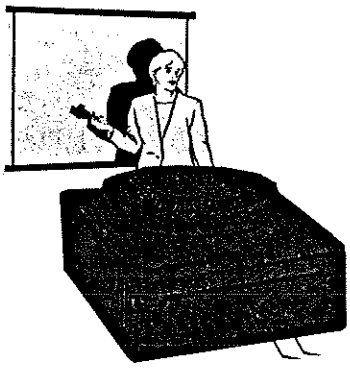
Professional Achievements

- Author: of over 450 publications, including four textbooks









- Presenter: of over 450 speeches, including 36 keynotes at international conferences
- Supervisor of graduate students:
  36 PhDs, 72 Masters
- Researcher: 67 externally funded projects
- Chair of conferences, president of
  International Society for Technology in Education,
- Consultant and advisor to both schools and universities and corporations

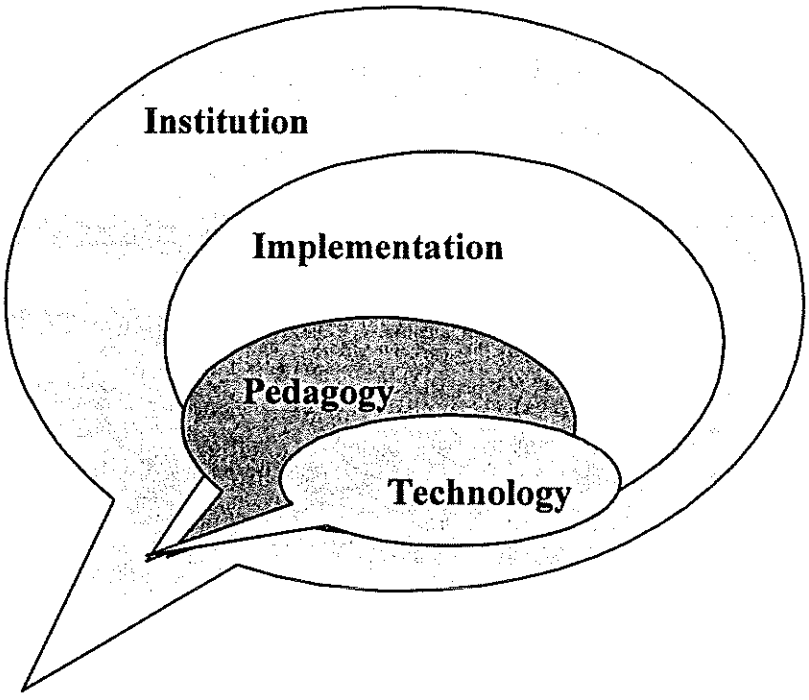
Royal Dutch Shell Group
Shell People Services–Learning Americas

Professor Dr. Betty Collis

Pioneering Academia and Business E-Learning Tools

The main questions throughout all Betty's work

- What are the learning-related problems in a given setting?
- Can technology help?
- If technology can help, will teachers/trainers/learners use it?
- If not, why not? And what can we do to change this?- via institutional changes, implementation and teacher support, new pedagogies, and better technology design?



Flexible learning in higher education

Royal Dutch Shell Group
Shell People Services—Learning Americas

Professor Dr. Betty Collis

Pioneering Academia and Business E-Learning Tools

Making a difference in education—The TeleTOP Experience (1997-2002)

THE UNIVERSITY OF TWENTE CHALLENGE:

Because a great majority of the current student population were "working" students, University of Twente needed a "face-to-face alternative.

Within a year, I was to make the complete curriculum of our university program available to working people.

BUT not as a separate "distance education" variant.

INSTEAD, use the opportunity to make learning more flexible, more efficient, and an enriching experience for ALL students.

AND, do this in a way that optimizes instructor buy-in without any released time for instructors.

And we succeeded! THE CHALLENGE?

Royal Dutch Shell Group
Shell People Services–Learning Americas

Professor Dr. Betty Collis

Pioneering Academia and Business E-Learning Tools

Making a difference in education—The TeleTOP Experience (1997-2002)

TeleTOP

Powerful use of technology: As a tool to support learning-related activities.

Powerful but simple-to-use technology platform: one that eliminated the fear and intimidation of creating online programs for the first time.

Powerful, but simple-to-use tools for instructor support: A set of "Decision Support Tools" that encouraged success one step at a time.

And we succeeded! TeLeTOP

Royal Dutch Shell Group
Shell People Services—Learning Americas

Professor Dr. Betty Collis

Pioneering Academia and Business E-Learning Tools

Making a difference in education—The TeleTOP Experience (1997-2002)

THE TELETOP APPROACH — WHY IT WORKS!

Incorporates a strong educational philosophy: "The Contributing Student".

Promotes a powerful education vision: More-flexible learning for ALL students.

Founded on a powerful change strategy: the "4-E Model".

Based on an effective buy-in strategy, focusing on 18 "lessons learned" from previous experience.

Created a new view of technology with faculty and students by using a tool to support learning-related activities.

Provided powerful, but simple-to-use tools for instructor support: "Decision Support Tools".

And we succeeded! WHY?

Royal Dutch Shell Group
Shell People Services—Learning Americas

Professor Dr. Betty Collis

Pioneering Academia and Business E-Learning Tools

Making a difference in education—The TeleTOP Experience (1997-2002)

A TELETOP APPROACH—THE TECHNOLOGY

Dr. Collis developed the a design technology tool for the computer that:

Was a powerful but simple-to-use technology platform — a system simple enough that faculty new to technology could use successfully and confidently.

Provided a framework for designing and creating individualized, on-line learning courses in a "blended environment".

Provided faculty with "Decision Support Tools" that allowed for easy migration of the best of their face-to-face sessions into interactive, positive learning experiences.

And we succeeded! HOW?

Royal Dutch Shell Group
Shell People Services—Learning Americas

Professor Dr. Betty Collis

Pioneering Academia and Business E-Learning Tools

The TeleTOP Approach, The Educational Basis

DR. COLLIS BELIEVES IN THE *CONTRIBUTING STUDENT*:

"Students who are teaching and learning from each other are the students who are learning."

Today's student thrives on less lecture and more learning discovery — rethinking how to use lecture and exploring new ways of giving new information.

A collaborative environment between student and faculty therefore, creating a more flexible faculty that provides a more-flexible learning environment for ALL students.

Creating a fertile environment for peer-to-peer teaching and learning.

And we succeeded!

THE EDUCATIONAL BASIS?

Royal Dutch Shell Group
Shell People Services—Learning Americas

Professor Dr. Betty Collis

Pioneering Academia and Business E-Learning Tools

Educational Basis of the Contributing Student

Study resources in the WWW. site are from the instructor and partially from the WWW

Prepare for upcoming face-to-face session by an orientation activity submitted via the WWW.

Build on the preparation; use session to focus on ideas studied in the "before" period to report on-going or finished activities, and also to prepare for follow-up activities.

(Possibly) integrate remote participants;

Capture key aspects of the session for re-use via the WWW site.

Follow-up afterwards;

Review and reuse resources

Individually or as a group, develop or locate resources to contribute to the WWW site; give peer feedback to contributed materials.

Phase 1 – BEFORE
The Preparation

Phase 2 – DURING
The Face-To-Face Event

Phase 3 – AFTER
The Follow-up

Use material contributed in the follow-up as resources for the next "before" session

Royal Dutch Shell Group
Shell People Services—Learning Americas

Professor Dr. Betty Collis

Pioneering Academia and Business E-Learning Tools

Powerful change strategy: based on the "4-E Model"

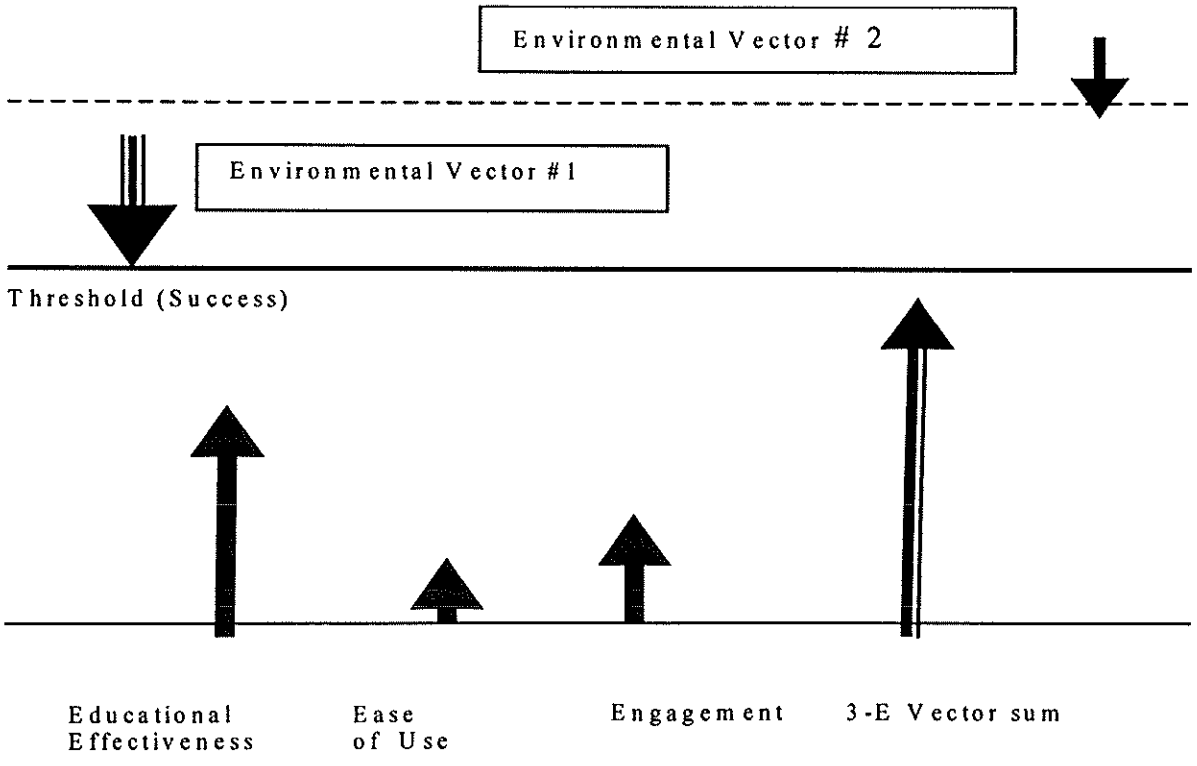
Educational Effectiveness — what is the perceived value of the learning. And the desire to learn something new.

Ease of Use — How easy it the learning to obtain and achieve.

Engagement — What is the level of interaction and engagement with the learning.

Vector sum — the sum value of Educational Effectiveness, Ease of use, and Engagement.

Environmental Vectors — the degree to which one can achieve success.

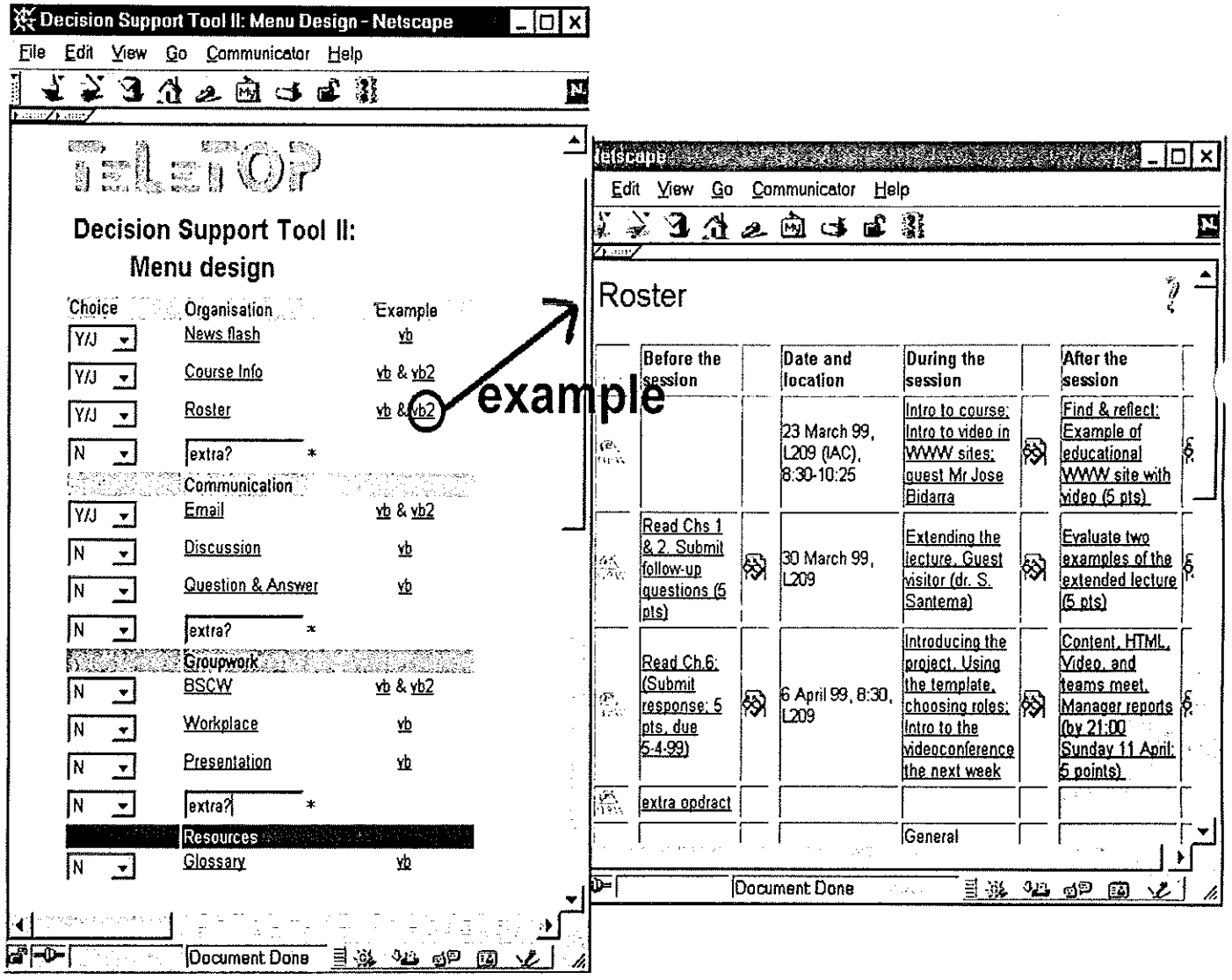


Royal Dutch Shell Group
Shell People Services--Learning Americas

Professor Dr. Betty Collis

Pioneering Academia and Business E-Learning Tools

TeleTOP Example



Professor Dr. Betty Collis

Pioneering Academia and Business E-Learning Tools

TeleTOP Results?

Within 1997-1998, all courses in the first-year of the program were redesigned and were running with support of TeleTOP; Betty Collis voted "teacher of the year" by the students for her teaching with TeleTOP.

By 1999, almost all courses in the faculty redesigned and running within TeleTOP; courses in other faculties redesigned and running within TeleTOP.

By 2000, within the faculty, more working students than "regular students"; evaluation studies show students and instructors highly satisfied with TeleTOP.

By 2000, TeleTOP supported by the university as system for all courses; TeleTOP is used as a tool for everyone.

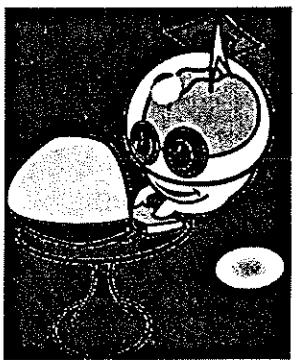
In 2000-2002, TeleTOP use spreads to other higher-ed institutions, schools, training centers (including the Dutch naval training school), and multinational companies (Shell Project starts).

Royal Dutch Shell Group
Shell People Services–Learning Americas

Professor Dr. Betty Collis

Pioneering Academia and Business E-Learning Tools

Applying TeleTOP to Business: Now, Betty is "Shell Professor of Networked Learning"...



Royal Dutch Shell Group
Shell People Services—Learning Americas

Professor Dr. Betty Collis

Pioneering Academia and Business E-Learning Tools

The task- Lead the way in "Blended Learning, Shell Style"

different types of learning resources.

different types of learning activities.

different places and times where learning activities take place.

different ways that people interact with each other.

grounded in a business-based learning model.

under the guidance and management of a capable facilitator.

with assessment.

with the whole process coordinated in an efficient way via a Web-based learning-support system (TeleTOP).

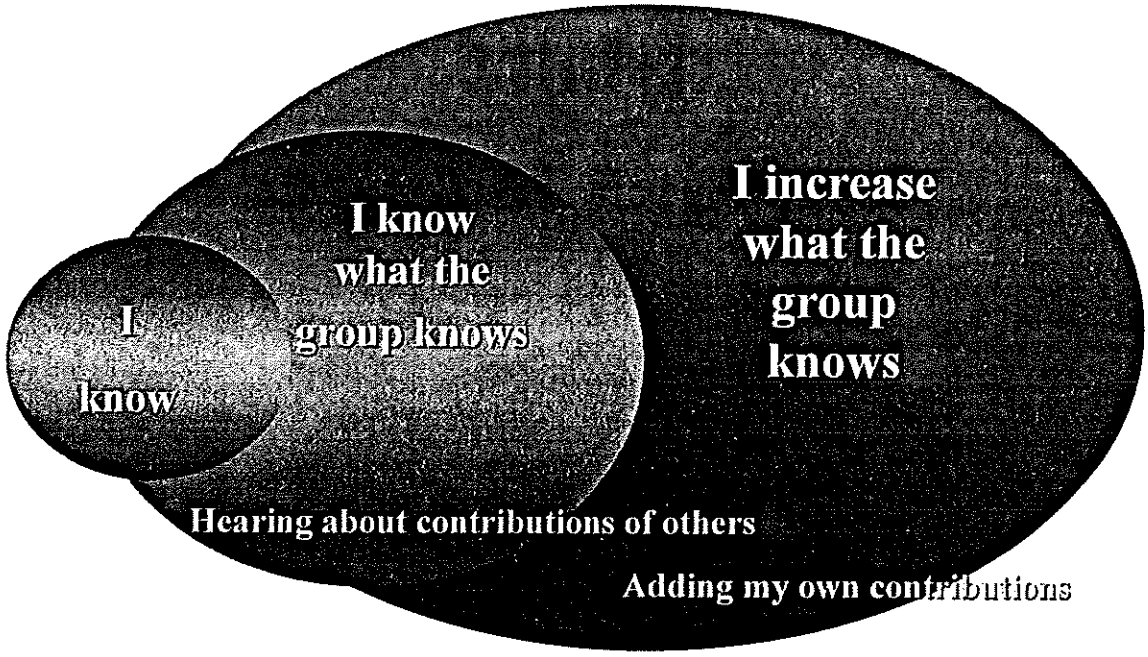
Royal Dutch Shell Group
Shell People Services–Learning Americas

Professor Dr. Betty Collis

Pioneering Academia and Business E-Learning Tools

Key to the Shell Blended Learning Model:

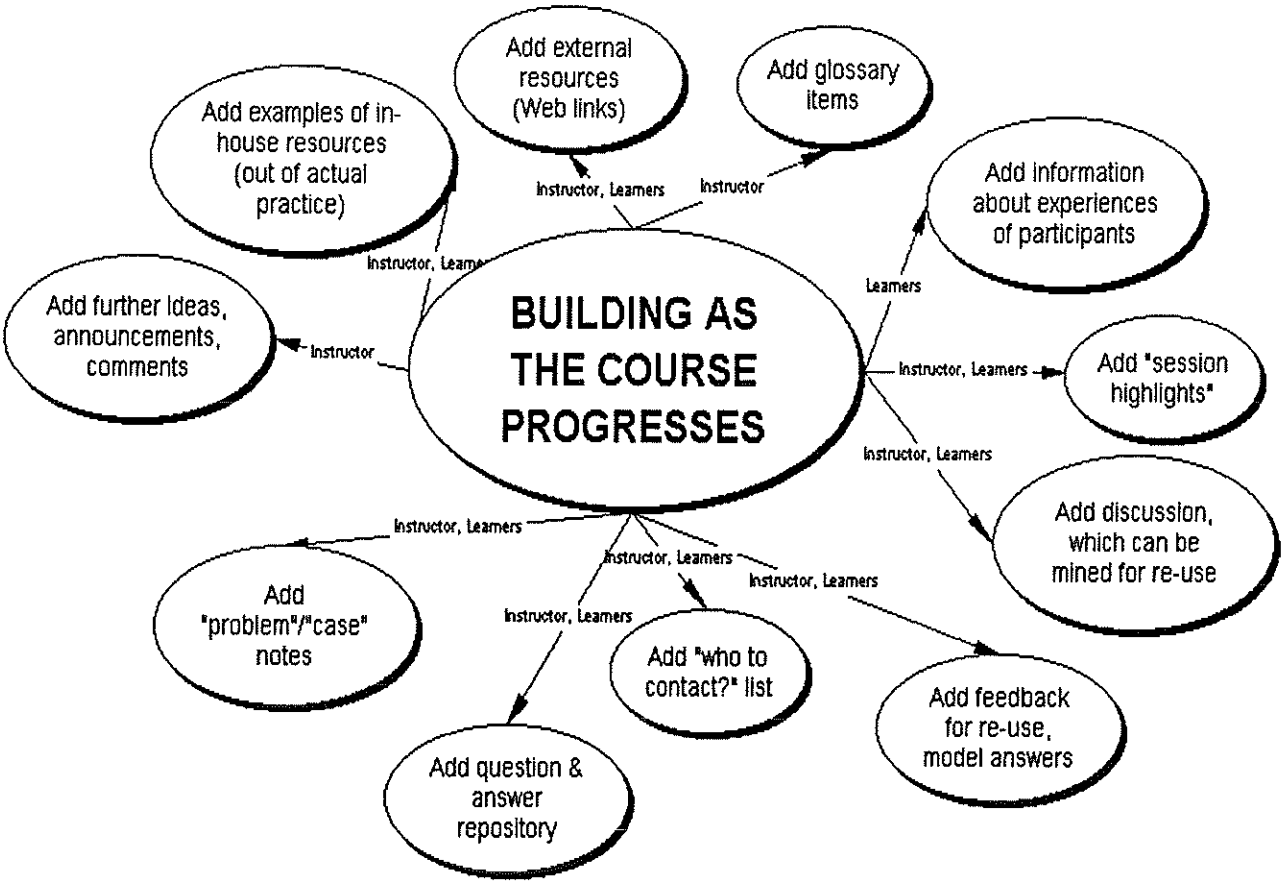
Sharing of Experience



Royal Dutch Shell Group
Shell People Services—Learning Americas

Professor Dr. Betty Collis

Key strategy: Capturing and building on workplace experience

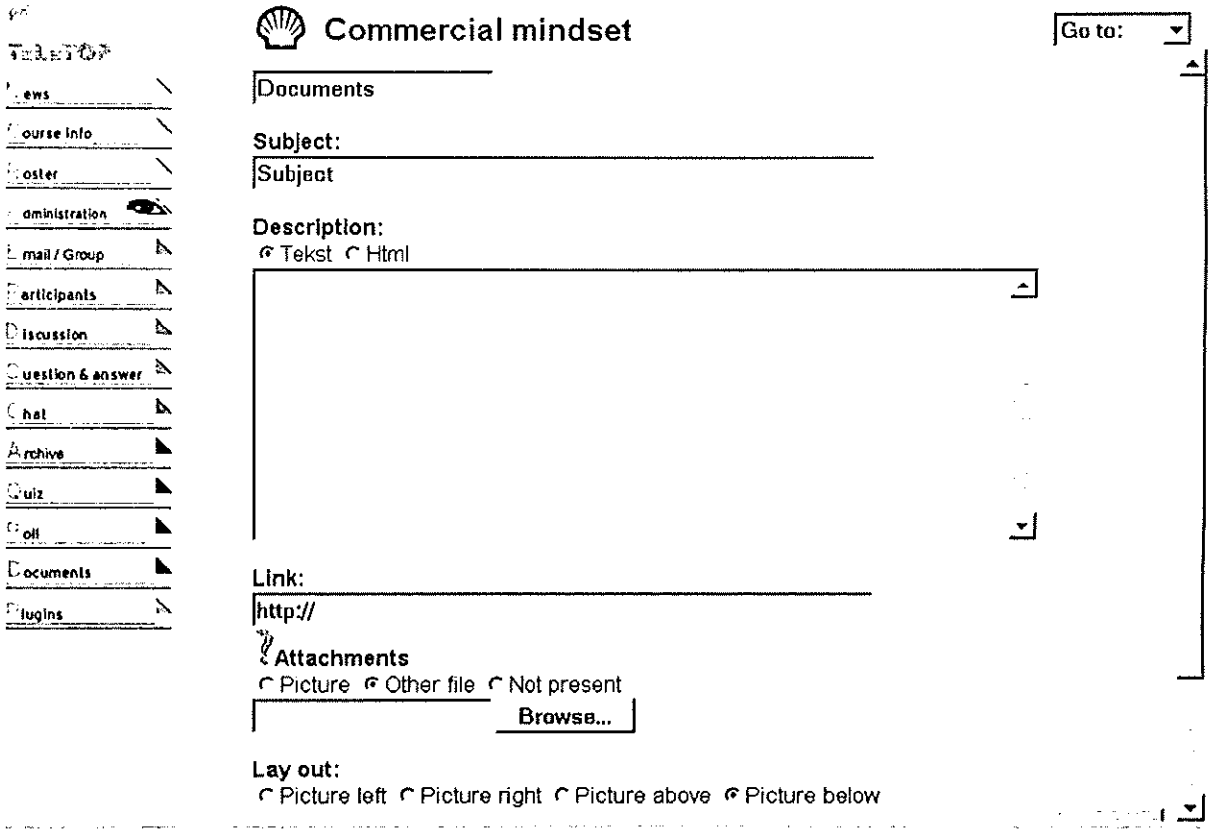


Royal Dutch Shell Group
Shell People Services—Learning Americas

Professor Dr. Betty Collis

Pioneering Academia and Business E-Learning Tools

People connecting with people...Make human expertise flexible to access, archivable, re-usable



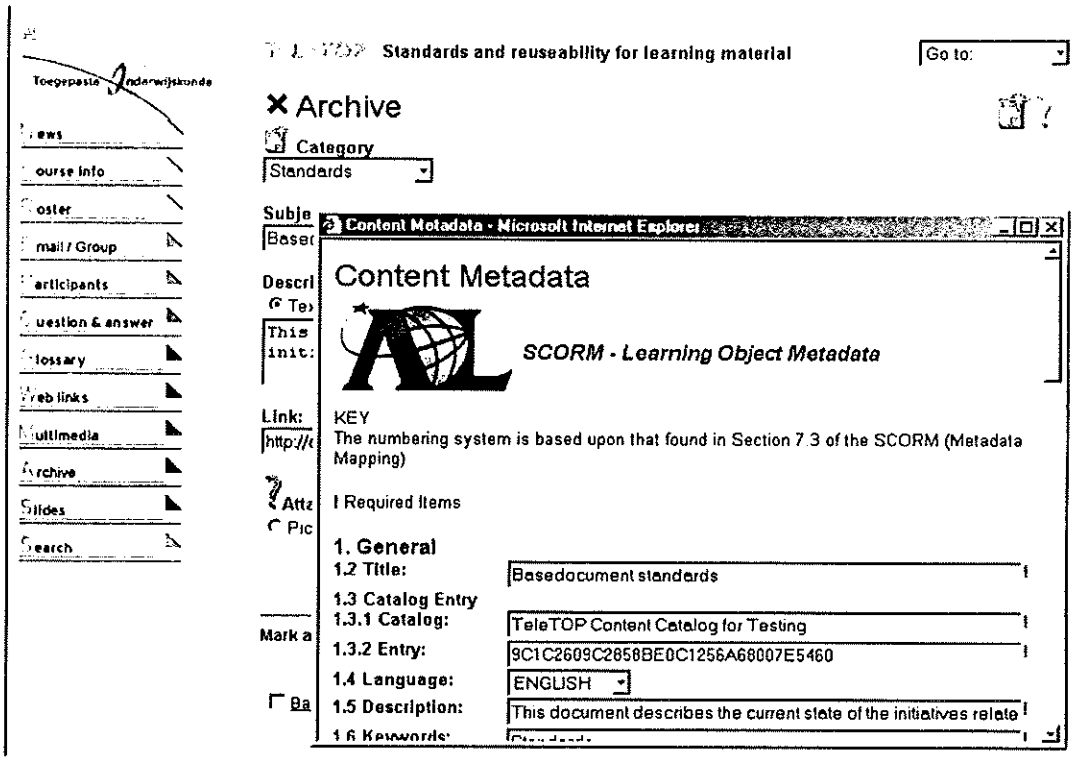
TeleTOP is again the key tool..

Royal Dutch Shell Group
Shell People Services–Learning Americas

Professor Dr. Betty Collis

Pioneering Academia and Business E-Learning Tools

Adding metadata for re-use: A new use of TeleTOP developed for Shell



TeleTOP is again the key tool..

Royal Dutch Shell Group
Shell People Services—Learning Americas

Professor Dr. Betty Collis

Pioneering Academia and Business E-Learning Tools

The future?

Instructors are "activity designers and supporters", not "instructional designers".

Contributions of learners become the key source of re-usable learning objects: A "content repository" grows as a result of the learning process.

Learners can choose their own blends, for each learning event.

Technology enhances the good learning situation, extends human contact and interactivity, and makes the learning process more efficient, accountable, and visible.

TeleTOP is again the key tool..

4 June 2001

Article submitted for publication in the December 2001 issue *of Educational Media International (EMI)*

Building on Learner Contributions: A Web-Supported Pedagogic Strategy

Betty Collis

Collis@edte.utwente.nl

Wim de Boer

W.F.Deboer@edte.utwente.nl

Jan van der Veen

J.T.vanderVeen@dinkel.utwente.nl

Abstract

Since 1997, we have been involved with the increasingly widespread use of a Web-based course-management system called TeleTOP *not only in our own university but also in other universities and training settings. We have accompanied the implementation of TeleTOP with an emphasis on a pedagogy that was new to almost all of the instructors involved: that of shifting the focus in a course from the presentation of content to the facilitation of learners making contributions to the course TeleTOP environment, contributions which serve as subsequent learning resources for others in the same course and can be reused as resources in other versions of the courses and other settings. In this article we describe the theoretical basis for our approach, illustrate how the pedagogy works in practice, and give some of the results.*

PEDAGOGICAL MODEL

A pedagogical *model* relates to the abstract concepts about the learning- and teaching process that underlie the instructional approach in a learning setting. Sfard (1998) identifies two basic

types of educational models, the *Acquisition Model* and the *Participation Model*. With the Acquisition Model, the focus of learning activities is on the acquisition of pre-specified knowledge and the development of pre-determined concepts. With the Participation Model, the focus of learning activities is on becoming a member of a community of practice, learning from the community but also contributing to it. With the Acquisition Model, what is to be learned is generally pre-determined. Frequently the extent to which the learner has learned is measured by a written test. Often there are pre-determined right answers. In contrast, with the Participation Model, the interactions that the learners contribute to may serve to change the knowledge base of the community even as they participate in it. The process of participation and contribution leads to products that can supplement traditional learning resources in a course. Both models are needed in higher education and professional training; what needs to be found is the balance between them in each particular learning setting.

Acquisition and participation are not new ideas, but contribution especially with reuse as an aspect is relatively unfamiliar. Jonassen, Peck and Wilson (1999) for example assert that the primary goal of education at all levels should be to engage students in meaningful learning – which they define as active, constructive, intentional, authentic, and cooperative. Interaction with learning materials and with others is also important to Laurillard's interaction-oriented approach (Laurillard, 1993). However, in these approaches, it is possible that all the activities and interactions that take place are based on pre-determined and pre-structured learning materials. "Action Learning" is well established in the literature (Dopper & Dijkman, 1997; Simons, 1999) and involves a focus on practical problems meaningful directly to the learner. However, this focus may restrict the applicability in terms of courses at the starting level in a programme. In our approach the students can contribute to the learning material based upon their own experiences, but also upon experiences from others, material already available in the WWW-based system, on the Web or in the literature. Table 1 summarises some of the main aspects of a contribution-oriented pedagogic model.

Table 1. Basic aspects of a contribution-oriented pedagogic model (Collis & Moonen, 2001, p. 88)

Table 1 about here

A contribution orientation not only has an educational motivation, but also some practical and strategic benefits. By shifting the task of filling the course environment to the students, the burden on the instructor or course designer prior to the course is reduced (although shifted to more work during the course, which we discuss later). Student submissions can be the source of model answers which other students can use to critique their own work. In a company setting, the tacit knowledge of the participants in a course can be articulated, submitted and reused in other settings, increasing the productivity of experience in the organisation (Collis & Winnips, 2001). In a situation where increasing flexibility is important in terms of options for course participation, a shift away from a fixed series of lectures toward more activities submitted via the course Web environment can facilitate more-flexible participation in the course. Contribution-oriented activities can be valuable parts of the activity mix.

Given this rationale for moving toward a contribution model of learning, how can it be carried out in practice?

PEDAGOGICAL APPROACH

The pedagogical approach that we support is one based on fewer lectures and more activities, activities where learners contribute something to the course Web site and then build on those contributions as the basis of subsequent activities. Figure 1 shows some of sorts of contributions which are becoming common with the use of the TeleTOP system.

Figure 1 about here

Figure 1. Building on contributions: Submissions made by participants (or reused from previous participants) can be built upon in subsequent activities

Activities can take many forms and be carried out both in an individual fashion or by a group. A sample of the sort of activities indicated in Figure 1 includes examples such as the following (Van der Veen, De Boer, & Collis, 2000). In each case, the WWW environment is used as the workplace for working on, contributing, and subsequently accessing the contributions.

1. Searching for additional information or examples and making these available for others
2. Working with a case as a basis for problem solving and contributing some additional materials for the case for use by others
3. Participating in a role-play situation and leaving some record of the results of the role play for others to consider
4. Creating a report to then be used as a learning resource by others
5. Creating a product, such as a multimedia resource or a design, that is also a resource for others
6. Extending and applying theoretical principles in new settings and adding these results to a course repository of extension materials
7. Testing one's insight through the development of test questions to be used by others
8. Participating in a discussion and leaving a record of key aspects of the discussion for use by others

The "others" in the above list of activities types may be other students in the same course or within a student's group in the course. But they may also be other students in other cycles of the course or students in other courses or learners who are not in a course context at all but could refer to the materials via a database rather as they now use a library. The idea of re-use of students' work and of moments of good communication in a course supports flexibility: for those who were not present when a moment of good communication occurred, for example, or to facilitate the development of a substantial database of learning resources that can be re-used and combined in many different combinations.

EXAMPLES FROM PRACTICE

In our own faculty, Educational Science and Technology, we have been following our colleague-instructors' instructional practices very closely since 1997. In the academic year 1999-2000, for example, we found the types of activities and feedback used in 27 of our courses to be those shown in Table 2. We discuss feedback approaches later in this article.

Table 2. Sample of contribution-oriented activities and feedback responses from 27 courses (only the major types of activities per course are tallied)

Table 2 about here

Recent interviews with 22 instructors indicate the same patterns for the 2000-2001 academic year (Slotman, 2001).

How do these sorts of contribution practices work in practice? The following example shows a typical sequence of steps, using the senior elective course named "Tele-Learning" as an

example. In this course, the students study at a professional level some aspects of using Web-based technology to support learning.

- In the preparation for the course, the instructor chooses the textbook and identifies the objectives of the course, as usual, but then focuses on planning the activities for the course. This activity planning is where she spends most preparation time. In the "roster" for the course, a table-like structure , she indicates the basic planning and integration of the three main aspects of the course: self-study with submissions related to the course textbook, (optional) face-to-face sessions where activities also occur and result in submissions to the course site, and the sequence of major activities that lead toward the final product that each student will produce in the course (in this case, a Web site with examples, analyses, reflections, and case material all relating to a sector or school situation of relevance to the individual student). Figure 2 shows the roster.

Figure 2 about here

Figure 2. Roster for the course, showing relationship of activities to other study materials and face-to-face sessions

- Much care also needs to be spent on writing clear instructions for the activities, including specifics about how the activity will be evaluated and how points will be awarded. Partly this is because clear instructions avoid many questions from students that arise if instructions are not clear; partly it is because in our situation some students choose to attend the course in a distance-flexible manner so may not be present at a face-to-face session to hear an elaboration. Also, indicating the evaluation planning in advance helps students to feel confident that they know

what is expected of them and that they are covering aspects in their contributions that will be valued. Figure 3 shows some activity instructions.

Figure 3 about here

Figure 3 Instructions for a contribution-oriented activity, including peer-to-peer comments on contributions

- A Web environment that allows easy and flexible submission of student contributions is essential for this sort of approach. Also, the submissions should be easy to view in different formats, for example, per student, or per activity, or by date. All of this requires a Web-based system that is combined with a good database, to allow views of different sorts at the instructor or even student's own preferences. Figure 4 shows a view of submissions via a particular cell in the roster, also showing if feedback has been given. The instructor can easily set the view so that all, some, or only the submitting student sees a particular submission and feedback. For example, the submissions may not be visible to all until a certain time, when all submissions are in.

Figure 4 about here

Figure 4. Overview of submitted work, for two steps of a multipart activities, in this case submissions of draft planning and peer feedback on another student's draft planning. Each of these steps receives marks.

- It is helpful if there are many ways for students to couple comments, feedback and reflection directly to submitted work. Figure 5 shows the comments of a student to his groupmates, via a shared workspace area in the course site.

Figure 5 about here

Figure 5. Example of peer feedback, within a group's shared workspace area in the course

Table 3 summarises the typical steps that an instructor manages when monitoring a contribution-oriented activity with the TeleTOP system.

Table 3. Typical instructor tasks related to a contribution-oriented activity (Van der Veen, De Boer, & Collis, 2000, p. 11)

Table 3 about here

MAJOR ISSUES: IMPACT ON THE INSTRUCTOR

There are many new sorts of activities in these processes for the instructor, as well as for the students. We have been studying the way instructors in our university gradually adopt these new processes, what their attitudes about these processes are, and what the time- and management burdens on the instructor become (Collis & Messing, 2001; Collis & Gervedink Nijhuis, 2000; De Boer & Peters, 2000; Gervedink Nijhuis, 2000; Slotman, 2001; Van der Veen, De Boer, & Collis, 2000; Winnips, 2001). Table 4 summarises some of the results of these studies.

Table 4. Aspects of new forms of activities supported by the TeleTOP system and their implications for the instructor

Table 4 about here

Not surprisingly, these implications involve time and management challenges for the instructors. Feedback is a particular challenge. In general, the options for feedback are: Structured or non-structured, process oriented or product oriented, and elaborated or short. We are studying the eight combinations of these options in order to improve both the effectiveness of the feedback for the learners and reduce the time demands of feedback for the instructor (Collis, De Boer, & Slotman, 2001). The option of the instructor giving each student individual written feedback (still the option chosen most by the instructors; see Table 2) is the most time-consuming for the instructor, and will be less and less feasible when the student numbers are high and as students become more active and participate more flexibly in courses. An example of the guidelines we offer to instructors about feedback includes:

Give the students via the WWW environment:

- personal feedback when they all have to carry out the same assignment.
- public feedback when you want them to learn from each other's answers or maybe use each other's answers for a new assignment.
- group feedback when the number of students in the course is large and could not be handled with personal feedback with regard to time constraints
- one answer key to all students when many students make the same mistakes in their answers.
- peer feedback when you want to guide the students in learning how to evaluate and give feedback (Remmers & Collis, 2000)

In recent research at our own institution we have found that students do not necessarily need or want lengthy or personal feedback, as long as they get feedback in a timely manner when they submit their work for comments (Collis, Winnips, & Moonen, 2000; Winnips, 2001). This is good news for the instructor, because the management of active-student activities is potentially a time and task burden for those who give the feedback. Also, we have found that instuctors tend to choose the level of activity and level of feedback that they feel they can manage (Collis & Messing, 2001); if their perception or expectation is that the level will be unmanagable, they just don't attempt it.

IMPACT RELATED TO STUDENTS

Not only does the instructor have new tasks, but also there are new issues confronting the instructor directly related to students' reactions (see a discussion in Collis & Moonen, 2001, pp. 104-107). From the students point of view, one problem relates to the expectation of the students as to how quickly they will get personal responses and feedback. Whereas before students would have waited perhaps a week for an instructor's office hours, now they complain if an e-mail is not responded to within a short period of time, or if feedback does not appear on their submissions also in a short period of time. Students will send repeats of their e-mails, asking why they did not get a response. The instructor must manage this; who did she respond to?, saying what?, when? How can she archive this communication for handy reference?

A more conceptual issue is the fact that some students do not, in fact, want to become more active and co-responsible for the course. Some may protest, saying that it is the instructor's job to "teach them". They complain that looking for additional study materials "takes too much time; why don't you just give them to us?" They want to read study materials as being the definitive and last word; having to evaluate materials and decide if indeed they are

appropriate is not something for which they have desire or skills. The higher-order skills and maturity needed to assume more personal responsibility for learning need to be developed via a process of scaffolding and monitoring by instructors, over many courses and years (Winnips, 2001). If activities are not part of the evaluation process of the course (i.e., if they are not graded), then many students are not likely to take part (see also Alexander & McKenzie, 1998; Collis & Moonen, 2001, p. 107). Finding the best balance in terms of size and spacing of activities, for both instructor and students, remains a challenge.

CONCLUSION

Shifting the pedagogical model in a course from an emphasis on prespecified, professionally developed content for the student to assimilate to one in which there is at least a balance between an acquisition and contribution approach has lead to a high frequency of use of our TeleTOP system, for short periods--the amount of time it takes to clarify an assignment, communication with peers, submit work of various sorts, and look at submissions of other students. Our students in general do not do their main "studying" from the Web site; they prefer to use books and other print materials for extensive reading. Our instructors are coming to elect to spend more time on monitoring and giving feedback to contributions during the course than on preparing traditional study materials in advance of the course.In order to keep the instructor's feedback tasks at a manageable level, it is important to plan the way feedback will be given and to communicate the way of working to the students (expectation management). This contribution approach results in a rich and extensive set of course resources from a variety of origins, which can be easily copied and reused in subsequent versions of the course (Strijker, 2001). However, reuse is not only a technical issue but also must fit with pedagogical practice. The contribution-oriented activities will need to gradually make more use of previously submitted contributions in order for reuse to become part of regular practice.

REFERENCES

Alexander, S., & McKenzie, J. (1998) *An evaluation of information technology projects for university learning*. Canberra, Australia: Committee for University Teaching and Staff Development.

Collis, B., De Boer, W. F., & Slotman, K. (2001) Feedback for Web-based assignments, *Journal of Computer-Assisted Learning* (submitted for publication).

Collis, B., & Gervedink Nijhuis, G. (2000) The instructor as manager: Time and task, *The Internet in Higher Education* 3(1-2), 75-07.

Collis, B., & Messing, J. (2000) Usage, attitudes and workload implications for a Web-based learning environment, *Journal of Advanced Learning Technologies* (ALT-J*), 9*(1), 17-26.

Collis, B., & Moonen, J. (2001*) Flexible learning in a digital world: Experiences and expectations,* Kogan Page, London..
http://education1.edte.utwente.nl/00FlexibleLearning.nsf/FramesFrom?ReadForm

Collis, B., & Winnips, K. (2001) Two scenarios for productive learning environments in the workplace*, British Journal of Educational Technology* (submitted for publication).

Collis, B., Winnips, K., & Moonen, J. (2000) Structured support vs learner choice via the WWW: Where is the payoff?, *Interactive Learning Research, 11*(2), 163-196.

De Boer, W. F., & Peters, O. (2000) *New didactics for WWW-based learning environments: Examples of good practice at the University of Twente.* Paper presented at the Campus 2000: Lernen in neuen Organisationsformen Conference, Innsbruck, Austria.

Gervedink Nijhuis, G. (2000) *Academics in control.* Internal report. Faculty of Educational Science and Technology, University of Twente, Enschede, NL.

Jonassen, D.H., Peck, K. L, & Wilson, B. G. (1999) *Learning with technology - A constructivist perspective.* Upper Saddle River, NJ: Prentice-Hall.

Laurillard, D. (1993) *Rethinking university teaching: A framework for the effective use of educational technology.* London: Routledge.

Remmers, E., & Collis, B. (2000) Didactical activities and strategies in the use of WWW-based course-support environments: Design guidelines for instructors. In J. Bourdeau & R. Heller (Eds.) *Proceedings of ED-MEDIA 2000* (pp. 898-903), : AACE, Charlottesville, VA, USA.

Sfard, A. (1998) On two metaphors for learning and the dangers of choosing just one, *Educational Researcher, 27*(2), 4-13.

Slotman, K.(2001) *Results from the CSOW Feedback Study.* Internal report. DINKEL Institute, University of Twente, Enschede, NL.

Strijker, A. (2001, May 11). *TeleTOP and reuse.* Presentation at Katholieke Universiteit Leuven, Belgium.

Van der Veen, J., De Boer, W. F., & Collis, B. (2000*) Didactics for Web learning environments: Active learning.* Report for the SURF-TeleTOP Alpha-Beta Project, DINKEL Institute, University of Twente, Enschede, NL.

Winnips. K. (2001) *Scaffolding by design: A model for Web-based learning support.* Doctoral dissertation. Faculty of Educational Science and Technology, University of Twente, Enschede, NL.

Authors Notes:

Prof. Dr. Betty Collis holds the Chair "Tele-Learning" at the University of Twente and has been the leader of the TeleTOP Project in the Faculty of Educational Science and Technology at this same university throughout the entire project. She has extensive international experience in computer- and network-related technology in education and training. Her new book, "Flexible learning in a digital world: Experiences and expecations", co-authored with prof. dr. Jef Moonen, summarises this experience and offers an extensive case study of the TeleTOP project. See http://users.edte.utwente.nl/collis/

Drs. Wim de Boer is one of the educational designers working on the TeleTOP team of the Faculty of Educational Science and Technology, and also a member of the Department ISM where he is doing his PhD research on models of e-learning for flexibility and enrichment. For an overview of his work and background, see his homepage: http://users.edte.utwente.nl/boerwf/

Dr. Jan van der Veen is an educational consultant and tele-learning researcher at the University of Twente. He advises faculties on the use of computers and the Web in their education and researches the same topic in daily practise of Higher Education. In 2001 he finished his PhD with a dissertation on "Telematic Support for Group-based Learning". See: http://www.tup.utwente.nl/uk/catalogue/educational/telematic/ , or e-mail the author for an electronic version.

Table 1. Basic aspects of a contribution-oriented pedagogic model (Collis & Moonen, 2001, p. 88)

Key Aspects	Specifics of the Key Aspects
Key ideas:	Learners contribute to the learning materials via contributions made available to others in a WWW-based system. The others may be others in the same group or others at other times.
Key characteristics:	The course WWW site is largely empty at the start of the learning experience except for instructions for the course activities and some resources contributed previously; the learners and the instructor will fill the site via the process of many activities during the course. Learners learn from realistic materials as well as peer-created materials as much as or more than professionally developed materials. Learning materials contributed by students are re-used in other learning settings.
Role of instructor:	Designer of activities and of feedback and monitoring strategies for activities.
Role of technology:	To facilitate all aspects of the activities.

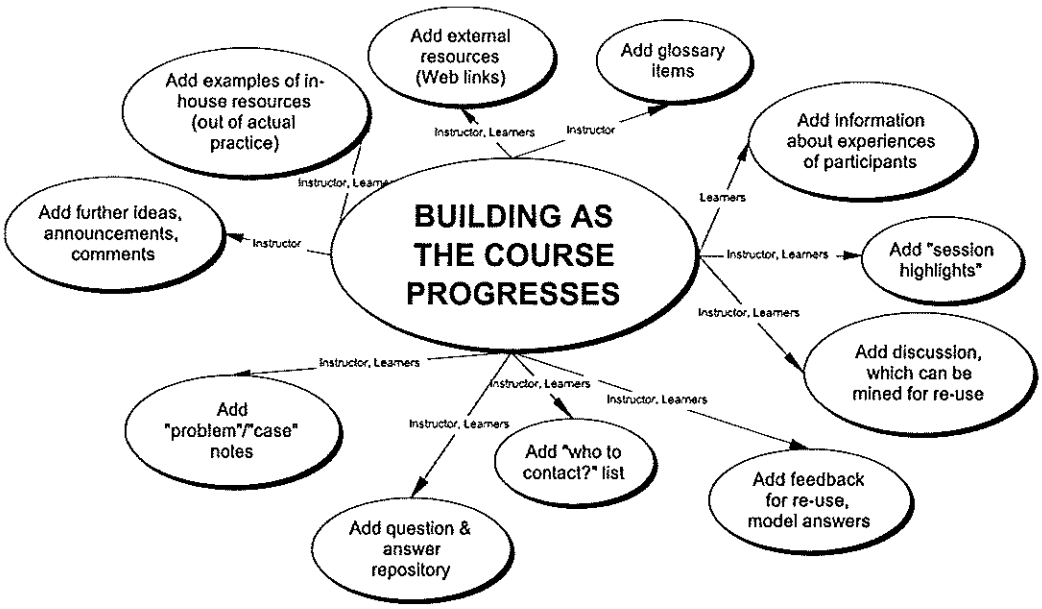


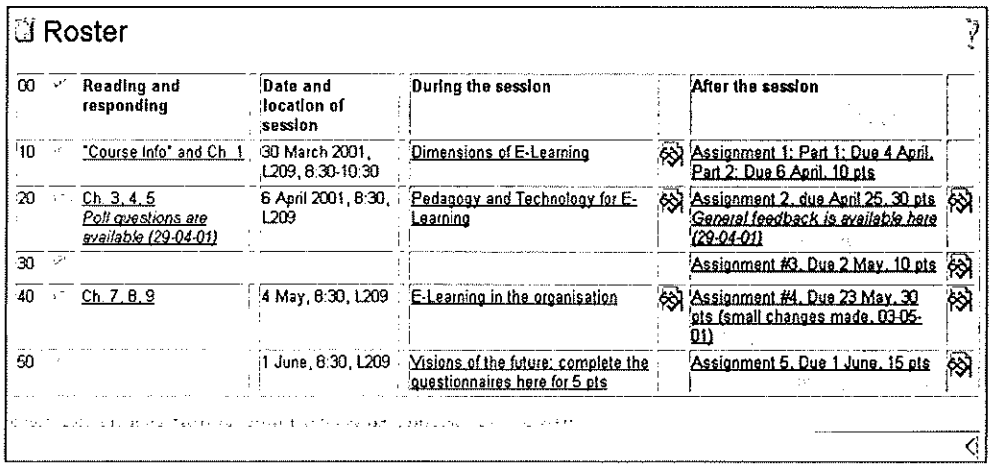
Figure 1. Building on contributions: Submissions made by participants (or reused from previous participants) can be built upon in subsequent activities

Table 2. Sample of contribution-oriented activities and feedback responses from 27 courses (only the major types of activities per course are tallied) (De Boer & Peters, 2000)

Form of Feedback: / Type of Activity:	Instructor gives individual feedback via the Web site	Model answer is available in the Web site	Students give peer feedback via the Web site	No feedback via the Web site (generally provided during a lecture session)	Computer-generated feedback	Total
1. Find information (Web or library), submit it with reflections into the course site	5		1			6
2. Submit (as a group) an analysis of a case into the course site	3	1				4
3. Participate in a role play, submit preparatory and supporting resources into the course site, reflections on the role play afterwards		1				1
4. Work as a group on a multi-part report, with partial products submitted via the Web site and the final report available via the Web site	1					1
5. Work as a group on a design project, with partial and final products available via the Web site and with feedback from peers and also comparisons of own work with that of peers	2		1	3		6
6. Reflection and application activities based on course theory; submissions available via the Web site with model answers chosen for study by others	6			2		8
7. Skills practice, comments about own experiences (hints, observations, etc) added to Web site for others	1			3		4

8. Creation of multiple-choice test questions for self-study					1	1
Totals	*18*	*2*	*2*	*8*	*1*	*31*[a]

[a] In some courses, there were two major types of activities.



Roster

00	Reading and responding	Date and location of session	During the session	After the session
10	"Course Info" and Ch. 1	30 March 2001, L209, 8:30-10:30	Dimensions of E-Learning	Assignment 1: Part 1: Due 4 April, Part 2: Due 6 April, 10 pts
20	Ch. 3, 4, 5 *Poll questions are available (29-04-01)*	6 April 2001, 8:30, L209	Pedagogy and Technology for E-Learning	Assignment 2, due April 25, 30 pts *General feedback is available here (29-04-01)*
30				Assignment #3, Due 2 May, 10 pts
40	Ch. 7, 8, 9	4 May, 8:30, L209	E-Learning in the organisation	Assignment #4, Due 23 May, 30 pts (small changes made, 03-05-01)
50		1 June, 8:30, L209	Visions of the future: complete the questionnaires here for 5 pts	Assignment 5, Due 1 June, 15 pts

Figure 2. Roster for the course, showing relationship of activities to other study materials and face-to-face sessions.

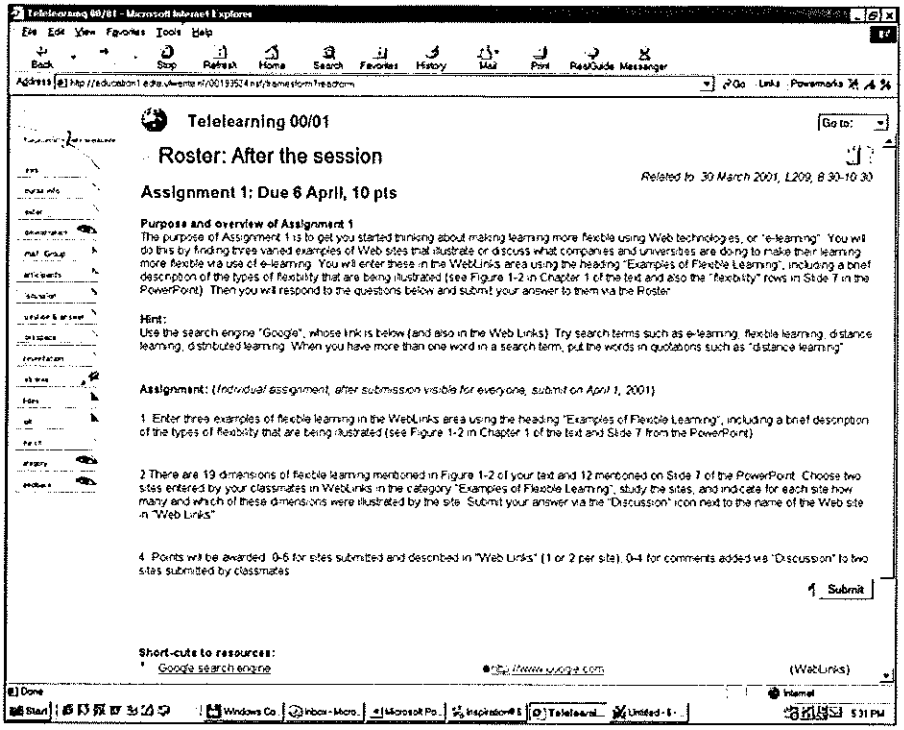
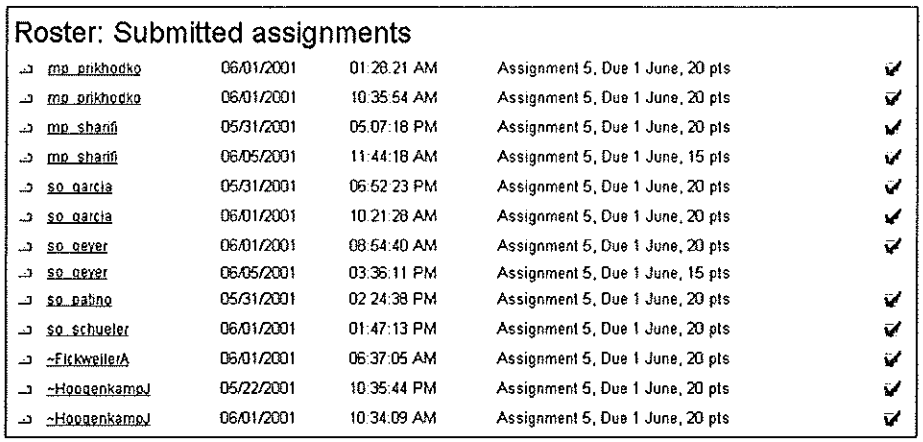


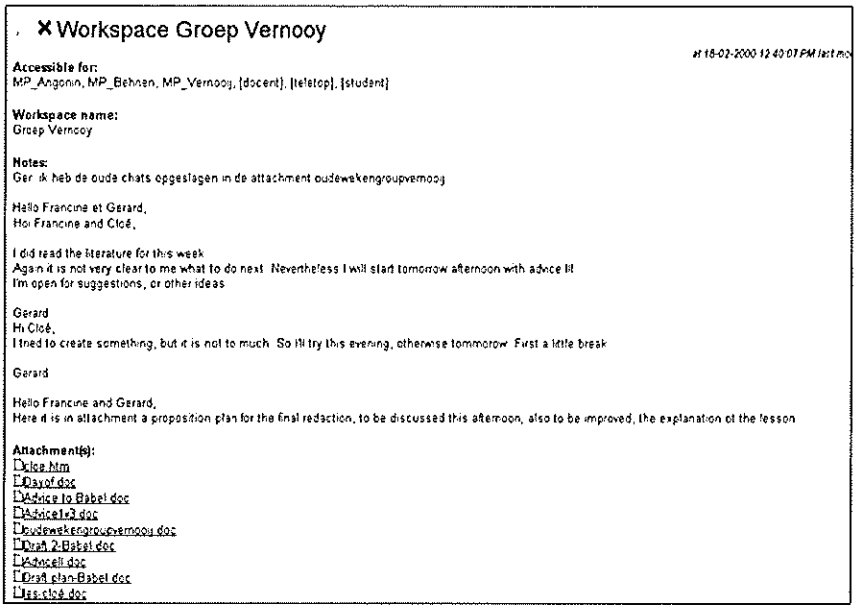
Figure 3 Instructions for a contribution-oriented activity, including peer-to-peer comments on contributions.



Roster: Submitted assignments

mp_prikhodko	06/01/2001	01:26:21 AM	Assignment 5, Due 1 June, 20 pts	✓
mp_prikhodko	06/01/2001	10:35:54 AM	Assignment 5, Due 1 June, 20 pts	✓
mp_sharifi	05/31/2001	05:07:18 PM	Assignment 5, Due 1 June, 20 pts	✓
mp_sharifi	06/05/2001	11:44:18 AM	Assignment 5, Due 1 June, 15 pts	✓
so_garcia	05/31/2001	06:52:23 PM	Assignment 5, Due 1 June, 20 pts	✓
so_garcia	06/01/2001	10:21:28 AM	Assignment 5, Due 1 June, 20 pts	✓
so_geyer	06/01/2001	08:54:40 AM	Assignment 5, Due 1 June, 20 pts	✓
so_geyer	06/05/2001	03:36:11 PM	Assignment 5, Due 1 June, 15 pts	
so_patino	05/31/2001	02:24:38 PM	Assignment 5, Due 1 June, 20 pts	✓
so_schueler	06/01/2001	01:47:13 PM	Assignment 5, Due 1 June, 20 pts	✓
~FickweilerA	06/01/2001	06:37:05 AM	Assignment 5, Due 1 June, 20 pts	✓
~HoogenkampJ	05/22/2001	10:35:44 PM	Assignment 5, Due 1 June, 20 pts	✓
~HoogenkampJ	06/01/2001	10:34:09 AM	Assignment 5, Due 1 June, 20 pts	✓

Figure 4. Overview of submitted work, for two steps of a multipart activities, in this case submissions of draft planning and peer feedback on another student's draft planning. Each of these steps receives marks.



✕ Workspace Groep Vernooy

at 18-02-2000 12:40:07 PM last mo

Accessible for:
MP_Angonin, MP_Behnen, MP_Vernooy, [docent], [teletop], [student]

Workspace name:
Groep Vernooy

Notes:
Ger ik heb de oude chats opgeslagen in de attachment oudewekengroupvernooy

Hello Francine et Gerard,
Hoi Francine and Cloé,

I did read the literature for this week
Again it is not very clear to me what to do next. Nevertheless I will start tomorrow afternoon with advice it
I'm open for suggestions, or other ideas

Gerard
Hi Cloé,
I tried to create something, but it is not to much. So I'll try this evening, otherwise tommorow. First a little break

Gerard

Hello Francine and Gerard,
Here it is in attachment a proposition plan for the final redaction, to be discussed this afternoon, also to be improved, the explanation of the lesson

Attachment(s):
Cloe.htm
Day of.doc
Advice to Babel.doc
Advice1e3.doc
oudewekengroupvernooy.doc
Draft 2-Babel.doc
Advicell.doc
Draft plan-Babel.doc
Les-cloé.doc

Figure 5. Example of peer feedback, within a group's shared workspace area in the course Web site.

Table 3. Typical instructor tasks related to a contribution-oriented activity (Van der Veen, De Boer, & Collis, 2000, p. 11).

Task	Instructional Strategies and Use of TeleTOP
1. Choice of task for the activity; tasks should involve the students making an active contribution to the course Web site in some way and also interacting with each other in some way	1.1 Previous activities can be reviewed, available via the TeleTOP database 1.2 Instructions, examples of good submissions by students, feedback, can all be copied from previous versions of the course
2. Details of the activity are communicated to the students	2.1 Instructor places the instructions for the activity in the roster to integrate it with appropriate readings, class sessions, etc. 2.2 The instructor specifies who and when can see each other's submissions 2.3 Activity instructions should be written in a step-by-step manner, so that expectations and marking plan are clear to the students; a model response can be provided if appropriate
3. Students submit contributions, as individuals or as a group	3. 1 The roster is used so that all submissions are in a common location, and the instructor can see what has been submitted, when, by whom 3.2 When contributions are submitted in other parts of the course site, such as Web Links or the Workspace, students have to be aware where feedback and points can be found
4a. Feedback: from instructor	4. 1 Instructor checks student submissions and enters feedback via the Web site; marks can also be directly entered into the course database 4.2 Instructor can choose from list of previously stored feedback, comments, model answers, etc. to speed the feedback process
4b. Feedback: from peers	4.1 Instructor sets up procedure for peer comments, and specifies a location in the Web site for peer comments 4.2 Instructor must monitor peer comments and intervene when appropriate
5. Handling exceptions: Students who are sick, late, want an adapted activity, etc.; In group situations, dealing with problems of unequal contribution within the group	5.1 Instructor must make a decision about the exception, maintain a record of the decision, monitor that the student does eventual carry out the modified activity 5.2 In group situations, the instructor may have to intervene and reorganise the group or speak individually with members of the group and readjust marks and task assignments.
6. Assessing overall performance and adapting next class activity accordingly	6. Instructor must decide if certain aspects of the activity need general attention, if the next activity needs to be adapted, if aspects need to be discussed in the next class session, etc.
7. Adapt, based on student performance	7.1 Use the "News" feature to give some general comments about the assignment and any general misconceptions 7.2 Add a link to a model or interesting response in the course site, and ask students to compare their work to these responses 7.3 Use communication tools such as "question and answer" or chat or discussion board, to further handle difficult points 7.4 Revise the following assignment, if appropriate, via the description in the Web site; inform students of the changes via the "News" function
8. Review activity process for following year	8. Store model responses, key feedback comments, student misconceptions, etc., revise activity description text for better clarity of expectations

Table 4. Aspects of new forms of activities supported by the TeleTOP system and their implications for the instructor (Collis & Moonen, 2001, p. 106).

Types of change in activities
When new forms of activities based on ***the contributing-student*** idea and flexibility occur, they often involve: • Less reliance on lectures and more time spent on new forms of learning activities, such as new forms of activities, where the contact between students and the instructor takes place at least some of the time via a WWW environment • More student participation, often via the practice of students entering new resources into the course WWW site or being involved in asynchronous discussions via computer conferencing or WWW boards • More group projects or collaborative activities, supported by groupware tools • New forms of learning activities involving international aspects such as students in two different courses in different countries working together on some common task • New forms of assessment activities, such as electronic portfolios and journals; also more opportunities for self and peer assessment • More time spent on student presentation of their work; work is made for and presented to an audience via the WWW site, and comments are given on the work by those in the audience
Implications for the instructor:
The instructor must: (a) Select and use appropriate tools to make flexible participation possible and support students in the use of these tools (b) Think of new forms of student activities (c) Learn how to set up and describe the activities, explaining very clearly what the expectations are both contentwise and also related to time, form, and method of submission (d) Communicate precisely how students will be evaluated on the new forms of activities, particularly for group projects and peer evaluations (e) Monitor and appropriately intervene when there are problems within groups with group work (f) Handle much more contact with students, via their submissions into the WWW site or e-mail, their comments and discussions, their comments on each others' work (g) Develop new methods of grading student performance, so that process is also graded; apply these methods in a consistent way and so that students understand your criteria (h) Monitor the quality of what students submit into the course WWW environment for other students to see and study; inappropriate material must be quickly removed and the individual submitting it contacted. *Inappropriate* covers a large number of aspects, from being factually wrong to being potentially offensive to others (i) Monitor potential copyright problems with what students submit into the course WWW site (j) Keep records relating to student process and participation, to use for monitoring and grading (k) Manage incoming and outgoing activities, e-mail, contacts from individual students (l) Become an "expert participant" and co-learner as well the instructor still responsible for the acquisition aspects of the course

To be published in the *British Journal of Educational Technology*. Permission granted by the publisher to distribute in the videoconference support materials. (13 March 1999)

Designing for differences: Cultural issues in the design of WWW-based course-support sites

Betty Collis

Prof. dr. Betty Collis is Professor of Tele-Learning in the Faculty of Educational Science and Technology and Senior Researcher, Advanced Learning Technologies at the Centre for Telematics and Information Technology, both at the University of Twente in The Netherlands. Her research interests include WWW-based course-support systems, factors that influence use of telematics applications in education, and educational applications of asynchronous video integrated in WWW environments. She is also the Chair of the TeleTOP project, for faculty-wide redesign of courses for more-flexible participation. Address for correspondence: Faculty of Educational Science and Technology, University of Twente, Postbus 217, 7500 AE Enschede, The Netherlands. Fax: 31-53-4894580, e-mail: collis@edte.utwente.nl, http://www.edte.utwente.nl/user/ism/Collis/home.htm

Abstract

Culture is a critical influence on the acceptance, use of, and impact of learning resources. WWW-based course-support sites are becoming an increasingly familiar type of learning resource in higher education. How might different aspects of culture be predicted to affect the institution's, instructor's, and student's reactions to WWW-based course-support sites? How can such sites be designed to anticipate a match between cultural expectations and WWW-site aspects, especially when different cultures are involved? This article analyses various of these cultural aspects, and argues that WWW-based course-support sites should be designed to be adaptable to different types of cultural differences through systematic attention to a set of ten design guidelines. An example illustrating the design guidelines, the TeleTOP Method from the University of Twente, is described and evaluated relative to the design guidelines. Important considerations related to feasibility as well as to conceptual and strategic choices are included in the scope of the guidelines; the instructor's cultural ecology requires particular attention. But WWW sites and guidelines in themselves are not enough for cultural flexibility; sensitivity and appropriate responsiveness remain human activities.

Introduction: Culture and the design of WWW-based course-support sites

Culture, "the beliefs, value systems, norms, mores, myths, and structural elements of a given organization, tribe, or society" (Watson, Ho & Raman 1994, 45) manifests itself in the shared and identifiable ways in which a group interprets and reacts to its environment. The behaviour of individuals and collectively of institutions "is affected by the values and attitudes that they hold and the societal norms that surround them. When values are widely shared by a group of people, they are provided with a common mechanism by which they can share understandings and interpretations of their world, and establish what is important and clarify priorities" (Wild & Henderson, 1997, 183). Culture affects the individual's response to computer-related systems. For example, Watson, Ho, and Raman (1994) note that the design of software systems designed to support group activities is "often based on the customs of the particular culture in which it was developed" and thus "both technical and social facilities may need modification for successful adoption in another culture" (p. 45). Culture also has a strong influence on the acceptance of, use of, and impact of learning-related interventions. Jin and Cortazzi (1998) for example, in comparing the effect of class size in Western and Chinese schools, argue that the instructional approaches in a particular instructional setting are "embedded in a cultural context of beliefs, expectations, and values. These do more than support the (instructional) techniques. They are a part of them. They may be the reason the techniques are successful. To take the techniques without their roots may

not be as useful...A culture of learning is less-easily transferred...for it involves teacher and pupil effort, discipline, respect, collective notions, family support, and moral aspects as well as tools to support communication, information handling, and group activities used within the learning context" (p. 786).

WWW-based course-support sites are an example of a learning intervention involving computer technology and as such their acceptance, use, and impact will be influenced by culture-related aspects. These cultures include those of the institution, the subject disciplines, the instructors, and also the learners. WWW-based course-support sites are collections of WWW pages, resources and tools that support a course, most typically in higher education, and at the very simplest, contain information about the course. Most sites are more complex, and offer some or many of the forms of learning and organisational support shown in Table 1. The purpose of such sites is to increase the efficiency of course delivery and participation, enrich aspects of course participation, and make various aspects of course participation more flexible to better meet the needs of different groups of students or individual students (Collis, 1998a,b).

Table 1. Examples of support types in WWW-based course-support environments (Collis, 1998a)

Course aspect	**Functionalities in a WWW-based course-support site to increase efficiency, enrichment, and/or flexibility**
1. General course organisation	- "Newsflash" areas on the WWW site present announcements, changes, updates -Administrative information (names of students, e-mail addresses, scores to date, etc.,) are available through the WWW site -Faculty bureau maintains channels of personal contact and availability, printed material still available on courses, timetable, etc; E-mail and the WWW used for student contact, updates in information, sign-ups for elective courses, etc. -Instructor still provides course outline but also has it in the WWW; all updates and announcements are in the WWW or via e-mail -The course-support site is integrated with other WWW sites with faculty-wide information
2. Communication	-Convenient communication through an e-mail centre in the WWW sites, where not only individuals can be messaged but also groups within the course (via aliases). Group members can have their own private communication areas within shared workspaces -The opportunity for guided reflective discussions via a WWW board (a form of computer conferencing within a WWW site) -Tools for scheduling and carrying out real-time communication at a distance including chat, Internet telephony, desktop meeting tools (such as *NetMeeting*)
3. Lectures, instructor presentations	-Notes available before a lecture via the site -Highlights of lectures are captured as digitised video, made available as streaming video on the WWW, synchronised with notes, for students not physically present -Follow-up reflections or questions can be posted and responded to via various WWW-based forms and communication tools in the course site

Table 1, continues...

4. Self-study and practice	-Expand existing study materials by adding interactive tools (such as applets) for self-study via the WWW -Expand and update study materials by using links to additional resources via the WWW -Provide support for exercises and small assignments, by having them submitted via the WWW site and by being able to offer (a) direct (automatic) feedback (for exercises with a pre-determined correct answer), (b) making a model answer available via the WWW after the student has submitted his work, or (c) via general feedback from the instructor or (d) by the students to each other (possible when student responses are available via the WWW site)
5. Group-based projects	-Offer tools to support group activities such as a shared workspace -Require continual posting on the WWW site of work relating to the on-going progress of project work, such as design decisions, task allocation agreements, draft versions; use the WWW site for students to give each other feedback on work-in-progress and for instructor comments -Link final products to the WWW site and include student reflection on each other's work as part of the course requirements
6. Evaluation	-Present some forms of evaluation such as reflective comments via the WWW, where questions are posted at a certain time and responses must be submitted within a specified time limit -Provide password-protected test sessions, with automatic feedback when appropriate to the form of the test question

With course-support environments, no one course needs to include all of the options shown in Table 1. Ideally, the instructor selects those options that relate to his or her own course and its own situation. WWW-based course-support environments can be simple or complex pedagogically as well as simple or complex technically. They can be created and maintained by the individual instructor, but increasingly, such sites are maintained as part of an integrated system serving an entire department or faculty. These systems are an integrated combination of a database, a collection of WWW-compatable tools and resources, a management system, and a procedure by which user-tailored user interfaces are presented to different groups of users (see, for example, Collis, 1998b; Firdyiwek, 1999).

As Table 1 suggests, the educational potential of WWW-based course-support sites is considerable. However, there are other reasons besides direct learning intervention that motivate an institution to adopt a WWW-based course-support system. Important among these is the interest in attracting increasingly diverse groups of students to one's institution and the parallel need to respond to increasingly diverse learner populations. WWW-based course-support systems provide a way for students at a distance to access an institution's course-support environments and thus increase the possibility of course attendance and interaction regardless of location. In addition, WWW-based systems also are bringing a new level of operationalisation to the long-standing desire to find a way to share, or sell, computer-related learning resources outside of the market in which they were originally produced (for a summary of more than a decade of effort in respect to educational computer software, see Collis 1996). However, despite this educational potential, both from learning and institutional-strategic perspectives, there appears to be little research yet that systematically relates design decisions for WWW-based course-support sites and systems to cultural appropriateness, builds upon this analysis to suggest design guidelines to make such sites

and systems culturally appropriate, puts the guidelines into action in an institutional settings, and gets enough data to evaluate its proposals. Wild and Henderson (1997) are among those who call for such research; this article responds to this need.

In the article, factors affecting the cultural appropriateness of a WWW-based course-support site will be identified, and a general strategy for accommodating different values of these factors in WWW-based course-support systems based on flexibility increase will be identified. Design guidelines based on this strategy will be identifed. The *TeleTOP Method* at the University of Twente in The Netherlands will be used as an example of a procedure that operationalises the design guidelines. The general question being addressed is: How can WWW-based course-support sites and systems be designed to offer optimal flexibility in terms of culture-related differences in its users?

Culture-related variables affecting the use of WWW-based course-support sites

Culture as related to the acceptance, use, and impact of WWW-based course-support sites occurs at a number of levels: societal, personal, organisational and discipline. There is the general culture of the society as whole, which in turn relates to language, ethnic group, religion, and history, and is reflected in a complex number of norms, mores and acceptable behaviours. Individuals carry the culture which was formative to them when they move to other cultural settings, although they may in time adapt to a new culture, or influence its adaptation. Adaptive Structuration Theory (AST) has been suggested as a theoretical way to explain such adaptation (Poole et al, 1985). "In time either the new person changes and conforms to the group's rules and the old system is maintained, or a new system ...emerges" (Watson et al, 1994, 47-48).

In addition to the formative societal culture, there is the culture of the organisation in which the course takes place. This may be more than one culture, in that faculties and departments within faculties and even groups within departments often evolve cultures palpably different from each other. An important contributor to this palpable difference is the influence of subject-related culture. Differences in acceptance of computer-mediated communication within courses may be associated with subject area; for example, more appropriate for social sciences and less for technical sciences (Sheddick and Woolgar 1994). Even more profoundly, the tendency to choose a certain subject area may be related to one's individual preferred learning style, with technical subjects more amenable to serial thinkers than social or non-exact sciences (Pask, 1976). Such deep-seated differences will have an influence on the culture of the discipline and in turn on its norms and mores for acceptable use of a WWW-based course-support site.

In what ways can these different cultural levels (societal, personal, organisation, discipline) affect the acceptance, use and impact of WWW-based course-support sites and systems? A number of different perspectives can be noted, based on analyses relating not necessarily to WWW-based course-support systems in themselves but to other forms of learning support.

Henderson (1996) has presented one of the most comprehensive analyses. Her Multiple Cultural Pedagogic Model of interactive multimedia instructional design is based in turn on the 14 dimensions of interactive learning of Reeves (1992). Reeves' 14 dimensions are labelled: Epistemology (Objectivism vs Constructivism), Pedagogical Philosophy (Instructivism vs Constructivist), Underlying Psychology (Behavioral vs Cognitive), Goal Orientation (Sharply focused vs Unfocused), Instructional Sequencing (Reductionist vs Constructivist), Experiential Value (Abstract vs Concrete), Role of Instructor (Teacher Proof vs Equalitarian Facilitator), Value of Errors (Errorless Learning vs Learning from Experience), Motivation (Extrinsic vs Intrinsic), Structure (High vs Low), Accommodation of Individual Differences (Non-existant vs Multifaceted), Learner Control (Non-existant vs Unrestricted), User Activity (Mathemagenic vs Generative), and Cooperative Learning (Unsupported vs Integral). Henderson's key addition to Reeves' set of dimensions is the idea of incorporating multiple cultural perspectives into an *eclectic paradigm*, so that multiple cultures maintain their identities and can have their respective cultures accommodated. This in turn requires that both ends of the dimensions must be taken account of in the course context. (She also argues that Reeves' choice of endpoint values, at least for the dimension Epistemology, may in turn by based on Western notions or theories of the nature of learning and of knowledge, and argues that different

endpoints can be defined based on Asian or Australian Aboriginal epistemologies). In any case, different profiles based on these dimensions may be optimal for different cultural groups, and the also may vary within the timeline of a learning experience itself (for example, an instructivist pedagogy at some points and a constructivist at others).

Using another approach, Collis, Vingerhoets and Moonen (1997), in the context of an European project investigating cross-cultural adaptation of courses using advanced learning technologies (the TeleScopia Project), summarised 19 dimensions which could be either fixed or flexible in a course, and gave examples of how such flexibility could be realised. The dimensions included four related to time (time of starting and finishing a course, time expectations within a course, tempo of studying, and timing of assessments); five related to the content of the course (flexibility related to the topics covered, the sequence in which topics are covered, the amount and scope of the content, the level, and the assessment criteria); one related to flexibility in expected prerequisites; four related to instructional approach and resources (social or individual learning activities, language used, study materials, and pedagogic approach); and five related to course delivery and logistics (time and place where help can be obtained, way of obtaining help, types of help, locations for participating in the course, and delivery channels including face-to-face and technology-mediated varieties). In addition, implicit dimensions related to the underlying philosophy of the course (instructivist or participative), the expected role of the instructor, the expected role of a student, and the role of the course in a larger context (ie, part of a degree programme, required by employer, informal learning) also can be noted. The results of the research showed that instructors involved chose very few of these flexibility-dimension options when redesigning their courses, in general focusing on options relating to location for participation in lectures or group discussions and on options for different forms and different timing of personal communication with the instructor.

In addition to the work of Reeves and Henderson, other sets of dimensions in computer-related learning materials sensitive to culture-related differences and likely to be influential to the acceptance, use and impact of WWW-based course-support systems have also been identified. Table 2 summarises some of these.

Table 2. Dimensions sensitive to culture-related differences in terms of the acceptance, use and impact of computer-related learning resources

Dimensions	**Cultural Sensitivity**
Group size, member proximity, task type, in relation to software systems to support group collaboration	Egalitarianism, non-critical acceptance of ideas, decoupling thoughts and their provider, and leveling of status guide Western designers of group-support systems; such assumptions are different for Asian cultures (Watson et al 1994)
Pedagogic philosophy, subject-area disciplines, deep and surface learning, horizontal and vertical communication,	A deficit model (ie, the learner begins with a deficiency in terms of lack of pre-defined knowledge) vs a social-participative model (ie, the learner learns through communicative interaction with others) vary by national and institutional culture and are also discipline-related; "Surface" learning relates to a deficit model while "deep" learning to a social-participative model; Horizontal (communication between students) vs Vertical communication (between instructor and student(s)) vary in appropriateness in different cultures (Sheddick and Woolgar 1994; Jin and Cortazzi 1998)

Table 2 continues...

Table 2, continues...

Language, visual aspects of the user interface	Language involves also differences in acceptance tone and style of communication, and in understanding of inferences and neologisms; Icon recognition and response to the design and layout of the user interface varies among cultural groups (Griffiths et al 1994; Mirshafiei 1994)
Infrastructure differences, access differences, technology-skill differences	Groups of potential users differ in terms of the network and support infrastructure available to them and also in the amount of competance and comfort they have with technology use (NODE 1998)
Responsibilities of learners, instructors; teaching-styles, student behaviors	Cultural differences in perception of appropriate allocation of responsibilities between students and instructors; in appropriate teaching styles and forms of student behavior (Collis and Remmers 1997; Ikuta et al 1998; Jin and Cortazzi 1998)
Human-computer interaction	Cultures differ on willingness to accommodate new technologies, acceptance of trial-and-error in terms of computer use, differences in expectations for technical support, preferences for precision vs browsing, preferences for internal vs system/instructor control, differences for tolerance of communication overlaps and interrupts (Nakakoji 1993)
Institutional aspects such as requirements for examinations, time-tables for course participation, prerequisites for courses, accrediation requirements, locations for course participation	Operational practices become associated with institutional culture, "doing things differently" becomes not acceptable or suspect in terms of quality (Borremans 1996; Collis 1998a)

For adaptations related to the dimensions in the left-hand column of Table 2 to occur, at the institutional, instructor, or even student level, a WWW-based course-support system must be designed to anticipate user choices about a large number of variables, each of which have different optimal values in different cultural settings. Many different examples of the impact of these variables could be given (see Borremans 1996; Nakakoji 1993; Mirshafiei 1994; Henderson 1996; Sheddick and Woolgar 1994; Watson et al 1994). As just one example, Jin and Cortazzi (1998) compared the responses of 129 Chinese students and 205 British secondary school students on a variety of attitudal items relating to their perspections of a good teacher and a good student as well as to reasons for different types of student behaviours. Chinese students were significantly more likely than British students to define a good teacher as: someone with deep knowledge, someone who sets a good example, and someone who teachers the students about life. British students were significantly more likely than Chinese students to define a good teacher as: someone who arouses the students' interests, is helpful, explains clearly, is sympathetic to individual students, and organises a variety of classroom activities. In terms of what characterises a good student, Chinese respondents were significantly more than British students impressed by students who respect the teacher, study independently, develop a good character, answer the teacher's questions, ask questions during and after class, and prepare for the class in advance. British students in contrast saw a good student as someone who learns from others and pays attention to the teacher. In terms of interpreting why some students do not ask questions in the classroom,

Chinese students suggested that it might be that the students can find the answers themselves. British students in contrast felt that this was a reluctance based on fear of peer disapproval (afraid others may laugh, afraid of making mistakes) or just not being interested enough to bother. Clearly these differences profoundly affect the decisions made in a WWW-based course-support site in terms of types of student activities, the role of the instructor, and what sorts of communication to expect from students.

How can choices in WWW-based course-support sites be offered to reflect such a variety of culture-related variables? The answer lies in designing the underlying system for flexibility from its very beginning. In the following section, some design guidelines for culture-related flexibility based on the arguments above are given.

Design guidelines for culture-related flexibility in WWW-based course-support sites

From the above analysis, and based on five years' of experience (beginning in March 1994) at the Faculty of Educational Science and Technology at the University of Twente with the use of WWW-based course-support sites with students representing a number of different cultural backgrounds (for example, in the Master of Science programme for Education and Training Systems Design, an English-language programme for non-Dutch students), as well as other input, the following design guidelines for WWW-based course-support sites and systems seem appropriate:

1. **Plan for flexibliity** and adaptation when the WWW-based course-support system is defined (Griffiths et al, 1994)

2. Design for a **variety of roles for both instructors and students**; allow roles to be interchangable or modifiable. Within the same system, offer support for an **ecletic variety of types of learning experiences.** For example, instructivist approaches as well as constructivist, group-based vs individually experienced, instructor provided vs student generated (Henderson, 1996; Ikuta et al 1998; Jin and Cortazzi 1998)

3. Do not assume students will use the course-support site as a primary source of course content; many students cannot be on-line often or for long periods of time and many do not respond positively to reading from the screen, even when access is not a problem **Books and print materials are better for primary study materials** in terms of portability, ease of use and cultural fit than computer materials (Griffiths et al. 1994; Collis & DeBoer 1998)

4. Use the course-support site to **supplement study materials, and to integrate and manage student study activities.** The course-support site should initially be **as empty as possible, to be filled by the instructor and students in their own ways as the course proceeds**, including accessing student-created or instructor-created materials from previous sessions of the course via the underlying database (Collis and Remmers 1997; Collis, Vingerhoets and Moonen 1997; Nakakoji 1993)

5. Design the WWW site so that students and instructors can **input and make use of variety of combinations of supplementary media and resources**: multimedia materials, links to external WWW-based materials, student-created materials, instructor-created materials including computer-based presentation files and notes (Collis, Vingerhoets and Moonen, 1997)

6. Design for **minimal technical levels:** levels of technical support, for minimal levels of computer-related skills and competencies, for minimal levels of on-line time. For example, keep the amount of time a learner has to be on-line connected to the WWW-based system as short as possible; make initial use comfortable and direct even for persons not experienced with WWW sites (NODE 1998)

7. Reduce **text fixed on the screen to a minimum**; use a minimum of graphic and iconic elements and provide context-sensitive help (ie, via pop ups). For example, avoid problems with inappropriate tone and style of communication by limiting the communication that is pre-set in the system. Design so that the students and instructors enter the communication (Griffiths et al, 1994)

8. Offer a flexible assortment of tools that can be combined for **different communication configurations**. For example, anonminity of responses should be a switchable feature Support both parallel and asynchronous communication. Do not assume more communication is better than less, or that more student-student interactivity is better than less; let the amounts reflect cultural considerations. Let local users determine the style and tone of communication, as well as the language used. Design for human-human communication, not human-computer interaction (Collis and Remmers 1997; Mirshafiei 1994; Watson et al 199)

9. Design for organisational flexibility: so that courses of **different lengths**, offered at a variety of times, and with different types and levels of prerequisites and **examination/assessment requirements** can be supported. For example, offer a choice of many different types of assessments including assessments based on student-made portfolios as well as fixed-response and open-response types of items. (Borremans 1996; Collis, Vingerhoets and Moonen 1997)

10. **Be realistic about what instructors can and will do**; instructors have little or no time and little or no interest in creating electronic learning materials and often do course-related activities (preparing lectures, giving feedback to student work, setting test questions, etc.) at the last minute. Design the system to reflect these realities. (Collis 1998a)

How does this work in practice? In the next section the *TeleTOP Method* is described.

The TeleTOP Method: An example from the University of Twente

The TeleTOP Method has been developed at the Faculty of Educational Science and Technology at the University of Twente in The Netherlands, during 1997-98 during which all of the first-year courses in the Faculty were re-designed for more flexibility and are in full operation during 1998-99 (Collis 1998a,b; see also http://teletop.edte.utwente.nl). There are two cohorts in each first-year course: the regular students and what we call the "Friday" cohort, mature students who work during the day and only come to the campus once every two weeks, on a Friday when they attend face-to-face or practical activities along with the other students in the course. The rest of the time the Friday cohort participates in the course via the course WWW sites. However, the regular students use the sites just as extensively as the distance students; there are not different courses for the two cohorts, the students just participate in different ways. Also during 1998-99 all of the second-year courses are being re-designed for this model, and in the following two years the remainder of the courses will be re-designed. Flexibility provision is particularly related to instructional methods and learning resources, to differences in student backgrounds and characteristics, and to differences in instructor and subject-area characteristics. The eight aspects of the TeleTOP Method are:

1. The principle of extending, not replacing, the good instructor; respecting his or her views as to appropriate ways of teaching and organising a course, but then using the WWW-based course-support site to bring flexibility into those ways, and how the students can choose to experience them.

2. The technical environment created for TeleTOP that consists of the code developed by the TeleTOP team for the integration of a Domino server, a Domino database engine, and a HTTP server, and that generates the user-friendly WWW-based user interface characteristeristic of TeleTOP course-support sites. (for more details, see Tielemans and Collis, 1998).

3. The WWW-based *TeleTOP Decision-Support Tools* (Version 1, for use during initial decision making by the instructor relating to functionalities for his or her course-support environment, and Version 2, for final decision making about the functionalities), so that the instructor can choose WWW-site features tailored in form and combination to his or her own setting.

4. The matrix-like "Roster" as the integrating area for course-support activity within

each course's WWW environment; the *News*, *Roster*, *E-Mail Centre*, and *Course Information* areas as the minimal course-support environment; and after this, instructor choice as to pedagogical approach and other WWW-based tools to support this approach.

5. The technique for synchronising the replay of captured student and instructor presentations via the combination of video, audio, and PowerPoint slides on demand and in any sequence to increase add asynchronous access to events that were originally synchronous.

6. The strategic principle for the "multiple use" of courses: of designing a course to *teach once, adapt within for individual differences*. In particular, to alter aspects related to assignments, study materials, participation at lectures, and number and timing of assessments, based on the characteristics of groups of the students, but having all integrated within the same WWW site.

7. A specific analysis approach used for the course-redesign process, involving a 6 x 3 matrix (six categories of course components X three focuses for adaptation) (see Collis and De Boer 1998).

8. The *TeleTOP rapid-prototyping approach*, whereby each instructor goes through a eight-step sequence of contact sessions, involving successive prototypes and partially-to-fully finalised versions of the instructor's course-support environment (Collis and De Boer 1998).

For more information, see http://teletop.edte.utwente.nl. Three of the courses are available for public visiting; many others are described and illustrated with samples. Figure 1 shows an instructor's view and the students' view of a roster for one of the TeleTOP courses; each course develops its roster differently which the instructor can do by what he or she types into the matrix-like empty template (to which rows and columns can be added or deleted at the instructor's wish, even while the course is in operation).

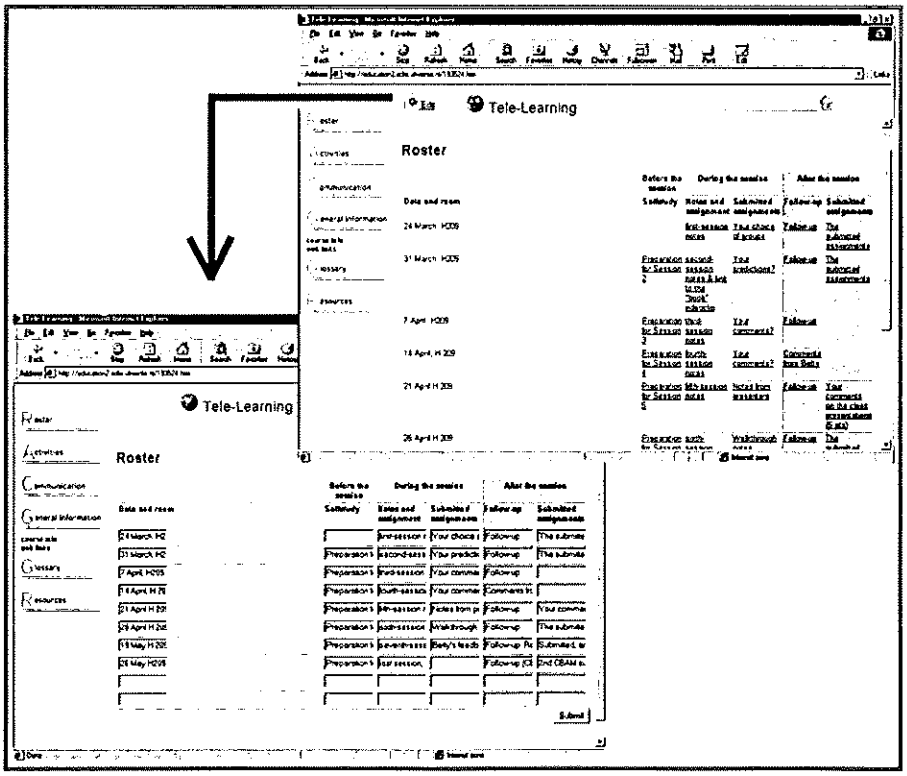


Figure 1. Instructor's and students' views of a WWW-based roster.

Using the TeleTOP Method, over 30 courses are adapted and in operation. The courses represent a variety of instructional approaches, from project-oriented to skills training in programming, from courses focused on statistical methodologies and their applications, to courses involving substantial amounts of theoretical, conceptual materials. The course-support sites include a wide diversity of WWW-based features, from very few to very many, and show a great diversity in how the instructors are using them and organising their courses.

What is common are the following: (a) all instructors are providing in the same course and via the same WWW site for both regular students and the mature students working during the day and attending the course primarily at a distance and after working times via the WWW site; (b) all instructors are providing more flexible ways of communication not only for the distance students but also the regular students; (c) all instructors are using the WWW sites for student submission of assignments and comments and for feedback to the students, with both the regular and distant students; (d) all instructors are providing some alternative forms of contact sessions, assignments and/or some of the study materials supported within the course sites; and (e) every instructor has handled this with no released time for preparation, and in a way that is sustainable (ie. not just in the framework of a fixed-time project). All instructors in the faculty are participating, and the first set of results available from an external evaluation carried out during the 1998-99 academic year show that the instructors and students are generally satisfied and all is running smoothly and managably.

We are currently also testing the Method in a different discipline and social culture: a faculty of Informatics, for the development of WWW-based course-support sites for a new Telematics programme (including for international Masters students and students studying some or all at a distance). Also, the students in the Faculty of Educational Science and Technology's international Masters Programme will soon be participating in the courses (both on site and at a distance), along with the regular and "Friday" students. We are succeeding in being flexible, and we believe flexibility is a necessary (but not sufficient) condition for responding to culture-related differences among different actors in the university-course context.

Relating the TeleTOP Method and the design guidelines

How well does the TeleTOP Method relate to the ten design guidelines for culture-related flexibility in WWW-based course-support sites? Table 3 relates the two sets.

Table 3. Relating the TeleTOP Method to the ten design guidelines for culture-related flexibility in WWW-based course-support sites

TeleTOP Method	**Culture-related Design Guidelines**
1. Extend the instructor, make current practice more flexible; do not assume all instructors will follow the same approach to teaching	#1, plan system for flexibility #2, support a variety of roles for instructors and students, and easy change in these roles #4, use the site to support and supplement the course, not replace the teacher
2. The TeleTOP technical system, based on ease of use; instructor and student alike only have to handle an ordinary WWW browser (no special tools) with no special technical assistance or training	#1, plan system for flexibility #5, emphasise student and instructor input, and use of a wide variety of learning resources #6, make the technical aspects of using the system as easy as possible #10, be realistic about instructor time and skill levels
3. The WWW-based Decision Support Tools give the instructor examples and the opportunity to make just the choices he or she feels will fit the social and subject-area ecology of his or her course	#1, plan system for flexibility #8, let the instructor tailor the communication and interaction approach
4. The matrix-like course Roster and the course "communication centre" are standard features of the WWW sites, but can be tailored and adapted to the instructor's wishes, and can be supplemented by anything available via the WWW (tools, external resources, interactive applets, multimedia, etc) as well as any kind of file the instructor or students can make themselves. This supplementing can be done by students as well as the instructor.	#1, plan system for flexibility #2, support a variety of roles for instructors and students, and easy change in these roles #4, use the site to support and supplement the course, not replace the teacher #5, emphasise student and instructor input, and use of a wide variety of learning resources #7, let the instructor tailor the communication and interaction approach
5. Communication and presentations that happen in face-to-face settings can be made available as asynchronous streaming video, in whatever segments the instructor or students wish via the WWW site for use at different times and/or locations	#3, let the instructor and student tailor communication and interactivity expectations #4, use the site to support and supplement the course, not replace the teacher #8, let the instructor tailor the communication and interaction approach

Table 3 continues....

Table 3, continued...

6. The principle of one-course/multiple use of corresponds to Henderson's Multiple Culture Model	#1, plan system for flexibility #7, have a minimal amount of fixed text or images so that adaptation to different cultures is anticipated #9, avoid pre-set assumptions about any aspect of course organisation, including form of assessmen
7. Instructors are provided with an easy-to-apply analysis approach for the re-design process, based on concrete aspects of a course (the lecture, student assignments, assigned study materials, etc.). Only choose to use the WWW site when it offers added value compared to other media	#3, use the WWW site to supplement the course activities, not replace the textbook
8. The Rapid Prototyping Method involves instructors in the design and building of their own course-support sites at the same time as they develop their own skills and competencies in handling the sites	#6, make the technical aspects of using the system as easy as possible #10, be realistic about instructor time and skill levels

The mapping shown in Table 3 indicates a good fit between the TeleTOP Method and the ten design guidelines.

Conclusion

As student mobility continues to increase across subject areas, geographic borders, and regular study programmes, the need to accommodate cultural differences in an increasingly hetergeneous study popular will also increase dramatically. For this to occur, institutions and instructors will have to not only improve their insight into cultural differences that affect teaching and learning, but also operationalise these insights into manageable ways to respond to multiple cultures (such as Henderson's Multiple Cultures Model 1996). Instructors themselves belong to multiple cultures, determined by their own personal characteristics and also by the disciplines in which they work, and the cultures of their local workplaces. Thus, if instructors are to participate in the re-design of their courses for more cultural flexibility their own cultural ecologies must be respected.

While the individual instructor can re-design his or her course for more cultural flexibility, institutional leadership and investment is needed before students can experience a consistent and system-wide flexibility. Institutional decision makers are increasingly being faced with the problem of how to choose a WWW-based course-support system for their jurisdiction and are searching for criteria to apply (Firdyiwek 1999). The ten design guidelines given in Table 2 are offered as such a set of criteria. The experiences being obtained with the TeleTOP Method at the University of Twente indicate that such criteria are realisable, and lead to more-flexible results. But increased flexibility is only a necessary but not sufficient base for better cultural sensitivity in our courses. That sensitivity needs to come from better skills and more wisdom in terms of listening to and observing persons from cultures outside our own. This is a human activity, not a technical issue. Jin and Cortazzi (1998) call this "the notion of cultural synergy, a reciprocal learning about cultures". Their comments about cultural synergy provide a fitting conclusion for this discussion:

> *We can be aware of and learn from others' ways of learning by examining their*

> *cultural presuppositions and expectations of learning, as others can learn of ours, without necessarily feeling obliged to follow theirs or surrender our own. ...Applying the notion of cultural synergy is to set up intercutural dialogue about learning. To engage in this last kind of dialogue is to heighten awareness of more local cultures of learning, including one's own. In any multicultural society, there will be many cultures of learning: the talk and culture which mediate learning must be polyphonous (Jin and Coratzzi, 1998, 758)*

References

Booremans A (1996) Adapting Dutch courses for Flemish students *Epistolo Didaktika: The European Journal of Distance Education* **27** 2, 57-61.

Collis B (1998a) New didactics for university instruction: why and how *Computers & Education* **31** 4, 373-395.

Collis B (1998b) Teleware: instrumentation for tele-learning *Education & Information Technologies* **4** 1 (forthcoming).

Collis B (1996) The evolution of educational software portability *in* Ely DD and Minor B B (eds) *Media and Technology Yearbook 1995/96.* Libraries Unlimited, Englewood, Colorado, USA.

Collis B and DeBoer W F (1998) Rapid prototyping as a faculty-wide activity: An innovative approach to the redesign of courses and instructional methods at the University of Twente *Educational Media International* **35** 2, 117-121.

Collis B and Remmers E (1997) The WWW in education: issues related to cross-cultural communication and education *in* Khan B (ed) *Web-based instruction* Educational Technology Publications, Englewood Cliffs, NJ USA.

Collis B, Vingerhoets J and Moonen J (1997) Flexibility as a key construct in European training *British Journal of Educational Technology* **28** 3, 199-218.

Firdyiwek, Y (1999) Web-based courseware tools: where is the pedagogy? *Educational Technology* **39** 1, 29-35.

Griffths D, Heppell S, Millwood R, and Mladenova G (1994) Translating software: what it means and what is costs for small cultures and large cultures *Computers & Education* **22** 1/2, 9-17.

Henderson L (1996) Instructional design of interactive multimedia: a cultural critique *Education Technology Research & Development* **44** 4, 85-104.

Ikuta T, Langner I and Kurokami H (1998) A comparative study on Internet utilization for problem centered learning in Germany and Japan *in Proceedings of ED-MEDIA '98*, AACE, Freiburg, Germany.

Jin L and Cortazzi M (1998) Dimensions of dialogue: large classes in China *International Journal of Educational Research* **29**, 739-761.

Mirshafiei M (1994) Culture as an element in teaching technical writing *Journal of Technical Communication* **15**, 276-282.

Nakakoji K (1993) Cross-cultural considerations in designing human-computer interaction *American Programmer* **6** 10, 18-24.

NODE (The) (1998, November). Distance education and challenged communities *The NODE: networking* [WWW document] URL http://node.on.ca/networking/november1998/feature1.html (date accessed, 22 November 1998).

Pask G (1976) Styles and strategies of learning *British Journal of Educational Psychology* **46**, 41-48.

Poole M S and DeSanctis G (1990) Understanding the use of group decision support systems: the theory of adaptive structuration *in* Steinfeld C and Fulk J (eds) *Organizations and Communication Technologies* Sage, Beverly Hills, CA.

Reeves T (1992) Effective dimensions of interactive learning systems *in Proceedings of the Information Technology for Training and Education Conference (ITTE '92)*, University of Queensland, Brisbane, Australia.

Sheddick A and Woolgar S (1994) Learning Environments and Cultural Difference in *Proceedings of the conference Educational and Cultural Barriers to Open and Distance Learning*, the University of Sheffield, Sheffield, UK.

Tielemans G and Collis B (1999) Strategic Requirements for a System to Generate and Support WWW-Based Environments for a Faculty *in Proceedings of ED-MEDIA '99*, AACE, Seattle (forthcoming).

Watson, R T, Ho T H and Raman K S (1994) Culture: a fourth dimension of group support systems *Communications of the ACM* **37** 10, 45-55.

Wild, M and Henderson L (1997) Contextualizing learning inthe World Wide Web: accounting for the impact of culture *Education and Information Technologies* **2**, 179-192.

Chapters 7 and 8 from: Collis, B., & Moonen, J. (2001). *Flexible learning in a digital world: Experiences and expectations*. London: Kogan Page. ISBN Hardback: 07494 33728, Softback 07494 3371X (accompanying Web site: http://education1.edte.utwente.nl/00FlexibleLearning.nsf/framesform?Readform)

Flexible Learning in a Digital World: Experiences and expectations

Betty Collis and Jef Moonen

Faculty of Educational Science and Technology

University of Twente, Enschede, The Netherlands

Flexible Learning in a Digital World: Experiences and expectations

Lesson 1*: Be specific:* We need to define our terms and express our goals in a measurable form or else progress will be difficult to steer and success difficult to claim.

Lesson 2*: Move from student to professional:* Learning in higher education is not only a knowledge-acquisition process but also a process of initiation into a professional community. Pedagogy should reflect both acquisition and contribution-oriented models.

2. You can't not do it

Lesson 3: *You can't not do it:* The idea whose time has come is irresistible, and conversely.

3. Will they use it?

Lesson 4: *Don't forget the road map:* Change takes a long time and is an iterative process, evolving in ways that are often not anticipated.

Lesson 5: *Watch the 4-Es:* An individual's likelihood of voluntarily making use of a particular type of technology for a learning-related purpose is a function of four "E"s: the environment context, the individual's perception of educational effectiveness and ease of use, and the individual's sense of personal engagement with the technology. The environmental context and the level of personal engagement are most important.

Lesson 6: *Follow the leader*: Key persons are critical.

Lesson 7: *Be just-in-time*: Staff-engagement activities to stimulate instructors to make use of technology are generally not very effective: Focus on just-in-time support for necessary tasks.

Chapter 4: Something for everyone

Lesson 8*: Get out of the niche:* Most technology products are not used in practice beyond their developers. Keep implementation and the 4 Es central in choosing any technology product.

Lesson 9*: After the core, choose more*: Technology selection involves a core and complementary technologies. The core is usually determined by history and circumstances; changing it usually requires pervasive contextual pressure. The individual instructor can make choices about complementary technologies and should choose them with flexibility in mind.

Lesson 10*: Don't overload*: More is not necessarily better.

Lesson 11: *Offer something for everyone:* A well designed WWW-based system should offer users a large variety of possibilities for flexible and contribution-oriented learning not dominated by any one background orientation. If so, it is currently the most appropriate (core or complementary) technology for flexible learning.

5. Pedagogy: Making the U Turn

Lesson 12: *Watch the speed limit*: Don't try to change too much at the same time. Start where the instructor is at, and introduce flexibility via extending contact sessions to include before-, during-, and after aspects with each of these made more flexible. Move gradually into contribution.

Lesson 13: *Process yields product:* Through the process of contribution-oriented learning activities, learners themselves help produce the learning materials for the course.

Lesson 14: *Aim for activity:* The key roles of the instructor are becoming those of activity planning, monitoring, and quality control.

Lesson 15: *Design for activity*: Instructional design should concentrate more on activities and processes, and less on content and a pre-determined product

Chapter 6: When do (or don't) we get our investment back?

Lesson 16: *Get a new measuring stick :* What we are most interested regarding learning as a consequence of using technology often can't be measured in the short term or without different approaches to measurement. Measure what can be measured, such as short-term gains in efficiency or increases in flexibility.

Lesson 17*: Be aware of the price tag:* It is not going to save time or money to use technology, at least not in the short term.

Lesson 18*: Play the odds:* A simplified approach to predicting return on investment (ROI) that looks at the perceived amount of relative change in the factors that matter most to different actors is a useful approach to support decision making or evaluation..

7 Practicing what we preach: Getting started

8 Practicing what we preach: Keeping going

About the authors

Betty Collis and Jef Moonen are currently both full professors in the Faculty of Educational Science and Technology in the University of Twente in The Netherlands but their backgrounds and reputations in the field of educational technology are broadly based.

Prof. Dr. Betty Collis (collis@edte.utwente.nl) was born in the USA and holds both American and Canadian citizenship. She began her professional exposure to the field of educational technology in the 1960s while a graduate student at Stanford University and has been a pioneer in two waves of technology applications--those relating to computers in education in the 1970s and 1980s and those relating to networked applications in education in the 1980s and 1990s. She remains at the forefront of pioneering work, at the current time with respect to WWW-based course-support systems in education through her leadership of the *TeleTOP* initiative in the Faculty of Educational Science and Technology at the University of Twente. This initiative involves institutional change toward more flexible learning supported by the TeleTOP WWW-based course-management system developed under her leadership (see http:/teletop.edte.utwente.nl for more information). She is *professor of tele-learning* at her institution and also *Senior Researcher, Advanced Learning Technologies* for the interfaculty research institute, Centre for Telematics and Information Technology (http://ctit.utwente.nl) at the same institution. For more information, see http://users.edte.utwente.nl/collis/

Prof. Dr. Jef Moonen (moonen@edte.utwente.nl) holds Belgian citizenship and was a pioneer in the design and development of computer-based teaching materials for statistics for use in higher education at the University of Leiden in The Netherlands using mainframe computers and including the PLATO authoring system in the 1970s. Since then he has served as founder and director of the National Centre for Computers in Education in The Netherlands (1981-89) as well as Professor of Educational Instrumentation (Educational Technology) at the University of Twente (1987 – present). From 1991-1994 he was dean of the Faculty of Educational Science and Technology at the University of Twente and during the period 1987-1999 he was also chairman of the Department of Educational Instrumentation within this same faculty. His expertise is in the area of the design methodology for electronic learning resources, implementation of electronic learning environments in education and training, and in the cost-effectiveness of educational technology, in particular in higher education (see http://users.edte.utwente.nl/moonen/). He has managed many large projects relating to

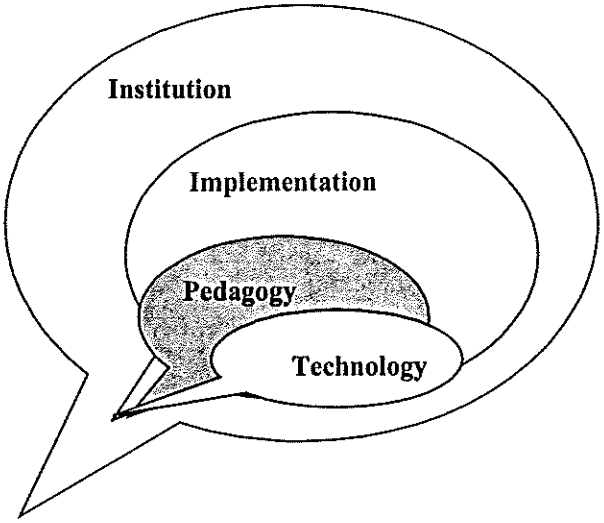
technology design, development, and implementation. He regularly participates in national and international projects, panels, review boards, and steering groups relating to technology in education.

While both authors have extensive professional and publishing experience, they are also practitioners themselves, and *practice what they preach* in their own courses. This balance is visible throughout the book.

Chapter 7

Practicing what we preach:

Getting started



Flexible learning in higher education

In the previous chapters we have developed a set of 18 lessons, which we predominately argued via literature references and general statements about our own experience. In this chapter and the next, we make that experience explicit. In particular, we focus on our experiences since mid-1997 in leading our faculty to more flexible learning with technology. Do we practice what we preach?

These illustrations will involve a case from our own institution, the University of Twente in The Netherlands, during the years 1997-2000. We are both members of the same

department in the same faculty (the Faculty of Educational Science and Technology, abbreviated as"T.O." from its Dutch name) in this institution, since 1987 and 1988. Many times we have worked together on the same projects, other times not. For convenience in Chapters 7 and 8 we will not differentiate who did what, but just use the general "we".

The purpose of the chapter is not only to illustrate the lessons, but also to give practical examples that others hopefully can shape to their own situations. The chapter will be a success to the degree to which others can say, "Yes, this is like our situation; I have an idea of how to apply the experiences in my own situation". The structure of the two chapters is as follows:

Chapter 7:

The pioneer phase: 1990-1997

The initiation phase: 1997-1998, Year 1 of TeleTOP

Chapter 8

The implementation phase: Year 2 of TeleTOP, 1998-1999

From implementation to institutionalisation: Year 3 of TeleTOP, 1999-2000

Institutionalisation: 2000 and beyond

Throughout the chapter we will refer to the lessons by referring to them in terms of the short phrases that begin each lesson. For convenience, we group the lessons together in Table 7-1.

Table 7-1. The lessons learned

Lesson 1 *Be specific*	We need to define our terms and express our goals in a measurable form or else progress will be difficult to steer or success difficult to claim.
Lesson 2 *Move from student to professional*	Learning in higher education is not only a knowledge-acquisition process but also a process of initiation into a professional community. Pedagogy should reflect both acquisition and contribution-oriented models.
Lesson 3 *You can't not do it*	The idea whose time has come is irresistible, and conversely.
Lesson 4 *Don't forget the road map*	Change takes a long time and is an iterative process, evolving in ways that are often not anticipated.
Lesson 5 *Watch the 4-Es*	An individual's likelihood of voluntarily making use of a particular type of technology for a learning-related purpose is a function of four "E"s: the environmental context, the individual's perception of educational effectiveness and of ease of use, and the individual's sense of personal engagement with the technology. The environmental context and the level of personal engagement are most important
Lesson 6 *Follow the leader*	Key persons are critical.
Lesson 7 *Be just-in-time*	Staff-engagement activities to stimulate instructors to make use of technology are generally not very effective: Focus on just-in-time support for necessary tasks.
Lesson 8 *Get out of the niche*	Most technology products are not used in practice beyond their developers. Keep implementation and the 4-Es central in choosing any technology product.
Lesson 9 *After the core, choose more*	Technology selection involves a core and complementary technologies. The core is usually determined by history and circumstances; changing it usually requires pervasive contextual pressure. The individual instructor can make choices about complementary technologies and should choose them with flexibility in mind.
Lesson 10 *Don't*	More is not necessarily better.

overload	
Lesson 11 *Offer something for everyone*	A well-designed WWW-based system should offer users a large variety of possibilities to support flexible and participative learning not dominated by any one background orientation. If so, it is currently the most appropriate (core or complementary) technology for flexible learning.
Lesson 12 *Watch the speed limit*	Don't try to change too much at the same time. Start where the instructor is at, and introduce flexibility via extending contact sessions to include before-, during- and after aspects, with each of these made more flexible. Move gradually into contribution-oriented activities.
Lesson 13 *Process yields product*	Through the process of contribution-oriented learning activities, learners themselves help produce the learning materials for the course.
Lesson 14 *Aim for activity*	The key roles of the instructor are becoming those of activity planning, monitoring, and quality control.
Lesson 15 *Design for activity*	Instructional design should concentrate more on activities and processes, and less on content transmission and a pre-determined product.
Lesson 16 *Get a new measuring stick*	What we are most interested in regarding learning as a consequence of using technology often can't be measured in the short term or without different approach to measurement. Measure what can be measured, such as short-term gains in efficiency or increases in flexibility.
Lesson 17 *Be aware of the price tag*	It is not going to save time or money to use technology, at least not in the short term.
Lesson 18 *Play the odds*	A simplified approach to predicting return on investment (ROI) that looks at the perceived amount of relative change in the factors that matter most to different actors is a useful approach to support decision making or evaluation.

THE PIONEER PHASE: EARLY 1990S-1997

We begin by reviewing a sampling of our pioneer experiences at the University of Twente that contributed to our current faculty-wide use of the TeleTOP WWW-based course-management system. We had both been pioneers with the use of technology in our own teaching for many years (for example, Collis, 1982, 1988; Moonen & Gastkemper, 1983; Moonen, 1989) but will pick up the story in the early 1990s at the University of Twente.

Pioneers, pre-WWW

In our faculty in the early 1990s our work evolved to the application of data-communication tools and systems for educational purposes into our own teaching, with our regular on-campus students. What we and some of our colleagues were doing was revolutionary, in The Netherlands at least, because we were using tools such as e-mail, computer-conferencing systems, and then in 1994, WWW sites not for distance education but to extend and re-design our teaching with students whom we saw face-to-face and who saw each other regularly. We evolved the term *"tele-learning"*, the application of information and communication technology (called telematics in The Netherlands and several other European countries) for learning-related purposes (Collis, 1996) to relate to this broad context. But for many years (and even still) we had to explain that there was more to flexible learning than only distance

flexibility and more to the use of network technology than only distance education. The next three subsections give an overview of this pioneer period.

Early experimentation: E-mail and collaborative tools

Our pioneer work during this period was partly with our own courses, but also via a number of special projects in which we were involved. In terms of examples from our regular, on-campus courses in the early 1990s, we used the annotation tools available in Windows so that students could contribute reflective comments to scientific articles and make these comments available to the instructor and each other via a type of shared electronic workspace. We began using e-mail and a listserv as tools for weekly assignments involving students locating extra course resources in the library and telling each other about what they had found. Along with another pioneer colleague, we used the computer-conferencing system *First Class* (http://www.softarc.communication/) for several years, to support discussion, collaborative learning, and general course organisation for our students. From these initial experiences and also our work in the 1970s and 1980s with computers in education, we learned many of our lessons. A first-year compulsary course in multimedia design called *ISM-1* in which we have been instructors for many years is a prime example Thus, we will now discuss it in some detail (summarised from Collis & Gervedink Nijhuis, 2000).

ISM-1, pre-WWW phase

Lesson 14: ***Aim for Activity***

The course ISM-1 was a required course for first-year students in our faculty that introduced them to the specialty of educational technology. In this course students learned to design and develop various media products for learning support in a group-based project setting based on the *Jigsaw Method* (Aronson, Blaney, Stephan, Sikes, & Snapp, 1998). This method involves each student having his or her own role in the group so that they learn from each other within their groups. In addition, they learn from those who share their specialisms in other groups.

The ISM-1 course evolved from an approach of teacher-guided practical sessions in the computer laboratory with extensive individual face-to-face communication between an instructor and students, to an instructional form of self-guided work within group projects and using computer communications (to begin with, computer conferencing) to support individual students as well as project groups (Collis & Breman, 1997; Collis & Meeuwsen, 1999; Collis, Verhagen, Gervedink Nijhuis, & Meeuwsen, 1996). The role of the instructor changed, from "teacher" to planner and monitor of student activities designed to be carried out by students working together on their own (with appropriate instructions and support materials).

Although the students had been using computers to create their media products for many years in this course, it was in the academic year 1995-1996 that computers were for the first time used to support the overall teaching and learning processes in the course itself. The computer-conferencing system *First Class* was used. Using this system made it easy to present assignments to all students via the computer so that an archival version was always at hand, to communicate in a structured way between the instructors and the students as a whole, and in informal ways within the groups. Separate from the folders in the computer-conferencing system was the private e-mail sent among the course participants. Some of this (over a thousand messages!) was in the *First Class* e-mail area, but others came via the ordinary e-mail system used in the faculty and thus were not archived in the *First Class* environment.

Lesson 17: ***Be aware of the price tag***

While the use of *First Class* helped us to make the conceptual jump toward the idea of using a networked system to serve as a communal communication, work, and archival area for students who otherwise were in regular face-to-face contact, it also taught us some major lessons. It was difficult for us as instructors to manage all of the course materials, as they were scattered among *First Class* folders, *First Class* e-mail, ordinary e-mail, and also in materials not submitted electronically (videotapes and desktop-published materials of various sorts produced by the students). We had over 3,000 items in *First Class* by the end of the course, and we did not even try to quantify all the other materials. We could barely manage all this activity. Having the print and video materials submitted by the students available in a central location where any member of the instructor team could access them when needed was cumbersome, and organising and handling the management of all of the course materials took us an enormous amount of time. We needed one integrated electronic environment in which communication, student projects, archival material, course information, course resources, and also our own internal team communication could all be conveniently managed. And we needed strategies to cut down on the amount of communication and material we needed to manage even while keeping the richness of what was going on.

Research developments

Lesson 5: *Watch the 4-Es*

Our pioneer work during this pre-WWW period was also of a research nature. For example, we carried out a project for the Ministry of Education on the state-of-the art internationally of educational uses of computer communications (Collis & De Vries, 1991). It was in this project that we first developed the *4-E Model* (Chapter 3; in those days it was the *3-G Model*, using Dutch words beginning with "g" for the vectors relating to educational effectiveness, ease of use, and personal engagement; we added the 4th-E for the environment later). In subsequent national and international studies in 1992 and 1993, we urged decision makers to apply the 3-G approach to guide the implementation of network technology and illustrated ways for this to occur, in Dutch education (Collis, Veen, & De Vries, 1994; Moonen & Kommers, 1995); and more generally (Collis & De Vries, 1993). Also, at the same time, in national and international projects focused on cost-effectiveness of technology in education relating to technology (Moonen, 1994, 1997) the roots of the simplified ROI approach (Chapter 6) were established.

Lesson 8: *Get out of the niche*

We also continued to be involved in national projects relating to the development and stimulation of educational software use (Collis & De Diana, 1990; Moonen & Beishuizen, 1992). From these experiences, the observation that most educational-software products developed in such special projects were rarely used beyond the project was re-enforced.

Pioneers with the educational use of the WWW

A major breakthrough occurred in early 1994. A radical new form of network interconnectivity called the *World Wide Web*, had been emerging at the CERN Institute in Switzerland and *browser* software began to be available. We began using WWW functionalities in our own courses, in particular a course called *On-Line Learning* (later *Tele-Learning*) and the course *ISM-1* (described above).

The Tele-Learning course

Our course *On-Line Learning* in March 1994 was one of the first courses anywhere not only to make use of WWW functionalities, but also to support new types of learning activities to extend the regular on-campus course via those functionalities. This course, now called *Tele-Learning*, has now gone through seven yearly cycles, and remains a source of pioneering activities integrating advanced WWW-based technology with new forms of pedagogy (Collis, 1997b, 1998b).

Lesson 13: *Process yields product*

We began using the term "pedagogical re-engineering" in this course to describe the re-design of teaching, supported by the WWW, for new forms of student engagement (Collis, 1997). Among the ideas that evolved in this course were: the use of the WWW for support of a collaborative writing project involving participants in other countries working together with our own students to produce WWW-based study materials that would be re-used and further developed by students in the next cycle of the course, an example of *process yields product*. We also began the use of a matrix-like structure which we called a *roster* integrated within a WWW site as a way to organise the content and assignments of a course and combine these with communication and instructor and student contributions to the course, the support of group-based projects with various WWW-based groupware tools, and the use of WWW-based fill-in forms to simplify and structure student and instructor communication. All of these helped us gain ideas and experience with the idea of students' creating study materials that could be re-used by others.

ISM-1, Early WWW uses (1996-1997)

From the experiences in the *Tele-Learning* course, we knew we wanted to apply WWW functionalities to remedy our management problems as well as enrich the learning processes in the ISM-1 course. Thus in the academic year 1996-1997 a WWW-based environment was built to support the students in all aspects of the ISM-1 course. We replaced *First Class* with a *Netscape* browser as the interface to integrate all aspects of the course. Figure 7-2 shows part of the *Week by Week Centre* that we designed for the WWW environment, showing the way that it served as an integrated entry point for students for both their theoretical study and their group-based project work.

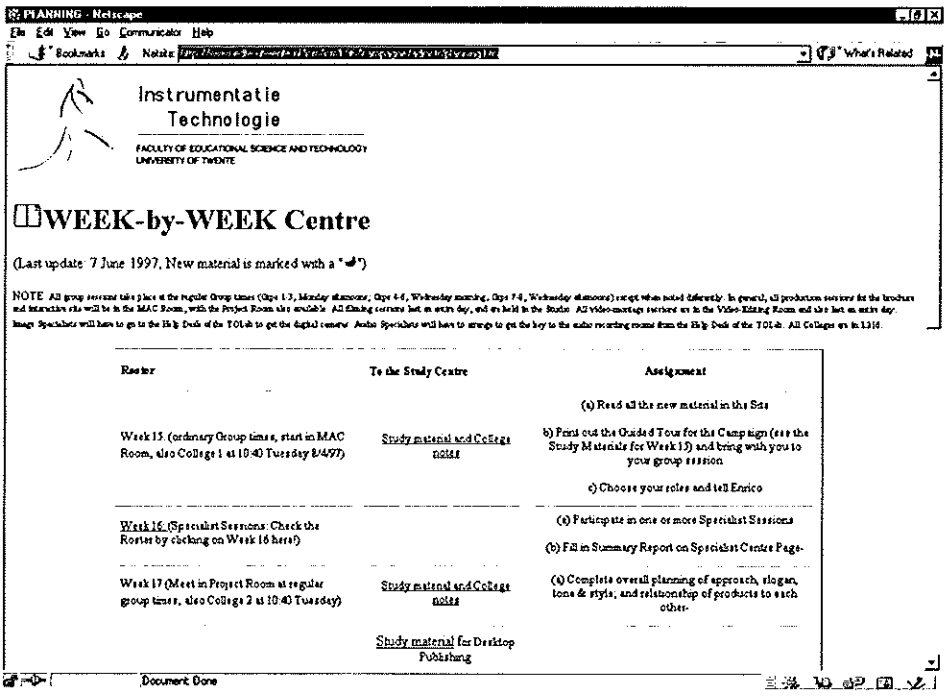


Figure 7-2. *Week-by-Week* Centre of Project 3 of the ISM-1 course, 1996-1997 (http://www.edte.utwente.nl/ism/ism1-96/campagne/admctr/planning.htm)

Figure 7-3 shows what we called a *Group Centre* for one of the projects. Via this page, there was an integration of instructions from the instructors and links to planning documents of the group; to their final projects (an interactive, multimedia WWW site with video); and to different forms of evaluation related to their products, from themselves as well as the instructors.

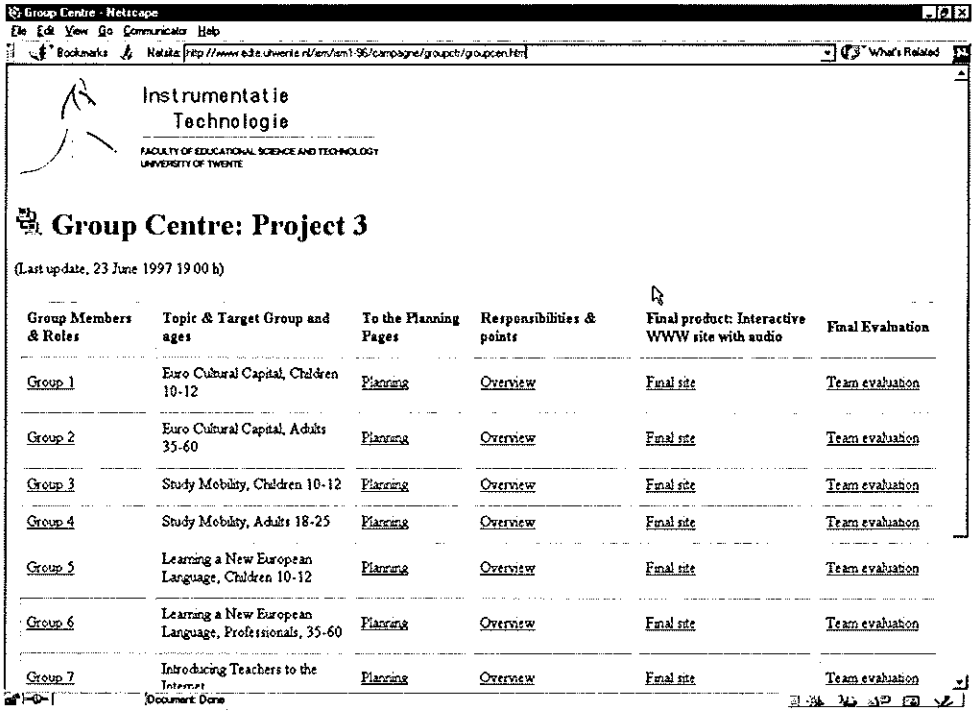


Figure 7-3. *Group Centre* page for one of the projects in ISM-1, 1996-97 cycle, showing the integration of materials from the instructors, groupware tools, the multimedia products made by the groups themselves, and feedback. (http://www.edte.utwente.nl/ism/ism1-96/campagne/groupctr/groupcen.htm)

The main advantages were the user-friendly WWW interface, the fact that all course information and materials were directly available in the same environment, and the ability to integrate visualizations and the multimedia products made by the students in a hyperlinked way to the overall course-support environment. All materials were presented using a menu structure available via a navigation frame, and icons clarified the functionality of specific areas of the WWW site.

For us as instructors, all of this helped us enormously with a number of management burdens associated with the course particularly through the integration of all course resources via one WWW site. But at the same time these ways of using WWW functionalities added new management burdens. We still spent a large amount of time on the course, but now much of that time was going into the management of the WWW site instead of leading face-to-face sessions with students. It was very helpful that student submissions were linked directly to *the Group Centre* pages so we could compare them with previous planning and feedback via a mouse click, but it took us a great deal of time to make these pages consistent in detail and layout and usable for the students. A database-driven system was needed so that

pages would be generated in a consistent way, and without an instructor needing to enter page content and set-up more than once. This led to our awareness of the value of a WWW-based course-management system.

In the 1997-1998 cycle of the ISM-1 course a revised version of the WWW environment was designed and used. A new technology approach made it easier for students to contribute materials to the environment as answers of students were not only posted automatically to the WWW site, but also in the correct layout. Students were then able to see the results, for example of the peer evaluations, and compare their reactions on assignments with the reactions of other students and with a model answer. This was another step forward toward a contribution-oriented approach in which student work is used as part of the study materials (Lessons 2 and 13). In Figure 7-4 an example of an assignment of this kind is shown in which students submitted a small JavaScript code which was automatically tested when submitted.

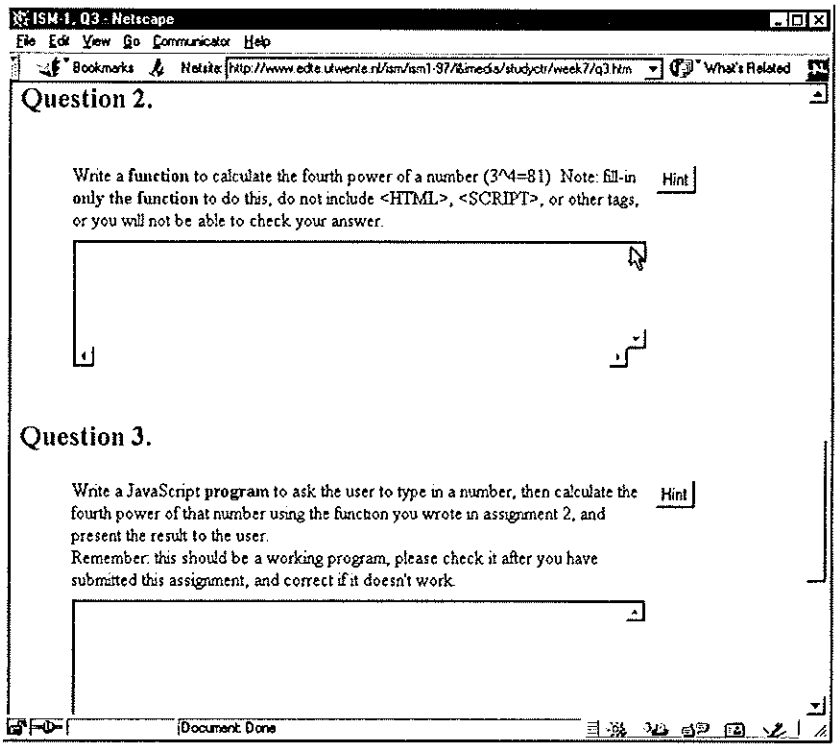


Figure 7-4. Exercises in the use of JavaScript in the 1997-1998 cycle of ISM-1, whereby the answers of the students were immediately archived within the course WWW environment, after which the student could compare his or her answer to those of other students and to a model answer.

From pioneers to initiation

As our own courses evolved in their use of WWW sites, tools, and resources, so also during the period 1995 through 1997 did the use of WWW-based resources, tools, and systems in several other courses in our faculty as well. In addition, experience with the WWW and more-flexible forms of teaching and learning accumulated through being the focus of a number of Masters' theses and externally funded projects (for example, European-Union sponsored *TeleScopia Project* (Collis, Vingerhoets, & Moonen, 1997) involving the design and development of innovative uses of WWW technology to support different forms of flexible learning). By mid-1997 there was a solid base of experience in our faculty in the application of telematics tools, systems, and resources for learning-related purposes. The faculty had moved from the pioneer phase into the *1.000 flowers blooming* phase (Collis, 1997a). Then a major step occurred: a decision by the faculty management to use the WWW as a tool for systemic, managed change and pedagogical re-engineering throughout the entire programme. The *TeleTOP project* was launched in August 1997.

The pioneer period and lessons learned

What lessons emerged or had the major impact during this pioneer period? Several have already been mentioned; others are described below.

Lesson 5: ***Watch the 4-Es***

The 4-Es (then, 3-Gs), helped us understand a number of experiences during this period. First, although eventually seven faculty members became involved with the use of the WWW or non-WWW computer conferencing during this period, the remainder did not. The 4-Es helped us interpret this. Those of us who did use technology had high personal-engagement levels and were convinced of the value of the new sorts of learning activities that we needed the WWW sites to support. Ease of use was certainly negative for us, but we persisted. Our colleagues, with low or negative values for all three of these variables (personal engagement, learning effectiveness, ease of use), did not.

The period also taught us that students need concrete incentives to respond positively to the use of technology and to new pedagogies. For our students, the effectiveness vector is expressed in terms of what they can earn points for in their courses (Collis, 1997c; Moonen, 1994). Students especially are annoyed if the use of technology forces them to spend time on procedural tasks that they didn't have to do before, such as printing study materials from the WWW site (Van Rennes & Collis, 1998). They much prefer printed text for their primary

readings, and do not like to read from the screen. Even with multimedia and interactive resources, they still want to print out the text, take it away, and read it at home or on the train. Ease of use is more compelling that (potential) learning effectiveness. This can be disappointing and frustrating to the instructor who has put considerable effort into a new learning activity involving technology, and adversely affect her level of personal engagement. Only the pioneers will go on.

Lesson 11: ***Offer something for everyone***

Several major lessons came out of our courses that made use of e-mail and listservs and computer-conferencing systems. These tools were not enough. It was frustrating that there was no convenient way to archive e-mail, and that everyone had to read e-mail via their e-mail programmes and that these were not integrated with other tools and environments. Also, while communication and discussion was important, it was not the only form of student participation we wished to support. Computer-conferencing in itself did not provide a good way to support group work on design projects, where the partial products needed to be referred to for discussion, WWW functionalities evolved quickly to offer not only all of the individual sorts of tools we had been using before in an unintegrated fashion, but also to offer the tools integrated with each other, and with student work and submissions as well as with other study materials.

Lesson 10: ***Don't overload***

Another lesson we learned during this time made a major impact on us. Having students communicate was good, but soon became overwhelming for the instructor. More is not better, after a point. One year we had over 3,000 items in the computer-conferencing environment for one of our courses, a mixture of entries from the instructor which were important course resources, student submissions and feedback from the instructors, general instructions and course information, and messages from students and from the instructors about procedures . We learned that communication should be structured, and stored in convenient, well-defined locations where it is accessible to everyone but not a bother to them. The folders in a computer-conferencing environment soon were too constraining. Either we had too many, or too many levels of nesting within folders. Also, we found that a certain amount of communication was procedural only, and could be avoided if we wrote instructions and expectations very clearly in the WWW site, even if we saw students regularly. We had to teach the students to "check the WWW site" first, before sending us an e-mail to ask a procedural question.

Lesson 9: ***After the core, choose more***

Yet another important lesson we learned from these pioneer experiences was the importance of a good choice of core and complementary resources.

In our courses, the course WWW site quickly became the core technology, but this did not mean that it should be the only technology. In particular, the WWW was not the best technology to present the primary reading materials for the course to the students. We learned over time to use the WWW site to supplement those printed reading materials with student- and instructor-submitted extra URLs, with structured communication about the readings, and with interactive applets or self-test questions to help students with understanding the study materials.

Lesson 13: ***Process yields product***

We started to talk about pedagogical re-engineering in 1996 (Collis, 1996d). We became aware of the distinction in our use of our WWW sites and before that, computer conferencing, between uses that were primarily aimed at the efficiency and flexibility of procedures, and uses that related to new types of student activities. The main examples became "active-learner", contribution-oriented activities (Chapter 5) in which the students themselves create and contribute study resources for each other, to build upon, to discuss, and to become part of the course resources for subsequent cohorts of students. Without well-designed technology, we just could not have managed these sorts of activities in any feasible way.

Lesson 12: ***Watch the speed limit***
Lesson 14: ***Aim for activity***

Finally, a major lesson from our pioneer days related to the change in our own roles as instructors. We shifted, from primarily being the facilitators of student acquisition to primarily being the designers and moderators of student activities, particularly in collaborative groups. This brought new tasks, and took more time than before. Interestingly, we also had to spend time defending these new approaches, to students, to our colleagues, to faculty committees, all of these distrustful that this was "real teaching" or that students could learn with these approaches or many other fears. Students feared they were being short-changed by having to take more responsibility for learning. Many worried that quality would unacceptably decline if the instructors were not always the source of course materials. Thus we learned from our experiences that new forms of student activity were possible, and exciting, but that the evolution toward them would have to take time and a culture change.

The culture change took place in the academic year 1997-1998.

PCL XL error

Subsystem: KERNEL

Error: IllegalTag

Operator: 0x25

Position: 22516