Flexibility Support for a Changing University

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FOR A
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PROEFSCHRIFT

ter verkrijging van
de graad van doctor aan de Universiteit Twente,
op gezag van de rector magnificus,
prof. dr. F.A. van Vught,
volgens besluit van het College voor Promoties
in het openbaar te verdedigen
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door

Willem Feike de Boer

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Het proefschrift is goedgekeurd door
Prof. dr. B.A. Collis, Promotor

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ACKNOWLEDGEMENTS

The first thing you probably will read is the last thing I have written down. I have finished my dissertation as it lays before you. My dissertation study is the culmination of a six-year period of working at the University of Twente. I very much enjoyed working in this changing and flexible environment.

The process of writing a dissertation is interesting and challenging. I was fortunate to be working in an environment that gave me this opportunity. First within the "TeleTOP team", and from 2000 on within the ISM department. I look backward to a rich experience that I wouldn't like to have missed.

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Enschede, January 2004

1 INTRODUCTION AND RESEARCH QUESTIONS

"Flexibility is seen as the key idea, and flexibility requires technology. Thus new developments in technology feature in much of the change in higher education" (Collis & Moonen, 2001, p. 31)

The field of education is changing, as the world is changing. Traditional and distance universities are in the process of providing quality education for rapidly diversifying student cohorts (Middlehurst, 2003). This change process is multi-faceted: broader and more diverse students, changing roles of instructors, more-flexible curricula, new delivery methods, new contacts between universities and other partners, and the globalization of higher education (Guri-Rosenblit, 1998). Bates (2001) argues that a mix of on-campus and flexible learning is an ideal mode of delivery for many of the new types of learners. He estimates that the lifelong learning market for formal university and college courses in knowledge-based economies is at least as great as the market for students leaving high school. This research will focus on flexibility and technology in higher education, introduced in Section 1.1. In the remainder of this chapter the problem statement and research questions will be described (Section 1.2). An experiment within this research was at the University of Twente, this context will be described in Section 1.3. Section 1.4 will conclude with the structure and an outline of the dissertation.

1.1 Flexibility and Technology in Higher Education

Higher-education institutions are anticipating more-diverse groups of students, but institutions in many countries lack a strategic view for responding to these new target groups (Middlehurst, 2003; Bates, 2001; WRR, 2002). In an international survey which was carried out in both developed and developing countries (Observatory of Borderless Education, 2002, Middlehurst, 2003) the conclusion was that institutions are changing slowly and not radically. Middlehurst (2003) found that online learning has had only relative impact on campus and on distance education. Change has been relatively rapid with respect to the uptake of a "modest" amount of online components and institution-wide learning platforms, but a fundamental move away from on-campus provision has not happened. In general institutions are still focused on their traditional target group (high-school leavers). However, as changes occur, technology often plays a role.
One particular type of ICT technology that seems flexible for educational use is that of course-management systems (CMSs). Collis and Moonen (2001) define a CMS as

"a comprehensive software package that supports some or all aspects of course preparation, delivery and interaction and allows these aspects to be accessible via a network." (p. 78). CMSs (further introduced in Chapter 2) can support the instructor-rooted classroom-orientation model (Gustafson & Branch, 1997) which still can be seen as the most dominant approach to course design and delivery within higher education. However, certain pedagogies can be enriched or reengineered by appropriate use of technology in order to make learning and teaching more student centered and flexible even with the instructor-rooted classroom-orientation model. Pedagogy approaches that enable flexibility with the support of CMSs include authentic task-based learning or problem-based learning; discussion-based learning; active learning, and group-based (problem) learning (also further introduced in Chapter 2).

Although flexible learning is a strong underlying paradigm within higher education (discussed in Chapter 3), how to operationalize it is not always clear (De Boer & Collis, 2003). Within courses, different types of students should have options for different ways of experiencing the learning process. But how can this be operationalised in practice? A thorough analysis of flexibility in order to guide subsequent choices about options and better assess the progress of an institution in terms of offering flexibility in learning is needed. While institutions can make system-wide decisions about flexibility in admission and program requirements, the individual instructor is the key player in offering flexibility within the course itself. In order for quality assurance relating to flexibility, there needs to be consensus relating to ways in which options can be offered within courses. With such a consensus, the degree of flexibility within a course, as well as within the institution, can be measured and progress tracked (Collis & Van der Wende, 2002; De Boer, 2002). *Identifying such a framework and applying it in practice is the basis of this research*.

Within a more-flexible course scenario the use of technology is not predominantly for distance education but instead emphasizes the increased flexibility that can come to the teaching and learning process through the combination of the new possibilities offered by the Web and new ways of teaching and learning. This research focuses upon the way *internal performance support (through the CMS) could support instructors in offering more flexibility through CMS use.*

1.2 Problem Statement and Research Questions

There are three main areas of problems that will be the focus within this research and will be reflected in the research questions. First, higher education is reacting to a changing world with new types of students, and it is rethinking their roles and strategies toward new models. It seems that a more-flexible approach where institutions still emphasize face-to-face contact with the traditional (18-24 year old) student groups is occurring, but without systematic acknowledgement or support (Collis & Van der Wende, 2002). The number of new types of students such as international students and lifelong learners is increasing and an increase of the flexibility of courses for regular on-campus students can be seen as major focuses within higher education in the forthcoming years. This represents a first problem addressed by the research focus on the changing higher-education sector and the need for a new flexible scenario for higher education and leads to the following question:

1. What are key types of flexibility involving Web-supported learning in higher education and what framework best expresses these in terms of course design?

Secondly, the way to support this change through the use of ICT is also a main focus. CMSs seem good tools to support instructors within new flexible scenarios. But can the tools within a CMS be used for the creation of information/educational content, the delivery of information/ educational content, for communication, and for course organization in a flexible way? Related to this is how certain pedagogies can be used to enrich or reengineer courses with appropriate use of technology. The pedagogy options and approaches that can be identified that seem well suited for the use of CMSs for flexible learning could be focused upon authentic task-based learning or problem-based learning, discussion-based learning, active learning, and group-based (problem) learning. Are the pedagogy options and approaches familiar enough to instructors? The use of CMSs in higher education is evolving very rapidly, but the second problem addressed by the research is if and how the CMSs can be used in a flexible educational context, to support pedagogies that relate to flexible-learning scenarios. The second problem statement focuses more particularly on the use of technology and instructional strategies and pedagogies, reflected in the second research question:

2. What combinations of Web-based tools, functionalities, and systems coupled with what instructional strategies best support these types of flexibility in course design?

And finally, a problem that relates to the one-sided and limited use of technology in higher education in general is the available support for the instructor. In general it seems that instructors do not have clear goals and tailored support for course organization, pedagogy and technology based on time, delivery, quality, and scalability of the support (See Chapter 2). Instructors in general have the feeling that they solve most of their CMS problems themselves (Gervedink Nijhuis, 2002). The implementation of the TeleTOP CMS in the University of Twente demonstrates this problem (Chapter 4). A third major problem addressed by the research is therefore: how can how instructors be supported in adapting and using more flexible options within the CMS in their educational practice? The last problem relates to supporting the instructors as they make decisions about how to systematically provide more flexibility in their courses. The problem is reflected in the third and last of the overall research questions:

3. How can an instructor be helped to choose a blend of Web-based course tools to achieve the flexibility targets for a given course? How can this approach be implemented in a support system?

1.3 Context of the Research

This PhD research has been conducted at the University of Twente in the Netherlands. The University of Twente will be used as an example that could be used as a representative of other higher-education institutions within the western world.

The University of Twente finds it important to focus on research related to the Internet and the Web. Within its educational settings the application of technologies such as CMSs has a high priority. Although the research reported here has been conducted within several faculties of the University of Twente, the Faculty of Behavioral Sciences, formally known as the Faculty of Educational Science and Technology, was the first faculty that systematically used a CMS in order to make learning more flexible. The faculty operates in a traditional university setting, where course design and delivery takes place predominately in the classroom orientation. Within this faculty it was decided at the policy level to organize *managed change* in the instructional practice. In mid 1997 the decision was made that by September 1998 students entering the course program could participate as local students, or as part-time lifelong learning students, with a higher need for flexibility. It was decided that the flexible program should be made out of a blend between the flexible use of technology and traditional ways of teaching. A new, flexible educational approach for both the regular students and the mature students who remained in their homes and jobs while they participated in the faculty's program was called C@mpus+ (Carleer & Collis, 1998). Key to the decision was that flexibility, in terms of more options, was to be offered to all students, not only the life-long learning cohort.

To support these changes with technology a course-management system (the TeleTOP CMS) was designed and developed. At the Faculty of Educational Science and Technology instructors were supported through the use of two cycles of an evolving decision-support instrument that was integrated with the TeleTOP CMS. These two TeleTOP DSTs (Decisions Support Tools), as a type of Web-based performance support, and the experiences with them and other support are described in Chapter 4.

The other faculties at the University of Twente followed the example of the Faculty of Educational Science and Technology within the following years, although with different motivations. At this moment (2003) most faculties use TeleTOP within their programs, for over 60% of their courses (See Chapter 4).

1.4 Structure of the Dissertation

The general purposes of this research are to identify types of flexibility involving Web-supported learning in higher education and how Web-based course-management systems can support instructor and learner choices with respect to flexibility. Important is the support that instructors need for the use of course-management systems and new pedagogies that relate to more-flexible learning and teaching models.

The structure of the research can be explained through the development research approach of Reeves (2000) in Figure 1.

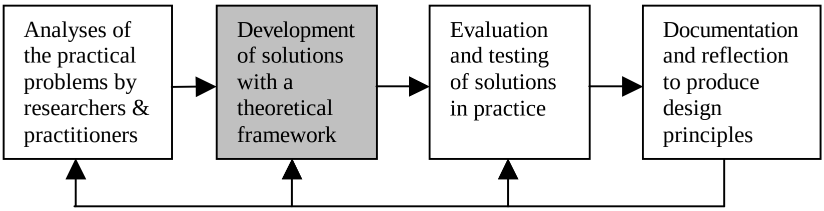

Figure 1. Development research approach (Reeves, 2000, p. 25).

This dissertation will start with an *analysis of the practical problems* (Chapter 2 as based on literature and a case example in Chapter 4). A *theoretical framework* for flexibility in higher education will be developed (Chapter 3) and will be validated in terms of recognizability and use. In Chapter 5 the methodology for development research (Reeves, 2000) will be used for the *development of a support solution* and an *evaluation and testing of solutions in practice* will be described in Chapter 6. Finally the *documentation and reflection* will be given in Chapter 7.

In all chapters the development research approach of Reeves (2000) will be used to explain which of the steps is most applicable for that chapter.

Next a short overview for each chapter is given.

In Chapter 2, the new models in higher education for new types of students and a particular scenario for flexibility within higher education, called "Stretching the Mold", will be introduced and discussed. The pedagogy and Web-technology tools for stretching the mold will be discussed and how these relate to the options in Web-based course-management systems (CMS) as the key technology for stretching the mold will be indentified. Support for instructors is important. How are the needs of instructors using a CMS for stretching the mold reflected in approaches to instructor support? One category of instructor support, performance support through support tools integrated with a CMS, will be discussed

In Chapter 3 a further analysis of flexibility will be made in order to guide subsequent choices about options and better assess the progress of an instructor or institution in terms of offering flexibility in learning in a stretching-the-mold context. The focus will be on the individual instructor as the key player in offering flexibility within the course itself. Chapter 3 will start with an overview of key dimensions in that can occur in flexible learning and the flexibility dimensions that have been identified will be validated for their recognizability, and for their use. After a validation of a framework derived from this literature study, the degree of flexibility within a course can be measured and progress tracked. The support that is relevant for the identified flexibility dimensions related to Stretching the Mold will be discussed.

In Chapter 4 the context of the University of Twente will be described. The design and development of the TeleTOP course-management system and the new pedagogical concepts that should make learning more flexible will be discussed. The way instructors were supported within the implementation process through the use of integrated decision-support tools within TeleTOP, their problems, and outcomes will be discussed.

In Chapter 5 the design and development of an integrated performance-support tool within the TeleTOP CMS will be discussed. The tool, that is called the Flexibility Support Tool, consists of two main interfaces and supports the instructor in the (re)design process of a particular course through the use of a TeleTOP CMS environment. Three formative usability evaluations and the revisions that followed will be described.

In Chapter 6 the experiment with the TeleTOP Flexibility Support Tool that has been conducted will be described. At the University of Twente 32 courses were designed with the support of the new TeleTOP FST. The degree of flexibility within the courses and the use of TeleTOP will be compared to courses that did not have this new kind of support. The degree of flexibility will be measured and the possibility of change because of the new support will be measured. Furthermore other factors that have an influence on flexibility will be examined and discussed with instructors.

In Chapter 7 the results of the PhD research will be discussed. The research questions will be used to see what answers were found and what general conclusions can be derived from them. The results and further analyses that were derived from Chapter 6 will lead to important insights towards flexibility, CMS use, and support.

2 FROM NEW STUDENTS TO NEW TOOLS: STRETCHING THE MOLD AND THE INSTRUCTOR

In Chapter 1 the context and problem definition for this dissertation research were described. This chapter will focus on the analyses of the practical problems as experienced by researchers and practitioners, as visualized within the first box in Figure 2 of the Development Research approach model (Reeves, 2000).

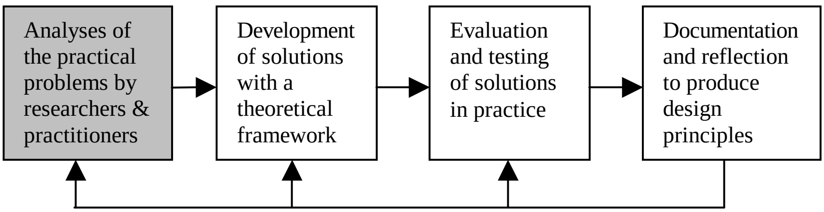

Figure 2. Development Research approach (Reeves, 2000, p. 25).

The chapter starts with a description of new models in higher education for new types of students (Section 2.1) and introduces a particular model called "Stretching the Mold". Then pedagogy and Web-technology tools for stretching the mold are discussed (Section 2.2). Section 2.3 deals with options in Web-based course-management systems (CMSs), as the key technology for stretching the mold. The needs of instructors using a CMS for stretching the mold are discussed in Section 2.4, and in Section 2.5 these needs are related to approaches to instructor support. One category of instructor support, performance support through support tools integrated with a CMS, is discussed in Section 2.6. In Section 2.7 the conclusions of this chapter will be given and related to the research questions from Section 1.2.

2.1 Institution Options: New Models for New Students

The environment in which higher-education institutions have to operate has changed significantly in the last decade and is still changing. Information and communication technologies have had an important influence and are related to new national and institutional policies, new cohorts of students, and new learning models in higher education. There is a need and urge to change. Students are more diverse than earlier in age, profession, skills, and needs. Higher-education institutions are broadening their borders to serve not only their local target groups but also new students that come from both near and afar. New types of students are emerging, and their characteristics and diversity gradually will influence educational institutions to adapt their (educational) models. A major model in this respect that is appearing can be called "Stretching the Mold" (S-t-M) (Section 2.1.1). Some examples of this model appear in Section 2.1.2. Section 2.1.3 concludes the section with a comment about the pace at which the S-t-M Model is becoming entrenched.

2.1.1 New models for new students

New students attend the traditional and distance universities. In addition to new and more-diverse cohorts of students, changes are occurring in higher education in many ways: changing roles of instructors, more-flexible curricula, new delivery methods, new types of contacts between universities and other social parties, and the globalization of higher education (Guri-Rosenblit, 1998). Hall, Thor, and Farrell, (1996) observe an educational paradigm shift. They see that the process of educating students is changing, with the ways teachers teach and learners learn rapidly altering. There is more than one shift: Changes are noticed in the nature of knowledge itself: from objective towards constructed, towards a knowledge-based society, where the old model of instruction is changing towards learning and communication becomes more important.

Who are the new students? The new students are called “knowledge workers” by Drucker (1994) and they do not so much need a fixed body of knowledge and facts, but a way to find, access, and value information on an ongoing basis. Lifelong learning (Fisser, 2001) is a common term for people who have done their basic studies but still need to professionalize themselves over and over again throughout their careers. Lifelong learning is, as the EU Commission in 1983 already defined (Kenny, 1983), the purposeful learning activities undertaken on an ongoing basis with the aim of improving knowledge, skills, and competences. Other definitions stress lifelong learning as learning over the entire life span including all learning activity whether formal or informal, with the aim of improving knowledge, skills, and promoting personal fulfillment (Richardson, 2001). Learning does not stop anymore when a student finishes his/her degree. Green, Eckel, and Barblan (2002) note that a relatively new emphasis on lifelong learning in Europe “is attracting new older and part-time students into higher education and diversifying the student population” (p. 9). Bates (2001) argues that a mix of on-campus and flexible learning is an ideal mode of delivery for lifelong learners and that in knowledge-based economies lifelong learning has become critical for economic development. He estimates that the lifelong-learning market for formal university and college courses in knowledge-based economies will be at least as great as the market for students leaving high school for university and college.

Because the nature of students is changing, universities need to change, and some warn that it is even dangerous to be stuck in "old, outmoded ways of doing things" (Guri-Rosenblit, 1998; Roll, 1995). Kerrey and Iskason (2000) mention in their report to the President and the Congress of the US that the power of the Internet for learning is that learning can be more student-centered, with a focus on the needs of the individual learners. These ideas relate to lifelong learning. According to Guri-Rosenblit (1998) it is possible to make lifelong learning of high quality accessible for a broad audience by making use of new technology.

There are new paradigms needed, suggesting that the current models of universities are about to change into new undetermined structures (Hall, Thor, & Farrell, 1996). In this context, Collis and Gommer, (2001) identified four main scenarios for educational delivery, distinguished around two main dimensions.

> One line of development in this model relates to the "local vs. global" issue. Should the university move toward strengthening itself as a home base for its learners, or move toward a future in which its students little or never come to the home campus. A second line of development relates to the program and content to be offered. How should this be obtained, and offered to clients? As total programs? As individual courses? As portions of courses which can be combined in different ways? (Collis & Moonen, 2001, p. 196).

Figure 3 gives four scenarios for educational delivery (Collis & Gommer, 2001; Collis & Moonen, 2001), related to these two underlying dimensions.

Scenarios of the future in which flexible learning will be part of a setting …

	Where local and face-to-face transactions are highly valued	*Where global and network-mediated transactions are the norm*
In which the institution offers a program and ensures its quality	**Scenario A** Quality control of a cohesive curriculum, experienced in the local setting (current situation) ***Back to the basics***	**Scenario B** Quality control of a cohesive local curriculum, available globally: ***The Global Campus***
In which the learner chooses what he wants and thus takes more responsibility for quality assurance	**Scenario C** Individualization in the local institution: ***Stretching the Mold***	**Scenario D** Individualization and globalization ***The New Economy***

Figure 3. Four scenarios for educational delivery (Collis & Moonen, 2001, p. 199).

The four scenarios will be elaborated further. Scenario A, Back to Basics, can be seen as the dominant situation for many traditional post-secondary institutions at this moment. Within Scenario B, The Global Campus, these institutions are starting to focus on distance students participating in the established programs. Scenario C, Stretching the Mold, focuses on more flexibility with or without changing the underlying pedagogical and organizational campus-based model within the institution. Scenario D, The New Economy, combines change on each of the two dimensions and gives increased flexibility within the pedagogical program as well for distance students participating in programs.

The four scenarios for educational delivery were validated within a single university (Collis & Gommer, 2001) and then via a large international survey (Collis & Van der Wende, 2002). In the next section these results and other data that relate to the findings will be discussed.

2.1.2 The Stretching the Mold Scenario: Validation via an international survey

Section 2.1.2.1 gives the general results of an international study relating to change scenarios in higher education, and Section 2.1.2.2 identifies Stretching the Mold as well as the other change scenarios in terms of validation data from the study. Section 2.1.2.3 gives an overall conclusion.

2.1.2.1 International survey results

CHEPS (the Center for Higher Education Policy Studies) and the Faculty of Behavioral Sciences of the University of Twente in The Netherlands have recently completed an international comparative study on models of technology and change in higher education (Collis & Van der Wende, 2002; De Boer; 2002). In the international study (nine countries, including seven in Europe), 690 respondents (instructors, decision makers, and support professionals) within higher-education institutions gave their opinions relating to the variables in a model for predicting change, through a Web-based questionnaire that was developed and piloted. The study will be discussed further in Section 3.2. The purpose of this project was to study factors that influence current models relating to change and technology use in higher education and which predict how institutions are likely to evolve, given their current conditions. Consequently, the research explored the ways in which higher-education institutions perceive their changing environments and how they are responding to challenges related to these changes. Furthermore, the study reviewed how strategic responses translate into internal policies and implementation plans and what effect these are perceived to have on teaching and learning practices.

A selected sample of universities in the nine target countries was identified, using information sources in national Ministries of Education. ICT contact persons were contacted at each of the institutions, and asked to approach decision makers, instructors, and support personnel in their institution with the request to respond to the questionnaire. Approximately 30% of the approached institutions responded fully to the survey (for full details, see Collis & Van der Wende, 2002).

The first general conclusion of the study was that change is slow, and not radical. The campus as the base for learning stays very important, and although actors see that new students are demanding more flexible forms of education, a "business as usual" approach is taken, without anticipating any real dramatic changes in mission, profiles, or market position. The second general conclusion was that ICT, and in particular Web-based technologies, are in general use. The ‘course’ model with a significant component still involving face-to-face traditional teaching is the main model, but technology is gradually enabling blended approaches to extend and complement face-to-face sessions (De Boer, 2002). The final general conclusion was that instructors in a modest and efficient way use technology, but do not get many incentives for this (Gervedink Nijhuis, 2002).

With regard to policy, the study found that the higher-education institutions show moderate changes in the degree to which student demands are currently affecting the institutions' ICT policies. Some more influence is expected for the future and institutions seem to be generally aware that lifelong learners and international students will need more flexibility. There is a demand for more-flexible access from traditional students for on-campus courses. ICT-related policy focusing on the demand for more flexibility in locations of learning, delivery of education, and pace of learning, as well as lifelong learning, and programs for international students is emerging, but in fact this change seems very moderate, not radical.

Institutions in many countries lack a strategic view on using ICT for the new target groups. And more generally, the development of institution-wide ICT strategies is still weak (Collis & Van der Wende, 2002; Ling, Arger, Smallwood, Toomey, Kirkpatrick, & Barnard, 2001; Middlehurst, 2003; Bates, 2001; WRR, 2002). Higher-education institutions do not expect a revolutionary change as a result from or related to the use of ICT. However, changes are still happening even without a strategic view. Institutions that do have a clearer view on their mission with respect to serving different target groups (e.g. lifelong learners or international students) with ICT and on their position in that/those particular markets, usually demonstrate higher levels of use of ICT and a higher influence of ICT on general teaching practice (Collis & Van der Wende, 2002, p. 64).

The results of the Collis and Van der Wende (2002) research build upon the conclusions made in other international surveys, which were carried out in both developed and developing countries (Ling, Arger, Smallwood, Toomey, Kirkpatrick, & Barnard, 2001; Middlehurst, 2003; Observatory of Borderless Education, 2002). Paralleling their conclusion that change is slow, and not radical, Middlehurst (2003) also found that Web-based learning has had only relative impact on campus and on distance education that change has been relatively rapid for the update of Web-based components and for institution-wide learning platforms (CMSs), but a fundamental move away from on-campus provision has not yet happened.

2.1.2.2 *Validating the scenarios*

The four typical learning settings (See Figure 3) as defined by Collis and Gommer (2001) were used in the international study about models of technology and change in higher education discussed in Section 2.1.2.1 (Boezerooy; 2002; Collis & Van der Wende, 2002; De Boer; 2002; Gervedink Nijhuis, 2002) to see where the instructors, support staff, and managers think they and their institutions are now and where they are heading in the next five years. The international study shows how the typical learning settings occur now and in the future (Table 1).

Table 1. Extent to which typical learning settings occur now and in the future (Boezerooy, 2002, p. 23).

Typical learning setting (N=690)	Now		Future	
	Mean	SD	Mean	SD
On-campus settings for course activities (“Back to the Basics”)	4.55	0.75	4.26	0.80
Many variations in where and how students participate in courses, but campus-based settings remain the basis (“Stretching the Mold”)	3.34	1.21	3.96	0.95
Many students are attending at a distance (“The Global Campus”)	2.05	1.16	2.80	1.19
Students use the home institution as a base but pick and choose their courses from many locations (“New Economy”)	1.85	0.98	2.81	1.10

1=little or none, 3=some, 5=very much the case

As can be noted from Table 1, there are modest changes that managers, support staff, and instructors expect between now and 2006. Comparing the data in Table 1 shows that Back to the Basics is still seen as likely to be the dominant model, but that each of the other scenarios is seen as growing in importance. The movement towards more flexibility is recognized for both dimensions, on one hand towards more global and network-mediated transactions, and on the other hand towards learner choices. The “load” however in general is still in a university setting, where local and face-to-face transactions are highly valued. The main future model for traditional higher education institutes therefore seems to be within the “Stretching the Mold” scenario (See Figure 3).

2.1.2.3 *Conclusion: Modest changes, towards Stretching the Mold*

New cohorts of students in a changing world are making higher-education institutions rethink their roles and strategies and begin to move toward new models. However, the international ICT survey (Collis & Van der Wende, 2002) also showed that many higher-education institutions do not yet overtly feel a concern about being forced to change by external forces or developments. Rather, a "business as usual" approach is taken, in which the face-to-face contact with the traditional (18-24 year old) student groups is still very important, but where the number of new students such as international students and lifelong learners is gradually increasing. Higher-education institutions are gradually "Stretching the Mold" (See Figure 3); offering more flexibility in their procedures and programs as a process of change from within as well as opening possibilities for distance students to attend. The flexibility can also be provided in the way instructors organize their courses, dealing with more heterogeneous groups of students, and offering options to these different students (The way the stretching the mold can occur through courses with the use of course-management systems will be elaborated in Chapter 3). The changes, however, are gradual and usually slow. Stretching the Mold is occurring without formal acknowledgement or policy. Furthermore, it seems that the current level of Stretching the Mold is more sensitive to the level of computer use than to the particular policy of an institution (Collis &Van der Wende, 2002; Collis & Gommer, 2001).

Within the context of stretching the mold new ways of teaching, often involving Web technology, are starting to emerge. In the next section these new options in pedagogy will be explored.

2.2 Pedagogy and Web Technology: Tools for Stretching the Mold

An important effect of introducing technology in education is the potential for the reshaping of teaching and pedagogy (Green, Eckel, & Barblan, 2002). It is important that the pedagogy models in teaching are not technology driven, although technology can provide options for stretching the mold. In Section 2.2.1 pedagogy dimensions and approaches suited for stretching the mold will be discussed. Then in Section 2.2.2 some current pedagogical experiences and Web-technology usage relative to stretching the mold will be described.

2.2.1 Pedagogy options for stretching the mold

Pedagogy has been called "the art and science of teaching," the "knowledge and skills that practitioners of the profession of teaching employ in performing their duties of facilitating desired learnings in others" (Dunkin, 1987, p. 319). The increasing use of technology in education has also led to a rethinking of current pedagogical approaches. There have been many models and dimensions identified that deal with the use of technology within higher education that can be applied in a stretching-the-mold situation. First, an overview of some of these pedagogical dimensions will be given (Section 2.2.1.1). After that some main pedagogical approaches will be discussed (Section 2.2.1.2). An introduction of a "blended-learning" approach related to stretching the mold is given in Section 2.2.1.3, followed by a conclusion to the section.

2.2.1.1 Pedagogical dimensions

Courses in higher education are sometimes designed by a design team, but in most cases by the instructor himself. During this design process there are many options to consider and decisions to make. The introduction of Web technology within education has not reduced this range of decisions to make, but has increased it. A number of researchers have made overviews of the design decisions that instructors have to make when pedagogy involves Web technology use.

Bonk, Cummings, Hara, Fischler, and Lee (1999) distinguished ten levels or dimensions in pedagogical choices that instructors make in terms of Web-related decisions. The dimensions include using the Web as a way to promote courses, using the Web to facilitate access from a distance, using Web technology so that students in an "active learning" approach can contribute resources to the course Web environment that can be used by fellow students, as well dimensions related to how instructors organize and present their resources and keep track of the 'course experience'.

Khan (2001) gives a holistic view of a course and distinguishes several dimensions for the use of technology within such a view. He mentions a series of components of a pedagogical dimension, such as the goals/objectives, content, design approach, organization, methods and strategies, and media; and a series of components of a technological dimension (infrastructure planning, hardware, and software). In his view, instructors are also responsible for the interface design of any Web technology used, for the assessment of learners, the evaluation of the instruction and learning environment, for the maintenance of the learning environment, and the distribution of information and resource support. Other dimensions relate to flexible communication, re-use and distance/flexible learning.

Reeves (1994) defined 12 pedagogical dimensions for computer-based education terms of a bipolar set of variations as theoretical dimensions for standalone computer-based learning products. As the use and possibilities of the Web in education emerged, Reeves (2002) modified his model, of can been seen in Figure 4. The dimensions can be visually presented in terms of a set of parallel lines a profile of a particular computer-based resource could be shown, by noting where on each of the dimensions the product could be positioned.

1.	Task-oriented	Academic	< = >	Authentic
2.	Challenging	Simple	< = >	Complex
3.	Collaborative	Unsupported	< = >	Integral
4.	Constructionist	Replication	< = >	Origination
5.	Conversational	One-way	< = >	Multi-faceted
6.	Responsive	Superficial	< = >	Genuine
7.	Reflective	Shallow	< = >	Deep
8.	Formative	Fixed Assessment	< = >	Developmental

Figure 4. Eight dimensions of effective Web-based learning environments (Reeves, 2002).

Reeves used this framework to evaluate courses and teaching programs, but it can also be used to (re)design courses or programs in the Stretching-the-Mold Model. The dimensions that Reeves uses can be used as options for course planning. Different 'paths' in the design of a course for different purposes can be made.

Depending on the need of the institution and/or its students a course program need for example more or less authentic tasks or more-or-less complex activities.

Pedagogical dimensions relate to the (re)design of courses. Instructors can use them to rethink goals, content, design approaches, course organization, and instructional methods and strategies (Khan, 2001). Learning with the use of technology can be more authentic; can place more emphasis on formative development; can introduce complex, collaborative, and constructive learning experiences, with options for genuine responses between learners and deep reflection about what is being learned (Reeves, 2002). To do this, appropriate pedagogical approaches must be chosen, and in some cases these will stretch the mold of teaching and learning. Several of these approaches are mentioned in the next section.

2.2.1.2 Pedagogical approaches

Pedagogical dimensions such as those identified in Section 2.2.1.1 are translated into practice through teaching approaches. Bourne, McMaster, Rieger, and Campbell (1997) talk about four main teaching paradigms: Learning by listening, discovery learning, learn by doing, and learning through discussion and debate. The teaching paradigms of Bourne, McMaster, Rieger, and Campbell (1997) for teaching within “asynchronous learning networks” (ALN), and/or in traditional course settings show that some pedagogies can be more optimal in certain settings.
Table 2 shows the teaching paradigms identified by Bourne and his colleagues and indicates which they feel are likely to be most successful in a Web-supported implementation.

Table 2. Common teaching paradigms (adapted from Bourne, McMaster, Rieger, & Campbell, 1997, p. 44).

Paradigm	**Traditional use**	**Web implementation**	**Likely success with Web use**
Learning by listening	Lectures: very common; succeeds with dynamic lecturers; students bored with dull "sage"	On-screen video played on-demand or downloaded	Fair to poor. Suffers from lack of presence of the "sage." However, permits replay, indexing of lecture.
Discovery learning	Library, literature searches;	Web searching	Web searches are often much better than traditional library searching
Learn by doing	Laboratory. Works very well in traditional model. Writing, creating things.	Learning modules, simulations on-line; writing on-line, critiquing	Learning modules can be very good, but on-line laboratory materials are not yet widespread. Web environments can be an excellent medium for writing and critiquing.
Learn through discussion and debate	Poor in large classes, excellent in very small classes with the right instructor	Network conferencing	Scales up to many learners; potentially much richer than classroom discussion

Mason (1998) found that the use of technology in courses by instructors can be categorized in three main ways: The content and support approach, the wrap-around approach, and the integrated approach. In the content-and-support approach the student will use Web technology for self-study of content. In the wrap-around approach, studying of the course materials will take approximately half of the students' time, with the other half taken by discussions, both of which can be supported by Web technology. In the integrated approach most of the learning time is spent supported by Web-based environments and the course consists of combinations of collaborative activities, learning resources, and assignments. Important elements in the models of Mason and of Bourne, McMaster, Rieger, and Campbell are self-study, discussions, authentic activities, collaborative learning, and resource-based learning. These elements will be elaborated in the following paragraphs.

- Self-study. When learners can make choices with regards to their learning route as well as their place and pace of learning (King 1993; Parsloe, 1986;), self-study is often the resulting approach. This type of learning is mostly designed for individual students and focuses on reading. Assessment can be self-organized via Web-based tests. Communication with other students, and/or instructors is limited. Courses can be delivered to learners in pre-packaged forms (Pickles, 2001).

- Discussions. Learning through discussion and debate is a popular way of using Web technology within education. Gilbert and Moore (1998) make it clear that interaction is of great importance within education, and discussion and debate involve peer interaction. Oliver, Omari, and Herrington (1998) report that Web-supported learning environments for on- and off-campus students often focus on particular communication approaches, such as discussion groups, use of chat rooms, and document sharing.

- Authentic activities. Gay (1997) sees that Web technology can offer an ideal venue for practicing constructivist principles. Constructivist approaches are described by many (Bruner, 1996; Jonassen, 1985, 2000; and an overview in Thompson, 2000). Reeves (2002) and Herrington (2002) argue that in Web-supported learning environments it should be "the task that matters most" rather than content transmission. Tasks should and can be more authentic instead of academic. Other researchers support this emphasis on authentic and active pedagogy. Sfard (1998) speaks about the change from a dominance on a knowledge-acquisition approach toward a focus on a participative approach. The students' role can be either focused on acquisition or shift toward contribution (Collis & Moonen, 2001), where the students will actively contribute to the learning materials and discussions within a course in a way that their contributions become part of the learning materials for other students, in their own cohort and future cohorts.

- Collaborative learning. Oliver, Omari, and Herrington (1998) define collaborative learning as a pedagogy. Van der Veen (2001a) defines group-based collaborative learning as “the series of activities in which groups of learners work together in order to complete a task” (p. 29). These activities can follow a pre-set program or structure, or they can be more open and flexible. These approaches encourage questions-and-answers among the students. Green, Eckel, and Barblan (2002) mention the use of Web technology to foster active and group learning both in and out of the classroom. Sfard (1998) also supports this approach.

- Resource-based learning: Ling (1997) sees that the student can be more active as pedagogy moves towards resource-based learning supported by Web technology. This means that delivery of information can be more teacher-independent than in conventional face-to-face teaching.

2.2.1.3 Blended learning as way to stretch the mold

Instructors and classrooms are important educational elements in higher education (Collis & Van der Wende, 2002). Gilbert and Moore (1998) mentioned that types of social interactivity related to learning such as body language, greeting, socializing, and face-to-face contact are still very important. So, is Web technology always the best solution? A new development in technology-based and/or supported learning is blended learning. Bianco and Margaryan (2002) identified more than 30 definitions of blended learning, and found that the blend could emphasize combinations of technologies/media/modes for delivery or combinations of learning methods and approaches. These dimensions can lead to a following definition: Blended learning is a way to design courses that blends different kinds of delivery and learning methods that can be enabled and/or supported by technology with traditional teaching methods.

Mason (1998) mentions that the start to use Web technology in a course can be within the ordinary course itself. When the traditional course is taken as a starting point, options to re-design the course from traditional to a blended-learning model could stretch the possibilities for students. A course that will adapt its activities and supports them with technology can become more flexible in many ways, such as in the way sessions are planned for distance students. Collis and De Boer (1999a) describe how this process occurred at the University of Twente (See also Chapter 4). Collis (1996) thinks it is not necessary to involve direct changes in the underlying educational model of the course when moving to Web use and a stretching-the-mold approach. The same sorts of lectures, assignments, and study expectations can be the basic elements within the redesign; what becomes more flexible, or "stretched", is the way in which students can carry out or participate in these. Bates (2001) agrees that the introduction of Web technology in education does not always have to replace previous practices but instead can complement them:

> "Computers are now commonly used for PowerPoint presentation to deliver lectures and the Internet is now being used more and more to access Web sites to support lectures. Technology used in this way does not replace either the teacher or the classroom. Using technology to supplement classroom teaching does not radically change teaching methods. It merely enhances what would be done in the classroom in any case" (p. 17).

Bates (2001) distinguished two ways to look at technology-enhanced classroom teaching; distance learning and distributed learning. Distributed learning can be seen as a mix of a deliberately reduced amount of face-to-face teaching and Web-supported learning (for instance one face-to-face lecture or seminar a week, with the rest of the teaching and learning done via a Web environment). This can be seen as an example of a blended-learning model. According to Bates, distributed learning rather than distance education will become the dominant paradigm for higher education. Bates' concept of distributed learning, which is in other contexts sometimes described as "mixed mode" or "flexible learning", coincides with the stretching-the-mold scenario. Both distance learning and distributed learning, as defined by Bates, are examples of blended learning.

2.2.1.4 Conclusion: Starting where the instructor is at

The introduction of technology within higher education has led to a number of approaches for the (re)design of courses and learning programs. There are several pedagogical dimensions related to the (re)design of courses, whereby instructors should rethink goals, content, design approach, organization, methods, and strategies, and emphasize more authentic, complex, and collaborative tasks. It looks like that learning has to be fully (re)designed. But is this necessary?

The Back to the Basics model is still the most common model within higher education, and implies that the instructor and his/her traditional course is the core organization model for teaching. In this way, redesign toward a gradual stretching the mold could start from the course as instructors already know it. The use of technology to better support flexible options for new types of students can be based on the traditional course that has been redesigned and has become more stretched. A blend of traditional teaching delivery and the use of Web technology, as well as a blend between traditional teaching pedagogies and new pedagogies, would integrate the best of two worlds. Some new pedagogies seem to be particularly appropriate for Web-supported learning. Key among these are authentic task-based learning, active learning, discussion-based learning, and collaborative learning.

How are these ideas actually being implemented in higher-education institutions? In the next section current teaching practice with regards to new cohorts of students, new models of change, and the use of technology will be described.

2.2.2 From potential to practice

Reshaping of teaching and pedagogy can be an important effect of introducing technology in education (Green, Eckel, & Barblan, 2002). The use of Web technology within education has increased during the last five years (Collis & Van der Wende, 1999, 2002; Droste, 1999, 2000, 2002; Veen et al, 1999), but how are the pedagogical approaches that were introduced in the previous section actually being implemented in practice? Sections 2.2.2.1 - 2.2.2.3 demonstrate that use of Web technology for pedagogical purposes is still moderate and when it does occur, is generally part of a blend.

2.2.2.1 Basic use of technology for pedagogical purposes

In the international survey described in Section 2.1 (Collis & Van der Wende, 2002), the pedagogical use of Web-based technology was one of the subjects of research. Instructors were questioned about their teaching and teaching-related use of technology and indicated that they make "some" basic use of available technology options and focus on supporting the student, i.e., through basic processes of tools for students writing reports, and for transferring knowledge (such as through support for oral presentations or by making available digital forms of reading materials). Other instructional orientations are also used, but less often. It is interesting to see that the use of testing and other formal assessments still is not supported much through the use of technology, although many software solutions are available on the market. Table 3 shows one set of results from the survey, related to instructors' current use of ICT (including Web technology).

Table 3. The extent to which ICT is used to support certain orientations in a typical course (De Boer, 2002).

ICT used to support practices in one's own courses (N=347)	Mean	SD
Students producing/creating reports and products using ICT tools	3.58	1.32
Knowledge transfer	3.57	1.16
Providing feedback on assignments	3.33	1.30
Skill development	3.23	1.27
Re-using materials made by someone else or found elsewhere (appropriate re-use, not plagiarism)	3.19	1.27
Connecting to prerequisite knowledge	3.19	1.27
Developing positive attitudes towards the discipline	3.05	1.28
Students planning their own learning processes	2.77	1.28
Giving guidance / Informally monitoring progress and effort	2.74	1.30
Motivating on-going participation	2.71	1.30
Offering access to course activities via the Web?	2.71	1.30
Giving feedback after formal assessments	2.65	1.30
Testing and other formal assessments	2.04	1.15

1=rarely, 3=some, 5=extensively

In a similar result, Green, Eckel, and Barblan (2002) report that many professors in Europe and North America are adopting Web technologies, but limit the use to posting course syllabi and texts on the Web, and in these ways that they use Web technology to stretch the mold of large lecture courses. Rankin (2000) did a large survey on the use of course Web sites and Web-supported Web-based syllabi and studied 115 course Web environments from 23 institutions in the United States. Rankin concluded: "in spite of the growing number of students working with the Internet, most instructors have failed to take full advantage of the growing resources available to them Web-based" (p.41). Less than 50% of the courses provided something more then a copy of the syllabus that students previously got as a hard copy at the start of the course. Van der Veen, De Boer, and Van de Ven (2000) did a series of case studies in The Netherlands and also reported limited use of the available Web tools. Less than 30% of the available tools were used more often than once a week during a course.

Moving from usage data to pedagogical analysis, Mioduser and Nachmias (2001) looked at 500 educational Web sites to find out what pedagogical approaches were being used. They found that most educational Web sites support cognitive processes such as retrieving information or rote learning. Higher-level learning skills such as inference processes, problem-solving, and decision-making were much less present. Within the 500 cases less than 3% supported any real form of collaborative learning. "Only a few sites included feedback, either automatic (16.3%) or human (5.5%)" (p. 19). The researchers concluded that the potential of the new pedagogical forms are emerging out of unique features of the technology but are still far from being implemented in most educational Web sites.

Collis, De Boer, and Slotman (2001) confirmed this finding in an evaluation study in which activities and structured instructor-student communication (feedback) mediated by a Web-based course-management system were studied. They found that many of the courses in their sample had moved from an emphasis on lectures and a final examination or single large project, to an approach involving several assignments, each submitted via the Web environment and in many cases, receiving instructor feedback also through the same environment. In an analysis of 25 courses that used Web technology to make the courses more flexible eight different types of activities were identified. About 13 of the assignments focused on adding new materials to the course environment and 50% of the 31 assignments analyzed were group and/or problem-based activities. Table 4 shows the results of the analysis.

Table 4. Forms of assignments and feedback, Faculty of Educational Science and Technology, a sample of 1999-2000 courses (n=25) (Van der Veen, De Boer, & Collis, 2000).

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

It is interesting to see that the instructors predominantly chose the most labor-intensive sort of feedback (personal feedback given by themselves).

2.2.2.2 Web-supported learning is a part of a blend

Web-supported learning is thus most typically part of a blend of resources and approaches (De Boer, 2002; Collis & Van der Wende, 2002). This was the conclusion of the international study by Collis and Van der Wende (2002) and is supported by other studies (Bunjes, Ronde, & Wijngaarden, 2001; Jorg, Admiraal, & Droste, 2001; Veen et al, 1999; WRR, 2002). Although instructors have better connections to the Internet, and more tools as well as support is available, they still are building upon their traditional ways of teaching; again "stretching the mold". Face-to-face contact with students is and will stay very important. Traditional ways of teaching and learning are gradually being stretched but the available Web technology is used increasingly often for organizational purposes (including course preparation) and outside-classroom activities more than it is for communication and in-classroom activities. Face-to-face interaction and direct communication between instructors and students and among students is still very important in the ways in which instructors teach. Technology is used in a way which is complementary to this, but does not replace what traditionally has occurred in the teaching and learning process (De Boer, 2002). Table 5 supports these conclusions with an overview of how instructors teach their courses based on the data from the ICT international survey.

Table 5. Overview of how instructors teach their courses (De Boer, 2002) (N=347).

Features	Mean	SD
How much interaction with the instructor occurs in the course? (1=Very low, 5= Very high amount)	4.08	0.89
How much interaction among the students occurs in the course? (1=Very low, 5= Very high amount)	3.73	0.89
With what type of knowledge does the course deal? (1= Stable knowledge, 5= Newly emerging knowledge)	3.07	0.90
How are the learning materials used in the course acquired? (1= All predefined/ acquired by the instructor, 5= All found or created by the students)	2.80	0.94
Does the course involve the re-use of materials made by someone else or found elsewhere? (1= Not at all, 5= Very much)	2.78	0.98
How does the student participate in the course? (1= Individually, 5= As part of a group)	2.65	0.86
How much of the course is Web-based? (1= None, 5= Entire course is Web-based)	2.54	1.19
How does the student communicate within the course? (1= face to face, 5= Only via the computer)	2.22	0.85

Thus instructors value face-to-face interaction and direct communication between themselves and their students and among the students very highly. The use of Web technology is complementary to traditional ways of teaching and does not yet replace what traditionally has occurred in the teaching and learning process.

2.2.3 Conclusion: Gradual stretching, more organizational than pedagogical

Although there are many visions and possibilities with regards to the use of Web technology in education, the actual use of the possibilities is still marginal and as a complement to traditional approaches. Instructors are making basic use of available technology options, to support basic processes such as students writing reports, and transferring knowledge. Sometimes only syllabi are put on a Web site, and nothing much changes. Instructors are not really eager to change and still value the face-to-face interaction and direct communication between instructors and students and among students. Though new forms of the blend between the use of technology and traditional ways of teaching are emerging, instructors find what traditionally has occurred in the teaching and learning process still to be very important. The instructor is however gradually "stretching the mold" where technology use is part of his daily practices.

So far in this chapter Web technology in education has been mentioned in a general way. In the following section, the particular form of Web technology called course-management systems will be discussed in more detail, as these systems have become the integrated interfaces for many Web-based tools. In the next section the specific components of course-management systems and some experiences with these systems will be discussed. The relationship to stretching the mold and pedagogy will be a theme throughout the section.

2.3 CMS Options

There are many tools and functionalities supported by Web technology that could be used for educational purposes. In the last five years the course-management system (CMS) has evolved as a integrated combination of Web-based tools specifically focused on the educational support of distributing content and enabling communication and organization and pedagogical support within courses. Section 2.3.1 deals with the origins of course-management systems. In Section 2.3.2 the specific components that can be distinguished in these systems will be discussed and Section 2.3.3 will conclude with some experiences about the use of course-management systems relating to stretching the mold.

2.3.1 Origins and main elements of Web-based course-management systems

A subset of instructors in higher education have been using the Web for educational purposes since it was available (Collis, 1996). The pioneers did all HTML coding themselves. Applications of the Web for the delivery and/or support of information and communication related to the educational process has rapidly emerged, as when dynamic pages linked to databases became possible. With dynamic pages and databases the creation of self-made HTML pages by instructors became less common (Lee, 1999). Four lines of development that have influenced these database-driven course-management systems will be discussed in Section 2.3.1.1. In Section 2.3.1.2 the main elements and some definitions of course-management systems will be given.

2.3.1.1 Four lines of influence for CMSs

Four main ways of using Web technology based on previous orientations for computer support for learning can be differentiated. One line of development can be called the interaction line. Jonassen (1985) calls interactive and adaptive teaching and learning a major focus for learning and discusses design processes for educational computer software to support these orientations. Gilbert and Moore (1998) made clear that interaction is of great importance within education, but that the fear of instructors that interaction will be poor or not even possible within Web-based or Web-supported learning is not valid. The Web enables all sorts of social interactivity and instructional interactivity (Gilbert & Moore, 1998), such as greetings, socializing and exchanging personal information, or questioning, answering, and exchanging information with the use of tools such as e-mail, Web-based chat, and moderated discussions.

A second line of development relating to the use of Web-based technology within education is the use of knowledge-management systems, or educational multimedia databases (Hiddink, 2001). These systems can store and manage (educational) data in a structured way, where a main focus is on the reuse of the particular data (Hiddink, 2001; Perisco, Sari, & Viarengo 1992; Rada, 1995). The resources can be managed and are made available through the Web. A recent development in this field is the labeling of data that are stored in the databases underlying course-management systems (Collis & Strijker, 2001-2002; Duval, 2001; Strijker, 2001), so that users can store, find, and re-use particular learning objects.

A third line of development of computer technology related to education that is influencing CMSs is that of Computer- Based Training (CBT). CBT is a form of computer-aided learning that has been often used in the context of training since the 1960s (a summary appears in Al Najar, 2002). CBT programs offer a learning environment with different sorts of media (such as text, pictures, audio, and video) and depending on how they are designed can give learners the flexibility to make choices with regards to their learning routes as well as their places and paces of learning (King 1993; Parsloe, 1986). An assumption often was that no instructor was really needed. Later, some of these programs have been made available through the Web, but the focus stays on self-study and students working alone. The current CBT programs that are Web-based can provide comprehensive tracking and scheduling of a variety of learning components/activities (Barron & Rickelman, 2001). Pickles (2001) notes that for many people, Web-based learning still means 'courses' delivered to learners via pre-packaged units. In earlier days these were developed and stored on a multimedia CD and now, more recently, on a Web server.

The fourth key dimension of experience with computer support for learning that is influencing CMS relates to collaborative Web-based learning and tools for its support (Pickles, 2001). This use of technology enables groups of people to interact together; which can take place in 'real' time as well as asynchronously. Van der Veen (2001a) defines this group-based learning as “the series of activities in which groups of learners work together in order to complete a task” (p. 29). It can follow a pre-set program or structure, or it can be more open and flexible. Its use can encourage questions and answers among the students and it can be highly flexible. Web-based collaborative learning tools are now developing many of the characteristics of group-oriented classroom-based training but without the necessity for learners to be in the same physical room. This approach is similar to computer support for cooperative work (CSCW) through the Web (Bentley et al, 1997). Shared-workspace systems can be accessible though the Web and provide basic facilities for collaborative information sharing, using diverse sorts of documents and tools for making appointments and doing scheduling, among other group-related tasks. Oliver, Omari, and Herrington (1998) mention that Web-based learning environments for on- and off-campus students have focused on particular communicating approaches, such as discussion groups, use of chat rooms, and document sharing. In their approach they put the focus on an integration of such tools and adopt collaborative learning as their primary pedagogy. This is particularly appropriate for stretching the mold in that there are more opportunities to make the learning process more flexible when leting students make choices within (parts of) courses.

These four sets of influences for Web-based course-management systems can be integrated around two dimensions. The interaction systems can be seen as one end of a dimension, with the knowledge systems as the other end. The other dimension is that of informal, work-oriented learning versus formal, instruction-oriented learning. The four influences are visualized around these dimensions in Figure 5.

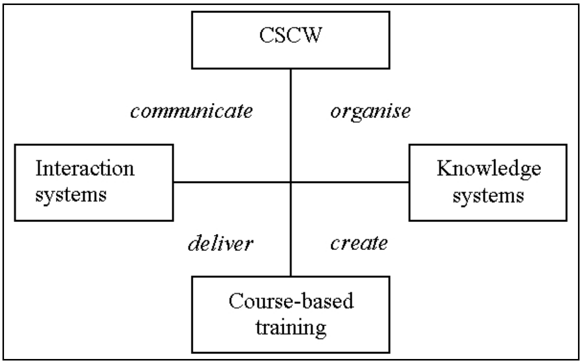

Figure 5. Influences on course-management systems.

Figure 6 shows that a course-management system is an integrated system reflecting in different ways and weights these four sets of influences.

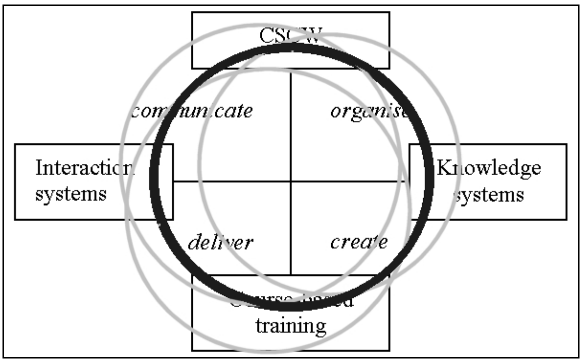

Figure 6. Dimensions in CMSs.

The circles represent the different sorts of CMSs. This visualization indicates that CMSs have different combinations of emphases, or backgrounds. The larger circle shows that there are also systems that integrate all of the dimensions. These systems are very flexible for educational use, particularly for different responses to stretching the mold in a course. In the next section this general analysis of CMSs in terms of their background influences will be followed by a more-specific examination of the components of CMSs in current practice.

2.3.1.2 Main elements within course-management systems

Barron and Rickelman (2001) define a course-management system as "a software program that is specially for the delivery and management of a finite amount of Web-based, asynchronous curricula" (p. 58). Collis and Moonen (2001) also give a definition: "A WWW-based course-management system is a comprehensive software package that supports some or all aspects of course preparation, delivery and interaction and allows these aspects to be accessible via a network." (p. 78). A more-general definition could be that course-management systems (CMSs) are Web-based database-driven systems that enable or support learning. A number of analyses are available of the sorts of tools and functionalities that can be integrated in such systems.

Bourne, McMaster, Rieger, and Campbell (1997) made such an analysis (although they use the term Asynchronous Learning Networks (ALNs) instead of CMSs). Functionalities they identified were based on computer conferencing for submission of homework; discussion of issues; provision of digital materials (syllabus, assignments, readings, problems, and interactive learning modules); management tools; and tools for interaction with students (using e-mail and list-servers). Such ALNs are most typically Web-based tools, functionalities, and systems.

The use of databases to organize content and users enables individual instructors to set up CMS environments that support or enable their courses. Robson (1999) mentions five common sets of functionalities offered by CMSs related to their underlying databases: Computer-mediated communication functionalities; navigational tools (organizational structures that tell students what to do and where to do it); course-management functionalities (keeping track of students and their records); assessment tools (such as via a Web-based quiz that returns immediate pre-determined feedback); and authoring tools (which allow instructors to upload and organize material, create discussions, create and edit on-line quizzes, and otherwise control the features offered by the environment). These results are similar to those coming from the analysis of Collis (1999b) who found five main purposes of using teleware (a broad term for Web-based tools, resources, and systems): publication and dissemination of information; structured communications; collaboration; information and resources handling; and support for course delivery.

The overviews of Robson (1999) and Collis (1999b) can be used as resources for a general overview of main elements that can be found in course-management systems. Table 6 shows an overview of what characteristics different researchers have found and relate these to the structure of content, communication, and organization tools within a CMS.

Table 6. Characteristics of course-management systems.

	Creation	Content delivery	Communication	Organization
Nachmias & Tuvi (2001)	Manipulation of information & creation of content environment	Instructional delivery	A communication facilitator	
Robson (1999)	Authoring tools, assessment tools,	Navigational tools, assessment tools,	Computer-mediated communication functionalities	
Mioduser & Nachmias (2001)	Resource-creation support	Content delivery, instruction delivery	Communication support	
Collis (1999a,b)	Information and resources handling	Publication and dissemination of information	Structured communications; collaboration	Support for course delivery
Droste (2000)		Subject-matter delivery	Communication support	Organization support
Collis & Moonen (2001)	Information management	Computer-based learning	Communication-system, groupware background	

The overview shows that CMSs can be characterized by communication support, and organization and creation/ content-delivery components. These elements originate from the systems that influenced and have lead to the course-management systems (see Figure 5 and Figure 6). The particular characteristics of these types of options in Web-based course-management systems will be described in the next section.

2.3.2 Options in Web-based course-management systems

What are the options in Web-based course-management systems? In this section Web-based options will be described, and the characteristics of various functionalities defined. Web-based options will be described in three groups of components: Creation and delivery of information/educational content (Section 3.2.2.1), (enabling communication (Section 3.2.2.2), and course organization (Section 3.2.2.3). Each group has an overall inventory of options that can be implemented in CMSs.

2.3.2.1 Creating and delivering information/educational content

Options or tools in a CMS for content creation can present information in several formats including HTML pages, PDF-format documents, PowerPoint sheets, and Word documents (Robson, 1999). An instructor can use the documents that are made with programs (editors) he uses already and easily put the documents in the CMS, without having substantial (editing) work. These options save considerable work for instructors, and they can easily provide more course materials for their students.

There are also options or tools in a CMS that can deliver multimedia resources (Collis & Peters, 1999). Audio and video can be recorded and digitized. Servers with appropriate digitized audio- and video-handling capacities can stream the audio and video to a client, so that the user can watch and hear the media through the Internet without having to wait long periods for downloading entire audio and video files and with less bandwidth problems. These options make it easy (depending on bandwidth) for audio and video segments to be used in Web-based learning environments, for example saving (portions) of course lectures. Students can review interesting parts of given lectures, which can be seen both as an enrichment and flexibility improvement for the students and instructors. This can also contribute to stretching the mold.

Course-management systems enable automatic posting of input data (Robson, 1999). In an automatic entry, instructors and students can put data into a form on a Web-page and submit the form. The data will automatically show in an output page, which can be available for students and instructor. Additional information can be added to the output page, such as the date and time the author submitted the form.

Many kinds of content can be posted and structured in the course-management system (De Boer & Hamel, 1998). For example the course provider and/or instructor can create a searchable glossary of terms, and links from different portions of the course environment to the glossary entries can be added automatically by the database (under the control of the designer). Articles, web-links, pictures, or simulations can be uploaded and linked.

A number of systems also offer possibilities to create on-line exercises and tests (Landon, 2002; Landon & Robson, 1999). Exercises and tests can be written by the instructor and delivered on-line. Once completed and marked, the grade assigned can be, along with comments, made available to the student. A status page can be available to indicate for each student whether that student has completed an activity. A completed activity, along with an indication of how long the student took to complete the activity, can be made available in the CMS.

2.3.2.2 Communication tools

Options or tools in a CMS that can be used for communication include e-mail, discussion lists, chat, co-operative workspaces, and Internet conferencing (Looi, 2001). Messages, usually text, can be sent from one person to another via the CMS. E-mail can also be sent automatically to a large number of addresses using a mail list (or mailing list). This is a (usually automated) system that allows people to send e-mail to one address, whereupon their message is copied and sent to all of the other subscribers to the mail list. In this way, people who have many different kinds of e-mail systems receive and respond to the same messages. When the mail system is integrated in the CMS, the messages can be searched based on the sender, content, and the date of sending, as in the bulletin-board option described next.

A bulletin-board tool is a computerized meeting and announcement system that allows people to carry on discussions, upload and download files, and make announcements without the people being connected to the computer at the same time (De Boer & Hamel, 1998; Looi, 2001)). Articles can have embedded URLs, which are clickable. Pages of content can automatically have a dedicated discussion forum so those questions about a page are easily found later for reference. When a message is posted directly from a content page, the reader can click on the message subject to present that page in a separate window.

Internet chat is basically a multi-user live communication facility. Anyone can create a "channel" and all others in the channel see anything that anyone types in a given channel. Private channels can be (and are) created for multi-person conference “calls”. The interface shows the chat channel and the names of participants.

A co-operative workspace, such as BSCW (GMD, 1997), enables collaboration via WWW environments. It is a ‘shared workspace’ system, which supports document uploading and downloading, event notification, and some sort of group management.

Internet conferencing can be used to connect one person to another for actual voice and video communication. Rather than by typing, a phone option can be left on, so that a student can page the instructor when he logs into the Web-based environment, or to let a group of people talk together. Web-based conferencing tools typically have program-sharing facilities.

The communication can thus be real time, with the chat and the Internet conferencing tools, or can be asynchronous, as with the email, the workspaces, and discussion lists. All possibilities have their own characteristics and advantages for specific use.

2.3.2.3 Course organization tools

Options or tools in a Web-based learning environment which deal with the organization within a course can include a calendar tool (Collis & Moonen, 2001; Landon, 2002; Robson, 1999). CMSs support the organization and management of Web-based teaching and learning (Oliver & McLoughlin, 1999). Functions of the particular system in use should be efficient and effective in use. A calendar (such as a daily planner) that can handle entries (including information, start and end times, and links) can be added. The instructor can make entries (for all course participants to view) or entries only visible to a group of persons.

Within the course-organization portions of a CMS instructors have options to administer and manage learning (Oliver & McLoughlin, 1999). A progress-tracking tool is commonly available. Progress tracking allows the instructor to maintain an overview of student progress in the course. An administrative overview can be given for every student with scores, attendance data, and results on assignments. This can be available for the instructor, and it can be possible that the students are allowed to see their own data.

Course-management systems allow many possibilities for co-operation, interaction, storage of important data and interactivity, all with the computer through a Web interface (client). The current CMSs contain many different tools and the overview here is only a selection of the most-common options. CMSs have been used now within higher-education institutions for some years, since 1997, with experimentation before that. As with pedagogy, there may be a gap between potential and practice. It is interesting to see what is actually done within these CMS course environments and to some extent, how the particular tools are being used. This is discussed next.

2.3.3 Experiences in the use of CMSs and their tools

Course-management systems are becoming commonplace in higher education (De Boer, 2002). Implementation is growing, and many instructors have adopted CMSs (2.3.3.1). On the other hand, their use is qualitatively limited and the focus seems to be on organization and resource options within the CMS (2.3.3.2) rather than flexibility relating to pedagogy. This section will end with some conclusions about the experiences in use of CMS (2.3.3.3).

2.3.3.1 Implementation is growing, instructors have adopted CMSs

The implementation and use of CMSs is high in The Netherlands compared to other countries (Bunjes, Ronde, & Wijngaarden, 2001; De Boer & Boezerooy, 2003). All the traditional universities in The Netherlands have implemented a form of CMS, either at an experimental level, as a pilot, or already institution-wide (Bunjes, Ronde, & Wijngaarden, 2001). In 70% of the institutions for higher vocational education a form of CMS has been implemented. It is interesting to see that in 50%

of these higher-education institutions more than one CMS has been implemented. The most popular systems currently are Blackboard, WebCT, and Lotus Learning Space (Droste, 2002).

The use of course-management systems is growing very rapidly in countries outside of The Netherlands. Morgan (2003) interviewed 100 instructors in several higher-education institutions in the United States that made use of CMSs. She concludes that the implementation of course-management system is extensive, and is still growing. The purposes for which it is adopted are varied. She found the following factors playing a role in driving instructors' adoption of course-management systems:

- Through a particular teaching problem or a pedagogical challenge. (34.3%)
- Through training offered. (28.5%)
- Through influence of colleagues. (13.6%)
- Administrators or department decision. (7%)
- Student requests. (3.15%)

In many cases faculty (instructors) have the option to start using the CMS when the institution makes it available. Most instructors then start to use a CMS themselves based on their own individual decisions. This is interesting to see, because this is in fact a bottom-up approach where technology and facilities are most of the time made available by the institution but the instructor is the one making the end decision to actually use the CMS. This is of course not always the case, as Droste (2002) and Verstelle and Benthem (2002) show in their descriptions of the implementation of CMS in The Netherlands: CMS can also be implemented institution wide through policy or management.

In an exploration in which the implantation of a technological educational innovation was the focus of research the experiences of ten institutions who presented their experiences in case studies were compared (see De Boer & Collis, 2001a). In most cases (six) the university board or the dean was concerned in the decision and enabling of the educational innovation concerning the use of Web-based systems. In four cases a small group of innovators or pioneers were the main initiators. The way the innovation was implemented was very different among the cases. A more top-down implementation was applicable in four cases, bottom-up in three cases, and a combination of these in another three cases.

Instructors see and expect that a CMS can help them with several organizational and communicational tasks and help them providing course materials. It is interesting to see what instructors think of the CMSs as environments for these tasks. Morgan (2003) reports that tools such as a grade book (course administration) were seen as very important by instructors, however, they found the gradebook tool in a particular CMS to be inflexible, difficult to use, and limited in its functionality. Instructors were more positive about the use of the discussion tool for Web-based discussions in their classes and the possibilities to provide students with additional course materials. Morgan (2003) notes that only a small minority of the instructors used the CMS in a way to enable more complex pedagogical approaches. (Information about the use of a CMS at the University of Twente will be given in Chapter 4).

The international survey (Collis & Van Der Wende, 2002) gives more specific insight into the actual use of the various available tools and applications available in a CMS. Table 7 shows to what extent support staff responding to the survey estimate that instructors use the following technologies in their teaching practice (De Boer, 2002). The first column of the table indicates which of the tools can be part of a CMS.

Table 7. The extent to which support staff estimate that the following technologies are being used within the institution (De Boer, 2002).

Can be part of a CMS?	Tools used (N=132-148)	Mean	SD
	Information presentation tools	3.53	1.19
	Personal bookmark collections	3.37	1.37
yes	Authoring tools	2.74	1.15
yes	Course planning tools	2.63	1.15
yes	Newsgroups	2.58	1.13
yes	Instructional design tools	2.52	1.21
yes	Testing tools	2.21	1.01
yes	Tools for analysis and tracking student performance	2.20	1.17
yes	Chat	2.19	1.11
yes	Groupware	2.17	1.10
yes	Whiteboards	2.13	1.14
yes	Tools for on-line marketing	1.95	1.01
yes	Desktop video conferencing	1.70	0.86

1=very uncommon, 3=somewhat, 5=very common

Course-management systems contain most of the tools that are mentioned in Table 7. The personal tools for instructors (such as information-presentation tools and personal bookmark collections) are also commonly used. In contrast many of the tools that can be part of course-management systems are uncommon or only somewhat used. De Boer (2002) reports that in general there are only minor differences between countries in the use of CMSs, with the use of CMSs in Finland significantly higher ($p<.05$) than the average among the nine countries responding to the survey, while within Germany it is significantly lower ($p<.05$). The use of CMSs in The Netherlands is also statistically significantly higher then the international average ($p<.05$).

2.3.3.2 Use of CMS focus on certain options

In the evaluation study by Morgan (2003), she looked at many course sites of courses that used CMSs. She concluded that some tools within the CMS are much more-often used than others. The tools that focus on the placing of syllabi and static content are most popular. Use of communication tools such as discussion boards, the grade book, and quiz tools are much less extensively used. In Figure 7 a diagram shows the use of particular tools within the CMS at the University of Milwaukee as reported by Morgan.

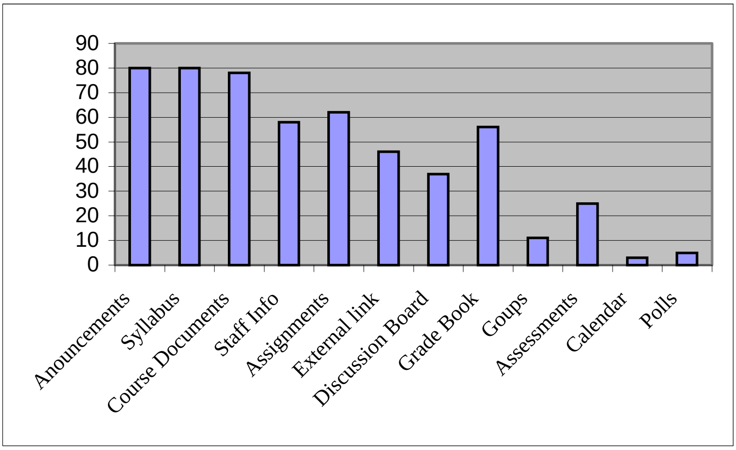

Figure 7. Use of different CMS tools (Morgan, 2003).

Morgen looked at a number of other institutions and found similar use patterns of CMSs there. Similarly, Van der Veen and De Boer (1999) did an evaluation of the use in practice of CMSs at several universities in The Netherlands. A number of courses were evaluated, within three institutions and with three different CMSs. Table 8 shows the parts of the CMSs that were used most often and the purposes for their use.

Table 8. The parts of the CMSs within three educational institutions in The Netherlands which were most used, (scores higher than 2.3 on a 1 to 5 scale) (Van der Veen & De Boer, 1999).

Institutions Tools	A	B	C
Email for submissions		X	
Discussion / announcements	X	X	
Schedule / roster	X		X
Place resources			X
Read pages			X
Search	X	X	
Progress overview	X	X	

A number of tools available in the CMSs were left out in this overview, as they were only used in a very limited way or not at all. The study also showed that only some tools and educational activities were used in the evaluated cases. Thus use of the

CMSs was only moderate in its variety or extent, stretching the mold seems to be just started.

A study of Gommer and Visser (2001) of 60 courses that used the TeleTOP CMS at the University of Twente shows similar results. They found that the environments were mainly used for the dissemination of information and much less for communication options. The CMS was used to help students prepare for learning and to orientate on course content and class sessions. It was less-often used for giving feedback, monitoring activities, and giving assessment. The researchers concluded that the use is very basic, and interesting possibilities to enrich or make learning more flexible were not generally known and/or used. Thus stretching the mold was at a beginning level.
The CMS used at the University of Twente was also evaluated within the Faculty of Educational Sciences. In one evaluation study of the use of the different options within the TeleTOP CMS, De Boer and Collis (1999) report on the use of the tools within 21 courses. The organizational tools were used extensively, as well as the tools to place resources into the CMS. Communication options were less popular. Messing (2000) reports similar results after an evaluation study of the use and usefulness of the same CMS in different faculties of the same university one year after the De Boer and Collis inventory. He found that the tools that were used the most were also valued highest. More about the evaluations within the University of Twente is given in Chapter 4.

2.3.3.3 Conclusion: CMSs are used, but not optimally

The evaluation studies show a general pattern. Instructors limit their use of CMSs, and focus on only some of the available tools. Instructors use the CMS to place syllabi and static content, do some course administration, and make announcements, but are not using the communication tools such as discussion boards and shared workspaces.

The use of CMSs is increasing, but instructors are struggling with them. There are many opportunities to use a CMS, and a number of instructors have particular ideas and needs. In practice, the use seems to be limited to marginal use of only some of the available tools. What could be the problem? Stokes (2001) states that end-users in education (students and instructors) are still waiting for “learning providers to develop easier to use, more flexible e-learning solutions” (p. 1), using CMSs as flexible tools. There are more problems. Collis and Gervedink Nijhuis (2000) found that instructors have many problems with regard to the use of CMSs in their courses. They identified management tasks and problems, technical administration, monitoring, communication, assignment handling, and preparation problems. To get more detailed insight in these problems, the problems and concerns for instructors that teach with the use of a CMS within a stretching-the-mold scenario will be discussed in the next section.

2.4 Instructor Needs for Using CMS for Stretching the Mold

In Section 2.1 it was concluded that higher-education institutions are gradually "Stretching the Mold" by offering more flexibility within courses and programs as well as opening possibilities for students to attend regardless of location. In Section 2.2 new pedagogies were introduced related to stretching the mold and in Section 2.3 CMSs as the form of Web-based technology most associated with stretching the mold were discussed. It was concluded that although they are gradually making use of CMSs, instructors are still struggling with new technology and pedagogy if they wish to go beyond the first steps of stretching the mold.

Instructors have to deal with new students, new technology, and new pedagogies. All of these are part of a blend, as stretching the mold emerges and makes learning and teaching more flexible and student centered. But what specific problems and concerns do instructors have? This section deals with these instructor needs. It begins by positioning instructor concerns within the larger context of some general implementation issues relating to CMS use and stretching the mold within the organization (Section 2.4.1). The need for a clear educational goal for the use of a CMS is important for the instructor (Section 2.4.2) and the need for the CMS to fit with the familiar educational approach and climate in the institution, at least at the start of Stretching the Mold, is discussed (Section 2.4.3). CMSs should be flexible and have a high quality or else instructor concerns will increase (Section 2.4.4). Concerns of instructors with regards to their new roles and about time-management issues will be discussed in Section 2.4.5. This section will be concluded with an overview of the main problems and concerns facing instructors as they deal with new cohorts of students, new pedagogies, CMSs, and stretching the mold (Section 2.4.6).

2.4.1 General implementation issues and their relationship to instructor concerns

Problems and concerns of instructors with respect to CMS-supported teaching and learning relate to the wider implementation process in which a complex system such as a CMS is introduced and supported within the institution. Visscher and Fung (2003) found four managerial and organizational variables that determine the usage and impact of another type of complex technology, a School Information System (SIS) used in primary schools. Their analysis can also be used for studying the use and impact of CMSs in higher education as well. The groups of variables are: quality, use, implementation process, and the school organization. First the organizational aspects will be discussed.

There are many ideas about how innovative changes, such as responding to new cohorts of students, new roles for instructors, and new technologies, can be approached. It is important to note that the changes are significant and all the problems and concerns will not be addressed by one answer. A development approach in which the institutional culture, structure, and behaviour change together will however generally be the case (Boonstra, 2000). Droste (2002) discusses whether the implementation of CMS in higher education involves second- or third-order changes. These levels differ in the way that while second-order changes have a more-or-less fixed result, third-order changes are less specified, and reflect the not-one-solution aspect. Because changes in higher education are still occurring at a reasonably modest rate, Droste decides that second-order changes are most appropriate in terms of implementation goals. This would be illustrated by a stretching-the-mold orientation with a specific focus on certain types of flexibility. A problem could be that the model for this more-fixed 'solution' is not very clear for instructors.

As Visscher (1995) indicated, the institutional management is a critical factor in the likelihood that appropriate implementation methodologies will be carried out. In the initiation phase of defining what educational scenario to choose to relate to the introduction of a CMS, the management has the role of setting up or guiding the initiation processes. Often little extra time and money is made available, while the willingness to re-allocate funds is not only a necessary strategy if technology-based teaching is to become a core part of a university's operation, it is also a measure of the level of commitment to the concept by different organizational units (Bates, 1997; Ellis, 1999). The management should therefore also acknowledge that change will take time and will require financing through this time. Hall, Thor, and Farrell, (1996) agree and state that changing roles for instructors need to be supported by the vision of the institution and therefore also in how the management develops and implements incentives and reward systems. Without such a vision and associated financial and policy support, instructor concerns and problems are likely to increase as they have to try on their own to respond to new demands of increased flexibility from students.

Important aspects in managerial support relate to the key requirement that the organization knows where it is heading and its management supports the change by effective communication and facilitation of the change. Collis and De Boer (1999a) and De Boer and Collis (2001a) indicated ten key dimensions related to the implementation of Web-based technology in higher education. These were: Initiation target; Innovative culture; Key figures to initiate; Educational target; Fit with instructional practices; Budget; Quality hardware/network; Build/buy software/ hardware; Project team; Top down & Bottom-up; Embedding of use; Structural support group. These parallel the set identified by Muntslag (2001) which includes vision, sponsorship, communication, integrated change organization, and education and support. Although these dimensions are all of importance for the use of a CMS within higher education, the first four dimensions on Muntslag's list will not be subject of further study within this research, as the scope would become too wide. The emphasis here is on instructors and issues related to their daily practice. The main problems and concerns that are addressed here are the educational goal, fit, and time issues, both with regard to technology use and managing new pedagogies. These problems and concerns are discussed further in Sections 2.4.2-2.4.5.

2.4.2 Instructors' concerns relating to a clear educational goal

Instructors will have problems with CMS use if the reason for this use in their educational practice is not clear to them. Visscher (1995) noted that a clear goal is a necessity for introduction and utilization of an ICT / telematics application in an educational institution. Plomp, Feteris, Pieters, and Tomic (1992) and Fullan (1991) note that the educational target is an important change entity and differentiate four aspects of such a target: relevance, clarity, complexity, and quality. With respect to relevance and clarity, it is important that those involved with the change know what the goals of the change are and also recognize the importance of the change. Rogers defined an innovation as “an idea, practice, or object that is perceived as new by an individual or other unit of adoption” (1995, p. 11). He also notes that an individual (or other decision-making unit) needs to form an attitude toward the innovation, decide to adopt or reject it, and then implement this decision (Rogers, 1995).

One way that an institution can help instructors deal with their concerns about the target or goal for CMS use is the technique of "visioning". Bates, (1997) talks about visioning as a "technique that allows those working in an organization to understand the full range of possibilities for teaching and learning that technology can facilitate, and the possible outcomes, acceptable or otherwise, that might result from its implementation. The technology infrastructure plan should be driven by, not lead, the university's overall vision and strategy for its teaching” (Bates, 1997). Bates (1997) also mentions that the (educational) target should not be the use of possible techniques and technologies in themselves, but the techniques and technologies should serve the educational changes that are to be initiated.

Instructors therefore need to know what educational target they are aiming at, in order to make good decisions. The focus can differentiate between organizational options in order to offer flexibility, or new pedagogies, or a combination of these. Without institutional clarity, instructors will need to develop such particular targets for themselves, which can lead to problems and concerns, or alternatively, to lack of consideration of targets at all.

In addition to variations in the extent to which an educational target is well defined, the target for the use of a CMS can itself vary from institution to institution. With TeleTOP (See Chapter 1 and Chapter 4) at the University of Twente, for example, the target was to enable the C@mpus+ approach (Carleer & Collis, 1998), whereby part-time, working students primarily at a distance can participate equally and fully with on-campus students in course activities. In contrast, at Lincoln University in New Zealand, the educational target was to increase the engagement of students in active-learning experiences (Hunt, 1999). Veen and Tartwijk and their colleagues (1999) found that most institutions in The Netherlands initiated Web technologies in their organizations with motives relating to educational innovation in a broad sense rather than with targets relating to raising levels of effectiveness and efficiency in the teaching and learning process.

Even when institutions make a strong commitment to a CMS implementation, they may not base this commitment on a clear educational target. De Boer and Collis (2001a,b) found in ten case studies of institutions with institution-wide implementation of a CMS that only one of them had a clear and measurable educational target for the use of Web-based technology. The rest saw CMS implementation as related to strategic choices but not in an overall and measurable sense. Educational targets that were found were: More group-based learning (three of the ten cases); more-active learning (three cases); project work (one case); and learning by problem solving (two cases). Flexibility in learning was mentioned in two of the cases, in terms of distance flexibility (external flexibility)

Even when the management adopts external-flexibility goals, the problem of communication with instructors remains. Van der Veen, De Boer, and Van de Ven (2000) reported that institutional goals for a CMS aimed at time and location flexibility for students are not always clear for the instructors. Again, without a clear direction about goals, instructors are likely to drift into a level of usage of a CMS that may or may not relate to the emerging needs of new cohorts of students. Stretching the mold will gradually emerge, but without a clear sense of direction.

The educational goal can therefore relate to many different dimensions. External flexibility seems a very important one in practice, whereas targets related to changes in pedagogy to improve the quality of education are other or complementary change targets. Contextual issues relating to problems and concerns of instructors with regard to pedagogical changes often relate to the fit of the proposed change with existing educational practice. The idea of educational fit is discussed in the next section.

2.4.3 Educational use and fit

In Section 2.1, the Stretching the Mold Model has been indicated as a major model within current and future higher education. The new cohorts of students are a very important factor in the transition from Back to the Basics to Stretching the Mold. Instructors need to know that their target group is changing from a more-or-less homogenous group to a group that is much more diverse. Students are not always on-campus, are older, more experienced, have clearer objectives, and more specific needs than cohorts of previous decades. Garland (1993) identified several potential barriers for distance-education students, which also become problems for those students that now use Web technology regardless of location. Garland (1993) mentioned the need for a rich and high quality-learning environment, with possibilities to get support from peers. Goals, time-management strategies, and learning approaches should be communicated very well and sometimes adapted for students. Making changes in instructional approach to relate to the needs of these new cohorts of students is a major concern for instructors. In a Stretching the Mold approach, the changes are not, initially, radical but rather gradual.

An instructor that starts to use technology to stretch the mold of his course to better serve new cohorts of students will most of the time start with his own ‘traditional’ course. Redesign can be a difficult process. The characteristics of the CMS are important. Visscher (1996) indicates that a technological system should have a high success factor in early usage. For example, an instructor should be able to get started quickly and successfully with a small and orderly part of the CMS in order to support some aspect of flexibility increase within the "mold" of his traditional course.

How well the instructor perceives that the course-management system fits his or her established instructional practices is a major determinant of the instructor’s subjective reactions (see House, 1974, for relevant comments about earlier technologies). It is not always clear if the implementation strategy that an institution carries out with respect to use of a CMS emphasizes such a fit. De Boer and Collis (2001a) report that only three of ten cases that they analyzed focused on finding a fit with the instructional practices familiar on the organization. In three other cases the innovation did not seem to fit in with the existing instructional practices, and in another four cases there seemed to be only a partial fit.

Laga, Clement, and Buelens (2002) mention that instructors have certain concerns when new technology is introduced which will increase if educational fit is low because then not only are new tools involved but also new pedagogies. They quote Fuller (1969) and indicate that first a self-oriented concern, (What does this technology mean for me?) occurs, followed by a task concern (How can I work with this new technology?), and only later an ‘other’ concern (How can it help/improve my students?). An instructor will go through these phases, and only in the last phase is the student actually at the center. In practice, instructors seem to get to and then remain in the second phase: How can I work with this new technology? The Concerns-Based Adoption Model (CBAM) is a model for change in individuals (Hord, Rutherford, Huling-Austin, & Hall, 1987) and also deals with these questions. The questions are reflected in the international survey data from the study led by Collis and Van der Wende (2002, See Section 2.1.2). Within this, De Boer and Boezerooy (2003) report that instructors indicate that their experience in using CMSs in their teaching is still somewhat occasional. Despite this, instructors indicate that the use of Web-based technology in their teaching has already led to some changes in their teaching but if these relate to the 'other' concerns of Laga, Clement, and Buelens is not clear.

When instructors can reach the 'other' level, students appreciate the use of technology to make learning more flexible. Biesheuvel (2001) found in an evaluation study that distance students that participated in a flexible program valued the use of a CMS very highly, especially when instructors used the system in a structured and consistent way. Some instructors however did not use it very well, or did not use the variety of options that the system offered that could help the students in their learning. The students valued these courses less than when the CMS was used in a structured and consistent way. Structured and consistent use of a CMS is partly a result of the design decisions of the instructor, but also is a function of the characteristics of the system itself. This leads to another set of contextual aspects that are related to instructor problems and concerns.

2.4.4 Instructor concerns related to CMS characteristics

In order to fit with stretching the mold, Appelt, Hinrichs, and Woetzel (1998) argue that CMSs should be configurable by instructors in order to meet the personalized requirements for optimal use of the system in their working practice. It is interesting here that the instructor's perceptions of the quality of the system based on his or her experiences with it will have a larger influence than objective criteria on the likelihood of the instructor's acceptance of the system (Van der Veen & De Boer, 1999). If the instructor has problems with the use of the system, he is likely to avoid non-required use.

Stokes (2001) reports that the ease of use of a CMS should be a major decision argument for the choice of a particular system. Learning to work with the CMS should not take instructors much time, and the system should be easy to integrate into existing courses. It is important that the system can adapt to the way that an individual instructor wants to work, even as the instructor too will need to make some adaptation in his or her typical teaching practices. Morgen (2003) shows that instructors do feel this is important. She reports that the instructors she interviewed were negatively disposed towards the use of CMSs because of their perception that CMS use leads to highly structured courses. This has a negative influence on their sense of control and creative use. Morgen also emphasizes the ease-of-use aspect for CMSs. When instructors do not understand how the system is used, they perceive a loss of autonomy. CMSs therefore should be flexible and easy to use, which is also one of the main findings of in the research of Collis, Peters, and Pals (2000) in their 4E Model research. They conclude that environmental factors and the simplicity of an educational technological system determine to a great extent the threshold for use. And as House (1974) already noted some decades ago: The extent to which it takes the instructor time and energy to make the change (i.e., in the current context, to learn how to use the course-management system) is an useful index for the amount of resistance that will occur to the change.

The ease of use therefore reflects the design of the interface. McGraw (1995) emphasizes the importance of the design of the system in terms of the amount of support that a user will need. "The better the system (the CMS) and its human-computer interface is designed, the less performance support will be required" (p. 13). It is also important that the CMS is task-based. Raybould (1995) talks about performance-centered designs, where the interface of CMS focuses on the user (the instructor) as a performer, rather than only a user of a system. He notes that this also relates to 'good systems design'.

2.4.5 New roles, time issues

Thus the roles for instructors gradually change, as new possibilities in CMSs and pedagogy emerge and new cohorts of students enter the higher-education institutions. The use of technology in courses is most times part of a blend of methods and resources of different types (De Boer, 2002). Gay (1997) found that an instructor must be better organized than an ordinary classroom teacher when handling more-complex blends of resources and methods. Additionally, an instructor must be at ease with new technologies such as CMSs, and not let them dominate when teaching a course. Instructors are being called upon to collaborate more, be potentially constrained in some aspects of their academic freedom, become facilitators instead of lecturers, and learn to work within and with the new learning environments (Guri-Rosenblit, 1998). To get the instructor on a higher professional level with regards to the use of CMSs to serve 'new' students, the attitudes of the instructors, their computer-use skills, and the perceived added value of the CMS compared to practice without a CMS need to be positive and high (Roozen, 2002).

New roles, new technologies, and new pedagogies lead to a number of concerns for instructors. Fisser, Van de Kamp, and Slot (1999) found in an evaluation study that 50% of the instructors interviewed expected that the amount of time it would take to prepare a course, using a CMS, would increase. Instructors indicated that it also would take students more time to complete the course. It was expected that the frequency of interaction with students would be increased, whereas the frequency of interaction through face-to-face contact would be the same. The instructors believed that the quality of interaction should either stay the same (40%) or increase (50%) because of these new methods.

The time issue seems an important concern (Collis & Gervedink Nijhuis, 2000; Collis & Messing, 2001). The Task Force on Learning Technologies of the Council of Ontario Universities (COU, 2000), gives a list of concerns that explain instructors' reluctance to use learning technologies in their teaching. An important concern was that of time pressures, meaning lack of adequate time to prepare, time taken away from other tasks, and lack of incentives to spend time on new pedagogical approaches or new uses of CMSs (See also Gervedink Nijhuis, 2003). Thus time and management concerns related to using a CMS for stretching the mold are important issues for instructors.

2.4.6 Summary: Instructor needs within the stretching-the-mold context

To successfully implement a CMS within an educational institution where stretching the mold is developing, it is important that the educational target is clear, that the materials (in this case, the CMS) should be easy to use and perceived as practical to the instructors, and that the management should be committed and seen as committed to the change. Management has to provide time and money and support for the change. Technology should be of high quality and implementation of it should be focused on clear goals. Instructors should get possibilities to professionalize and learn how to use the technology to better serve new students. The instructors need to know what pedagogical approaches are suitable for their courses and students and how much time new forms of teaching involving CMS use will require. New pedagogies should relate and build upon those which the instructors are used to. New technologies and pedagogies are part of a blend for stretching the mold. The use of the CMS and the related pedagogies to open and stretch the mold lead to the following main questions for instructors:

- What are the characteristics and needs of my students?
- What options are available within the CMS?
- What 'types' of pedagogy are available?
- How can I best use the CMS and pedagogies in my educational practices to provide a form of blended learning that would suit the needs of my students?
- How does this relate to my current teaching practice? How much time will it take me?

Although many aspects influence a successful implementation, the main focus in this research will be the support for instructors in response to these major questions. The instructor that teaches within the classroom orientation (Gustafson & Branch, 1997), still the majority within higher education, has to adopt new roles as the new models for universities and new students, such as the "stretching the mold" model, emerge. Instructors need to be supported in such a way that instructors have sufficient technical skills and that builds on and stretches educational practices with which they are already comfortable. Instructors should be able to build on small positive experiences in working with the system. Earlier experiences (problems and solutions) should become known to them, so that instructors can identify and choose among pedagogical and technical options and possibilities. In that way instructors can work with a CMS in their courses and make good decisions with regards to the options in organization, pedagogy, available tools within CMS, and communication to support or deliver their courses in an optimal way. For all this to occur, forms of support need to be available for the instructors.

Based on these new roles for the instructors and related problems and concerns, issues and options related to instructor support will be discussed in the following section.

2.5 Issues Related to Instructor Support for Stretching the Mold

Reasons contributing to the emergence of the Stretching the Mold Scenario , the options of a CMS that can support this stretching, new pedagogical models related to this, and the new roles for instructors and their concerns and problems as they explicitly or implicitly deal with stretching the mold have been discussed. The question examined in this section is how to support instructors in such a way that implementation of a stretching-the-mold of courses with the use of CMSs will be successful. In Section 5.2.1 issues related to support and types of instructor support will be discussed. In Section 2.5.2 experiences with regards to instructor support will be examined.

2.5.1 Instructor support: Teams and types

In this section support teams for instructor support will be discussed (Section 5.2.1.1) and the types and characteristics of support and their ability to address instructors' problems and concerns (Section 5.2.1.2) will be examined.

2.5.1.1 Support teams

Instructor support for a Stretching-the-Mold Model in higher education is of great importance, as the roles of instructors are changing and with this related problems and concerns are developing. Instructors should not only have support with regard to the use of the technology, but primarily on how the innovation can become a part of their training or teaching repertoire in the context of change orientation such as stretching the mold. "Concentration on technology to the exclusion of human factors is a prescription for failure" (Dooley, Metcalf, & Martinez, 1999, p. 114).

One question is how to arrange such strategic support? A typical way in higher education to facilitate instructor support is through a support team that could work both responsively and proactively to coordinate and lead all the on-going activities. Bates (1997) identifies three kinds of support teams:

1. A technical-support team: The people who make the networks operate and service computers and software systems such as CMSs.
2. A media-production and services team: The people who produce educational products or supply educational-technology services, such as interface designers, graphics designers, video-conferencing managers, or graduate students who create Web-based products.
3. An educational-services team: Those who offer support for instructional design, faculty-development workshops and courses, and evaluation.

CMS use for stretching the mold can be a focus of each of these different sorts of teams. However, within this broad range of support through support teams, technical support is a basic condition; no CMS can be implemented without good software, hardware, and network infrastructures. Thus the first type of support team is a necessary condition for instructor support. The services of a media-production and services team are less-frequently used. As most instructors in higher education design their courses in the classroom-orientation model (Gustafson & Branch, 1997, p. 30) where the instructor himself carries out all aspects of course design and delivery, there is usually no production team to assist an instructor in the production of learning materials. The instructor will be his own educational-production team, responsible for the media resources that are used in the CMS for his particular course. Although this may sound difficult, most CMSs are designed in such a way that instructors can actually do these kinds of media-production activities as long as they stay with easy-to-handle resources such as PowerPoint presentations or Word files. The third type of support team that Bates (1997) mentions, educational-services teams, can also offer pedagogical support. This kind of support is definitely needed in a Stretching-the-Mold context, as can be concluded from Section 2.4.2 (Problems and concerns), but how can this type of support be organized? The following section addresses this question.

2.5.1.2 Types and characteristics of support and their ability to address instructors' problems and concerns

In this section, four aspects of types and characteristics of support are considered. These include types of support, influences on the choice of support, and instructors' concerns about support.

1. Types of support. Some common alternatives for types of support include:

- Ongoing training in the form of regular observations of a master teacher, training in the use of the new technologies, and the chance to network with other instructors on course progress (Gay, 1997).
- Workshops and training, most likely undertaken in small groups (Ellis, 1999).
- Structured contacts among instructors. B. Moonen (2001) found that instructors are more influenced about educational-technology use by the experiences and opinions of their peers than they are from structured-support options. In this context, Siegel (1995) talks about a train-the-trainer model that helps support staff encourage instructors to work as teams when they develop instructional units, to with technology as a tool, not the focus. Visscher (1996) talks about supporting a community of practice where peer contacts form a central role.
- Opportunities to see what others have already found out concerning new roles and skills for instructors. Morgan (2003) mentions that the role of peers is of great importance in such opportunities. Recommendations of colleagues can have a powerful effect in persuading other instructors to start using a CMS and if they are already users, to use certain options within the CMS that they had not tried before. Instructors can learn about CMSs and their potential uses and advantages from a wide range of colleagues, not only those in their immediate departments. Peer recommendations are important influences both in getting to start using the technology and in decisions about how to implement the technology in one's daily practice.

This list is only one way of categorizing support types. Lewis (2002) made a similar inventory of different ways to support instructors that ranges from “doing nothing”, to fund projects, provide IT training, and/or ‘ePedagogy’ training that can be part of a project. Other ways are individual help with projects, or making use of software that is so easy no direct help is needed, or for the institution to provide a development unit.

Thus there are many possible ways to organize support for instructors that have to deal with new developments, new students, new programs, increased flexibility, new tools, and new pedagogies. Synthesizing inventories such as Lewis' suggests two important dimensions that relate to the options in support. These are the organizational form (direct fit vs. structured support) or the support and its 'medium' (human vs. computer support). This is visualized in Figure 8.

	Human support		
Direct fit	Direct help	Workshops	Structured
	Integrated support	Web-based individual support (manuals/tutorials)	
	Computer support		

Figure 8. Dimensions and types of support.

In the categorization shown in Figure 8, four main types of support are shown:

- Workshops are face-to-face sessions where instructors come together at a specific moment. The support staff has prepared presentations, but also interactive discussions and hands-on are often part of the workshop.
- Web-based manuals or tutorials can be accessed anywhere at anytime through the Internet and provide a structured overview of (mainly technical) topics. They generally deal with 'how to' questions. Web-based tutorials can be compared with workshops, they are structured and deal with relevant technical/pedagogical topics but are organized in an electronic form (examples are portal Websites for instructors, www.digitaledidactiek.nl; Dasselaar, 2002; Peters, 2002).
- A technical or pedagogical support unit can provide direct help. This human type of support can be problem driven, and should a have high 'this is what I need' factor.
- Integrated support is a type of Web-based support that is available through the software (CMS) and can be designed to support instructors through decision and performance-support tools.

2. Factors that influence a choice of type of support. A choice for support type can be based on many factors. Every type of support has its own characteristics with regards to the flexibility of the support, such as 'fit' and costs. Table 9 gives an overview of different types of support, their possibilities, advantages and disadvantages, based on factors that influence the choice of support type.

Table 9. Types of support, possibilities, and key factors.

Types of support	Possibilities	Key factors	Costs and/or time investment
Workshops	Discussions; lectures; experience/hands on	Cost Time Delivery Quality Scalability	High High Rigid High Limited
Individual sessions	Lectures; experience/hands on	Cost Time Delivery Quality Scalability	Very high High Flexible High Limited
(Web-based) manuals	Guides; references	Cost Time Delivery Quality Scalability	Limited Limited Flexible Moderate High
Integrated support	'Lectures'; experience/ hands on; guides; references	Cost Time Delivery Quality Scalability	Limited Limited Flexible High High

Table 9 is one way to indicate factors that influence the choice of support type. Lewis (2002) identified 18 key factors that deal with cost, time, delivery, skills, flexibility, and scalability of the support. A short-list of Lewis' important factors is given in Table 10.

Table 10. Key factors related to support (from Lewis, 2002).

Key factor	Examples
Cost	Cost to produce, maintain, ...
Time	Academic staff time Technical staff time
Delivery	Reaction time to need Speed of delivery Flexibility to changing needs
Quality	Embedding of skills within departments Transferability within the institution Skills and confidence levels of target audience
Scalability	Scalability of support Likelihood of success

This overview shows that different kinds of support have different characteristics. What sort of support is optimal for what occasion? Or does one type of support serve all occasions? These questions should be answered from the perspective of instructors' needs and concerns.

3. Support related to instructors' needs and concerns. The set of main concerns of instructors that were identified in Section 2.4.1 (support) are given in Table 11, together with an indication of what kinds of support would be able to serve instructors to what degree. The signs in the cells are based on the degree in which a kind of support can deal with a particular concern. General questions can be more easily answered with 'general' support, such as a piece of text or a standard PowerPoint presentation. Specific questions need a more 'intelligent' response. This could be personal or through artificial (computer program) intelligence. The two main dimensions therefore are the 'intelligence' of an answer and the degree of personal response.

Table 11. Concerns of instructors related to kinds of support

Main instructor concerns	Work-shops	Indivi-dual sessions	(Web-based) manuals	Integra-ted support
What are the characteristics and needs of my students?	++	++	+	+
What options of technology are available?	+	+	+	+
What 'types' of pedagogy are available?	+	+	+	+
How can I best use the technologies and pedagogies in my educational practices to provide a form of blended learning that would suite the needs of my students?	+	++	+/-	++
How does this relate to my current teaching practice? How much time will it take me?	+	+	+/-	+

Where +/- is not very suitable and ++ is very suitable

There are differences in how certain types of support probably could deal with the concerns of instructors. The more specific questions of instructors need more specific support. Individual support seems one of the best options, but while in this section the support types in abstract terms have been discussed, the following section focuses on instructors' actual experiences with support.

2.5.2 Experiences with different types of support

Different types of support have been indicated in Section 2.5.1. In this section examples of instructors' experiences with these types of support will be described. Is there enough support available, how is it provided, and what do instructors think of it? Do some types of support fit more to instructors' specific needs than others? Three main focuses are discussed: What types of support actually are available? (Section 2.5.2.1), Are there incentives for instructors to respond to support opportunities? (Section 2.5.2.2), and what are main problems with types of support (Section 2.5.2.3) and how might these be most efficiently addressed (Section 2.5.2.4)?

2.5.2.1 Modest options in support available, emphasis is on technical support

Overviews of actual support opportunities can be found at both the national and institutional levels. Three examples of national-level studies are those of Verstelle and Benthem (2002); Collis and Van der Wende (2002); and Ellis, O'Reilly, and Debreceny (1998).

Verstelle and Benthem (2002) made an overview of how instructors in The Netherlands were being supported in learning new pedagogical and technical skills. They found that approaches differ among universities: some are more technically based, some more instructional; some are more individual in orientation, some are more group-based; some are compulsory, some are the instructor's free choice. The power of groups of instructors working together in a workshop was emphasized, but it seems that a mix of both individual and group-based professional support-strategies are the most-common practice in The Netherlands. In almost all the cases the power of using peer experiences as examples is confirmed.

Collis and Van der Wende (2002) and De Boer (2002) as part of the international comparative study of technology use and change in higher education described in Section 2.1.2, compared how instructors, support staff, and management think of and value the amount of support that is available. Table 12 shows a list of the availability of the different types of support as reported in the international survey.

Table 12. Extent to which various types of support are available for instructors (De Boer, 2002, p. 35).

Available types of support (N=503)	Mean	SD
An ICT technical unit or help desk	3.64	1.13
Materials made available via the Web	3.54	1.01
Short courses or workshops	3.35	1.17
Handbooks for self-study, or other printed reference material supplied by the institution	3.17	1.11
A pedagogical-support unit	3.05	1.40
Special projects to stimulate ICT use	3.07	1.23

1=not at all, 3=some, 5=major feature

Table 12 shows that the emphasis in support provision, at least in the institutions represented in the survey sample, is in general towards technical support. Pedagogical-support units are only available in some occasions, and are less part of the professional environment of the instructor than technical-support units. Other results of the survey show that instructors value the level of support as average, and are significantly ($p<.05$) more critical than managers and support staff about the amount of support that is available (De Boer, 2002).

The same conclusions were made in a study among 20 Australian universities. Ellis, O'Reilly, and Debreceny (1998) found that traditional methods of classroom presentations and tutorials in staff development were more used than Web-based methods of training. In almost every case in their study (of 20 universities) a part of the staff development was through workshops. More then half of the cases however, also provided Web-based support. Technical skills were the major topic of the support programs, in only three cases were pedagogical issues in designing CMS-supported courses part of the instructor staff-development programs, whereas ‘pedagogical issues in designing Web-based courses’ and ‘designing Web pages’ were the topics that were rated most highly as primary interests of the instructors.

Support options can also be studied within a specific institution. As an example, in the context of a study of the implementation of the TeleTOP CMS (Bloemen, 1999) in the Faculty of Educational Science and Technology at the University of Twente, the support available to instructors was evaluated. Table 13 gives an overview of how the instructors appreciated the available support.

Table 13. Overview of how instructors appreciated the available support (Bloemen, 1999).

Type of support	Mean	SD	N (21)
Through an introduction and selection tool	1.50	0.80	12
Discussion session	1.13	0.62	16
Workshops	1.73	0.65	11
Individual guidance by educational specialists	2.35	0.49	20
Student-assistants	1.92	0.67	12

0 =totally not effective, 1= not effective, 2 = effective, 3= very effective.

This evaluation made clear that the individual guidance was most appreciated, whereas discussion sessions were appreciated as lowest. In general, the instructors indicated that the level of support was satisfying, and that they had room to create their own ideas about their course design. Problems were indicated with regards to the increased amount of time to learn to work with the CMS system and the new didactical approaches.

In another institutional study, Morgan (2003) found in her evaluation that instructors in several institutions also very much appreciate support in the form of personal individual guidance. She noted that a concern about support and training in the use of course-management systems can relate to control issues in the sense that instructors perceive a loss of autonomy if they do not have easy and close access to those responsible for training and supporting them in their use of course-management systems. Support should be nearby, instructors should be able to walk down the hall and find the person who can help them with their CMS site. If support is further away, faculty fear a loss of access and a vulnerability that translates into unhappiness with using the course-management system and a reduction in the use of the software.

The way instructors experience the support that they get, and the ‘distance’ to this support probably are related. Stokes (2001) found in another institutional study that over 60% of the instructors did not appreciate the training services that were provided. Ely (1996) sees that instructors need to become “technology literate” (p.33), but reports that although institutions report that they have spent considerable money on faculty training, most instructors indicate they have taught themselves most of their skills.

2.5.2.2 No incentive for instructors to respond to support

In Section 2.4.1 (instructor support) cost and time issues were mentioned as matters that influence the delivery, flexibility, and quality of support. A problem is that support is expensive. Ellis, O'Reilly, and Debreceny (1998) note that "The cost of staff development and a perceived lack of funds added to the difficulties of implementing training programs. Where organizational change was well underway, “planning the roll-out order” was cited as an issue to be addressed**"(**p. 198**).**

The need to allocate money for change processes and to develop and implement incentives and reward systems (Hall, Thor, & Farrell, 1996) is seen as an important way to professionalize instructors and prepare them for their changing roles. However, in many evaluation studies the conclusion can be made that apart from specific projects no money and incentive systems are really setup for on-going support provision (Gervedink Nijhuis, 2002; Valcke & Schellens, 2000). There are often no structural ways to arrange financial or time-related incentives for instructors to respond to support for new approaches to pedagogy and CMS use. This problem is also illustrated within the international ICT survey by Collis and Van der Wende (2002). They found that the instructor is using Web-based resources such as CMSs as part of daily practices. And while instructors do not indicate serious concerns about this, and express a generally positive feeling about technology's effect on personal work conditions and efficiency, there also are little or no systematic rewards to move instructors to do more than the gradual "stretching".

2.5.2.3 Concerns with support

From data such as those reported in Section 2.5.2.2, it seems that instructors are being supported in such a way that they can get technical support for using CMSs to stretch the mold, such as how to login and upload files, and instructional support to the extent that they get support with the first set-up of a CMS environment for support of their courses. This can happen in individual sessions or in workshops. The omission seems to be support for the actual (re)design of the course. There appears to be very limited support available, whereas instructors indicate that this kind of support would be very valuable (Bloemen, 1999; Ellis, O'Reilly, & Debreceny, 1998). It seems that the individual approach is valued highly, but a problem is that this is also very expensive (Dooley, Metcalf, & Martinez, 1999), and not always nearby. Instructors feel an urge to make their teaching more flexible by using the CMSs , but they struggle with learning to work with them (Stokes, 2001). A general overview of how support is been given and valued, based on the problems and concerns of the instructors is given in Table 14.

Table 14. Problems and concerns and experienced support.

Problems and concerns	**General eperience**
What are the characteristics and needs of my students?	Moderate
What options of technology are available?	Good
What ‘types’ of pedagogy are available?	Moderate
How can I best use the technologies and pedagogies in my educational practices to provide a form of blended learning that would suite the needs of my students?	Moderate
How does this relate to my current teaching practice? How much time will it take me?	Moderate

In general, the support that is provided is not highly valued by instructors. Instructors notice a lack of direction, resources, knowledge, and tools. They have a general feeling that they are providing their own support, although they are not really complaining about it (Collis & Van der Wende, 2002; Gervedink Nijhuis, 2002). But in order to make a significant step forward to a Stretching-the-Mold Model in higher education, support should improve. It seems that an emphasis on the ‘types’ of pedagogy that can be associated with Stretching the Mold and how instructors can use CMSs and pedagogies in their educational practices should be improved.

From these different studies about support, two general observations can be made. The first is that the technical and pedagogical tasks confronting the instructor should be closely related. Laga, Clement, and Buelens (2002) for example, found that an integrated program of both technical and didactical aspects within a self-guided study-plan helped their instructors to use a CMS in a more-successful way in their teaching practice in order to help students and improve teaching than when technical support and pedagogical guidance were not integrated. A second general observation relates to a consistent problem that instructors face when confronting any change relating to technology, the lack of adequate time. Veen et al (1999) found that the most important bottleneck in the implementation of ICT is the lack of time on the part of the teaching staff. Instructors need this time to adapt their teaching to using ICT, to learn how to work with the various ICT tools, and to develop the pedagogical skills necessary for using new types of teaching (p. 3). Time for example is major reason why instructors do not attend workshops that support staff offer to them (Verstelle & Verburg, 2002). In general, it is often the case that no extra time and or resources are made available for instructors as they move into a stretching-the-mold orientation (Collis & Van der Wende, 2002; Gervedink Nijhuis, 2002).

2.5.2.4 A solution for support?

A solution to both the integration problem and the time problem could be to make support more flexible and more closely related to the instructor's tasks at the time in which he has to perform those tasks. Ellis, O'Reilly, and Debreceny (1998) note that instructors' existing Web-based course materials should be used to get instructors committed to use of a CMS and to support them in their development of pedagogical practices that are supported by the CMS. Wills, Nouwens, Dixon, and Lefoe (1997) note that if there is a “paradigm shift in the way educational institutions deliver education, there will need to be a paradigm shift in staff development” (p. 628). As an example, Stevens and Stevens (1995) mention electronic performance-support tools as a way to support instructors. "The key to successfully providing instructor support hinges on the development of motivation and the provision of knowledge and skills at the appropriate time, at an appropriate level and in an appropriate way" (Ellis, & Phelps, 2000, pp. 40). A way to serve a significant number of instructors in a very flexible and not-expensive way is through integrated decision and performance support tools within the CMS that they can use when they need to work with the CMS and which will directly support their instructional decisions concerning stretching the mold. In the next section this theme will be elaborated.

2.6 Issues in Decision and Electronic Performance Support Tools

In this section, general issues related to electronic performance-support tools are addressed (Section 2.6.1) and the way integrated performance support could address the problems that instructors have when working with a CMS will discussed (Section 2.6.2).

2.6.1 Needs for electronic performance support

Many of the approaches to instructor support described in Section 2.5 such as help desks and workshops have been regularly studied. Support that focuses on both pedagogical and procedural issues however do not get very much attention, whereas instructors indicate that they should appreciate this kind of help very much.

An electronic performance support system (EPSS) could be a solution. Gery (1991) defines an EPSS as “an integrated electronic environment that is available to and accessible by each employee and is structured to provide immediate on-line access to the full range of information, software, guidance, advice and assistance, data images, tools, and assessment and monitoring systems to permit job performance with minimal support and intervention by others” (p. 34). A similar description is given by Barker and Banerji (1995): An electronic performance support system is "an interactive computer-based environment that is intended to facilitate and/or improve human problem solving capacity within some target application domain" (p. 4). A task that is being executed, for example by an instructor using a CMS, should be able to be done in a fast way, without errors, and produce a result of high quality (Barker & Banerji, 1995). An EPSS should support workers to solve “problems” by carrying out better diagnoses and treatments that relate to the diagnoses chosen (Stevens & Stevens, 1995). Stevens and Stevens (1995) compare an integrated EPSS with “on the job training”. The support that can be provided is right on time, during the performance, and can contain advice and examples (Reeves & Raven, 2001).

Electronic performance support can focuses upon different sorts of problems. Stevens and Stevens (1995) discuss problems outside the system that performance support could relate to:

- A lack of job skill and knowledge
- A lack of immediately needed, task and situation-specific information
- A need for expert advice to solve problems
- A need for customized tools
- A need for coaching computer-based job skills

Reeves and Raven (2001) note that instructors can be seen as knowledge workers. Reasons in this context that instructors need performance support could be:

- they are poorly prepared for new complex skills involving technology
- they are dependent on external support
- the time lag between training and performance is too large
- service should be quick and efficient
- time spend for training should be minimal

Instructors work with new tools (CMSs) in order to make learning more student centered and flexible. The problem of the need for specific information at a specific time is essential and not available in the current support packet. A performance and support tool could be a solution for this problem. In the next section the way integrated performance support could address the problem mentioned will be described.

2.6.2 Integrated performance support

An important starting point for a support tool is that the CMS should already be designed to be a powerful tool for the instructor. In Section 2.4.4 the need for an easy to use CMS system was already discussed. Gery (1995) calls a good design of a CMS system itself ‘intrinsic performance support’. It is basically seen as related to the usability of the software itself. As an example, Gery (1995) refers to the way an ‘alt’ text of a picture appears when a mouse is being held on that picture (i.e. a button).

However, the support that is provided to instructors with standard CMSs does not seem to be sufficient, and a number of the indicated problems in Section 2.6.1 are not dealt with. Integrated performance support could offer answers to this. Gery (1995) is talking about extrinsic performance support that is computer mediated and integrated within a system, the CMS. It adds on to the CMS, and can give all kinds of support such as through tips, advisors, explanations, demonstrations, and examples.

There are a number of dimensions that can be distinguished within integrated electronic performance-support systems. An integrated performance system can be used by individuals or by groups; it depends on the task for which it is going to be used. A performance-support system can contain any combination of a variety of components, such as: help, advice, step-by-step guidance, training, assessment, job-aids, operating procedures, regulations, cases and examples, models, templates, and specific tools for decision support (Reeves & Raven, 2001). It can be embedded within the system it refers to, or operate as a stand-alone system (Raybould, 1995). The embedded support can have different components, such as a help system, an advisor/coach tool, and support in the form of short tutorials (McGraw, 1995). These components vary in terms of interactivity and complexity; a help system is a less-complicated technology solution than a EPSS designed to train a user (an instructor) for a specific task via embedded tutorials. McGraw (1995) used the three levels of Gery (1991) to categorize EPSS functionalities, as is shown in Table 15.

Table 15. Levels of EPSS functionality (McGraw, 1995, p.18).

Level Component	Level 1	Level 2	Level 3
User interface	Human-computer interface is standard	Separate, adapted human-computer interface	Human-computer interface is intelligent, diagnosing user error patterns, giving feedback to user.
Help	Hypertext Help is user-initiated	Full multimedia support, more detail and resources. Help is user initiated.	Full multimedia support, more detail and resources. Help should be user initiated.
Coach	Static procedures and hints/tips	Advisor provides dynamic hints/tips.	Advisor provides heuristic-based reasoning and explanation facilities
Tutor	Embedded training includes quick tour, no full tutorial	Quick tour and tutorials r are present, with demo and practices, i.e., through video and feedback	Quick tour and tutorials are present, with demo, practices and monitor modes. Emulation and animation with diagnostic answer judging and feedback can be available.

Table 15 shows that there are many options in the types of help that an EPSS can offer and the level in which this help is made available. An important requirement for an integrated EPSS within a CMS is that it should support instructors in the (re)design of their course with a CMS in a fast way, without errors, and producing results of high quality (Barker & Banerji, 1995).

The identified problems and concerns for instructors (See Section 2.4.6) and the more-specific needs that instructors could have when using a CMS to design their courses are summarized in Figure 9.

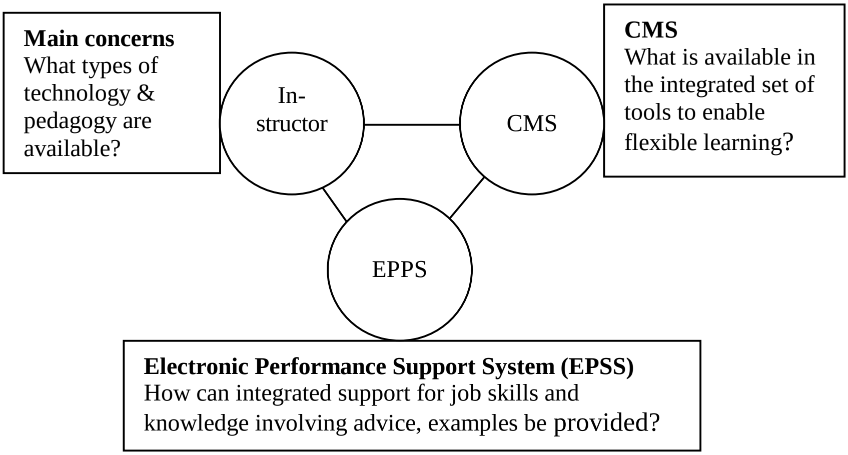

Figure 9. Problems and concerns related to EPSS.

An integrated EPPS could address many of the main problems and concerns of instructors about the types of available technology and pedagogy and the choices involved in (re) designing their courses and using technology to stretch the course towards a flexible blend of traditional and new technologies and pedagogies. An integrated EPPS can minimize the time lag between training and performance, and can hold the time spent for training to a minimal level. Integrated performance-support tools could help instructors in the (re)design of their courses towards a stretching-the-mold scenario by providing features such as help, advice, step-by-step guidance, cases and examples, models, templates, and decision support directly within the CMS available as the instructor makes decisions about his or her course.

Integrated performance and decision-support tools are not yet very common in CMSs (Landon, 2002). The possibility of having integrated support could answer many of the concerns of instructors and would be a way to have flexible and affordable support available for increasingly flexible courses. It should be noted that this kind of support is not always the best solution for all instructor-based problems and concerns, but can be very well used to answer those concerns that relate to technology and pedagogy issues in order to design a flexible course.

2.7 Conclusions: Relating Concepts, Issues, and Strategies to the Research Questions

The conclusions from this chapter can be given around the main research questions of this thesis as indicated in Section 1.2. These conclusions are given in Table 16.

Table 16. Research questions and main conclusions for Chapter 2.

Research questions:	Conclusions
1. What are key types of flexibility involving Web-supported learning in higher education and what framework best expresses these in terms of course design?	Stretching the mold is an important (future) educational model leading to more flexibility in higher education.
	Flexible learning is the underlying but not always clear paradigm for Stretching the Mold.
2. What combinations of Web-based tools, functionalities, and systems coupled with what instructional strategies best support these types of flexibility in course design?	CMSs should be easy to use and should offer many options in tools aimed at flexibility to offer therefore good options for a "Stretching-the-Mold' scenario.
	Pedagogies could be enriched or reengineered by appropriate use of CMSs.
3. How can an instructor be helped to choose a blend of Web-based course tools to achieve the flexibility targets for a given course? How can this approach be implemented in a support system?	Instructors should have clear goals and tailored support for course organization and pedagogy. They need to have support for/about time, delivery, quality, and scalability of the CMS technology.
	An integrated Web-based decision and performance support system (EPSS) could be an efficient and effective way to support instructors.

The relation of conclusions from this chapter is related to each of the main themes from Section 1.3 1 as follows:

Stretching the mold is an important (future) educational model leading to more flexibility in higher education.
Higher education is reacting to a changing world with new types of students. Higher-education institutions are rethinking their roles and strategies toward new models, although they do not expect a revolutionary change as a result from or related to the use of Web-based technology. It seems that a Stretching-the-Mold model where institutions still emphasize face-to-face contact with the traditional (18-24 year old) student groups, but where the number of new types of students such as international students and lifelong learners, is increasing. Courses are more blended in terms of combining technology with face-to-face contact. Increasing the flexibility of courses within a Stretching-the-Mold evolution can be seen as major focuses within higher education in the forthcoming years.
Flexible learning is the underlying but not always clear paradigm.

Within the “Stretching-the-Mold” model, flexibility is a major focus. "Stretching" in one way means that borders become less important and education can be taken (partially) from a distance. "Stretching" within the campus situation means that traditional courses will stay campus-based within higher education, but through stretching the student can have more options to define his own ways and paths through and within programs and courses. Although the instructor is "stretching the mold" where CMS use is part of his daily practices, the forms of flexibility that can be given and supported through these systems and new pedagogies are still unfamiliar.

CMSs should be easy to use and should offer many options in tools aimed at flexibility to offer therefore good options for a "Stretching-the-Mold’ scenario.
Course-management systems (CMSs) are Web-based database-driven systems that enable or support learning. The tools within a CMS can be used for the creation of information/ educational content, the delivery of information/educational content, for communication, and for course organization. These options within CMSs should be clear for a user, fit within his or her educational practices, and should be easy to use. Learning to work with the CMS should not take instructors much time, and the system should be easy to integrate into existing courses. It is important that the system can adapt to the way that an individual instructor wants to work, even as the instructor too will need to make some adaptation in his or her typical teaching practices as he or she comes to make use of the CMS. The extent to which it takes the instructor time and energy to make the change (i.e., to learn how to use the course-management system) is an useful index for the amount of resistance that will occur to the change. When meeting these demands, CMSs in general are flexible for educational use and therefore good tools for a "Stretching-the-Mold’ scenario.

Pedagogies can be enriched or reengineered by appropriate use of technology.
When attempting to design courses for the “Stretch the Mold” model it should be noted that the instructor-rooted classroom-orientation model (Gustafson & Branch, 1997, p. 30) is the dominant approach to course design and delivery within higher education. The weaknesses of this classroom orientation can also be its strengths (Collis & Moonen, 2001, p. 42). The instructor as content expert fully responsible for the course can mentor, stimulate, scaffold, and personally interact with his or her students so that the course is much more than a systemic way to meet pre-defined objectives but also can be a framework for an apprenticeship-type mentoring relationship between instructor and learner (Sfard, 1998). Instructors can also monitor and adapt during the instruction; tasks that are often difficult to accomplish with technology based instruction.

Pedagogy options and approaches can be identified that seem well suited for the use of CMSs for stretching the mold. Some options focus more on organizational matters and some are very specific to the learning moment itself. A list of important focuses are flexible learning with respect to organizational matters; and pedagogical approaches such as authentic task-based learning or problem-based learning, discussion-based learning, active learning, and group-based (problem) learning.

Instructors should have clear goals and tailored support for course organization and pedagogy. They need to have support for/about time, delivery, quality, and scalability of the CMS technology.

Instructors need to be supported in such a way that they have sufficient technical skills and that there is a fit with their educational practices. Instructors should quickly gain small positive experiences in working with the CMS system. Earlier experiences (problems and solutions) of peers should be made known, and instructors need to become familiar with the pedagogical and technical options and possibilities of the CMS. In these ways instructors can work with a CMS in their education, and make good decisions with regards to the options in organization, pedagogy, available tools within CMS, and communication tools, to support or deliver their courses in an optimal way. There are different sorts of support that can be structured around different dimensions, in particular: direct fit vs. structured support and human vs. computer support. These dimensions distinguish four main types of support: workshops, personalized help, Web-based support, and integrated support.

The general opinion of instructors with regard to how support is provided to them and the experiences they have had with the support is not high. Instructors notice a lack of direction, resources, knowledge, and tools within the support. They have a general feeling that they are responsible for providing their own support, although they not really complaining about it (Collis & Van der Wende, 2002).

An integrated Web-based decision and performance support system (EPSS) could be an efficient and effective way to support instructors.

Instructors have all sorts of problems with regards to the use of CMSs in their courses. Pedagogy support is often not provided nor conveniently available. In order to make a significant step forward to a Stretching-the-Mold Model in higher education, integrated and timely support should increase. It seems that an emphasis on the 'types' of pedagogy that are available and how instructors can use the technologies and pedagogies in their educational practices could improve support. A way to serve a significant number of instructors in a very flexible and not-expensive way is through integrated decision and performance support within the CMS.

In Chapter 3 a further analysis of flexibility will be made in order to guide subsequent choices about options and better assess the progress of an instructor or institution in terms of offering flexibility in learning in a stretching-the-mold context.

3 DIMENSIONS IN FLEXIBLE LEARNING RELEVANT TO "STRETCHING THE MOLD"

In Chapter 2 the problem statement was analyzed, and practical problems for designers and practitioners were described. Making use of the methodology for development research (Reeves, 2000) this chapter will describe and validate a theoretical framework (Box 2 in Figure 10) for the development of solutions for the problems.

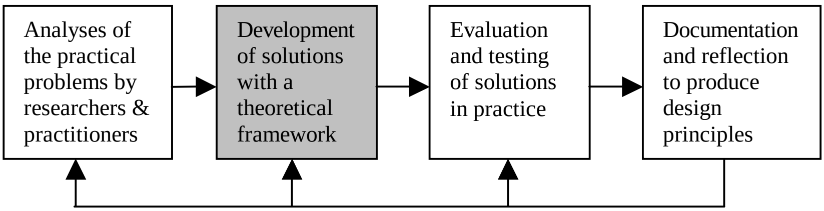

Figure 10. Development research approach (Reeves, 2000, p. 25).

The analysis of flexibility will be made in order to guide subsequent choices about options and better assess the progress of an instructor or institution in terms of offering flexibility in learning in a stretching-the-mold context. While institutions can make system-wide decisions about flexibility in admission and program requirements, the individual instructor is the key player in offering flexibility within the course itself. In order for quality assurance relating to flexibility, there needs to be consensus relating to ways in which options for stretching the mold can be offered within courses. With such a consensus, the degree of flexibility within a course, as well as within the institution, can be measured and progress tracked.

This chapter will start with an overview of key dimensions in that can occur in flexible learning (Section 3.1). Next, the flexibility dimensions that have been identified will be validated for their recognizability in Section 3.2, and for their use in Section 3.3. In Section 3.4 the support that is relevant for the identified flexibility dimensions related to Stretching the Mold is discussed, and in Section 3.5 the conclusions of this chapter will be given and related to the research questions from Section 1.4.

3.1 Dimensions in Flexible Learning

In this section flexibility as a key concept in higher education will be discussed (Section 3.1.1). How flexibility can be best expressed in terms of dimensions and options for course design in higher education leading to a framework that can guide decisions, particularly by the instructor, in terms of flexibility options for learners is discussed in Section 3.1.2.

3.1.1 Flexibility as a key concept in higher education

In Chapter 2 the changing field of higher education was described. The Stretching-the-Mold Model was identified as a model that reflects the way traditional universities are in the process of providing quality education for rapidly diversifying student cohorts. “There must be more flexibility to meet the needs of the learner, through adaptability to different learner needs, learning patterns and settings, and media combinations” (Van den Brande, 1993, p. xxi). This change process towards broader and more diverse types of students therefore is leading to changing roles of instructors, more-flexible curricula, and new delivery methods. Universities have to become more flexible in many of their organizational and didactical approaches, to better facilitate more learners with a broader diversity of backgrounds. A blend of on-campus and flexible learning is an ideal mode of delivery for many of the new types of learners (See Section 2.1 and 2.3).

This kind of blending is characteristic for the Stretching-the-Mold approach where both instructors and courses are stretched in order to become more flexible. However, as has been discussed in Section 2.1, institutions are changing and stretching slowly and not radically. Change has been relatively rapid with respect to the uptake of a “modest” amount of online components and institution-wide CMS learning platforms, but a fundamental move away from on-campus provision has not happened. In general institutions are still focused on their traditional target group (high-school leavers). CMSs provide a tool for supporting more flexibility in practice, even for this target group but also for other groups who are gradually also appearing. Within the course, different types of students should have options for different ways of experiencing the learning process. But how can this be operationalised in practice? The sorts of support discussed in Section 2.5 should be based on a systematic analysis of the meaning of flexibility in terms of instructor choices.

Collis and Moonen (2001) mention that "flexibility in higher education is not a new phenomenon. Learning regularly takes place outside of explicit course settings, as students read their textbooks, interact with classmates outside of class, take part in events such as guest lectures or debates or use computer tutorials" (p. 9). However, although the concepts of flexibility and blending may not be new, the terminology used for the Stretching-the-Mold Model has not been operationalized in a common way. In a study about flexible provision in Australia (Ling, Arger, Smallwood, Toomey, Kirkpatrick & Barnard, 2001), it was found that the term flexibility was not a common term and straight-forward interpretation of it within different universities did not occur. Most respondents did see flexible provision of higher education as offering choices to learners. However, there were universities who understood flexibility to be directed at options in access, where other universities understood flexibility as being about accommodating a range of learning needs and preferences. Another view emphasized the use of new learning technologies to address the quality of learning.

There is an important reason therefore to make clear what flexibility implies, what dimensions it has, and how to define them to those that should be able to use these flexibility dimensions in practice. Different attempts at definitions can be found. Van den Brande (1993) indicates that flexible learning should 'enable learners to learn when they want (frequency, timing, duration); how they want (modes of learning) and what they want (that is, learners can define what constitutes learning to them) (p. 2). Ling, Arger, Smallwood, Toomey, Kirkpatrick and Barnard (2001) note that "flexible provision in higher education refers to a mode of provision that provides learners with guided choice, in a number of domains, achieved through employment of various strategies including the use of learning and teaching techniques and technologies and the adoption of policies affecting choices for learners" (p. 3). However, these definitions still typically are too broad to be directly useful for the instructor.

Another reason for defining flexible learning in terms of dimensions and elements for the instructor in a Stretching-the-Mold situation is that flexible learning in the literature or in practice "is often taken as synonymous with distance education, but this is not necessarily so" (Collis & Moonen, 2001, p. 9). Flexibility can involve options in course resources, in types of learning activities, in media to support learning, and many other possibilities. The key idea is offering *learner choice* in different aspects of the learning experience.

> "Flexible learning is a movement away from a situation in which key decisions about learning dimensions are made in advance by the instructor or institution, toward a situation where the learner has a range of options from which to choose with respect to these key dimensions. Choices can vary in many ways, such as in the appropriate amount, contents and types of learning materials. Depending on where learners are (i.e. in a professional working environment) options with regards to place and time of learning are important but also options should be available in terms of forms of interactions and communications as well as other variables that relate to the learning experience" (Collis & Moonen, 2001, p. 9).

In Section 2.4 it was identified that the instructor is the key decision maker for many of these within-course options. The instructor as content expert is typically fully responsible for the course and can mentor, stimulate, scaffold, adapt, and personally interact with his or her students so that the course is more than a way to meet pre-defined objectives but also can be a framework for an apprenticeship-type mentoring relationship between instructor and learner. These various roles can all occur within what has been identified as the "instructor-rooted classroom-orientation model" (Gustafson & Branch, 1997). Within a Stretching-the-Mold Model instructors can use the CMSs to "stretch” the course with relation to each of their different types of roles. The same sorts of lectures, assignments, and study expectations may pertain; what is more flexible is the way in which students can carry out or participate in these.

Thus, as a starting point for a more-systematic provision of options to students related to course participation, the idea of gradually “stretching the mold” of the course without changing its key characteristics can be a change strategy for instructors if instructors have clear guidelines and an awareness themselves of the sorts of options they can offer. And if the stretching occurs often enough, it can lead to new models for higher education. Thus, starting with the instructor-oriented classroom-rooted model, what are ways to add flexibility so that stretching the mold begins to occur? In the next section dimensions that can relate to instructor-supported flexibility will be considered in order to identify the most appropriate set that can lead to a flexibility framework for stretching the mold.

3.1.2 Dimensions within flexibility leading to a flexibility framework

The need for more flexibility in instructional practices could be realized through focusing on specific flexibility dimensions. Many researchers have focuses on dimensions within flexible learning (Carleer & Collis, 1998; Collis, Vingerhoets & Moonen, 1996; Ling, Arger, Smallwood, Toomey, Kirkpatrick & Barnard, 2001; Moran & Myringer, 1999; Van den Brande, 1993; Sachsse, 1994; Zimitat, 2002). Although instructors experience the term flexibility as not being a common and straightforward term within learning (Ling, Arger, Smallwood, Toomey, Kirkpatrick & Barnard, 2001), it seems that within the literature there is more accordance about what flexibility implies. The main dimensions within flexibility can be seen as

- Flexibility related to time
- Flexibility related to content
- Flexibility related to instructional approach

The relation between these three different flexibility dimensions and categories that can be used to cluster dimensions are given in Table 17 where "+" stands for the fit within the category and "+/-" stands for a possible fit.

Table 17. Overview of dimensions in flexible learning and their 'fit' with three main dimensions.

Research of:	Dimensions:	Time	Content	Instructional approach
Sachsse (1994)	Greater independence in terms of what they learn		+	
	greater independence in terms of how they learn			+
	greater independence in terms of where they learn			+
	greater independence in terms of when they learn	+		
	greater independence in terms of how quickly they learn	+		
	greater independence in terms of when and where their learning is assessed			+
Van den Brande (1993)	When they want (frequency, timing, duration)	+		
	How they want (modes of learning)			+
	What they want (that is, learners can define what constitutes learning to them)		+	
Collis, Vingerhoets & Moonen (1998)	Flexibility related to time: Time (for starting and finishing a course); Time (for moments of studying within the course); Tempo/pace of studying; Moments of assessment	+		
	Flexibility related to content: Topics of the course; Sequence of different parts of a course; Size and scope of the course; Level of the course; Assessment standards		+	
	Flexibility related to entry requirements: Conditions for participation			+/-
	Flexibility related to instructional approach and resources: Social organization of learning; Language to be used during the course; Learning resources; Instructional organization of learning			+
	Flexibility related to delivery and logistics: Time & place where support is available; Method of obtaining support; Types of support available; Place for studying; Delivery Channels	+		+
Carleer & Collis (1998)	Flexibility in location			+
	Flexibility in program		+/-	
	Flexibility in types of interactions	+/-		
	Flexibility in forms of communication			+/-
	Flexibility in study materials		+	

Table 17 continues…

Table 17 continued

Moran & Myringer (1999):	Greater choice for learners and the university in the what of education, including curriculum content, length and make-up of qualifications		+	
	Greater flexibility for learners and the university in the where and when of education: mixing and matching on-campus teaching and remote delivery (workplace and home), and offering more flexible forms of access, entry and exit	+		+
	Greater variety for learners and the university in the how of education: especially through the use of self-instructional learning resources and online technologies			+
	Information literacy and support programs which assist students to become independent lifelong learners			
Ling, Arger, Smallwood, Toomey, Kirkpatrick & Barnard (2001)	The time at which study occurs	+		
	The pace at which the learning proceeds	+		
	The place in which study is conducted			+
	The content that is studied, which includes the concept of flexible entry and exit points to a program.		+	
	The learning style adopted by the learner			+
	The form(s)of assessment employed			+
	The option to collaborate with others or to learn independently			+
Zimitat (2002)	Participation and access	+/-		
	Progression and assessment			+
	Learner control and choice		+	+
	Access to learning technology and resources			+
	Learner support services			+
	Quality	+	+	+
	Web technology			+

Based on the analysis in Table 17, the flexibility options most under the control of the instructor that fit into these three main categories can be formulated. Decisions relating to location of the course are typically made at the institutional level, and thus the "where" aspects of flexibility are not so much determined by the instructor. With the instructor as the main focus, the activities in the course and the content for a course are the most important responsibility for an instructor. With regards to time, instructors can make a full program available, students can work ahead, as well as instructors providing options for students to submit later. Instructors often start a course with a whole group, but can make exceptions for students that need more time to finish a course. With regards to the content of a course there are possibilities to provide students options in the topics, the orientation, and assessment standards within a course. Finally the flexibility related to instructional approach and resources can focus upon the way an instructor gives students options for the different activities and contact sessions, the languages that can be used to communicate, the modalities in resources, and the required assignments for the course.

When designing a course, the instructor makes choices that relate to these aspects. Based on the identified categories mentioned in Table 17 the main dimensions for instructors are given, based on the identified categories by Collis, Vingerhoets, and Moonen (1996) as representative of the other sets in Table 17. Table 18 shows nine flexibility dimensions, organized around the categories related to time, content, and "instructional approach and resources” that can serve as a synthesis of the various sets of dimensions in Table 17.

Table 18. Instructor choices in flexibility, grouped according to three main categories.

1 Flexibility related to time:
Times (for starting and finishing a course)
Times for submitting assignments and interacting within the course
2 Flexibility related to content:
Topics of the course
Orientation of the course (theoretical, practical)
Assessment standards and completion requirements
3: Flexibility related to instructional approach and resources:
Ways in which the course is experienced (face-to-face; group, individual, combinations)
Language to be used during the course
Learning resources: (Modality, origin (instructor, learners, library, WWW), etc)
Assignments required for the course

In order for these dimensions to serve as a basis for guiding instructors in decision making and flexibility options and for quality assurance and progress assessment relating to systematic progress toward stretching the mold at the course and institutional levels, it is necessary to see if indeed they are recognized by instructors in practice and if they can be simplified further so as to provide a convenient-to-express but still supportive framework for instructors. These steps have taken place as part of an international comparative study on changes in higher education. Portions of the material in Sections 3.2 and 3.3 are adapted from De Boer and Collis, 2003.

3.2 Validating the Recognizability of the Flexibility Dimensions

In the international survey related to models of change in higher-education described in Section 2.1 (Collis & Van der Wende, 2002) responses from 347 instructors were received. A set of items related to the flexibility dimensions in Table 18 was part of the questionnaire. For each of the nine items, instructors were first asked “To what extent do you offer options relating to each of the following to students in your own courses?” and then secondly were asked to predict the extent to which they would offer the options in the future. The response options were: (1) No flexibility, (2) (Unlabelled), (3) Some flexibility, (4) (Unlabelled), (5) Extensive flexibility. (The decision was made for all items in the questionnaire to only label the first, middle, and end points on the five-point scale, and leave respondents to assume that the values of (2) and (4) were mid-way between the flanking values.)

Table 19 shows the means and standard deviations of the responses of the instructor sample to the items relating to the flexibility dimensions shown in Table 18 for 2002 (year of the research) and 2005 (prediction), with the results of t-tests for the significance of the difference between current amount and predicted future amount of flexibility.

Table 19. Amount of flexibility within courses currently offered and expected in 2005 by instructors in higher-education (n=347; De Boer, 2002).

Flexibility dimensions:	2002		2005		Difference	
	M	SD	M	SD	t	Sig. (2-t)
Flexibility related to time:						
Times for starting and finishing a course	1.82	1.02	2.29	1.16	-11.32	.000
Times for submitting assignments and interacting within the course	2.76	1.21	2.94	1.18	-6.12	.000
Flexibility related to content:						
Topics of the course	2.76	1.16	2.48	1.05	2.11	.035
Orientation of the course (theoretical, practical)	2.26	1.05	2.36	1.08	-3.24	.001
Assessment standards and completion requirements	2.15	.97	3.11	1.23	-16.31	.000
Flexibility related to instructional approach and resources:						
Ways in which the course is experienced (face-to-face; group, individual, combinations)	2.68	1.23	2.49	1.25	1.68	.094
Language to be used during the course	1.80	1.09	3.71	1.05	-32.25	.000
Modality and origin of learning resources: ((instructor, learners, library, WWW), etc)	3.40	1.07	2.86	1.16	7.78	.000
Assignments required for the course	2.47	1.10	2.96	1.04	-9.50	.000

1= no flexibility, 3= some flexibility, 5 = extensive flexibility

The data show that in 2002 most flexibility can be found within the learning resources. Six of the flexibility types are expected to significantly increase; in contrast for the item relating to ways in which the course is experienced, there is a non-significant decrease; and significant decreases were measured for the topics of the course and the modality and origin of learning resources. This was not expected. An explanation may be that currently much use is being made of the Internet for the location of new study resources, by both instructors and students, but that this orientation is expected to stabilize over time while still remaining high as a source of flexibility within the course.

Types of flexibility that are expected to significantly increase are the times for starting and finishing a course, and for submitting assignments and interacting within the course. For the content-related flexibility the orientation of the course and the assessment standards and completion requirements are expected to increase. A big increase in the flexibility in language to be used during the course was measured. This could indicate that more countries do intend to make their on-campus programs available to international students. Also the options within assignments required for the course increased.

However, it can be seen that most of the responses were within a standard deviation of the response of “Some flexibility”. Thus, there is a start toward stretching the mold that instructors in this sample at least have already made. In this context, the original nine flexibility dimensions can be said to be recognizable in practice. However, to serve as a tool for decision making and quality/progress assessment, it is desirable to see if the dimensions can be grouped as suggested from the review summarized in Table 18, or even can be reduced to a smaller set of components. To examine this, a principle components analysis was carried out on the responses to the nine items, using Varimax rotation with Kaiser normalization, converging after nine iterations.

Two factors with eigenvalues greater than 1.00 were retained for interpretation. The two factors explain 45,95 % of the variance. Table 20 shows the loadings of the nine flexibility-dimension variables on the two retained factors. The loadings in bold indicate the factor related to each variable for subsequent interpretation. For convenience, loadings less than 0.200 are not shown.

Table 20. Rotated component matrix.

Flexibility dimensions	Factors, eigenvalues, and per-centage of variance accounted for	
	Factor 1, eigenvalue = 3.085, 34.28%	Factor 2, eigenvalue = 1.051, 11.67%
Times for starting and finishing a course	**.326**	.263
Times for submitting assignments and interacting within the course	**.601**	
Topics of the course	**.686**	
Orientation of the course (theoretical, practical)	**.775**	
Assessment standards and completion requirements	**.695**	.204
Assignments required for the course	**.633**	.252
Modality and origin of learning resources (instructor, learners, library, WWW)	.350	**.544**
Ways in which the course is experienced	.275	**.578**
Language to be used during the course		**.816**

Factor 1 relates strongly to six variables all involved with the decisions the instructor makes in setting up a course. What topics will be chosen? Will the orientation be theoretical or practical? What assignments will be carried out, when must they be completed, and how will they be assessed? What needs to occur in order to complete the course? Together, these relate to the “course planning” of the course. For each of these, it is possible to offer some degree of flexibility to the learners. This factor relates to stretching the course, as flexibility can be introduced beforehand in terms of options within the course.

Factor 2 relates most closely to the learning setting as experienced within the course: What learning resources are used and to what extent they obtained from the students themselves? How do the learners in terms of group or individual or combinations experience the course? This factor most relates to flexibility for students in an interpersonal way, and stretches the pedagogical experience of the course. It relates mostly to the flexibility that individual students would benefit most from as the course proceeds, interpersonally.

Thus from the factor analysis it seems that from the nine tested dimensions of flexibility as identified in the literature two important dimensions are seen by the instructor as most recognizable. The dimensions also relate to two different aspects of stretching the mold. The new two-dimensional framework with associated items is shown in Table 21.

Table 21. New flexibility framework for stretching the mold, instructor’s perspective.

Factor 1	*Planning flexibility*
	Times for starting and finishing a course
	Times for submitting assignments and interacting within the course
	Topics of the course
	Orientation of the course (theoretical, practical)
	Assessment standards and completion requirements
	Assignments required for the course
Factor 2	*Interpersonal flexibility*
	Ways in which the course is experienced (group/individual; sessions)
	Language to be used during the course
	Modality and origin of learning resources (instructor, learners, library, WWW)

With these two factors retained for the framework, factor scores were calculated for each of the 347 instructor respondents in the international survey related to their current levels of flexibility (Table 22).

Table 22. Means of the two flexibility factors, current practice and the near future (instructors, international survey, De Boer, 2002; n=347).

Flexibility factors		2002		2005		Differences		
	N	Mean	SD	Mean	SD	t	df	Sig. (2-tailed)
Planning flexibility	347	2.37	.71	2.64	.79	8.02	346	0.00
Interpersonal flexibility	347	2.63	.78	3.02	.84	10.01	346	0.00

Where 1 stands for no flexibility, 3 for ‘some’, and 5 for high flexibility.

The data show that the first factor, flexibility related to the planning of the course, currently has low flexibility. The flexibility that relates to the interpersonal options for students scores significantly higher (t=-5.998, df=346, p=0.00) and currently can be valued as closer to ‘some flexibility’.

When the factors are used to see how instructors predict their future practices with respect to flexibility, there are differences, as can be noted from Table 22. Both types of flexibility are expected to increase in the near future (2005). The differences between the current amount of two dimensions of stretching the mold flexibility and the future are both significant

> *These two factors together form a “flexibility framework” that can be used as a guide for instructors for stretching the mold in two main directions.*

The two-dimensional framework that has been identified is recognizable in practice through its validation via the international research, thus can serve as a basis for metrics relating to flexibility. The first dimension relates to course organization prior to the course, while the second relates more directly to the way the course is experienced during the course. For each of these, flexibility options can range from none (all students treated the same) to some (ad hoc responses to individual students’ requests) to substantial (all students offered at least two options). Even offering some (ad hoc) options can lead to a stretching-the-mold effect. The two ways flexibility can be given lead to a new name for the Stretching-the-Mold type of education. A new name that includes the two types of flexibility could be "2 X Stretching the Mold", or shortened: 2S-t-M.

Perhaps these data, combined with the literature summarized in Chapter 2, can be interpreted that the planning flexibility dimension is more for new-target groups but with the same content of teaching, while the interpersonal dimension is for something new in terms of pedagogy with existing campus groups. These two dimensions within the 2S-t-M were already recognized in Section 2.2 where change was noticed towards the two flexibility dimensions within the four scenarios for higher education (Collis & Gommer, 2001). Figure 11 shows how these two could be visualized within the scenarios (See Section 2.1).

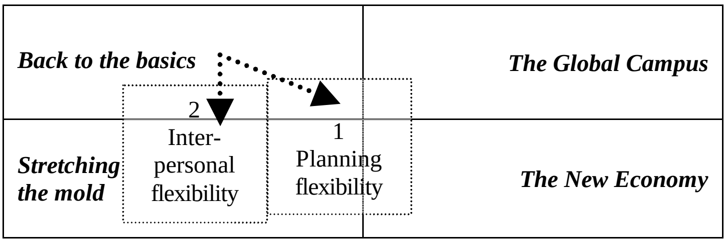

Figure 11. 2S-t-M dimensions within Stretching the Mold

The figure demonstrates how instructors deal with flexibility. The planning flexibility relates to the more-flexible students, although within a Stretching the Mold setting, towards time and activities. Within the interpersonal 2S-t-M dimensions, a new ‘pedagogy’ emerges that places the student more central in terms of activities. This flexibility within a Stretching the Mold setting is not provided because of international or life-long learning students, but within the known face-to-face campus setting.

The 2S-t-M types of flexibility were recognized by the instructors, who indicate that each type of flexibility is likely to increase in the near future. This starting point is important. The interpretation of the two dimensions will continue throughout this research. A following question is how the 2S-t-M flexibility framework can be used, and in what setting(s). This will be examined via a reanalysis of the survey data in the next section, and from a design perspective, in Chapter 5.

3.3 Validating the Use of the 2S-t-M Flexibility Framework via the Survey Data

The 2 S-t-M framework can be examined in terms of its relations to institutional focuses for the use of technology. Regression analysis can be used to see how the instructors that were questioned in the international survey on various other items saw a relationship between those items and flexibility and stretching the mold. Variables relating to the focus for the use of technology could be used as independent variables within a regression analysis. From the international survey, one set of questions specially related to focus for ICT use, is given in Table 23.

Table 23. Question in the international survey about general focus in relation to use of technology.

Please indicate in your view to what extent the following aspects are related to the use of ICT					
	1= *Not at all*		*3=* *to some degree*		*5=* *Very much*
Teaching traditional target groups	O	O	O	O	O
Teaching lifelong learners	O	O	O	O	O
Teaching international students	O	O	O	O	O
Innovation in teaching and learning	O	O	O	O	O

The variables and means from the instructors' sample of the ICT survey for these variables are given in Table 24. The table shows the means and standard deviations for focuses for ICT use in the institutions according to instructors.

Table 24. Means and standard deviations for particular focuses relating to the use of ICT (N=347).

	Mean	SD
Teaching traditional target groups	2.97	1.04
Teaching lifelong learners	2.54	1.16
Teaching international students	2.64	1.15
Innovation in teaching and learning	3.25	1.06

1= Not at all, 3= to some degree, 5= Very much

First a regression analysis to see how the focuses are related to the planning type of flexibility was made. The items in Table 24 were used as independent variables, the 2002 factor score for planning flexibility (Table 22) was used as the dependent variable. The analysis shows that the technology focus as expressed by these four variables explains only a very limited part of the variance (R-square=0.019); however the backward regression is significant (F=6.588, p=0.011). Because of the exploratory nature of the research, it was decided to look into the statistically significant relationship even though its practical relevance is very small. Table 25 shows the items from Table 24 that have a significant influence on planning flexibility.

Table 25. Typical focuses for ICT that have an influence on the planning 2S-t-M flexibility.

	B	Std. Error	Beta	t	Sig.
(Constant)	-.301	.129		-2.337	.020
Teaching lifelong learners	.118	.046	.137	2.567	.011
Excluded Variables:					
Innovation in teaching and learning			-.035	-.593	.554
Teaching traditional target groups			.036	.626	.532
Teaching international students			-.059	-.927	.355

The regression analysis shows that the only discriminating factor that has an influence on the planning type of 2S-t-M flexibility is the perception of the value of ICT for teaching lifelong learners. This means that the type of students, more diverse students, has an effect on the planning flexibility that instructors offer. It must be remembered however, that very little of the variance was accounted for.

For the second 2S-t-M flexibility dimension, interpersonal flexibility as indicated by the corresponding factor score in Table 22, a backward regression also was made. The variance explained is here also very limited (R-square=0.036). However, the regression is significant (F=12.46, p=0.000), so here also because of the exploratory nature of the research, it was decided to look into the statistically significant relationship even though its practical relevance is very small. Table 26 shows the items from Table 24 that have a significant influence on interpersonal flexibility.

Table 26. Typical focuses for ICT that have an influence on the interpersonal 2S-t-M flexibility.

	B	Std. Error	Beta	t	Sig.
(Constant)	-.480	.190		-2.535	.012
Teaching traditional target groups	.182	.051	.190	3.590	.000
Excluded Variables:					
Teaching lifelong learners			.046	.809	.419
Teaching international students			.067	1.090	.276
Innovation in teaching and learning			-.080	-1.258	.209

The regression analysis shows that the only discriminating item that relates to the interpersonal type of 2S-t-M flexibility is the use of ICT when teaching traditional target groups. This type of flexibility therefore does not only seem to relate to distance or flexible students, whereas the planning flexibility was more related to distance and time flexibility.

Both regression analyses were found to be significant, although the explained variance in both cases was very low. These results therefore should not be over interpreted. The regression results do however build upon the conclusions made in Section 3.2. It seems that a demand from lifelong learners may relate positively to planning flexibility, although this learning setting is most likely outside the choice of an instructor. The interpersonal flexibility however may relate more to the traditional target group of on-campus students.

Next, the way CMSs can be used to operationalize the 2S-t-M types of flexibility in practice will be discussed.

3.4 2S-t-M Framework Implications for CMSs

Flexibility has now become a more-concrete term through the validation of the 2S-t-M flexibility framework (discussed in Sections 3.2 and 3.3). Important however is the question whether and how the 2S-t-M flexibility dimensions can be supported by a CMS. The main components of CMSs were identified in Chapter 2 (Section 2.3) and were arranged around three sorts of tools for learning support:

- Course organization
- Course communication
- Content creation and delivery

The 2S-t-M flexibility dimensions can be set out against these characteristic elements of a CMS, in order to find out how of each type of flexibility can be enabled or supported through a CMS. Table 27 gives such an overview, where the flexibility option examples are adapted from Collis (1998b).

Table 27. 2S-t-M flexibility dimensions set out against CMS characteristics.

CMS component	Tool functionalities	2S-t-M flexibility dimensions	
		Planning	Interpersonal
Course organization	Course updates	- Updates placed and read anywhere and -time	
	Course information	- Varieties in descriptions	- Accessible anywhere and -time
	Course planning	- Fewer face-to-face sessions - Expanded sessions by having activities before and after	- Students at different locations in one course/session
	Activities	- Have different activities to choose from - Activities can be place- and time-independent	- Own experiences can be used as input - Materials from activities can be used as new learning materials
Communi-cation	Sessions	- Plan fewer face-to-face meetings - Have new forms of contact sessions - Capture sessions as digital audio and/or video and link to the course WWW site for later study - Let students who were not at the session review notes	- Use chat facilities/ real-time communication tools via the Internet for students in different locations
	Communi-cation	- Add a communication center to the course WWW site so that groups of students, or individuals, can be easily contacted via e-mail	-Stimulate students to interact with each other via different activities involving collaboration and peer review and discussion
	Group-work	- Plan that group members work collaboratively on projects without needing to be physically together, use shared workspace tools along with other communication and reporting tools	- Have opportunities for students to use relevant contexts and authentic problems - Have options for those students that have to or want to work alone

Table 27 continues…

Table 27 continued

	Discussions	- Make use of a discussion board for discussions about course topics as a major activity in the course; - Let students moderate - Plan to involve experts from outside the course	-Stimulate CMS-supported discussions among students, if they see each other regularly or not
	Feedback	- Choose from different forms of feedback: i.e. peer feedback, automatic feedback; model answers	- Have peer-support and feedback opportunities
Content creation and delivery	Web-resources	- Make use of the options in resources - make paper materials also available via the web	- Use the Web as a resource for all sorts of resources (i.e. multimedia /reports/examples) and let students contribute during the course.
	Activities	- Materials from activities can be used as new learning materials	- Facilitate students using each others' submissions as learning resources once these are available as part of the CMS environment

Table 27 confirms that if designed appropriately a CMS can be a tool to enable instructors to be more flexible in their teaching. The two types of 2S-t-M flexibility can be clearly recognized in the options that the CMS offers and a number of procedures have been suggested in Table 27 to operationalize flexibility in practice, in terms of the 2S-t-M framework. CMSs therefore could be used as integrated tools for individual instructors to support flexibility in their courses as they are stretching the course mold.

3.5 Current Support for 2S-t-M Flexibility

In Section 2.4 a number of possibilities for instructor support potentially relevant for stretching the mold were categorized. Within the international survey, instructors' opinions about the availability of these types of support were also asked. Table 28 shows the support options currently available to instructors within the cases studied by the international ICT survey described in Section 2.1 (Collis & Van der Wende, 2002).

Table 28. Options in support provided to instructors, means and standard deviations (N=347).

"To what extent do you make use of the following support in terms of applying ICT in your instructional practice".	Mean	SD
Teaching-related ideas and suggestions on the Web	3.71	1.07
A pedagogical-support unit	2.36	1.32
An ICT technical unit or helpdesk	3.19	1.16
Short courses or workshops	3.04	1.17
Handbooks for self-study, or other printed reference material supplied by the institution	2.72	1.15
Material made available via the Web	3.29	1.16

1= Not at all, 3=Some, 5= Extensively

An regression analysis was made to see how the kinds of support are related to each of the 2S-t-M types of flexibility. The analysis again explains only a very limited part of the variance (R-square=0.058). The regression for the planning type of flexibility that an instructor offers however is significant (F=3.48, p=0.002), thus as before, for exploratory purposes the regression results are further studied. Table 29 shows the items that have a significant influence on planning flexibility with regards to the types of available support.

Table 29. Support as experienced by the instructor that has an influence on planning flexibility.

Predictors	B	Std. Error	Beta	t	Sig.
(Constant)	-0.80	0.25		-3.26	0.00
Teaching-related ideas and suggestions on the Web	0.16	0.05	0.18	3.18	0.00
A pedagogical-support unit	-0.09	0.05	-0.11	-1.71	0.09
An ICT technical unit or helpdesk	0.03	0.06	0.03	0.42	0.68
Short courses or workshops	0.01	0.06	0.02	0.20	0.84
Handbooks for self-study, or other printed reference material supplied by the institution	-0.02	0.06	-0.02	-0.28	0.78
Material made available via the Web	0.10	0.05	0.11	1.81	0.07

Only one type of support is a significant predictor, teaching-related ideas and suggestions on the Web. This type has a strong predictive value (for the limited variance explained) on how instructors plan flexibility within their courses. The other support options do not have a significant influence.

The regression analysis of the second type of 2S-t-M flexibility also has a low explained variance (R-square=0.034), and in addition is not significant (F= 2.0, p=0.064). None of the support types were significant predictors of the instructors' level of inter-personal flexibility.

Thus with regard to the support provided to instructors with regard to flexibility in their instructional practices, it is at least suggested in the international survey data that planning flexibility relates to examples and ideas instructors get from the Web. It is interesting to see that none of the support types significantly relates to interpersonal flexibility. Does this support still need to be invented? In Section 2.5 and Section 2.7 similar conclusions and suggestions were made. It was noted that examples could be part of an integrated support tool accessible via a Web browser. The flexibility dimensions could be used as a systematic framework within an integrated support system.

3.6 Conclusions About 2S-t-M Flexibility

The conclusions form this chapter can be given around the research questions and main themes indicated in Section 1.2. In terms of the research questions, these are given in Table 30.

Table 30. Research questions and main conclusions for Chapter 3.

Research questions:	Conclusions
1. What are key types of flexibility involving Web-supported learning in higher education and what framework best expresses these in terms of course design?	There are a number of dimensions in flexible learning relevant to 'stretching the mold', but flexible learning can be classified in two main dimensions: course planning and interpersonal flexibility.
2. What combinations of Web-based tools, functionalities, and systems coupled with what instructional strategies best support these types of flexibility in course design?	A CMS can be used to support options relating to 2S-t-M flexibility.

In terms of the main themes:

There are a number of dimensions in flexible learning relevant to 'stretching the mold', but flexible learning can be classified in two main dimensions: course planning and interpersonal flexibility.
Flexibility is often categorized around flexibility related to time, content, and the instructional approach. As a result of the analyses in this chapter, a two-dimensional categorization was proposed and initially validated. Instructors recognize flexibility that can be given within their courses when they are stretching the mold. The two main dimensions here seem to be flexibility that relates to the planning part of the course and flexibility that is more focused on the interpersonal options for individual students during a course. As the two dimensions relate highly to the Stretching-the-Mold scenario of teaching and learning within higher education, the name that has been chosen for the flexibility framework is two-way Stretching the Mold, or shortened: 2S-t-M. Data from an international survey (Collis & Van der Wende, 2002) were used to validate the use of a flexibility framework organized around these two main dimensions. The validation of the use of this flexibility framework shows that instructors recognize both dimensions of 2S-t-M flexibility. Instructors

predict significant flexibility increase in both these dimensions in their courses in the near future.

A CMS can be used to support options relating to 2S-t-M flexibility.
There are a number of pedagogies and associated uses of a CMS that are related to the extent of flexibility within a course. The extent of 2S-t-M flexibility is also related in a limited way to the sorts of students that take a course. It is interesting to see that instructors learn the most from examples of courses that are on the Web for planning flexibility, whereas for interpersonal flexibility support this has not had any significant influence. The extent to which the instructor indicates that there is support via examples available on the Web may have a relation to the degree of planning flexibility subsequently offered by the instructor. However, support for the use of tools and pedagogies probably needs to be defined in order to increase the level of interpersonal flexibility through CMS use.

The CMS can be seen as an integrated environment that can be used to support flexibility making use of the options in pedagogy as described in Table 27. The 2S-t-M flexibility framework can be used to measure instructor-offered flexibility, but also to organize examples of these types of flexibility within a CMS in order to let instructors learn from these options and relate them to their own contexts.

How a CMS can be used to support options relating to flexibility at the University of Twente is part of the next chapter. How the 2S-t-M flexibility framework was used for an integrated performance support tool that was produced for this research will be shown in Chapter 5.

4 THE TELETOP CMS CONTEXT

Within the Development Research approach model (Reeves, 2000) this chapter emphasizes *the practical problems by researchers and practitioners* (first box in Figure 12), as well the *evaluation and testing of solutions in practice* (Box 3) of two support tools within the TeleTOP CMS.

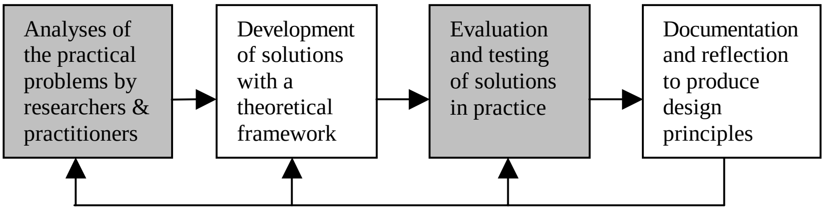

Figure 12. Development Research approach (Reeves, 2000, p. 25).

Whereas the *analyses of the practical problems by researchers & practitioners* (Box 1) already were discussed more conceptually in Chapter 2, and the *development of solutions within a theoretical framework* (Box 2) in Chapter 3, the context for this research will now be focused on one particular example, that of the University of Twente. Within the University of Twente a course-management system has been built to support new target groups and a new pedagogical concept that should make learning more flexible and thus systematically lead to stretching the mold.

The context for these changes and the design of the TeleTOP CMS will be discussed in Section 4.1. In Section 4.2 the initial instructor support for stretching the mold with TeleTOP will be described, followed by a more-detailed description of the use of the first set of integrated decision-support tools within TeleTOP that were available to support instructors in their decisions relating to flexibility (Section 4.3), and in Section 4.4 the second version of integrated decision-support tools within TeleTOP will be discussed. In Section 4.5 the use of TeleTOP, problems, and options relating to both of the S-t-M dimensions will be focused upon, and in Section 4.6 the need for a new support tool will be discussed.

4.1 From Flexible Demands to a Flexible CMS: TeleTOP

Within the Faculty of Educational Science and Technology[1] at the University of Twente, a CMS has been developed. The reasons and general context that led to this decision will be discussed in Section 4.1.1. In Section 4.1.2 the instructional design and system requirements for the CMS will be described, followed by a functional description of TeleTOP (Section 4.1.3).

4.1.1 Developments within the University of Twente, the T.O. Context[2]

The University of Twente in The Netherlands has a national and international reputation in the field of telematics, the European name for the branch of computer science involving the combination of information and communication technologies (in particular, related to the Internet and the World Wide Web). Not only is there an extensive amount of research being done in the area (see for example the work of the multi-faculty research institute, the Center for Telematics and Information Technologies (CTIT, http://www.ctit.utwente.nl/) but also the application of telematics applications to the teaching and learning process, what we call "tele-learning" (Collis, 1998b), has had a high priority since the mid-1990s. Tele-learning was a term that reflected the Stretching the Mold scenario, in order to use technology not only for distance education but mainly to emphasize the increased flexibility that can come to the on-campus teaching and learning process through the combination of the new possibilities offered by the Web and new ways of teaching and learning.

The Faculty of Educational Science and Technology (whose Dutch name was abbreviated "T.O."), was the first faculty at the University of Twente that started thinking about the use of technology in order to make learning more flexible. The faculty operates in a traditional university setting (See Section 2.2.1.3), where course design and delivery takes place predominately in the classroom orientation. In this context, a number of instructors in the faculty have been pioneers in the re-design of their courses involving new technologies. For example, members of the faculty were among the first to use the Web as a collaborative-learning environment for course assignments, in March 1994, so that experts in different places in the

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1 The Faculty of Educational Science and Technology is now called “Behavioural Sciences” but in the remainder of this chapter it will be called the Faculty of Educational Science and Technology as that was its name during the events described in the chapter.
2 The material in Section 4.1.1 is adapted from: Boer, W. F. de & Collis, B. (2001b). Implementation and adaptation experiences with a WWW-based course management system. Computers in the Schools, 17(3/4), 127-146. ISSN: 0738-0569

world could interact with the students in the course on the collaborative writing of course materials using the Web as a common dissemination environment (Collis, 1996). By the end of the 1996-1997 academic year, the faculty could be characterized as having moved from a *support-the-pioneers* stage with respect to the use of information and communication technology (particularly the Web) in instruction, to a *1,000 flowers blooming stage* (Collis & Moonen, 2001).

In the momentum of this experience, the faculty decided to move from the 1,000 flowers blooming stage to a stage of managed change in its instructional practice. This decision was based on a naturally evolving interest and momentum for course re-design taking advantage of the potential of Web technology for increased interactivity and communication within courses as well as the strategic choice to offer the educational program in a more-flexible way. In particular, the decision was made in mid-1997 that by September 1998 students entering the program could participate as local students, or as part-time mature students, already in the workplace and maintaining their jobs and home situations while participating in the program. The characteristics of such lifelong learners were introduced in Section 2.1. Instead of two different programs, on-campus and distance education, it was decided that the flexible program should be made out of a blend between the flexible use of technology and traditional ways of teaching for all students (see Section 2.2.1.3) in order to stretch the course mold. All cohorts would come together to the campus one day every two weeks for various common sessions and opportunities for face-to-face interaction, but after that each course in the first year (16 courses) as well as a variety of others (a total of 30) was being re-designed so that all cohorts could have their particular needs met within a shared course experience, with no extra instructional staff.

This new flexible stretching-the-mold educational approach for both the regular students and mature students who remain in their homes and jobs while they participate in the faculty's program was called C@mpus+ (Carleer & Collis, 1998). It was designed to extend the benefits of the university campus experience for both regular and distance students. This style strove to involve the best of old and new: maintaining good teaching, maintaining the positive experiences students have working collaboratively on design projects to solve real-world problems, but adding new flexibilities, new technologies, and new pedagogies to accompany these old values. This was realized through an innovative redesign of the existing courses to make maximal use of new technologies such as the Web, groupware, and video-conferencing as well as carefully planned group sessions at the faculty for instructors and students. A central aspect of C@mpus^{+} was that technology was used to extend the good teacher and to extend good human contact, not replace these. The approach was initiated to stimulate the innovative and appropriate use of the Web for learning purposes within the faculty in order to make the educational delivery more efficient, more enriched, and more flexible, where the levels of activity and engagement of students should be extended (Collis, 1998a). Carleer and Collis (1998) and others on the TeleTOP team based the re-design of the didactical and organizational approaches on the following principles that relate to the models in technology-based and/or supported learning as discussed in Section 2.2.1.2:

- Learning arises from the *active engagement* of the learner
- This engagement involves cognitively active roles for both instructors and learners
- Interaction and feedback are best served by a movement toward a more *communication-oriented* pedagogy
- Models of good learning are shifting from knowledge-based, instructor-transmission models to models which are process-based and learner-oriented. The most teacher-focused method of communication is the lecture; the most learner-focused method is instructor *scaffolding* of learner self-assessment and reflection.

Related to these new pedagogical approaches, learning should become more flexible. Carleer and Collis (1998) mentioned the following forms of flexibility as most important to the situation in the faculty:

- Improving *flexibility in location* relating to where the learner can carry out different learning activities associated with a course.
- Improving *flexibility in program*, assuming the learner has the relevant previous experience and knowledge, subgroups of courses can be chosen in terms of the learner's needs and interests.
- Improving *flexibility in types of interactions* within a course, within group interaction and group-based projects or more freedom to organize their own times and ways of studying and working alone.
- Improving *flexibility in forms of communication* within a course, so that learners and instructors have a wider variety of ways for more targeted and responsive communication than is the case when communication is limited to what occurs during face-to-face sessions such as lectures, or incidentally in the hallways.
- Improving *flexibility in study materials*, so that the students have a wider choice of resources and modalities of study materials from which to choose.

The types of flexibility also relate to the types in the two dimensions of the 2S-T-M framework that have been validated in Chapter 3. The flexibility dimension that relates to the planning of a course (See Section 3.1.2) relates to most of the C@mpus+ types of flexibility indicated above. However, the interpersonal types of 2S-t-M flexibility can be less recognized within this overview.

In Section 2.2.1.3 it was discussed that flexible and blended learning could be ways to stretch the mold. Within the C@mpus+ approach time was a flexible factor, but the course as an organization form stayed. Courses had a fixed start and end day, but within this instructors could be flexible with individual needs for rounding off the course. With regards to study materials, books and printed forms would still be used, and in their basic aspects be the same for all students. However, extending them would be a wide range of (multimedia) resources that the Web offered or that were obtained from other sources, such as personal materials of the instructors. For the lifelong-learning students that were partly studying from a distance, a "common day" was organized every second Friday, when all students came together physically on the campus. The number of traditional lectures decreased, and instead there was more interactivity, flexibly supported through the use of a CMS. While the general types of assignments were the same for all students, they should be able to choose between group-type projects and more-individual activities, between various approaches to a general assignment, and with variations in the ways in which communication and submission of course work occurred.

In order to carry out this ambition, the TeleTOP project was formed. TeleTOP, "TeleLearning at TO Project", had as overall goals to systematically support the professional development of the faculty in terms of potential CMS applications in their teaching, and to carry out the re-design of approximately 30 courses within the first year so that the faculty's education would become more efficient, more enriched, and more flexible. In order to steer and manage this complex change process, an instructional-development team, called the *TeleTOP* team, was formed. The task of the TeleTOP team was to lead and carry out a systematic and integrated course re-design initiative. For that, the team designed and developed a new CMS, the TeleTOP system. The TeleTOP team consisted of professional members, including a chair who was the Professor of Telelearning in the faculty, the director of the faculty's computer laboratory, five educational technologists (of whom one was the author of this dissertation), a Webmaster, and a database specialist.

In the next two sections the TeleTOP CMS that was built will be introduced and described, and after that the way instructors were supported with the introduction and the use of the TeleTOP CMS will be described in Section 4.2.

4.1.2 Towards the TeleTOP CMS: Instructional design and system requirements

The way the Stretching the Mold scenario was used to see how an ordinary course could be redesigned into a more flexible course was already being discussed in 1997, when Collis looked at the components of a course related to different kinds of improvement making use of Web-based features. The main starting point for the *pedagogical re-engineering* was based on a Stretching the Mold scenario, where the course's current organization was taken as the starting point. From that the instructor was asked to think of his or her course in terms of its decomposition into six major generic components, each of which presents a variety of tasks for the instructor (Collis, 1998a; Collis & Fisser, 1998):

- Organizational aspects of the course, including planning, developing course outlines, setting and revising objectives, choosing study materials, communicating with the students about procedures, maintaining records on student attendance and work, determining the final grades of the students and reporting these, etc.
- Preparing and delivering class presentations (usually lectures)

- Setting up the self-study expectations of the course; choosing study materials, organizing and handling on-going small assignments, dealing with questions relating to the course study materials usually in preparation for examinations; organizing and perhaps supervising laboratory or practicum sessions
- Setting up, guiding, and evaluating the major assignment(s) in the course
- Developing, monitoring, and grading the course examination(s) and discussing problems encountered on the examinations with individual students
- Providing opportunities for general individual contact and other forms of communication (establishing office hours, indicating how and in what ways students should make appointments for help, etc.)

For each of these components, the instructor was led to consider making an efficiency improvement, an enrichment improvement, and/or an increase in flexibility. For each choice, ways that a CMS could support the choice were also identified. Table 31 shows an example of the analysis approach.

Table 31. The components of a course related to different kinds of improvements making use of Web-based features (Collis, 1997).

Course Component:	Efficiency Improvement?	Enrichment Improvement?	Flexibility Increase?
1. General course materials & organizational information	General messages, updates		All via a single interface in one's own computer
2. Lectures/ presentations/ class sessions	Lecture notes, Updates	Extended Lecture Web Board	
3. Self-study of pre-set materials (textbook, reader, library resources; also practice sessions for hands-on self-study)		Student input to study materials	
4. Assignments & student work	Private communication Fill-in forms Project management		
5. Testing			Quiz tools
6. Other	The more course resources are available via an integrated Web environment; the less there are loose and missing documents, the less there are resources that cannot be found; the less there are misunderstandings about assignments, the less there is need for inefficient personal contact; and the more that new resources can be added, the more that students can clarify expectations from studying each other's work and models from the previous year.		

The main components in the first column of Table 31 could be seen as the main elements within courses. This categorization relates to the overview of the main elements of how the options within CMSs could be categorized which was discussed in Section 2.4. The CMS should offer possibilities to support organization, communication, and information flows within a course, all of which are involved in Table 31.

Furthermore, as the initiation phase of TeleTOP continued, the types of flexibilities were further defined, as the pedagogy insights of contributing students (Collis & Moonen, 2001) became a more-clear focus (see Section 2.2.1). Table 32 shows the increasing opportunities for flexibility and contribution-oriented aspects of a course (re)designed via the TeleTOP approach, with some examples (Collis, 1998a, Collis & Moonen, 2001).

Table 32. Increasing the flexibility and contribution-oriented aspects of a course, some examples involving TeleTOP CMS support (Collis, 1998a; Collis & Moonen, 2001, pp. 83)

Component	To increase flexibility for contact (sessions)	To increase flexibility and support a contribution-oriented pedagogy
1. General course organi-zation	-Post all announcements about course procedures on a course Web site -Make a calendar available on the Web site via which relevant dates and times highlighted	-Have students add links to resources related to the course, and to the work and homepages of experts related to the course
2. Lectures/ Contact sessions	-Have fewer traditional lectures and introduce new forms of contact sessions whose results can be studied by those who were not participating in the contact session directly. Extend the lectures and contact sessions so that: (a) the most relevant points are expressed in notes available via the Web site, (b) particularly important comments by the instructor are captured as digital audio and/or video and linked to the course Web site for later study (c) Students who were not at the session can review the instructor's notes, listen to or see the instructor explaining particular points (via streaming audio and video synchronized to the text notes), and can review the materials created and posted by the students who were present at the sessions	-Extend the lecture in terms of participation by having the students who are present at the same time (not necessarily at the same place), interact with each other in a way that engages them in discussing the lecture material and articulating their ideas in a summary. Segments of the instructor's lecture can be chosen, and expand upon. These new materials are immediately posted on the course site -Extend the lecture after the contact time by having all students reflect on some aspect and communicate via some form of structured comment via the Web page; or students can add to the lecture materials themselves, or take responsibility for some of the lecture resources -The instructor uses the students' input as the basis for the next session or activity -Capture student debates and discussions, make available as video on demand, and use as basis for asynchronous reflection and further discussion

Table 32 continues…

Table 32 continued

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 without needing to be physically together - Use real-time communication tools via the Internet for students in different locations who wish to meet and discuss - Stimulate reporting of on-going planning, work in progress, etc., to increase the feedback and effectiveness of project work	-Make shared workspace tools along with other communication and reporting tools available in the Web site to allow group members to work collaboratively on complex projects without needing to be physically together -Use real-time communication tools via the Internet for students in different locations who wish to meet and discuss -Guide students to provide constructive on-going feedback to each other, through the use of structured communication forms and by having their partial products accessible via the course Web site
5. Testing	-Present test items at a certain time, under secure conditions, so that students can write a test if not in the physical testing location -Provide feedback in a quick and targetted manner, without the student needing to wait to see the instructor face to face -Post feedback on the Web about aspects on the test where difficulties were encountered -Send feedback to different groups of students, based on their needs as shown by the test	-Integrate new forms of assessment, such as all students maintaining their own portfolios, with the course Web environment
6. General communi-cation	-Add a communication centre to the course Web site so that groups of students, or individuals, can be easily contacted via e-mail -Use real-time collaborative tools so that students can see and hear the instructor or other students 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 students take responsibility for moderating the discussions, adding links to external resources to justify their comments when appropriate -Involves experts from outside the course in the discussions

The Stretching the Mold flexibility elements that can be seen in the examples in Table 32, and relate to and build upon the flexibility examples presented in Section 3.4 (Table 27). Thus the flexibility types that relate to 2S-t-M flexibility could be seen as the starting point for the requirements for the CMS that should be selected for the C@mpus+ approach and the redesign of courses. Collis (1999a), and

Tielemans and Collis (1999) listed the main requirements for the CMS system. Table 33 gives an overview of these requirements and the implications for the CMS.

Table 33. Overview of requirements for the TeleTOP CMS.

Requirement	Implications
Low threshold of use for instructors	Create, read and modify all course materials through an ordinary Web browser, system works with all other Web products, for example Java applets and plug-ins.
Able to put in and take out whatever is necessary in the course site without needing direct technical support. Uploading and downloading attachments of a variety of types is particularly important	No or low use of HTML code and use of various types of fill-in forms
No standard pedagogical model that everyone is expected to follow but options to support a large variety of different types of instructional approaches, from courses focused on reading and written assignments with classic final examinations, to courses with complicated approaches to group work and project-based education.	Tools to support any instructional approach must be available, including shared workspaces, test banks, and discussion boards.
Allow the instructor to be the decision maker about the course site, but these decisions should be alterable over time, as the instructor gains more experience	A tool within which an instructor can choose from a number of tool options must be available. A large number of options should be possible in a course Web site; options can be added and/or removed.
Opportunities for student reflection, for communication, for student contribution of additional learning resources, for peer interaction and peer evaluation, and to add a "preparation for" and "follow-up from" each face-to-face session	A Schedule tool (Roster) to make course planning, organize activities and feedback, all within the system is important.
Organize the information streams within a course: make groups, address groups (news or feedback)	Tools for making groups, handling feedback need to be present
The system must be efficient to maintain, thus no labor-intensive hand-made HTML pages	System is database driven
Handle multimedia resources	Have tools for handling multimedia
Students are able to use the system without instruction	Consistent interfaces in all course environments are to be accessed through familiar Web browsers System can be coupled with other information systems of the faculty such as the bureau responsible for student issues and administration.

On the basis of the prior experiences in the faculty with CMSs, a detailed market research of available course-support systems (Tielemans & Collis, 1999), and participation in an international evaluation of several such systems (Van der Veen & De Boer, 1999; De Boer & Hamel, 1998) the conclusion was made that none of the commercial products available at the time met all of the requirements in Table 33, even those still in the advertisement stage. Thus, the decision was made to realize a system that would meet all the requirements listed above.

Based on the work of Strijker (1997) a prototype of a CMS was built in the second half of 1997. The requirements of an easy-to-use system that was totally Web-based led to the use of a Notes server with a Domino HTTP engine but with access to all users via a Web browser. The technology supported an environment that used structured forms for certain types of course-related materials, communication, and organization. Each course consisted of a Domino database. The design of the templates and features of the TeleTOP environment was made through the Notes client (by the system designer). Instructors as well as students only used the Web-client for interacting with or through the system. Figure 13 shows the basic architecture of the TeleTOP system.

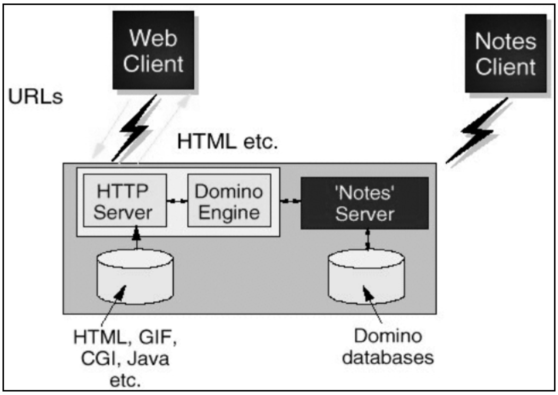


Figure 13. System architecture for TeleTOP.

The forms that would enable instructors to easily design courses within the TeleTOP CMS were based upon the elements of a CMS as first categorized by Collis (1997). The categories that were chosen for TeleTOP were organized around organization, communication, resources, and group activities, based in turn on the components in Table 31 and Table 32 (Section 4.1.2). Table 34 gives an overview of the options and the categories of the tools of the TeleTOP CMS environment (De Boer & Collis, 1999).

Table 34. The options for the TeleTOP environment (De Boer & Collis, 1999).

Categories	Options	Description
General course information, self-study, lectures and support	News	A place for up-to-date information
	Roster	This is the most- important part of the environment. Here, instructors can put their study materials, assignments, sheets, notes, and feedback related to the lectures or course topics, and students can enter their own work and receive feedback.
	Student administration	An overview is given of all the students who submitted material via the TeleTOP site during the course, organized per student.
	Quiz server	This option enables easy-to-make (self) tests.
	Course information	A course description can be put here. This can include course goals, organization, assigned texts, etc.
Communication	Email	In the mail-center addresses of individuals and groups can be found. Mails can be sent from here.
	Discussion	The discussion area can be used for a-synchronous discussions.
	Question and answer	Same as the discussion area, here with the focus on question towards the instructor.
	Chat	Synchronous communication.
Group-work	Groupware	An easy-to-use file management area, for collaborative work.
	BSCW	An advanced file and communication management area, for collaborative work (http://bscw.gmd.de/).
	Presentation	Student presentations and other products can be presented in this area.
Resources (content) & others	Glossary	Area where concepts can be explained. Relations with other areas can be made clear as well.
	Web links	Resources: pages on the Web
	Multimedia	Resources: in the multimedia database.
	Publications	An overview of interesting literature for the course.
	Slides	HTML pages can be made and presented in this area.
	Search	A search center: within the course environment or the Web

These categories and options were used for the design of TeleTOP. As Nieveen (1999) has described, a rapid-prototyping approach was used, in this case to design, create, implement and adjust the TeleTOP CMS environment; an approach that began in 1997 and continued for a number of years, through several versions of the system (TeleTOP will move into Version 5.2 in 2003). In the next section a more-complete description of the TeleTOP CMS will be given.

4.1.3 Description of the TeleTOP CMS

In Section 4.1.2 the requirements for the TeleTOP CMS were given. The design and development of the TeleTOP CMS started in late 1997, and through rapid prototyping several versions of the system were built in a short time. An important requirement was that of ease of use (Collis, Peters, & Pals, 2000), TeleTOP had to be a Web-based environment. Figure 14 is a screen dump of one of the course environments for one particular course in June 1998. At the left side of the screen the list of chosen options can be found. This is the menu area. In the right window all information is displayed. All courses have a similar interface design, but differ in their functionalities, based on the instructor's choices.

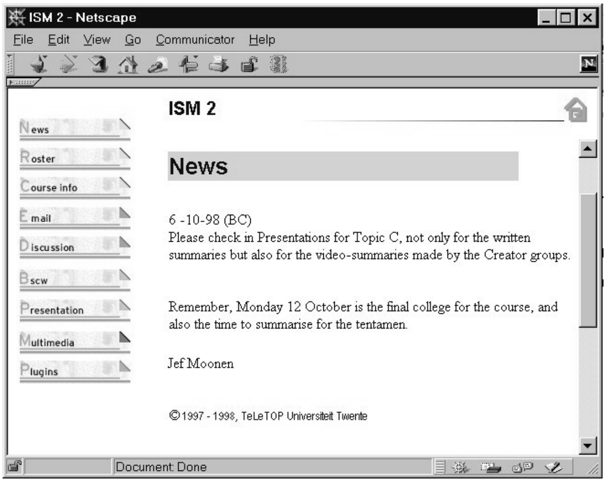


Figure 14. The home page of the Instrumentation Technology 2 course (see Winnips, Collis, & Moonen, 2000).

The options that are in TeleTOP were discussed in Section 4.1.2. A schematic overview of the categories and the functionalities is presented in Figure 15 (Gommer & Visser, 2001) that is based on the options for the TeleTOP Web-based course-support environments as described in Table 34.

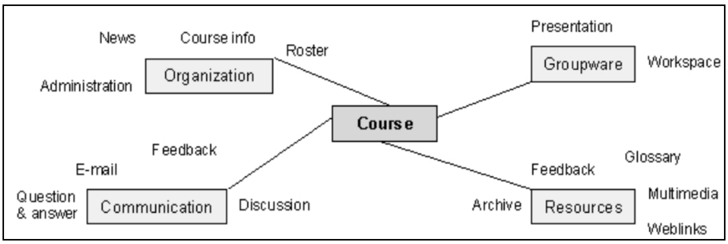


Figure 15. Schematic representation of TeleTOP (Gommer & Visser, 2001).

The menu options could be different in every course, as the instructors choose them. The options lead to the different functionalities within the system. The TeleTOP environment was built with the use of forms (templates) for different purposes within the CMS. The forms have a similar design, but differ as their function defines their purpose. An example within the Organization category is the “News” template. Figure 16 shows a News form that can be used to post a message to the TeleTOP CMS.

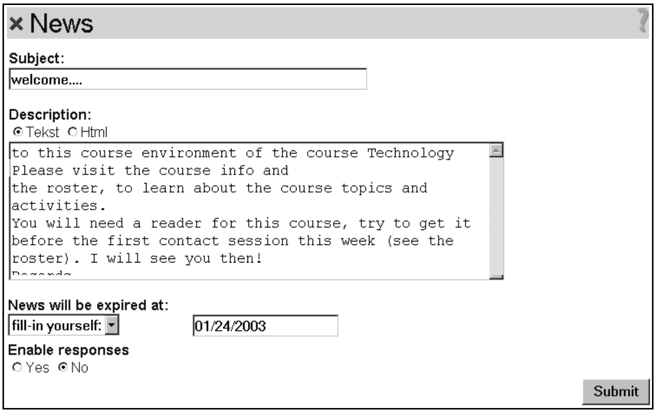
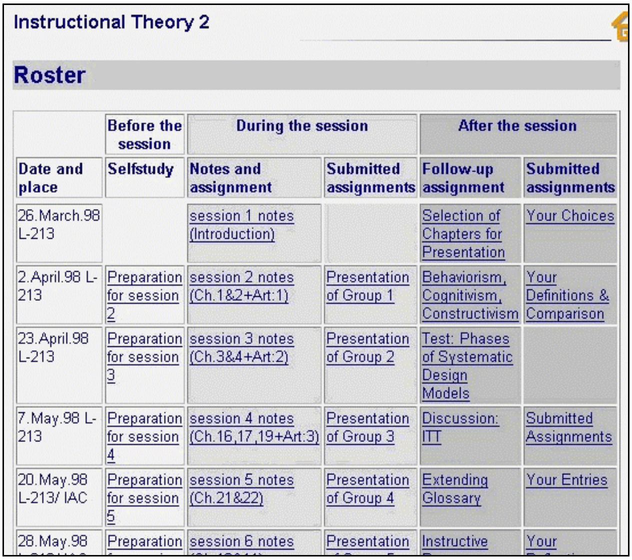


Figure 16. A News form within TeleTOP.

When posted, an instructor may wish to alter or remove the message. This is possible by clicking the intended buttons and confirming changes or deletions.

This way of interacting with the system is very similar throughout the system. There are forms that especially support communication (such as threaded discussion lists or FAQ forms) and forms that are designed for managing course materials, such as Web-links, Multi-media resources or PowerPoint slides. For the organization within the TeleTOP CMS a particular tool was designed. This was called the “Roster”. All instructors choose to use this matrix-like roster. This area helps them to place all organizational messages and materials needed before, during, and after each contact session. Students can find the self-study materials or instructions in the roster. They can find the lecture notes and sheets and possible follow-up assignments, and can submit their assignments and comments directly via the roster. Instructors do not receive these submissions in their ordinary e-mail. All submitted materials are directly posted in the CMS environment, where the instructor can access them in a systematic way, whenever and wherever he or she chooses. Figure 17 is an example of such a roster, used in the *Instruction Design Theories* course, 1998 (see also Collis, Dijkstra & Eseryl, 1999).



Instructional Theory 2

Roster

	Before the session	During the session		After the session	
Date and place	Selfstudy	Notes and assignment	Submitted assignments	Follow-up assignment	Submitted assignments
26.March.98 L-213		session 1 notes (Introduction)		Selection of Chapters for Presentation	Your Choices
2.April.98 L-213	Preparation for session 2	session 2 notes (Ch.1&2+Art:1)	Presentation of Group 1	Behaviorism, Cognitivism, Constructivism	Your Definitions & Comparison
23.April.98 L-213	Preparation for session 3	session 3 notes (Ch.3&4+Art:2)	Presentation of Group 2	Test: Phases of Systematic Design Models	
7.May.98 L-213	Preparation for session 4	session 4 notes (Ch.16,17,19+Art:3)	Presentation of Group 3	Discussion: ITT	Submitted Assignments
20.May.98 L-213/ IAC	Preparation for session 5	session 5 notes (Ch.21&22)	Presentation of Group 4	Extending Glossary	Your Entries
28.May.98	Preparation	session 6 notes	Presentation	Instructive	Your

Figure 17. The roster of the Instruction Design Theories course.

The form that TeleTOP has for the roster alters from most of its other forms. Figure 18 shows an example of the instructor's view of a roster page and how it can be generated or modified.

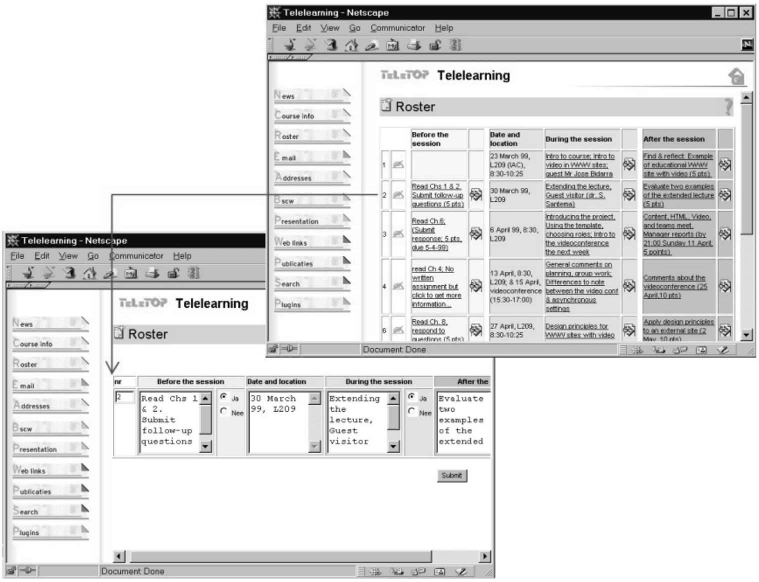


Figure 18. Instructor's normal view and edit view of a roster page.

In the edit view (lower part of Figure 18), the instructor can choose to add new rows to the roster, and can choose the labels for each cell in the roster. At the moment that the instructor types in a label on a previously empty cell, for example, a date indicating when a self-study assignment is due, a new page is associated with this link. The instructor can use this page to make a more-detailed planning of the course activities, session notes, readings, group-work instructions, and other course communication. All roster pages have a basic fill-in-form and an upload button, so that the student can submit his or her assignment directly through this new page. Figure 19 shows a page from the roster ready for the students to submit an assignment. The instructors can also decide if they wish the assignments to be readable by everyone in the class or only by the instructor.

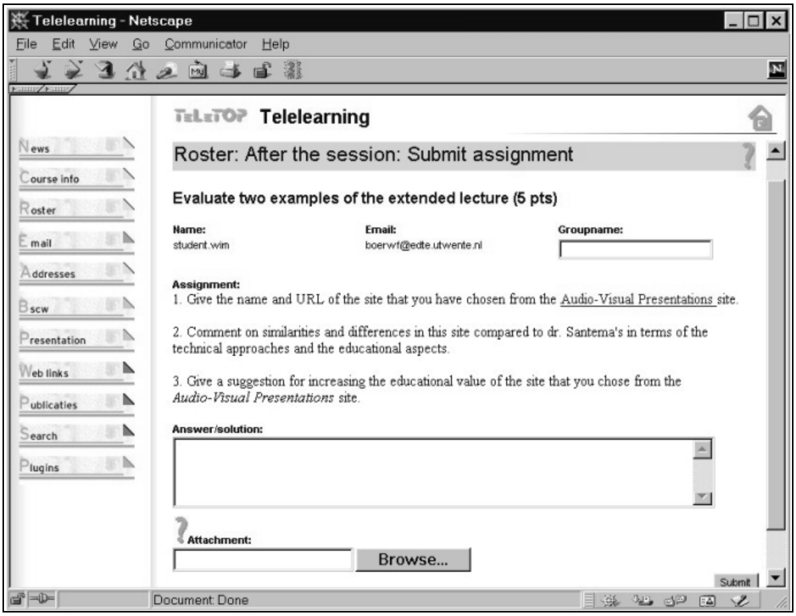


Figure 19. Student submission tools.

Students see TeleTOP as the instructors do. This is a convenient way for instructors to know how their students experience the CMS. There are differences: students cannot add or change anything, unless the instructor allows them. Also, an instructor can make use of more-advanced tools to form student groups, and with that address certain content and organizational matters to particular groups of students. For a more-detailed description of the elements within TeleTOP, see the TeleTOP Technical Guide (Van de Weer, Van Nes, Tappel, & De Boer, 2000) or the TeleTOP home site at http://www.teletop.nl/index_uk.htm. For examples of how the system is used in practice: De Boer (2001); De Boer & Collis (1999, 2000a & 2000b); De

Boer & Fisser, (2002); De Boer & Peters (2000); and Collis, De Boer, & Van der Veen (2002). Also in Section 4.4 the use of TeleTOP by instructors will be described in more detail.

In the next section the implementation of the TeleTOP system within the C@mpus+ instructional model will be described with a focus on the instructor support.

4.2 Instructor Support for Stretching the Mold with TeleTOP

In Section 4.2, the experience within the Faculty of Educational Science and Technology with systematic support for instructors within an overall plan for stretching the mold is described. In Section 4.2.1, the main elements of the implementation approach are discussed and in Section 4.2.2, the step-by-step procedure used in the approach in the 1997-1998 year is given. The use of the first TeleTOP Decision Support Tool was an important part of both the set of elements and the step-by-step process. Section 4.2.3 gives a brief summary of the results of the approach.

4.2.1 Main elements of the instructor-support approach

The main elements within the TeleTOP Course Re-Design Model were developed by Collis and De Boer (1999a), and emphasized extending the strengths of the instructor via technology, not reducing his involvement or personal impact. Therefore in developing an implementation strategy for TeleTOP, it was important to be aware of predictable problems and phases in the diffusion of an innovation in an educational setting, and in particular of factors that affect the instructor's likelihood of changing his or her instructional practice. The C@mpus+ pedagogical model that had been introduced (see Section 4.1) could guide the instructor's decision making about course re-design and technology integration, but an implementation plan was still necessary for the change process to occur.

Collis and De Boer (1999a) describe how the implementation was organized around six main elements. Table 35 gives an overview of the elements.[3]

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3 The material on in Section 4.2.1 is adapted from: Collis, B., & De Boer, W. F., (1999a). Scaling up from the pioneers: The TeleTOP Method at the University of Twente. *Interactive Learning Environments, 7,* (2/3), 93 - 112.

Table 35. Elements underlying the implementation method of TeleTOP.

The TeleTOP Method© consists of:
1. The C@mpus+ educational philosophy underlying all aspects of the TeleTOP Method: (a) extending, not replacing, the good instructor and the good textbook; (b) increasing student participation and communication; and (c) re-designing the nature of lectures to have fewer lectures but more student activity and instructor feedback before, during, and after the contact session, for both regular and part-time students.
2. The strategic principle for the "multiple use" of courses: of designing a course to teach once, adapt within for individual differences, via reusable units of learning materials contributed by students and the instructor
3. An educationally grounded analysis approach used for the course-redesign process, involving a 6 x 3 matrix (six categories of course components crossed with three focuses for adaptation; Collis, 1999a; see Table 31).
4. The Web-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) (Collis & De Boer, 1998; De Boer & Collis, 1999).
5. 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 & DeBoer, 1999b; De Boer & Collis, 1999).
6. The CMS, TeleTOP, created for the project 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 Web-based user interface characteristic of TeleTOP course-support sites (Tielemans & Collis, 1999).

Part (b) of the first element and the second element relate directly to goals related to Stretching the Mold, while Elements 4 and 6 relate to CMS-associated tools. The remaining elements relate to a step-by-step procedure for using the tools to meet the flexibility-related goals.

4.2.2 The step-by-step rapid prototyping procedure

The eight-step sequence of contact sessions mentioned in Element 5 of Table 35 was especially important in the rollout of the TeleTOP approach throughout the faculty. These steps in more detail included the following[4]:

1. The TeleTOP team was responsible for the planned steps to take for the transfer and adaptation of TeleTOP to the faculty in the 1997-1998 academic year. The implementation started with a weekly instructors' session in the faculty. These sessions were voluntary, and well attended. During the first two months of the sessions, instructors were introduced to a way of thinking about their courses, in terms of the matrix in Table 34 links to examples of how

[4] The material on Section 4.2.2 is adapted from: Boer, W.F., & Collis, B.A (2000b). Instructor's choices for a WWW -based course-support environment. *Journal of Network and Computer Applications*, 23, 17-26.

telematics applications could support each category of change corresponding to a cell in the matrix were demonstrated and discussed.

2. After several months of the lunchtime sessions, whose function was mainly awareness building, instructors were encouraged to consider their own courses and make a list of re-design options with could be facilitated by a TeleTOP course-support environment tailored for their own particular courses. Following this, one-hour individual sessions with the instructors of each of 25 courses were organized (all the courses for the in-coming first-year students and a variety of other courses). The primary goal of these sessions was to use the especially-made TeleTOP Decision Support Tool (DST) in order to interact intensively with the instructor whose course was being re-designed, trying to identify which Web-compliant tools and associated pedagogical approaches are most likely to be acceptable and interesting to the particular course of the instructor and his/her way of teaching. The second goal of the individual session was to respond to the instructors' reactions with ideas and suggestions, as well as to skip suggestions which did not seem like they would be comfortable for the instructor. The first TeleTOP DST is discussed in more detail in Section 4.3. Immediately after the last of the questions in the DST was completed, a Web page was generated for the instructor summarizing the choices that had been made, and providing the example links for those choices so that the instructor could further consider them via the use of an ordinary Web browser at his or her convenience. This site generated by the DST served as the product of the first round of rapid prototyping.

3. A follow-up visit in the instructor's office one week after the DST session also occurred, to walk through the first site generated from the instructor's decisions with the DST, and to make a second round of refinement of those decisions.

4. Following this, a first electronic prototype version of a course site tailored to the instructor's choices was generated, through the use of the TeleTOP database system.

5. The next step for the instructors was to come together every week and practice with these prototype environments. The *Wednesday sessions* in which this occurred became an important part of the implementation process in the initiation year (although they were not continued after the initial year as instructors no longer felt the need for start-up support). Instructors had the chance to work together and exchange ideas.

6. A few months later the instructors again went through the process of using a second Web-based decision tool, choosing a final set of options for their course-support environments.

7. During the course-preparation process, instructors could be supported by student assistants for tasks such as converting resource materials to digital form.

8. Before the launch of the course, a walkthrough occurred with a curriculum specialist in the faculty, to assure consistency in the course environments and suggest final adjustments.

4.2.3 Overall results of the instructor-support approach

As a result of this rapid-prototyping process, instructors not only were closely involved in the design process of the Web sites that would support their courses, but also developed competency in handling those sites and the associated tools and applications. The results of the process were tailored course-support environments to support enhanced flexibility and bring a systematic introduction of Stretching the Mold to an entire faculty at the same time. The DST tool made it easier for instructors to make decisions with regard to making (some of) the components of their own courses more efficient, enriched, and/or flexible in their new TeleTOP learning environments. The instructor needed to decide what (s)he thought was appropriate for his or her course.

Other results were the creation of a sense of community among the instructors and a heightened level of awareness and literacy throughout the faculty with regard to the handling of the TeleTOP system, network issues, and the instructional integration of Web applications into regular courses. Instructors also had an extensive opportunity to try out a large variety of CMS-related tools and applications over the course of the rapid-prototyping process.

A major result of the approach was that through it an extensive faculty-wide change-management process occurred within a brief time, in a systematic way. During October 1997 through June 1998, a sophisticated database-driven Web-based course-support system using a Domino engine, Domino databases, and a Lotus notes server, was built and put to use (see Tielemans & Collis, 1999); a sub-methodology within the overall implementation method for instructor engagement based on rapid prototyping was developed and used with more than 25 instructors, and a large variety of activities were undertaken to develop a cultural change and climate within the faculty for implementation. Three TeleTOP courses were in operation by March of 1998 and the entire first-year program has run, beginning in September 1998 to an incoming class of as many part-time students as regular students (between 35 and 40 each). A number of higher-level courses were also adapted and delivered during this same period.

The process, with some modifications, also was used in the faculty in the 1998-1999 academic year. During this time, all second-year courses were also redesigned and because of a curriculum change in the faculty, new first-year courses were also developed, so that in a little more than a year, approximately 40 courses are onboard. Preparations were in August 1999 beginning for 25 more courses to be redesigned during the following year, some of which were to be used by the Masters program, which came to involve nearly every instructor in the faculty.

In addition, the success of TeleTOP quickly led to other faculties and institutions within the university wanting to make use of the approach. Thus during the 1998-99 academic year the TeleTOP Method was also adopted for another faculty in the University of Twente (De Boer & Collis, 2000a). Later, various other faculties would rapidly follow as well as other universities (for a case study of the first two years of the TeleTOP approach, see Collis & Moonen, 2001).

Table 36 shows the log data for overall usage of the TeleTOP system between August 1998 and April 1999 (Collis & De Boer, 1999a).

Table 36. Log data of the TeleTOP system, August 1998-April 1999 (Collis & De Boer, 1999a).

Event	Data
Timeframe of the course	08/24/98 – 21/4/99
Number of successful hits for entire site	446,125
Number of page views	383,039
Number of users	375 students, 45 instructors; (Note: 8 TeleTOP team members & 10 student assistents not included in the log)
Number of user sessions	26,155
Average number of users per day on weekdays	192
Average number of hits per day on weekdays	3,303
Average number of users for the entire weekend	92
Average number of hits for the entire weekend	1,458
Average user session length	00:11:07 (11:07 minutes)

In the academic year 1999-2000 TeleTOP was chosen by the University of Twente as the default CMS for all courses. All faculties use a variant of the TeleTOP implementation model and most start with their first-year courses in rolling out the use. In 2000, one year after the central implementation of TeleTOP, without counting courses within the Faculty of Educational Science and Technology, 600 courses used TeleTOP within the university of Twente (Van der Veen, 2001b). Droste (2002) reports that within the University of Twente (with a population of approximately 7000 students, 1500 instructors/researchers and 1000 support people), that in the course year 2001/2002 about 1000 of the 1800 courses used TeleTOP. Currently the usage relates to a large majority of the courses.

Only a very general impression of how TeleTOP was implemented and supported within one faculty has been described here. There are more-detailed descriptions of this process, see for example Collis and Moonen, 2001; Droste (2002); Van der Veen (2001b); Gommer & Visser (2001); Fisser, Kamp, & Slot (1999); and Bloemen (1999).

A key element within the approach was the first TeleTOP Decision Support Tool (Collis & De Boer, 1998; De Boer & Hamel, 1998; Fisser, De Boer, Peters, Verheij, Strijker, & Collis, 1998). In the next section the use of the first TeleTOP Decision Support Tool (Element 4 in Table 35) as a key element within the TeleTOP Implementation Method will be described in further detail.

4.3 The first *TeleTOP DST:* A Tool to Support Structured Interviews[5]

In this section, the first TeleTOP DST is discussed in more detail. In Section 2.4 problems and concerns for instructors beginning to stretch the mold with the help of a CMS system were discussed. As learning is becoming more flexible, moving towards a Stretching the Mold scenario (Chapter 2), the 2S-t-M flexibility dimensions can guide instructors as they re-design their courses with the use of a CMS. New options in technology (CMS) use and pedagogy can emerge. Within the TeleTOP approach the support of instructors was intensive, and acknowledged the potential problems and concerns of instructors (Section 2.4). Support was at first individually organized (Section 4.2.1.2). Thereafter a support tool was built. An early experience to assist instructors in making decisions about the design of a CMS, prior to *TeleTOP*, had been conducted by De Boer and Hamel (1998) as part of an European project in which the Faculty of Educational Science and Technology was involved and in which flexibility dimensions were systematically analyzed (Collis, Vingerhoets, & Moonen, 1996). This was a paper-based type of support which was evaluated after user trials and in the TeleTOP context then changed into a first electronic version of a decision-support tool that was made in html (De Boer & Hamel, 1998). Section 4.3.1 describes the electronic tool, Section 4.3.2 describes the interview process in which the tool was used, and Section 4.3.3 summarizes an evaluation of the utility and usability of the tool.

4.3.1 Description of the first TeleTOP DST

The first TeleTOP Decision Support Tool was a Web-based environment consisting of a series of more than 65 questions related to the six major generic components

[5] The material in Section 4.3 originally appeared in: Collis, B., & Boer, W.F., de (1999b). *The TeleTOP Decision Support Tool (DST).* In J. van den Akker, N. Nieveen, & Tj. Plomp (Eds.), *Design methodology and development research in education and training,* (pp. 235-248). Dordrecht: Kluwer Academic Publishers.

that were the basis for systematic redesign (see Table 31 and also Table 32 and Table 34).

The questions in the first DST were very short and dealt with the "normal questions" that an instructor has to ask him- or herself when setting up a course, such as: "What kind of presentation formats will I use in my lectures?; How, when, and to what detail will I provide feedback on assignments?", etc.. Each such consideration was presented in terms of a question. Examples of the questions for the first TeleTOP DST included:

- For a course overview: Do you want to have the possibility to give short updates and announcements to students without them having to be present on campus? (S-t-M, Dimension 1)
- For communication: Do you want your students to participate in group discussions, where they can enter their reflections at a time convenient to them? (S-t-M, Dimensions 1 and 2)
- For lectures: Do you want to make additional information available to your students relating to material in the lectures that they can access whenever and where ever they like? (S-t-M, Dimension 1)
- For self-study: Do you want to give occasional personal feedback to the students based on their progress with self-study questions available through the Web site that they can access whenever and where ever they like? (S-t-M, Dimension 1)
- For major assignments: Do your students work in groups on a major assignment, and if they do, do they sometimes have problems managing themselves and staying on tempo? (S-t-M, Dimension 2)
- For testing: Do you want to give students access to previous test questions, along with feedback and overviews of previous students' answers that they can access whenever and where ever they want? (S-t-M, Dimensions 1 and 2)

Each question contained a link to a illustration of how a Web-based tool or the TeleTOP CMS itself could be used to support the situation described in each of the questions. In order to help the instructors to better consider their answers to these questions, and at the same time relate the answers to the range of new instrumental and technical possibilities in TeleTOP, examples from Web-based courses already operating in the faculty could be chosen and studied relating to each question. The value of the use of examples was already discussed in Section 2.5.1.2, and validated in Section 3.5. Examples of how other instructors have used technology and pedagogy within a Stretching the Mold scenario was found to be very valuable for ‘new’ instructors. The examples that were used were mostly taken from existing on-line Web-based support environments from courses in the Faculty of Educational Science and Technology, and sometimes from other parts of the world. Important however was the fact that they were all examples from an educational context. This made it much easier for instructors to "understand" the examples that went with the questions, in order to answer the questions in a more-considered way. In this way, the use of technology followed the instructors' systematic decision making about making their courses more systematic. The full set of questions as well as the examples associated with the questions is given in Appendix 1. Figure 20 shows a part of the first *DST* with the question window and the associated example window, in this case both referring to a TeleTOP course roster.

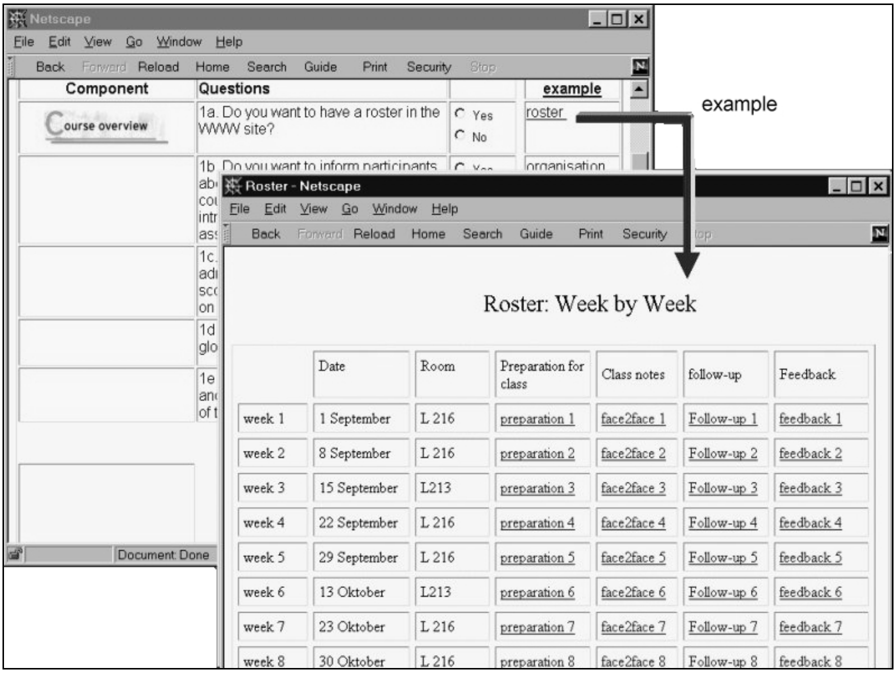


Figure 20. The first TeleTOP Decision Support Tool with an "example" window showing how a course roster can be operationalised in the form of a hyper-linked html page in a Web environment.

Each of the questions in the DST was answered by entering a yes or no choice. Instructors were encouraged to answer "yes" if they were potentially interested in an option; changes could be easily made in later rounds of prototyping. In some cases, a "no" answer jumped the user over a subsequent series of questions and examples; for example, if the instructor had no interest in group-based project work, then a range of questions about how to support such project work especially when students are not always at the same place at the same time was omitted. After completion of responses to all pertinent questions in the DST, the database which underlies the

DST automatically generated a unique Web-page with the specific answers and the chosen options made by the user. In this way, users immediately could see via the Web-browser or a printout what they had chosen, and could continue to examine the examples in their own offices, simply by loading the Web-page which was generated for them.

The *DST* was build upon a TeleTOP database, which organized the components, the questions, and the examples in a way that was directly related to the TeleTOP environment itself. The questionnaire was designed in a table, with in the left-hand column the components (e.g. *Communication*), then the questions with yes-no response options, and in the right-hand column, the hyperlinks to the examples. Examples were always displayed in a new browser, so that the *DST* itself would not disappear from the user interface, as demonstrated in Figure 20.

4.3.2 Process for using the first TeleTOP DST

The first TeleTOP DST was used in an interview setting. An appointment for one hour was made with each instructor of a course to be redesigned. A TeleTOP team member (usually the author) carried out the interview. The *DST* was introduced as a tool designed for support of a structured interview and to enable the instructor as well as the team members to make decisions in a structured and organized way.

After the interview, a "decisions-made" form for that particular course was generated. Via the homepage of the *DST* all instructors could find their courses and the pages that were generated containing the choices made by the instructors during the *DST* sessions. The instructors were able to compare the choices they had made with the choices of their colleagues, but also modify their own choices if they liked.

As noted in Section 4.2.2, the next step, after a few days, occurred when the TeleTOP team made a first prototype of the specific course-support environment, based on the decisions made by the instructor (see the steps in the TeleTOP rapid-prototyping method, noted earlier in this section). Figure 21 shows a set of interfaces for one course re-designed for TeleTOP: the *DST* environment, the output from the *DST*, the first prototype site of the course being re-designed, and the site as in use with a full group of students.

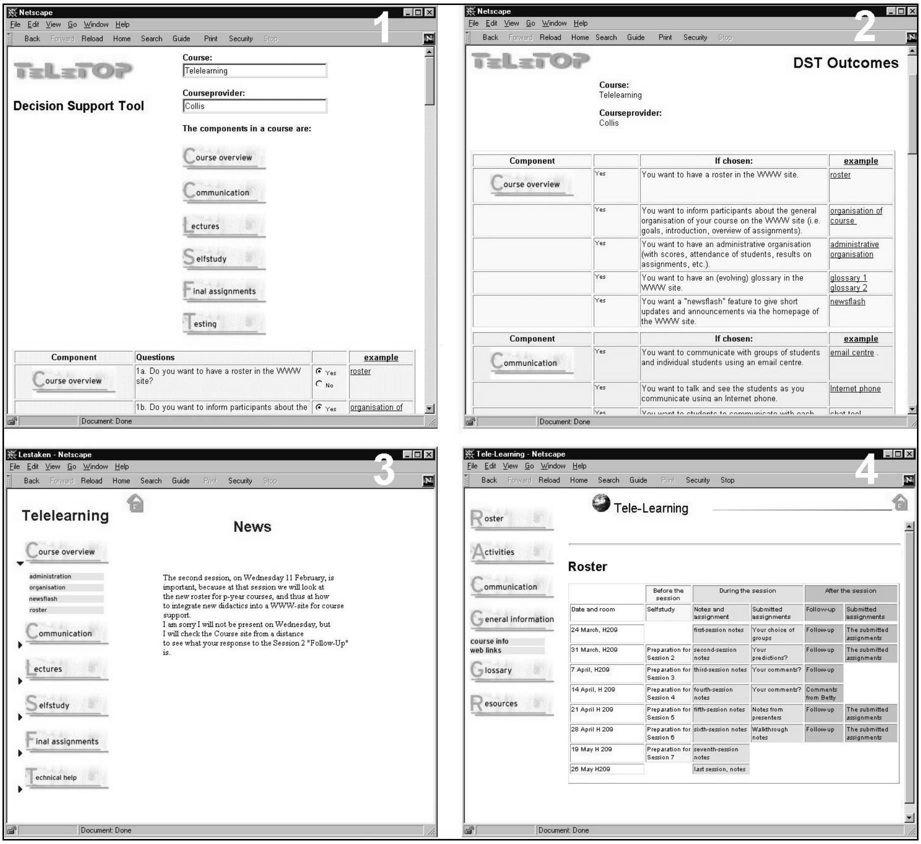


Figure 21. Interfaces of the four stages within TeleTOP (1. DST session; 2. DST output; 3. Prototype of the course; 4. Final course environment) of realising a Web-based course-support environment using the TeleTOP Instructional-Design Model, illustrated with the course named Tele-Learning.

4.3.3 Evaluation of the usability and utility of the first TeleTOP DST

The first *TeleTOP DST* was evaluated by the TeleTOP team in terms of both its usability and its utility during its use with the courses being adapted in the 1997-98 phase of TeleTOP (De Boer & Collis, 1999). Usability relates to how easily the user can interact with the system; utility relates to how well the system does the task it is meant to do (Nielsen, 1994; Sweeney, Maquire, & Schakel, 1993). Key results of these evaluations include:

> In terms of utility, the DST assisted instructors in their choice of options for the environments of their courses. The options *Newsflash*, *Roster*, *Course information* and *Email centre* were chosen by all instructors and thus were strongly advised as the basic environment for the new round of courses being

tailored during the 1998-99 academic year. The other available options were chosen in various combinations by the instructors. Instructors with specific needs could get tailor-made options, and when these options appeared to be popular with a number of instructors they were directly added as standard options in the TeleTOP system. Thus the system grew in a way that was directly based on the interviews that accompanied the use of the first TeleTOP DST. Figure 22 gives an overview of the percentages of the instructors who choose each of the options available in TeleTOP as offered through the first TeleTOP DST. These data are based on the first 21 courses offered between April 1998 through April 1999.

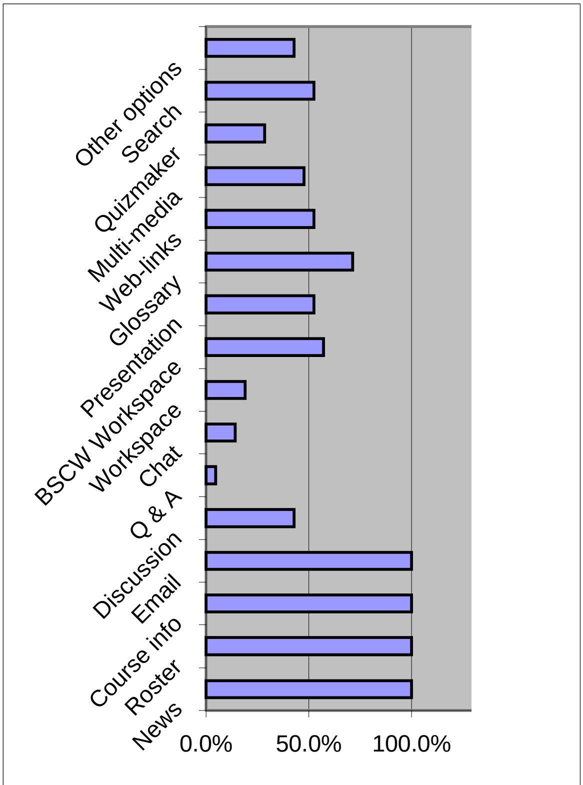


Figure 22. Percentages of instructors choosing various options (N=21) (De Boer & Collis, 1999).

In terms of usability, the first *DST* was found to be easy to use in the interview setting and then as a follow-up tool for self-study as well as for further design-oriented discussions between an instructor and TeleTOP team members.

As a mixture of both usability and utility considerations, instructors appreciated very much that immediately after their interviews they could be handed a printout of their choices made during the *DST* interaction, and also that their choices were immediately incorporated into a Web page linked to their names and course titles, so that they could review their deliberations. All persons involved appreciated the fact that the *DST* made the interview process time-efficient; each interview was completed in the one hour scheduled.

In terms of system utility, the *TeleTOP DST* was invaluable to the TeleTOP team. It served as a comfortable but businesslike tool for carrying out structured interviews, each staying within the one hour scheduled for it. It provided a clear and common focal point for discussions with the instructors, and the access to examples was critical to raise the instructors' awareness of what different Web-based functionalities could look like integrated into a larger course-support site. Thus it also provided an important staff-development function at the same time as serving to professionally facilitate what could have been a complicated or even contentious interview.

Thus the first TeleTOP DST was valuable for instructor support during the first full year of implementation of TeleTOP and of a stretching-the-mold approach within a faculty. At this time, a tool that was used in combination with an interview was appropriate, in order to deal with the culture change that was being introduced within the faculty. However, the approach needed to scale up to independent use.

4.4 The second TeleTOP DST: An Integrated Setup Tool

After one year of guiding the instructors in a very extensive way, the TeleTOP DST tool was redesigned in order for instructors to set-up their TeleTOP courses by themselves without the interview with a TeleTOP team member. The rationale for this was that instructors could build upon their own experiences by using an integrated version of the support. In Section 2.6 the advantages of integrated performance support were discussed. The first type of support, the interview method using the first DST, was very time extensive, and an integrated support tool would offer a less time consuming and more-flexible way for the set-up and design of a course though TeleTOP, once instructors no longer needed the basic awareness support. However, since the second DST would be used without extra human support, it was necessary to add more explanatory materials than had been the case in the first DST. Section 4.4.1 describes the second TeleTOP DST and Section 4.4.2 indicates some results of its use throughout the University of Twente from 1999 to the present day (2003).

4.4.1 Description of the second TeleTOP DST

With the second DST instructors could set-up their TeleTOP courses themselves, by making choices relating to extending flexibility from a number of groups of options and tools. The integration of the DST with the TeleTOP CMS made it possible that the instructor's TeleTOP course site was automatically generated at the moment the instructor finished the decision-making process. The main design and set-up decisions for an instructor related to the choice of tools that the instructor could use (setting the menu options) and the way the organization of the course would be set up (the Roster). Furthermore the instructor could choose to make re-use of materials of a previous version of a course, or from other courses in which he was the instructor. Figure 23 shows the interfaces for one course re-designed for TeleTOP with the second TeleTOP DST. In Window 1, the DST support for the design of the roster is shown, Window 2 shows the sort of explanatory help available to support each choice of menu item, Window 3 shows some of the copy tools available in the DST, and Window 4 shows the course environment generated automatically after use of the DST. This automatic generation is possible because the second DST was fully integrated in the TeleTOP system.

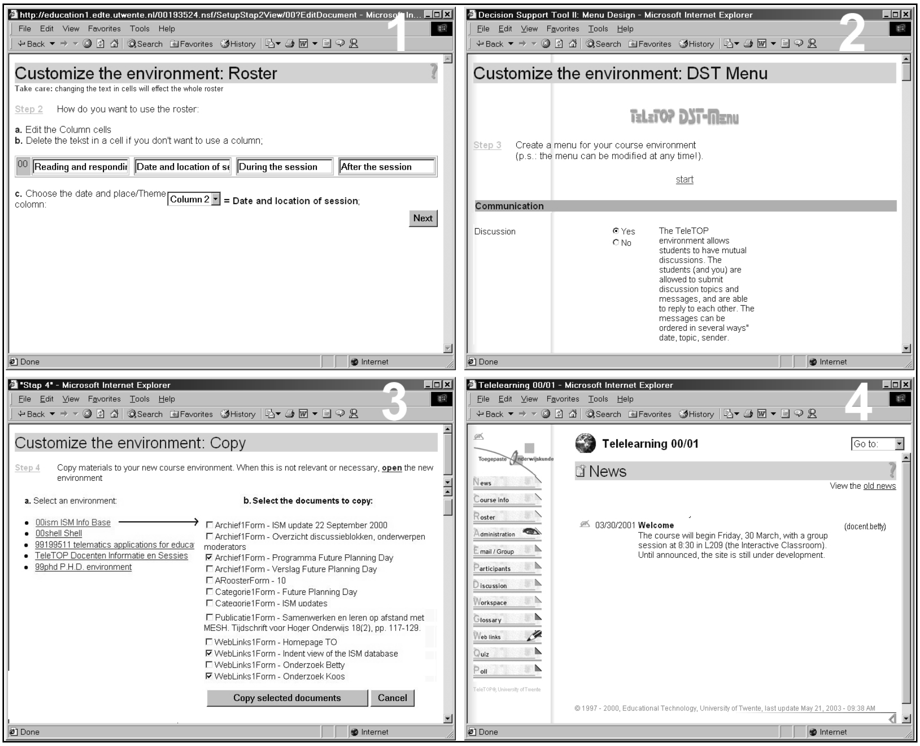


Figure 23. Steps in the use of the second TeleTOP DST: First the user is prompted to enter the roster headings. Second the menu options are chosen (from over 30 options), and then, third, materials from other TeleTOP sites could be copied. Confirming all this led to a newly generated TeleTOP course environment (4).

Because the second version of the TeleTOP DST was used when an instructor had already had gone through the interview session with the first TeleTOP DST (i.e. for his or her the course of the previous year), the decision process about options for flexibility was less time consuming for both the instructor as well as for the TeleTOP team. Thus the use of examples was only in the form of short text support, with more information available through the integrated PDF help files that were made available within each functionality of the TeleTOP CMS. Figure 24 shows an example of an integrated PDF help file. The integrated help files with short text descriptions associated with the second DST are given in Appendix 2.

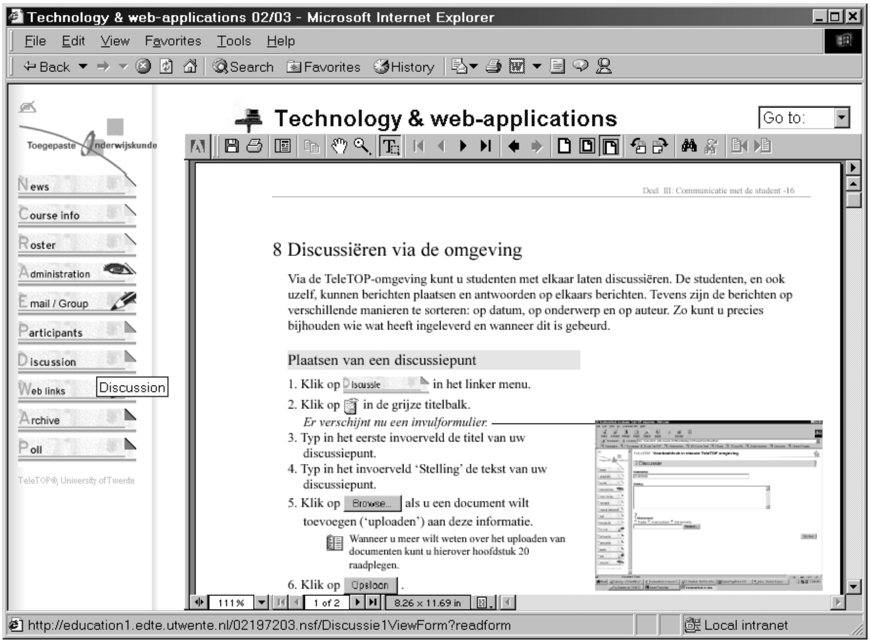


Figure 24. Example of an integrated PDF help file in the second TeleTOP DST (In Dutch).

The TeleTOP DST menu also made it possible for instructors to add or remove functionalities from their CMS during a course, as is shown in Figure 25.

Figure 25. The option in the second TeleTOP DST for instructors to add (or remove) TeleTOP options by clicking the 'edit' button of the menu (1), selecting an option (reading about it) and after submitting (2) the option is added to their environment (3).

In Section 4.2.3 the results of the instructor-support approach from the second year of TeleTOP in TO, where everyone had had interviews with the first DST the year before, were given. In the overall university situation most instructors do not have the DST interview anymore, especially not after the first year they have used TeleTOP for the first time. Also the support in terms of preparing the set-up for the TeleTOP environment differs amongst faculties. Some faculties already create a TeleTOP environment with an initial Menu and the Roster for all courses within the curriculum, the instructor then can decide if and how the TeleTOP environment will be used. In another faculty all content of the previous course environment is copied into the new course environment by a support person.

How these results of the use of the second TeleTOP DST in this context have emerged will be described in the next section.

4.4.2 Use of the second TeleTOP DST and the TeleTOP CMS

The second DST tool was used by most instructors to make decisions with regards to the menu options and roster heading. To see how the DST was used throughout the entire University of Twente, an analysis of the TeleTOP course environments that were made with the help of the second TeleTOP DST was done. Section 4.4.2.1 gives the methodology of the analysis and Section 4.4.2.2 an overview of the results.

4.4.2.1 Methodology for the analysis

To carry out the analysis, all TeleTOP environments at the University of Twente for the period of three years (2000-2003) were taken as the data set. A first decision was which of the environments to retain for an analysis relating to the use of the second TeleTOP DST. Not every environment that was initially set up was subsequently used, and a number of the environments were used for purposes other than course support, such as support for research projects or student projects. A decision was made that minimal use of an option was one document for a menu option. This means for example that instructors had at least have one Web link in the TeleTOP option Web-links to count it to be used. A TeleTOP environment was considered as used within a course when the News, the Roster, and the Course info together contain more than five documents. There should be more than one student who had access to the course environment, and the environment should be used for supporting a course with an official registered course code (not a project that is not directly related to a course).

Once the set of course environments was chosen for analysis, logfile data relating to options chosen in TeleTOP environments by instructors using the second TeleTOP DST were collected. The results of this analysis are given in the next section.

4.4.2.2 Results of the analysis: Does the second TeleTOP DST support instructors in their choices of TeleTOP options?

Figure 26 shows what instructors chose for their courses and how much of it was being used in practice for 1,422 courses that were set-up by the instructors during the period (see Section 4.4.1). Appendix 3 contains the data shown visually in Figure 26.

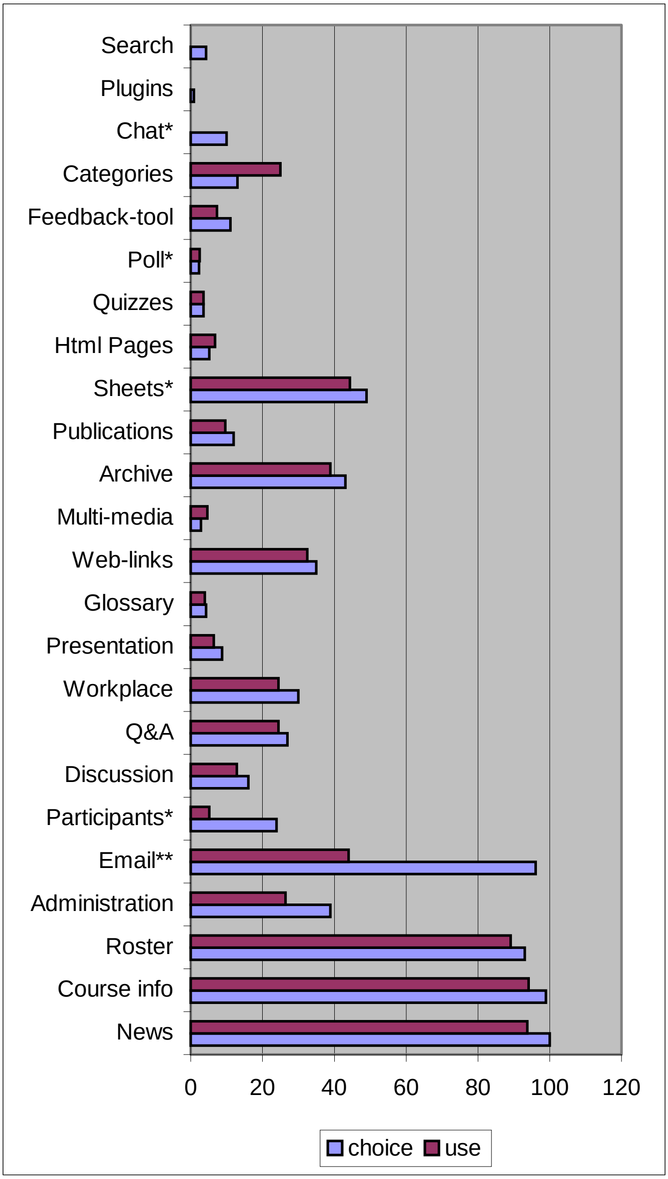


Figure 26. Instructors' choices before the start of a course, and use in practice, via use of the second TeleTOP DST (N=1422, for *, N= 275).

Note that for some of the TeleTOP options there is a *. This is because a number of TeleTOP tools were only available for the instructors of the Faculty of Educational Science and Technology. For Email (marked with **) the choice and use seem to differ a lot. However, this is because the group function that is available within this option is sometimes used, and only this was counted as ‘use’.

The analysis shows that the options that instructors choose for their TeleTOP environments mainly focus on the organizational options within TeleTOP. When an option is chosen, it is mostly also used (or deleted from the menu selection). The choice of an option and the use of it show a strong relation, the correlations between all choices for TeleTOP options and the use of the options are all significant, $p<.05$ (see Appendix 4). This suggests that the DST either helps instructors to make choices that subsequently get used in practice, or that the DST helps them to remove a choice that was initially made but then not used. Thus the utility of the second TeleTOP DST, as a tool used without additional human support, has been demonstrated in practice.

It can further be noticed that the general use of options within TeleTOP did not increase once instructors started to do the set-up of the TeleTOP environment by themselves using the second DST. When comparing the results shown in Figure 26 and Appendix 4 with the results from the use of first TeleTOP DST (with interview) as shown in Figure 22, it is clear that the use of resources at the first moment was higher (See Section 4.3.3). However, these data relate to one faculty, and the faculty with the highest number of pioneering users of Web technology and in a change-leader position in the university, whereas the data from the second DST relate to the entire university spread over several years of implementation with no particular focus on a stretching-the-mold target.

In the next section the experiences using TeleTOP and the second TeleTOP DST as tools for stretching the mold will be further discussed.

4.5 Current Use, Problems, and Options

Given the context of the embedded use of the second TeleTOP DST, this section goes more specifically into the general use of TeleTOP, examining the important question: Does the mold stretch (Section 4.5.1)? In Section 4.5.2 the experiences with options for active pedagogies and structured communications related to the 2StM flexibility dimensions will be discussed, and in Section 4.5.3 the pedagogical changes and related flexibility that have occurred at the University of Twente will be summarized.

4.5.1 General use of TeleTOP: Does the mold stretch?

At the University of Twente, all faculties have implemented the TeleTOP CMS in some or all of their courses. The implementation model within the other faculties was similar to the approach that was first used within the Faculty of Educational Science and Technology (described in Section 4.2). It is interesting to see if and how courses are becoming more stretched, as the use of TeleTOP and its embedded DST offers instructors and students options for a variety of types of flexibility. The methodology used to answer this question was the course-selection and logfile-analysis method described in Section 4.4.2.1 relating to TeleTOP databases in the academic years 2000/2001, 2001/2002, and 2002/2003. The results follow in Sections 4.5.1.1- 4.5.1.8, and in Section 4.5.1.9 the conclusions will be given.

4.5.1.1 Overview of general usage of the TeleTOP CMS

- At the university level, 2766 TeleTOP course environments were set up in the academic years 2000/2001, 2001/2002. and 2002/2003.
- Of these TeleTOP environments 83% were produced for courses, the other environments were used as project environments of various types.
- The average number of TeleTOP course environments produced has been about a 1000 per year, all via the second TeleTOP DST.

4.5.1.2 Implementation approach in other faculties

The implementation method that uses the approach of starting with the first year courses and then growing further year by year that was used in the Faculty of Educational Science and Technology can also be noticed in the other faculties, as shown in Table 37.

Table 37. Overview of TeleTOP course environments produced for courses and other projects at the University of Twente, 2000-2003, by study phase.

Phase	Frequency	Percent of total
First-year courses	616	22%
Second-year courses	536	19%
Third-year courses	225	8%
Fourth-year courses	755	27%
Masters programme courses	136	5%
Others (projects & miscellaneous)	498	18%
Total	2766	100%

4.5.1.3 Environment set up vs. use in practice

Not all course environments that were set up were used in practice. To analyze in more detail how course environments were actually used for flexibility support, the definition for the basic level of use of TeleTOP described in Section 4.4.2.1 was applied to the entire set of TeleTOP databases.

Thus the environments that were not defined as courses or were used as project environments were excluded from this analysis, so that 2268 course environments were analyzed. A first step was to see how many of these course environments met the basic level of use. Table 38 shows the results.

Table 38. Use of TeleTOP from 2000-2002.

Year	TeleTOP documents by instructor	Frequency	Percent	Student access to a TeleTOP environment	Frequency	Percent
2000	Less than five	25	5.7	No access	311	61.6
2001		181	41.6		119	23.6
2002		229	52.6		75	14.9
Total		435	100.0		505	100.0
2000	Five or more	385	21.0	Yes, more than one student	99	5.6
2001		697	38.0		759	43.1
2002		751	41.0		905	51.3
Total		1833	100.0		1763	100.0

The analysis summarized in Table 38 makes it clear that 435 course environments contained less than five documents. Also, 505 environments had no students with access to the CMS, and therefore could not use the environment within the course. There was overlap between these groups, leading to the result that a total of 845 (37% of the course environments) could not be used for further analysis, as they were not actually used according to the definition of use. Thus, having a tool with an embedded DST does not directly lead to meaningful use if the faculty does not have a policy requiring some aspects of flexible provision. The support strategy for some faculties to create TeleTOP course environments without consultation with the instructors probably influences the number of not used TeleTOP CMSs.

4.5.1.4 Instructor variations

A further point of analysis relating to course environments that were used is the range of use in terms of documents submitted into the environment by the instructor. Table 39 gives an impression of how many documents were placed in an active TeleTOP course environment by an instructor and the frequencies of courses in each of the categories.

Table 39. Documents placed in TeleTOP by an instructor, courses with active use of TeleTOP, 2000-2003, University of Twente.

# of TT documents	Frequency	Percent	Cumulative Percent
1 - 25	194	13.6	13.6
25 - 50	280	19.7	33.3
50 - 100	469	33.0	66.3
100 - 200	310	21.8	88.1
200 - 500	149	10.5	98.5
> 500	21	1.5	99.7
Total	1423	100.0	

The average use of the active TeleTOP course environments is 81 documents, but with a standard deviation of 68. Table 39 shows that there are major differences in the use of TeleTOP by instructors. In Table 40 a regression analysis shows that of the factors that could influence the number of documents submitted by an instructor; (the number of students, the year of implementation of the course, and the phase of the use of a CMS), only the number of students has a significant influence on the number of documents that an instructor has placed in a TeleTOP, as a measure for the degree of use (F=16.135 and p=0.00).

Table 40. Regression showing variables influencing instructor's level of use of TeleTOP (as defined by total number of submitted document).

		td. Error	eta		ig.
(Constant)	74.69	6.74		11.08	0.00
Number of students	0.17	0.03	0.17	5.88	0.00
Year of implementation	-0.81	2.92	-0.01	-0.28	0.78
Phase in program	-1.33	1.43	-0.03	-0.93	0.35

The number of students has an influence on the degree of use: the more students, the more an instructor uses TeleTOP. Table 41 shows how the number of students relate to the number of documents.

Table 41. Influence of number of students on the number of instructor-submitted documents.

#Students	N	Mean (#of docs)	SD
<10	167	53.78	48.61
10-25	282	74.63	54.72
25-50	330	81.42	58.12
50-100	360	85.90	70.80
100-200	214	88.99	69.70
>200	69	118.54	130.47
Total	1422	80.91	68.13

Why a larger number of students has an effect on the number of TeleTOP documents that an instructor places in the CMS is not clear. It could be that instructors find it convenient to organize communication and resources when groups of students become larger, and the use of groups is a convenient way to organize this within TeleTOP. A correlation analysis showed that the relation between the number of students and the use of the group-option in TeleTOP is significant (Pearson correlation=0.151; p=0.00).

4.5.1.5 Categories of options chosen by instructors

To further see in what degree TeleTOP was used for what purposes, another analysis was made. The main options that TeleTOP offers are categorized around four main themes (See Section 4.1.3). Figure 27 shows the proportions of documents that were put in TeleTOP by instructors related to the main categories of options in TeleTOP.

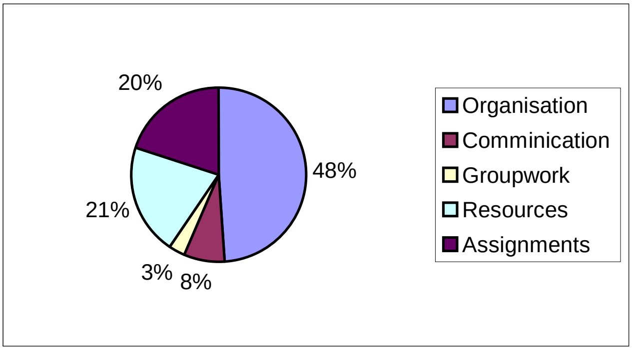


Figure 27. Overview of where TeleTOP is used for, with regards to documents (1423 course environments, University of Twente, 2000-2003.

Figure 27 shows that TeleTOP is in general used for organizational purposes. These include the use of the News, the Roster, and the Course Information. When looking at those course environments that have a high number of documents, that probably relates with a high level of use, another division can be seen, as demonstrated in Figure 28. The data associated with Figure 28 can be found in Appendix 5.

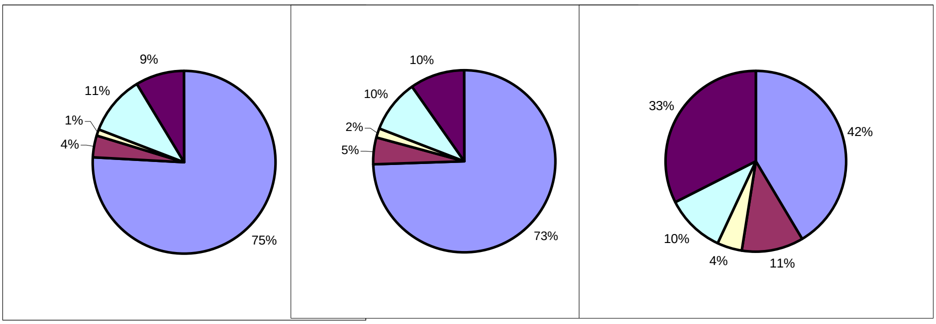


Figure 28. Differences in the use of TeleTOP: First circle has 5 thru 100 (N=404), second 100 thru 250 (N=611) and third over 250 documents (N=407) in TeleTOP by an instructor (See the labels in Figure 27).

Figure 28 shows that the percentage of organizational documents decreases when TeleTOP is used more extensively. The percentage of documents that relate to communication and activities increases significantly when there is more use of TeleTOP. However, although the number increases, the percentage of resources does not increase. Only when instructors use TeleTOP in a more-extensive way, is the nature of the use changing and do instructors use the TeleTOP environment more for communication, group work, and activities.

4.5.1.6 Flexibility for different groups of students

An important aspect of both dimensions of flexibility related to stretching the mold is offering options to different groups of students. To see whether instructors make a difference between the types of students they have in their course another analysis was made. The courses within a faculty that especially deals with life-long learning students were compared with the courses of a faculty that only deals with on-campus students. Figure 29 shows the result of this exercise.

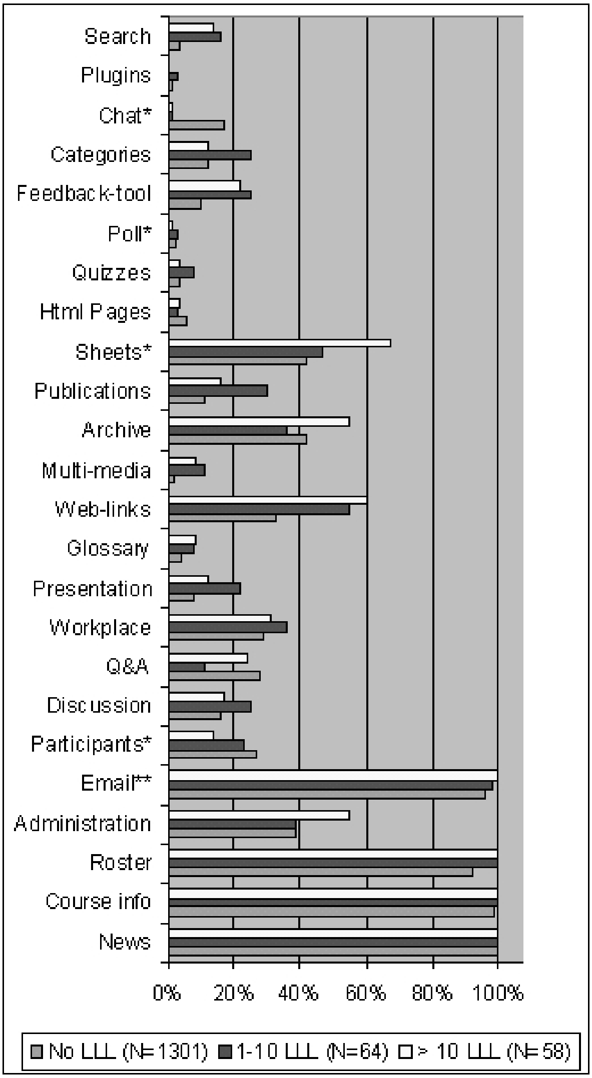


Figure 29. Differences between courses with different types of students

The courses that deal primarily with on-campus students ("normal") share a similar set of TeleTOP options, different to the courses that deal with the life-long learning students (that were not always on-campus). There were more activities in the administration part of TeleTOP for those courses that had many life-long learning students. This could indicate more student submissions and a more-active pedagogy compared to the courses of the faculty with the traditional single-cohort student population. However, Biesheuvel (2001) found in an evaluation study that lifelong learners were not satisfied about the options made available within courses. Often there were no or very limited options for those students, while they would benefit the most from a more-flexible, stretching the mold, program. Reflecting this in the University of Twente context, Gervedink Nijhuis and Collis (2003) found that although TeleTOP was being used throughout the faculties, its use could be very well be intensified on more levels in order to benefit more from the flexible possibilities of the CMS. These results build upon the conclusions that were made in Section 2.2.2.

4.5.1.7 Provision for student contributions

An option for instructors related to the second dimension of stretching the mold relates to more-flexible pedagogies. One way to demonstrate these new pedagogies is to stimulate students to contribute new entries to the course materials. Within TeleTOP instructors could choose the options that would enable students to submit resources to the environment. This option was also offered through the DST menu of TeleTOP. Table 42 shows how often this occurred.

Table 42. Percentages of resource options chosen for instructors only and also for students to add (N=1422, for *, N=255).

Type of resource option	Instructors only can add	Students can also add
Glossary	4%	0%
Web links	35%	5%
Multimedia	3%	0%
Archive	43%	2%
Publications	12%	1%
Sheets*	53%	1%

Outside of the archive and Web links, instructors do not often choose these options, but when they do the Web-links option is the most chosen option. Within a 2S-t-M flexibility type of course this option would be a very good chance to enable students to contribute to learning resources.

4.5.1.8 Support for flexible and varied pedagogies

In another evaluation carried out at the University of Twente, by Gommer and Visser (2001), 15% of the (at that time) TeleTOP environments used within all ten faculties were examined. A total of 60 course environments were randomly selected and studied. The main questions focused on the goal(s) for which the course environments were used, and how the course environments supported the learning processes of the students. The conclusions add on to the pictures that the log-file data gave about the use of TeleTOP as reported in Sections 4.5.1.1 - 4.5.1.7. Gommer and Visser (2001) found that all 60 of the courses used the CMS for organizational information. They looked at three categories: Information, communication, and course work. Almost all environments were used for content-related information (83.3%). Fewer environments were used for organizational communication (25%) or content-related communication (15%). The TeleTOP CMS was more used for individual course work (41%) than for group-based course work (20%).

Gommer and Visser (2001) found that the functions primarily used in TeleTOP relate to the flexibility dimensions that were found in Chapter 3 (See Section 3.3.2). Although the overall percentages of the pedagogy categories are reasonably high, the researchers concluded that the emphasis of the use of the TeleTOP CMS in these 60 courses is clearly on the dissemination of information from the teacher to the students. Ranges of different organizational and content-related purposes were commonly used within TeleTOP, but not so many course environments were used to support two-way interaction between teachers and students. Content-related communication was even less seen in practice.

4.5.1.9 Conclusions related to flexibility and the use of TeleTOP

The results of these analyses indicate that instructors at the University of Twente primarily use TeleTOP environments for information and organizational purposes and for helping students to practice and orientate on course content. The amount of guidance, monitoring, and feedback is low. Collis and Messing (2001) support these conclusions, based on an evaluation within the Faculty of Educational Science and Technology and the Telematics Department. Similar results were also found in a broader scale of research, the international survey as was discussed in Section 2.2.2. Thus the ways instructors use the TeleTOP CMS to Stretch the Mold with the use of the 2S-t-M flexibility dimensions is in practice limited although a start has been made. This conclusion is explored in terms of each of the two dimensions in the next two sections.

4.5.2 Options for 2S-t-M flexibility with the use of TeleTOP

In the previous sections the use of the TeleTOP CMS was discussed. A general conclusion is that instructors are using TeleTOP, but most of them are mainly focusing on certain points of use. The TeleTOP users with a moderate or low number of TeleTOP documents focused on organizational uses of TeleTOP, a type of use that only relates partly to the options for flexibility that were discussed in Section 3.4. However, specific examples can be seen of stretching the mold. In this section the research that was done in the Faculty of Educational Science and

Technology relating to the instructors' instructional practices since 1997 will be used to demonstrate examples of good practice with regards to possibilities for flexibility. As a reference, Table 43 shows the main dimensions within flexibility relevant for Stretching the Mold as discussed in Chapter 3.

Table 43. Flexibility dimensions for stretching the mold, instructor's perspective.

Flexibility within the course planning:	
Times for starting and finishing a course	A1
Times for submitting assignments and interacting within the course	A2
Topics of the course	A3
Orientation of the course (theoretical, practical)	A4
Assessment standards and completion requirements	A5
Assignments required for the course	A6
Interpersonal flexibility:	
Ways in which the course is experienced (group/individual; sessions)	B1
Language to be used during the course	B2
Types and sources of learning resources	B3

The options for flexibility will be discussed and where applicable demonstrated in terms of their realization in TeleTOP in the Faculty of Educational Science and Technology based on the research of De Boer and Peters (2000); Collis, De Boer and Van der Veen (2000); Collis, De Boer, and Van der Veen (2002); De Boer and Collis (2002); and Collis, De Boer and Slotman (2001) in the period of 1997-2002 in following paragraphs.

A1 Times for starting and finishing a course

Flexibility in the times that students can start and end a course is sometimes offered through the use of the TeleTOP CMS. It is possible to have flexibility on both sides of a defined time for a course. On one hand instructors are asked to set-up their course environment before the first session starts. The most elementary information and organization should be made clear through the CMS. This gives an option for students to start planning activities before the course actually starts. As a minimum within most courses, the most elementary course information, content, and activity descriptions in the TeleTOP course environments should be up and running two weeks before the first session, or other kick-of activity.

On the other hand TeleTOP offers more possibilities for extending a course date when an instructor decides to organize his course as such. Especially when a small number of students are attending a course, and the students enroll during the year. Figure 30 shows the Roster of a course environment of the educational program for students in the teacher-training program that offers this kind of flexibility.

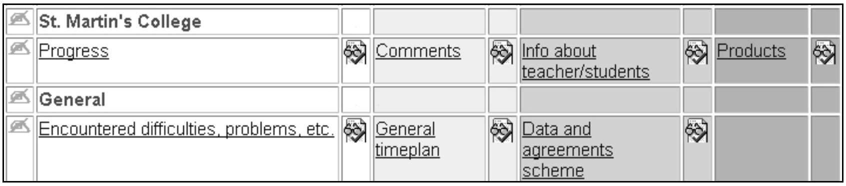


Figure 30. Example of a Roster with activities that are not related to a specific time.

A2 Times for submitting assignments and interacting within the course

The number of activities with graded submissions have increased with the introduction of TeleTOP (Biesheuvel, 2001; De Boer & Manehuwa, 2000). The options in activities have several dimensions, of which one is time. When using the TeleTOP CMS, an instructor has opportunities to create flexibility for students, while not losing the overview on these activities. Figure 31 demonstrates the main view for instructors in which he can see the submissions of students, if feedback has been provided, and if a grade has been given.

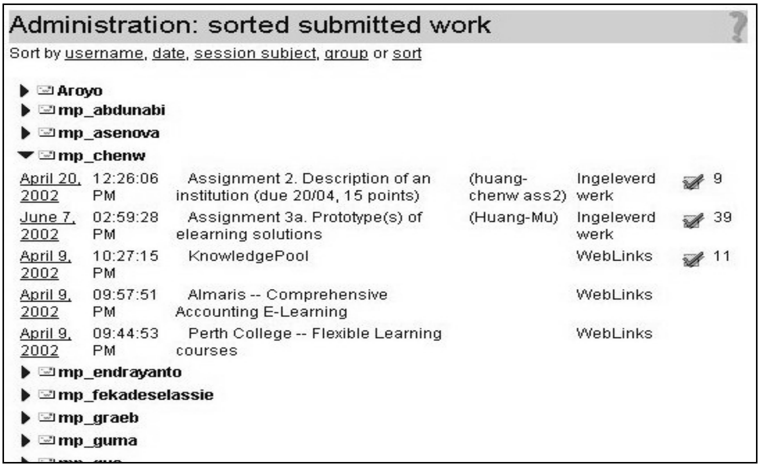


Figure 31. Example of the overview of assignments, feedback, and grades in Administration.

It is possible to have options in communications, such as feedback. An instructor could choose to offer feedback when students submit certain work within a certain time. Students who do not think they need this do not have to plan their work for that particular deadline (See Figure 32).

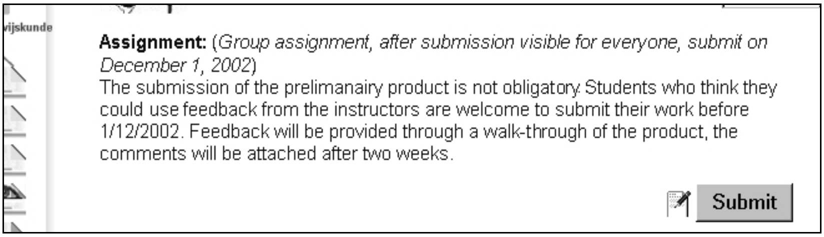


Figure 32. Possibility for students to submit and get feedback, it is not obligatory.

A3 Topics of the course

There are many possibilities for offering options that relate to the topics of a course. When adopting the active pedagogy of contributing students (Collis & Moonen, 2001), the activities where learners contribute something to the course TeleTOP site and then build on those contributions as the basis of subsequent activities could have many different forms. Figure 33 shows some of the sorts of contributions which are becoming common within the Faculty of Educational Science and Technology with the use of the TeleTOP system.

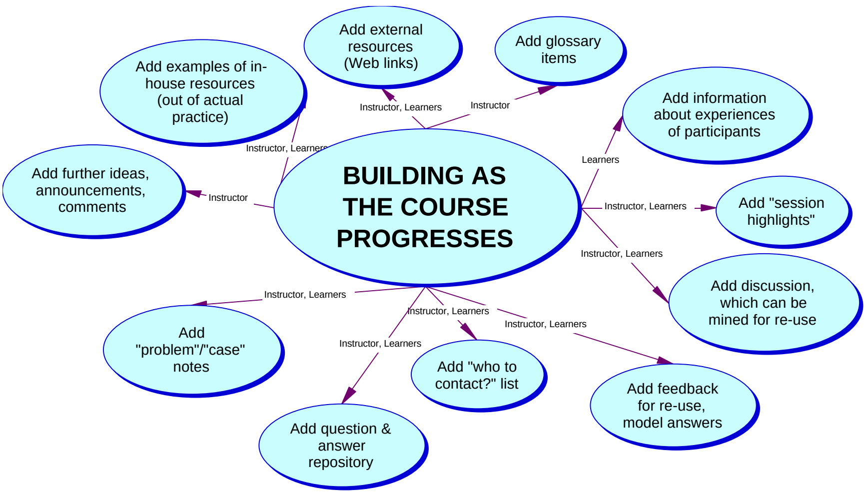
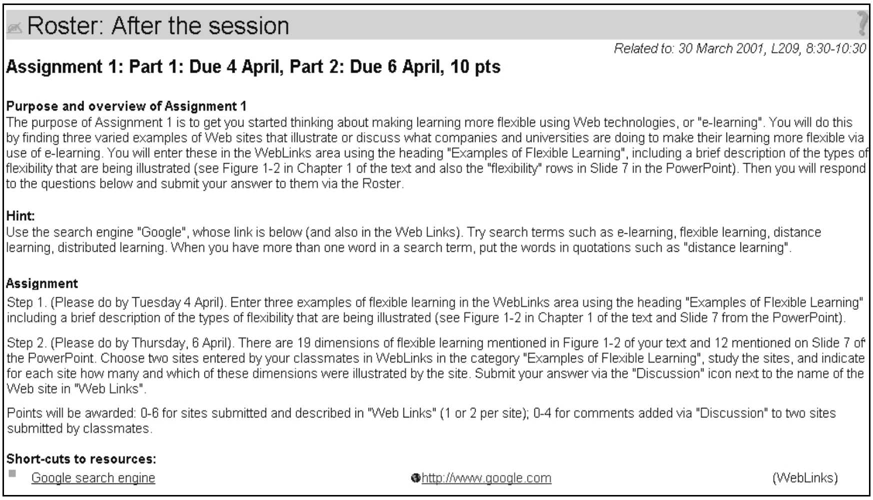


Figure 33. Building on contributions: Submissions made by participants (or reused from previous participants) can be built upon in subsequent activities (De Boer & Collis, 2002).

With these options the content can be very well related to the context of the learners, which is a strong and flexible way to offer students relevant learning experiences. Examples of options for course materials involving student contributions were given by Collis, De Boer, and Van der Veen (2002):

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

The different TeleTOP environment functionalities are thus useful for different kinds of contributions. Figure 34 and Figure 35 are examples of how student make contributions within the TeleTOP course environment.


Roster: After the session

Related to: 30 March 2001, L209, 8:30-10:30

Assignment 1: Part 1: Due 4 April, Part 2: Due 6 April, 10 pts

Purpose and overview of Assignment 1
The purpose of Assignment 1 is to get you started thinking about making learning more flexible using Web technologies, or "e-learning". You will do this by finding three varied examples of Web sites that illustrate or discuss what companies and universities are doing to make their learning more flexible via use of e-learning. You will enter these in the WebLinks area using the heading "Examples of Flexible Learning", including a brief description of the types of flexibility that are being illustrated (see Figure 1-2 in Chapter 1 of the text and also the "flexibility" rows in Slide 7 in the PowerPoint). Then you will respond to the questions below and submit your answer to them via the Roster.

Hint:
Use the search engine "Google", whose link is below (and also in the Web Links). Try search terms such as e-learning, flexible learning, distance learning, distributed learning. When you have more than one word in a search term, put the words in quotations such as "distance learning".

Assignment
Step 1. (Please do by Tuesday 4 April). Enter three examples of flexible learning in the WebLinks area using the heading "Examples of Flexible Learning" including a brief description of the types of flexibility that are being illustrated (see Figure 1-2 in Chapter 1 of the text and Slide 7 from the PowerPoint).

Step 2. (Please do by Thursday, 6 April). There are 19 dimensions of flexible learning mentioned in Figure 1-2 of your text and 12 mentioned on Slide 7 of the PowerPoint. Choose two sites entered by your classmates in WebLinks in the category "Examples of Flexible Learning", study the sites, and indicate for each site how many and which of these dimensions were illustrated by the site. Submit your answer via the "Discussion" icon next to the name of the Web site in "Web Links".

Points will be awarded: 0-6 for sites submitted and described in "Web Links" (1 or 2 per site); 0-4 for comments added via "Discussion" to two sites submitted by classmates.

Short-cuts to resources:
Google search engine http://www.google.com (WebLinks)

Figure 34. Instructions for a contribution-oriented activity, including peer-to-peer comments on contributions.

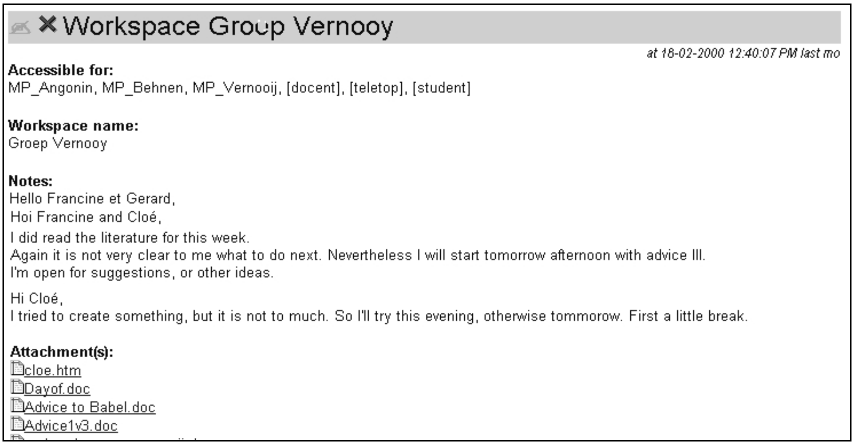


Figure 35. Example of creating a product, also a resource for other students.

A4 Orientation of the course (theoretical, practical)

The way the content of the course could be organized so that students can advance with an orientation best fitting their own experiences and contexts is also relevant for the way learning could be made more flexible. Figure 36 shows how within a course students could choose from two major assignments as the final assignment. One assignment had a more-practical focus, the other a more-theoretical focus.

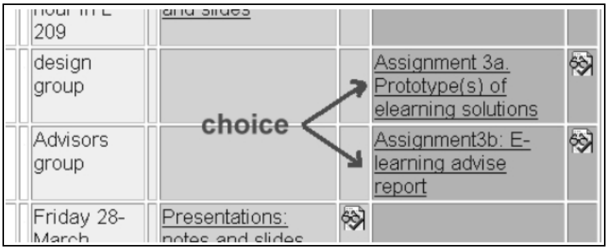


Figure 36. Options in orientation through activities.

A5 Assessment standards and completion requirements

When the group of students is not homogenous, the way instructors deal with the assessment standards and completion requirements could also be flexible. There are many ways to give options, but here it is also important for instructors to keep an overview through the Roster (See Figure 17) and when dealing with activities (See Figure 31). By organizing subgroups within the course this still is possible. The roster rows can offer instructors various ways to differentiate between groups, but keeping the basis of the learning material and activities still the same (See Figure 37).

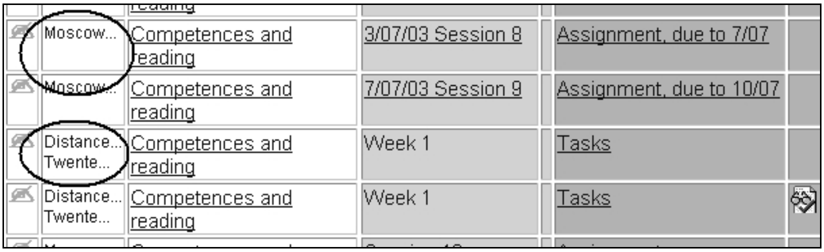


Figure 37. Roster in which two groups (Moscow and Distance students Twente) were distinguished.

Another example is that instructors allow students that already are in a relevant working environment to adopt the assignments in such a way that they are most relevant to their contexts. Another way in which flexibility can occur is through allowing distance students to do group work individually, with a modified assignment, if this is more convenient to them (See Figure 38).

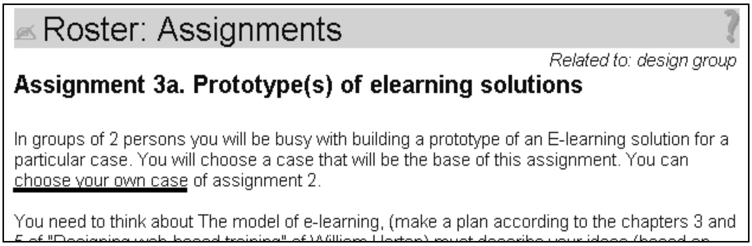
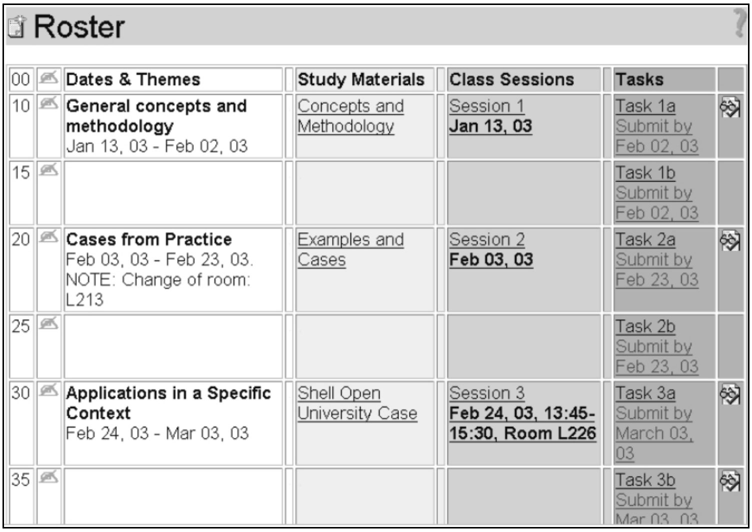


Figure 38. Students that already are in a relevant working environment are allowed to adopt their experience in the assignments.

With the use of TeleTOP active learning is possible and used to encourage students not to postpone their learning and working until the end of a course, but also be active through the course. The use of assignments to enable flexible and varied active learning is possible, when students are not forced to all kinds of deadlines, but are able to plan their study activities themselves and vary in a way that not every course in the curriculum uses the same approach of using assignments to make active learning possible. Some forms of active learning can be carried out by students individually, others in (small) groups; it is desirable if students can make their own choices.

A6 Assignments required for the course

The use of assignments has formed the basis of assessment and feedback within the Faculty of Educational Science and Technology. Assignments can also be discussed as a particular flexibility element. Within the contributing pedagogy activities through assignments are important elements within courses. Flexibility could also focus upon the assignments required for the course. When an instructor has a number of activities within a course, he could let students choose those activities that would be most relevant or interesting to themselves. Students also would have a more-flexible way in terms of planning and time when this type of flexibility is offered. Figure 39 shows a screen dump of a course in the faculty where this kind of flexibility was offered through the tasks.



Roster

00	Dates & Themes	Study Materials	Class Sessions	Tasks
10	**General concepts and methodology** Jan 13, 03 - Feb 02, 03	Concepts and Methodology	Session 1 **Jan 13, 03**	Task 1a Submit by Feb 02, 03
15				Task 1b Submit by Feb 02, 03
20	**Cases from Practice** Feb 03, 03 - Feb 23, 03. NOTE: Change of room: L213	Examples and Cases	Session 2 **Feb 03, 03**	Task 2a Submit by Feb 23, 03
25				Task 2b Submit by Feb 23, 03
30	**Applications in a Specific Context** Feb 24, 03 - Mar 03, 03	Shell Open University Case	Session 3 **Feb 24, 03, 13:45-15:30, Room L226**	Task 3a Submit by March 03, 03
35				Task 3b Submit by Mar 03, 03

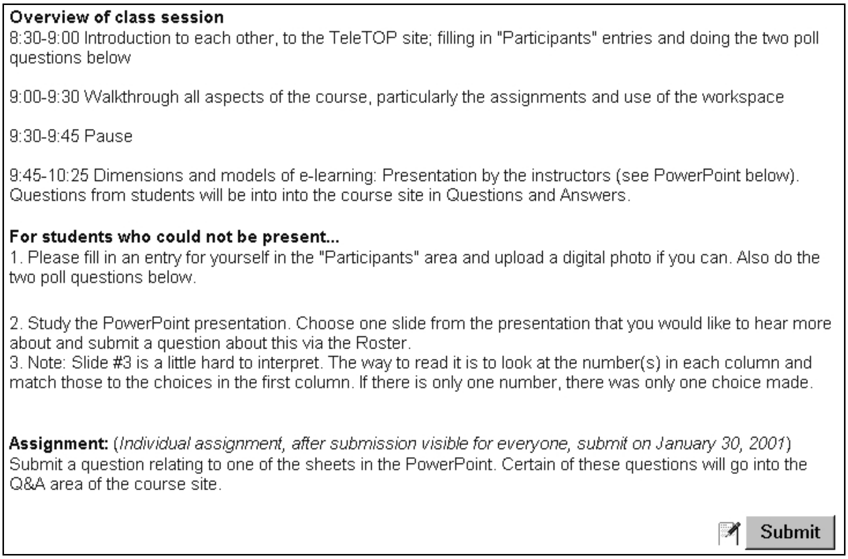
Figure 39. Options in tasks for students: Choose the 'a' or 'b' variant.

Figure 39 shows that the assignments required for this course can be chosen. Students choose that assignment that will fit their needs and goals or learning style best.

B1 Ways in which the course is experienced (group/individual; sessions)

With respect to interpersonal flexibility the way a student is participating within a course with regards to working alone or with groups relates to the interpersonal flexibility of Stretching the Mold. As operationalized in the Faculty of Educational Science and Technology, this aspect of flexibility is based on fewer lectures and more activities, and flexibility in course planning and communications. Within TeleTOP the group functionality can be used to organize the processes of different (groups) of students. Figure 37 showed a screen dump of the TeleTOP Roster where this opportunity has been used.

Activities can take many forms and be carried out both in an individual fashion or by a group (with modifications in instructions and assessment criteria). As this is the more-interpersonal type of flexibility, it is not always planned for and visible in the CMS. An example however of how different students 'attend' a session is given in Figure 40.



Overview of class session
8:30-9:00 Introduction to each other, to the TeleTOP site; filling in "Participants" entries and doing the two poll questions below

9:00-9:30 Walkthrough all aspects of the course, particularly the assignments and use of the workspace

9:30-9:45 Pause

9:45-10:25 Dimensions and models of e-learning: Presentation by the instructors (see PowerPoint below). Questions from students will be into into the course site in Questions and Answers.

For students who could not be present...
1. Please fill in an entry for yourself in the "Participants" area and upload a digital photo if you can. Also do the two poll questions below.

2. Study the PowerPoint presentation. Choose one slide from the presentation that you would like to hear more about and submit a question about this via the Roster.
3. Note: Slide #3 is a little hard to interpret. The way to read it is to look at the number(s) in each column and match those to the choices in the first column. If there is only one number, there was only one choice made.

Assignment: (*Individual assignment, after submission visible for everyone, submit on January 30, 2001*)
Submit a question relating to one of the sheets in the PowerPoint. Certain of these questions will go into the Q&A area of the course site.

Submit

Figure 40. Example of flexibility in attending a sessions.

B2 Language to be used during the course

Within courses that deal with different groups of students, the languages in which students can study and interact within the course could also relate to a flexibility dimension. In an international context the language of all senior courses in the Faculty of Educational Science and Technology is now English. Sometimes however Dutch students prefer to do assignments in the Dutch language, which they officially have the right to do. Instructors have to deal with this. Ways to evaluate and learn from each others' experiences and work, although the work is carried out in a different language, are important. Instructors can use final sessions in which a English summary of submissions done in non-mainstream languages is given as a way to make it still possible to have this important learning experience.

B3 Types and sources of learning resources

Within the 2S-t-M planning dimensions there were already many options that relate to the resources that students contribute and use for activities. The origin of materials can be more flexible as the use of the Internet allows many different types of materials to be made available within a course. The options in TeleTOP reflect this approach to offering flexibility in the types and sources of learning resources, when looking at the types of resources that are available. 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 (Collis & Moonen, 2001).

The way TeleTOP is used as a depository of a range of materials for students who not could attend at meetings is very valuable, as well for those who attended and would like to review materials. An example of how video is used as a new flexible resource in a course that had distance students and on-campus student is shown in Figure 41.

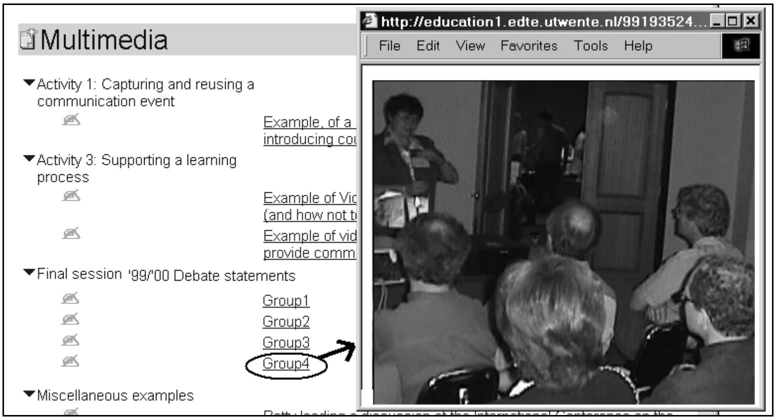


Figure 41. Example of how video is used as a new flexible resource.

In the previous sections the examples with the 2S-t-M options for flexibility were discussed and demonstrated. The TeleTOP examples of the courses at the Faculty of Educational Science and Technology show that the 2S-t-M flexibility dimensions are realizable and visible through the use of the TeleTOP CMS. In the next section the new tasks of instructor will be described in more detail.

4.5.3 Activities and communication as new focus points for an increase of 2S-t-M flexibility[6]

Many of 2S-t-M flexibility examples that were discussed in Section 4.5.2 relate to the active pedagogies of contributing students, and the new roles of instructors that have to take into account this in their planning and communication. In a study about the use of assignments and feedback within the Faculty of Educational Science and Technology, Collis, De Boer, and Slotman (2001) gave a number of examples of course activities and different sorts of feedback. Table 44 summarizes the typical steps that an instructor manages when monitoring these types of contribution-oriented activity with the TeleTOP system.

Table 44. 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	Previous activities can be reviewed, available via the TeleTOP database 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	Instructor places the instructions for the activity in the roster to integrate it with appropriate readings, class sessions, etc. The instructor specifies who and when can see each other's submissions 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

Table 44 continues…

[6] Elements in this section are adapted from: Collis, B., De Boer, W. F., & Van der Veen, J. T. (2002). Building on learner contributions: A Web-supported pedagogic strategy. *Educational Media International, 38*(4), 229-240.

Table 44 continued

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 reorganize 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

There are many new sorts of activities in these processes for the instructor, as well as for the students. The way instructors in the University of Twente are gradually adopting these new processes, what their attitudes about these processes are, and what the time- and management burdens on the instructor become have been studied in a series of research studies (Collis, De Boer, & Slotman, 2001; Collis & Gervedink Nijhuis, 2000; Collis & Messing, 2001; De Boer & Peters, 2000; Gervedink Nijhuis & Collis, 2003; Van der Veen, De Boer, & Collis, 2000; Winnips, 2000). Table 45 summarizes some of the results of these studies.

Table 45. 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 Web environment
• More student participation, often via the practice of students entering new resources into the course Web site or being involved in asynchronous discussions via computer conferencing or Web 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 Web 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 content-wise 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 Web 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 Web 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 Web 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

Not surprisingly, these implications involve time and management challenges for the instructors. The Stretching-the-Mold Scenario involves new models of teaching and communication with students. Options in student activities and more-structured but also more-flexible communication are particular challenges for the instructor to manage. There are many decisions to make, and an instructor has to rethink his role within the learning process.

4.6 Conclusion: The Need for a New Support Tool

Within the past five years TeleTOP has started to be an integrated part of course (re)design at the University of Twente. A flexible approach has been adapted to a certain extent, but is the mold really stretching? There are more options for students, and the diversity in pedagogies grows, but students indicate that the options are too limited to bring a substantial amount of flexibility into the educational process Biesheuvel (2001). There are many possibilities for instructors to use TeleTOP but their choice of options relating to increasing flexibility is still limited (Gervedink Nijhuis, 2001).

Thus TeleTOP offers options for Stretching-the-Mold flexibility, but it seems that the 2S-t-M options are not all recognized and adopted by instructors. Support that was given through the second TeleTOP DST resulted in the independent use of TeleTOP, but the analyses of the use of TeleTOP shows that it is mainly focused on organizational matters. When TeleTOP is more extensively made use of, it seems likely that there would gradually be more flexibility within courses, with more focus on activities by students in ways that relate to the active student and a contributing pedagogy. It was interesting to see that the effects of the first TeleTOP DST, that was based on demonstrating many examples, showed a higher use of the resources, group work, and communication options within TeleTOP than is now occurring when the second TeleTOP DST is available.

Attempts were regularly made between 1999 and the present (2003) to offer other types of support to instructors in addition to the second TeleTOP DST, such as through workshops where instructors were invited to listen and discuss more-flexible approaches, pedagogies, and new possibilities of active learning, dealing with lifelong learners and tricks and tips for TeleTOP. At one of the workshops, all of the support materials (such as good-practice examples) were gathered in a map (De Boer & Manuhuwah, 2000), but also made available through a TeleTOP environment, and instructors were able to look at the examples at their own place, in their own time. Another approach was the introduction of a one-day seminar, called the TeleTOP Best Practice day (Fisser, Gommer & de Boer, 2001). The problem with these types of support was that only a limited percentage of the instructors found them worthwhile, or found the time to visit the support sessions. It seems therefore that instructors do need more or another type of support beyond that offered by the second TeleTOP DST, but not one that requires their attending workshops at a fixed time and place.

An important question therefore is how all instructors could be supported in such a way that new models of learning that would enable more 2S-t-M flexibility for students are stimulated. How can a systematic approach to Stretching the Mold get a new impulse at the University of Twente as a main scenario for learning? Based on the research reported in Chapter 3, flexibility can be best categorized through course-flexibility aspects that deal with the planning and organization of a course, and flexibility aspects that relate more to interpersonal matters and the course as experienced by the students. The first and second TeleTOP decision support tools as well as the conceptual analyses carried out in Chapters 2 and 3 can serve as a basis for a next step in instructor support. The integrated support available through the second TeleTOP DST 2 now mainly emphasizes the tools within TeleTOP, while instructors need more pedagogical support (See also Section 2.5.2). The pedagogies that relate to flexible learning should be presented to the instructors through an integrated (within the CMS) electronic-performance support (EPS) tool in order to reach all instructors. The most important advantages of integrated EPS tools are that intelligent support is always available, especially when instructors are performing the task (See Section 2.6). The support that an instructor needs when setting up his course should be focused on the design of his course (Menu options, Roster headings) and design of the course organization. From that, flexibility options should be made explicit mainly through the use of examples and guidelines. To support the instructor in his choice-making processes for the design of the CMS environment, a set of templates that would express some main dimensions within the Stretching-the-Mold Scenario could guide the instructor more specifically. Instructors should become more aware of the flexible options that relate to activities, resources, and structured communication such as feedback as a learning tool, and at the same time make use of the TeleTOP system so that the flexibility options stay manageable, and less time-consuming for the instructor. When planning course activities, such as contact sessions, self-study, group work, and assignments, an instructor should also be supported through a desktop coach, tools, advice, and tutorials when needed.

In the next chapter the design and development of a new TeleTOP Electronic Performance System will be discussed based on these conclusions.

5 DESIGN OF THE FLEXIBILITY SUPPORT TOOL

This chapter will describe the design of the Flexibility Support Tool. First the rationale for the 2S-t-M flexibility performance support tool will be given (Section 5.1). In Section 5.2 the conceptual design and design approach of the Flexibility Support Tool will be described and in Section 5.3 the design considerations. Section 5.4 describes the specific design. Three formative evaluation studies that focused on different usability aspects were conducted (Sections 5.5, 5.6 and 5.7). In Section 5.8 the conclusions and implications from these evaluations will be discussed and described.

5.1 Rationale for the 2S-t-M Flexibility Support Tool

In Chapter 2 the Stretching-the-Mold scenario for higher education was recognized as a valid scenario within higher education for now and the near future. Within a Stretching-the-Mold scenario local face-to-face transactions are highly valued, but the learner increasingly chooses what he wants and thus takes more responsibility for quality assurance. In this scenario, where individualization within the local institution takes place, flexibility is a very important aspect. Technology in general and course-management systems more specifically play an important role in the process of redesigning courses and offering more flexibility to a more-heterogeneous group of students.

Within the Stretching-the-Mold scenario there are many variations in where and how students participate in courses, but campus-based settings remain the basis. This is the most-likely scenario for the short future. In Section 2.1 it was discussed that the course model is still the most-recognized model in higher education now and in the future, and therefore should serve as a starting point for flexibility increase. In Chapter 3 dimensions in flexibility were discussed. Flexibility is recognized by instructors when organized around two dimensions within flexibility: planning and interpersonal. This framework has been called the 2S-t-M flexibility framework. Stretching the course mold is possible through the use of a CMS within courses. The flexibility dimensions that were recognized by instructors and are related to the use of technology in a blended-learning setting that characterizes the Stretching-the-Mold scenario are summarized in Table 46.

Table 46. 2S-t-M flexibility dimensions (Repeat of Table 21).

Flexibility within the course planning:
Times for starting and finishing a course
Times for submitting assignments and interacting within the course
Topics of the course
Orientation of the course (theoretical, practical)
Assessment standards and completion requirements
Assignments required for the course
Interpersonal flexibility:
Ways in which the course is experienced (group/individual; sessions)
Language to be used during the course
Types and sources of learning resources

In order to make flexible learning possible within a course, technology can help instructors. In Section 2.4 and Section 4.5 it was concluded that course-management systems offer an integrated solution for the (re)design of courses, where the instructor plays an important role. Certain pedagogies fit well to the use of a CMS within courses, such as that of active students (Section 2.3 and Chapter 4). Flexibility also relates to a contributing-students approach, which can also very well be supported through CMSs. However, when looking at the use of CMSs in practice, it was seen that they are mostly used for limited organizational purposes (Section 2.3 and Section 4.5). In Section 2.4 and Chapter 4 it was found that the way instructors get support in their use of CMS is also relevant: Examples are important for giving the instructors ideas about the use of pedagogies and technologies, and it seems that instructors benefit more from this than from other types of support (Section 3.4).

In Section 4.2 the design, development and implementation of the TeleTOP CMS in the University of Twente was described. The purpose of the pedagogical model was to make courses more flexible. New cohorts of students found their way to the university, especially in certain programs, such as that of Educational Science and Technology. Several support strategies were used, of which a personal pedagogical support type was valued highest and had the biggest effect. Later when support was more technical (with the second TeleTOP DST) the use of TeleTOP and the related flexibility for students decreased.

Thus there is a need for more personalized support for instructors but at the same time this support must be manageable and scalable in practice. This support should emphasize the recognized model within higher education, the Stretching-the-Mold Scenario, and use the 2S-t-M flexibility dimensions as a rationale for the (re)design of courses by instructors. This support could be best built in an integrated performance support tool within a specific CMS, in this case the TeleTOP CMS. There is a need to organize support through the use of guidelines and examples and relate them to the decisions to be made when (re)designing courses with the use of a CMS, the TeleTOP CMS. Section 2.6 discussed the electronic-performance support that potentially gives powerful options to offer integrated help, tutorials, and advice.

This can serve as the basis for a new TeleTOP CMS focused on the 2S-t-M flexibility dimensions.

An electronic performance-support system within TeleTOP should support the planning design and interpersonal flexibility within courses. Most commonly at the University of Twente there is one TeleTOP CMS environment per course per year. The environment can be used by individuals or by small groups of instructors. The main choices that an instructor has to make relate to the options in 2S-t-M flexibility and to the course pedagogies and technologies that support these. The options which an instructor can choose from are related to the particular setting and the context in which he is teaching his course. For example, there could be a homogenous group of students attending the course, or there could be differences between levels or base locations of students attending the course. Furthermore the rationale of a course could differ. Based on these ‘settings’ the instructor should get help in deciding what choices to make with regards to the options that are related to flexibility, technology, and pedagogy. This support can be provided through an integrated performance support tool, or as Raybould (1995) calls it: An embedded tool within the system it refers to. It can have different components, such as a coach tool, and support in the form of short tutorials (McGraw, 1995). Based on this support the instructor can make the decisions for the design of the course.

Given this basis, in the next section the general design decisions of the new electronic performance support tool that is integrated within the TeleTOP CMS will be given. The name for this support tool will be the TeleTOP Flexibility Support Tool, or the FST.

5.2 Conceptual Design and Design Approach of the Flexibility Support Tool

The TeleTOP Flexibility Support Tool (FST) has to support the instructor that is (re) designing his course. The main tool for this flexible redesign is the TeleTOP CMS environment. The support for instructors is integrated within the TeleTOP CMS environment. An important aspect of the TeleTOP FST is the organization of information or options from which the instructor in his design process can choose.

The TeleTOP FST should suggest options based on the course setting and ideas of the instructor, such as the types of students and the main pedagogy that an instructor wants to follow. In making choices for learning activities it is very important that an instructor makes his own decisions based on his own situation.

The main elements that relate to the performance support within a 2S-t-M flexibility design for courses are given in Figure 42.

a. Conditions	b. Options	c. Course (re)design
Course settings →	Options in flexibility, technology and pedagogy →	Choices made in course planning flexibility
TeleTOP Flexibility Support Tool		

Figure 42. Elements/steps within the Flexibility Support Tool for course design within a CMS.

Figure 42 shows how the instructor comes to the course (re)design. The course settings (a) are important for the decisions in the range of options in technology, pedagogy, and flexibility; (b) The TeleTOP Flexibility Support Tool gives suggestions based on the course settings, (c) The instructor makes the decisions.

The design methodology for the FST that is being used is that of Development Research (Reeves, 2000). An overview of Reeves' expression of the methodology for development research is showed in Figure 43.

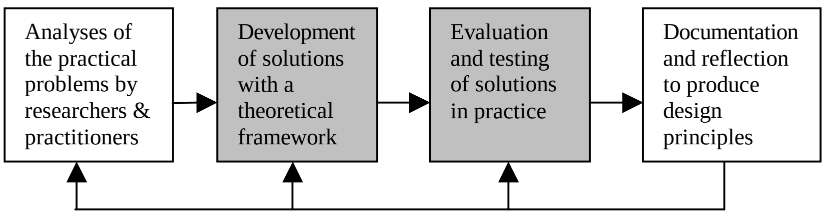


Figure 43. Development research approach (Reeves, 2000, p. 25).

This PhD research started with an analysis of the practical problems facing instructors when they wish to make their courses more flexible. This was reflected in the first research question, related to types of flexibility in course design in higher education. In the second cell Reeves focuses on the development of solutions within a theoretical framework. These steps are analogous to the activities for the second research question, about Web-based resources for flexibility in learning, and the third research question, about making a choice. Reeves' next development step is the evaluation and testing of solutions in practice. This step is being elaborated in the activities related to Research Question 3 in terms of the decision- support tools. The last step in Reeves' development research approach is documentation and reflection. Reeves suggests that this process should result in design principles. The whole development research approach process may seem a linear process, but instead is one of iterative loops as is visualized in the Figure 43 by the arrows.

Based on the preliminary experiences however the development of the FST could also be seen as a more solution-driven approach. As developers have stated: “…the most efficient way to get problem specifications clear is to provide the client with ideas or solutions, in the format of a concrete product or prototype" (Van den Akker, Branch, Gustafson, Nieveen, & Plomp, 1999, pp. 52-53). The method that reflects the design of the FST best is rapid prototyping. "Rapid prototyping models involve learners and subject matter experts interacting with prototypes and instructional designers in a continuous revision cycle" (Prestera, 2002). Van den Akker, Branch, Gustafson, Nieveen, and Plomp (1999) state that the first and main reason to use a prototyping approach is that prototypes can be a tool in identifying the needs and requirements of the course in relation to the target population, experts, and other groups. "Especially in development projects that aim at an innovative and complex product, with few experiences from which to draw, a prototyping approach appears to be appropriate" (Van den Akker, Branch, Gustafson, Nieveen, & Plomp, 1999, p. 129). Verhagen (2000) mentions another important advantage of such an educational design. The rapid prototyping approach as an artistic approach is also pragmatic (p. 20).

The rapid-prototyping method was used for the design and testing, evaluation, and revision phases of the FST. Within an iterative rapid-prototyping process a series of cycles were included, each involving an evaluation process. Within this process an initial design was tested, then corrected, and again tested and corrected, until a certain level of satisfaction was achieved (Bearman, 1997). J. Moonen (2001) mentions that "the primary objectives of prototyping are: To provide users with working examples of the proposed system and to help them to identify, define, and revise its specifications more precisely, thus reducing uncertainty and incorporating the eventual impact of the end-user context" (pp. 169-170).

In the next section the design considerations (5.3) and the design (5.4) of the FST will be described. After that, three formative evaluations will be described, each part of a rapid-prototyping cycle, followed by a section (5.8) that summarizes the revisions after each cycle.

5.3 Design Considerations for the Flexibility Support Tool

There are several design decisions that were important for the TeleTOP Flexibility Support Tool. These relate to the structure of the FST (Section 5.3.1), the components within the FST (Section 5.3.2), and how the support can be designed (Section 5.3.3). In Section 5.3.4 a summary of the most important guidelines will be given.

5.3.1 Structure and interface of the Flexibility Support Tool

According to Gery (1991) an EPSS as an integrated electronic environment should be easily available and accessible by users. The support should be accessible with minimal support and intervention by others. Reeves and Raven (2001) emphasized that the support should be right on time, during the performance.

Collis and Verwijs (1995) mention that the structure in an EPPS should be focused on the working and thinking patterns of many different users, and should be organized in ways related to the individual's daily work practices rather than by predetermined instructional routes and sequences. An EPSS structure should be based on strategies which reflect the nature of the work of end users (Stevens & Stevens, 1996). An EPSS must be flexible and appropriate for people with different needs. The instructors are at different levels, and need to be able to choose the information that is most appropriate for them.

Sherry and Wilson (1996) suggest that it is better not to make all information directly visible, but make it accessible when instructors need it, they (Sherry and Wilson) claim that the more the designer filters and structures the data in an EPSS, the more "canned" it is, and the fewer options the user will have to tailor the information to match his or her own situation or task(s) at hand. There needs to be a sound balance between the structure of the support and the way instructors can choose their own paths.

An EPSS could be organized around components but these components should be structured as well. According to Stevens and Stevens (1995) the user's needs should drive the ways in which information is located and used in an EPSS. Within the work of an instructor, that is (re)designing a course and using a CMS, there are three main design components that can be distinguished. In Sections 4.3.1 and 4.3.2 the course set-up and (re)design elements that are most important were described. The design of the Menu and the Roster on one hand and the Roster pages on the other hand are the most important components in the TeleTOP context. The FST could be organized around these components in order to base it on the strategies which reflect the nature of the work of the instructors.

5.3.2 Elements within the Flexibility Support Tool

In Section 2.6 the elements that an electronic performance-support system can have were discussed. Reeves and Raven (2001) mentioned combinations of different support elements, such as: help, advice, step-by-step guidance, training, assessment, job-aids, operating procedures, regulations, cases and examples, models, templates, and specific tools for decision support. In Section 5.2.1.2 the way examples from peers were discussed. Good examples are important for instructors (B. Moonen, 2001). This was confirmed in Section 3.4, where it was found that support through teaching-related ideas and suggestions on the Web had the most influence on the flexibility design of courses. The success of using examples was also confirmed in Section 4.3 where examples were an important and successful element within the first Decision Support Tool. McGraw (1995) divided three levels of functionality of support systems (Section 2.6.3); the type of integrated support within a CMS could be best defined as Level 2. Within this type of support via the interface with full multimedia support and many details and resources, the user is initiated. An "advisor" within the tool provides dynamic hints and tips and quick tours and tutorials are present with demo and practices, i.e., through video and feedback.

The main elements of the TeleTOP Flexibility Support Tool should support the instructor in making choices for flexible-learning activities. The suggestion-based type of support could be seen as an ‘advisor’. When advice is given further support should build upon that advice, such as a ‘tutorial’ with guidelines and technical assistance.

5.3.3 Design of support within the Flexibility Support Tool

The success of an EPSS depends mainly on the user interface of the system (Gery, 1991). The user interface should be separate from the main system and be an adapted human-computer interface. The user interface should provide user-defined access to all the components in a straightforward and consistent way as well as to the personally relevant components so that the user can work in a whole and meaningful context. The user interface typically will make available options clear to the user and may include functions such as backward and forward navigation. A person will use the interface information to select options or actions.

The help can be user initiated, or n the other hand it can be embedded. Lazonder (2001) found that although embedded instruction in tasks resulted in an increase of the task time of approximately 25%, the group that could use the tools with the embedded instruction performed significantly better that the groups that did not have this kind of support. Van der Meij and Carroll (1995) noted that embedded instruction is the most effective way to work with self-regulated skills. Support is embedded is such a way that an instructor can easily find additional information.

The support should be full multimedia support, with rich detail and resources. Mayer (2001) defines multi- media as the presentation of materials using both words and pictures (p. 2). The words can be both spoken and written, pictures can be graphics, photos, or maps as well as videos or animations. Mayer (2001) furthermore found that learners learn better from a multimedia presentation than from words alone. An implication is that adding illustrations to text can help learners better understand the presented explanation. Gellevij (2002) also found that screen captures can be used to improve manuals. His research showed that a goal-based, functional approach in using screen captures leads to more effective and efficient manuals. By supporting specific functions with screen captures, users learn more in less time.

However, it is important to define how text and pictures can contribute to better learning. One principle Mayer (2001) found is that learners learn better when corresponding words and pictures are near rather than far from each other on the same page or screen (p. 81). Also, pictures and words should be presented simultaneously (or in a very short in time) rather than successively. For the learning it is important that a message is to the point. Mayer (2001) talks about excluding extraneous materials within multi-media in order to not ‘hurt’ (p. 113) learning. Mayer finally found interesting facts about the modality of multi-media. Learners benefit more from animation and narration than from animation and on-screen text. Also learners learn better from words when spoken rather than printed. Finally there seem to be important individual differences that have an influence on the design of multi-media. It is important to have a clear and good design especially when learners are considered to be ‘low-knowledge’ learners. High-knowledge learners suffer less from a bad design.

The design of the support for instructors is of great importance. When using the Minimalist Theory of Carroll (1998) the learning tasks should be meaningful and self-contained and realistic activities. Instruction should permit self-directed reasoning and improvising by increasing the number of active-learning activities and training materials. Important is that there should be a close linkage between the training and actual system. These starting points fit the purposes of the EPSS for CMSs. It is important to emphasize building upon the learner's experience and minimize the extent to which instructional materials obstruct learning, and focus the design on activities that support learner-directed activity and accomplishment (Lazonder, 2001).

In all of these comments, the "learner" is the instructor learning how to make more-systematic decisions about flexibility within the design of his courses.

5.3.4 Guidelines for support for the Flexibility Support Tool

Important considerations for the design of the FST have been discussed in Section 5.3.3. The guidelines for the performance support according to the considerations made are summarized in Table 47. The implications for design are derived from these guidelines.

Table 47. Guidelines and implication for design.

Guidelines	**Implication for the FST design**
Structure of the FST	
The structure of an EPSS should be flexible for different groups of end-users and must reflect their work situation and needs (Collis & Verwijs, 1995; Gery, 1991; Stevens & Stevens, 1995).	The general structure of the FST is based on course set-up and (re)design tasks. Main components in the course set-up and (re)design are the design of the Menu, the Roster and the Roster pages.
Not all information should be directly visible, there is good balance between the structure of the support and the way instructors can choose their own paths (Sherry & Wilson, 1996)	The FST should contain templates to help instructors to choose their ‘path’. The structure contains different levels that should be optional, clear, and reflect the needs of the instructor, a ‘wizzard’ could help structure this.

Table 47 continues…

Table 47 continued

Support elements	
Types of support can be based on an advisor that provides dynamic hints and tips, and a tutor with quick tours and tutorials, with demos and practice, i.e., through video (McGraw, 1995; Reeves & Raven, 2001).	In the FST the use of examples is an important support element that builds upon the other types of support. The support will be shaped around an advisor and a tutor.
Design of support	
The interface should be easy to understand and use. It is user initiated and controlled (Gery, 1991; Lazonder, 2001).	For the main components two interfaces will be designed, one for the Set-up (Roster and Menu design), one for the specific design (Roster page design). The interface is orderly and consistent. The instructor has control and many choices.
Support should be easy available and accessible and therefore embedded (Lazonder, 2001; Van der Meij & Carroll, 1995;).	The first interface is embedded in the course environment through the set-up interface. The second component can be embedded in the interface of the Roster pages.
Learners learn better from a multimedia presentation than from words alone (Gellevij, 2002; Mayer, 2001)	Support is provided through a combination of several media. Screen-captures are used to support guidelines and videos with supportive texts will be made.
Support should be based on minimal instruction and build upon the learner's experience (Carroll, 1998; Lazonder, 2001)	Support is user initiated and controlled and builds upon the 'path' an instructor follows and therefore builds upon experience and minimizes the extent to which instructional materials are needed.

The design consideration and implications for the FST design in this section were used for the design of the TeleTOP Flexibility Support Tool. In the next section the design and the description of the FST and its main components will be given.

5.4 Design and Descriptions of the FST Components

This section will start with an introduction of the structure and main components of the FST (5.4.1). Sections 5.4.1 – 5.4.4 will be used to describe these primary components and their functional design.

5.4.1 Introduction of the structure and main components

The TeleTOP Flexibility support tool was integrated in Version 4 of the TeleTOP course-support environment. The guidelines that were used for the design of the FST stated that the interface should be easy to understand and use and be user initiated and controlled. The structure of the FST should reflect the working and thinking patterns of different users, and relate to the instructors' practices. The main design decisions for an instructor when setting up a course in the TeleTOP CMS are the options that should be chosen (reflecting the CMS functionalities) and the way the Roster is structured. Therefore a General Roster & Menu Support Tool should be part of the FST and consist of three parts: a template tool (related to the general setting of the course), a Menu design tool (relating to the functionalities chosen for the CMS), and a Roster design tool. Another element in (re)designing a course is the design of course activities and events. This is also part of the practice of instructors that work with TeleTOP, but is not part of a more-general set up of the course environment. It occurs during the design of the Roster pages. Therefore the FST consists of two main interfaces. A *General Roster & Menu Support Tool* and a *Roster Page Support Tool*. An important difference between these elements of the FST is the function: The first element of the FST is a course global set-up tool, whereas the second FST appears when instructors make their more-specified course designs within Roster pages. Another difference is therefore the location. The *General Roster & Menu Support Tool* options are all located at the set-up page of the course, and instructors mostly only run through them once. The *Roster Page Support Tool* appears every time instructors are busy in the Roster of their TeleTOP environments. The main components that follow from this approach are given in Table 48.

Table 48. Main components of the Flexibility Support Tool

Main component	Brief description	Purpose
I. General Roster & Menu Support Tool		
Template tool (Section 5.4.2)	Seven course models	To decide which course setting is relevant
Menu-design tool (Section 5.4.3)	A suggestion for CMS tools	Related to the course setting, to decide what tools will be relevant for flexibility and pedagogies
Roster-design tool (Section 5.4.4)	A schedule framework	To define the course planning, which includes the planning of 2S-t-M flexibility
II. Roster Page Support Tool		
(Section 5.4.5)	A tutor for course activities	Decide on the design of course activities, focused on support with regards to options in flexibility, technology, and pedagogy

5.4.2 The template tool

In Section 5.4.2.1 the structure of the template tool will be described. In Section 5.4.2.2 the design and description of the template tool will be given.

5.4.2.1 Structure of the template tool: Seven course models

In Section 3.3.3 the main dimensions that were related to the flexibility were discussed. On one hand the flexibility that relates to the planning of courses has been identified as an important flexibility dimension, on the other hand flexibility relating to the kind of individual experience within a course when taking it was the second dimension. Flexibility can occur when instructors are dealing with on-campus students as well as when dealing with lifelong learners. One consideration for decisions about a course setting therefore could be the different students attending a course.

In Section 2.3 (technology related to course pedagogies) a major conclusion was made that the use of CMS within teaching and learning can be optimal for certain pedagogies. It was said that active learning and "contributing students" benefit most from the use of flexible technologies. These assumptions were confirmed in Section 3.3, where it was concluded that pedagogies such as students planning their own learning processes, and producing/creating reports and products using ICT tools, as well as knowledge transfer and skill development, have significant influences on the flexibility that is provided within courses. This dimension therefore relates to the pedagogical rationale of a course, and the way students are expected to be active within a course.

In order to define how in practice instructors deal with these planning decisions, two main flexibility options are: how will students participate? (On-campus/traditional or off campus/Lifelong); and, what kind of activities are dealt with within the course (based on acquisition or on more-active/contribution)? These questions could be used for scenarios to serve as templates that would reflect the general course settings. The dimensions therefore lead to at least four course models or templates. Table 49 shows how the dimensions lead to a clear overview of recognizable models of a course.

Table 49. Overview of recognizable models of a course that could serve as templates.

		Students' setting	
		All students attend face-to-face sessions	(Some) students don't attend face-to-face sessions
Students' role	Acquisition	The Classroom Study Model	The Flexible Self-study Model
	Active/ contribution	The Active Classroom Model	The Flexible Classroom Model

In the Classroom Study Model the traditional university model is most appropriate. Students attend face-to-face meetings, and learning is based on acquisition. When students are more active and learning is more contribution based, the Active Classroom Model is relevant as long as students attend the face-to-face sessions. When not all students are attending the face-to-face meetings, and learning is based on acquisition the Flexible Self-study Model is applicable. Within the Flexible Classroom Model not all students do attend face-to-face meetings, but learning is based on contribution.

These four models of courses could serve as templates within the use of a CMS, in order to give instructors examples of how courses can be set up within each of the models and how to make decisions in order to stretch their course mold within each of the models.

Because the contribution types of course could also be divided into those with activities that are done by one person and those by a group, and some courses also have students that would not be able to attend any face-to-face session, the list of templates can be expanded (Table 50).

Table 50. Overview of 2S-t-M templates for course models within the FST performance support tool.

		Students' setting On campus	Some are off campus	All are off campus
Contribution activities	None (course is based on acquisition)	1 Self-study Model	2 Flexible Self-study Model	
	For individuals	3 The Classroom Model	4 The Flexible Classroom Model	
	Within group/project	5 The Classroom Project Model	6 The Flexible Classroom with Project(s)	7 Project-Oriented Distance Course Model.

At the University of Twente there are several programs for flexible students. Within these programs the active models (3-7) are most relevant and used.

The seven models shown in Table 50 that are judged most relevant for the university setting will be discussed next.

1. **Self-Study Model:** An on-campus setting for acquisition based learning. Collis and Van der Wende (2002) found that the traditional course models where face-to-face teaching is relevant are highly valued and still are the daily practice (Chapter 2). Students attend face-to-face meetings; there is a study book and learning is based on acquisition.

2. **Flexible Self-Study Model:** A (partially) flexible setting in terms of location for acquisition based learning. When not all students are attending the face-to-face meetings, and learning is based on acquisition the Flexible Self-Study Model is applicable. In the beginning of the Masters program at the Faculty of Educational Science and Technology, the distance programs that were designed were mostly based on high-quality materials that students could use for self-study. Not much interaction was part of the pedagogical concept. In Section 2.2 it was discussed that in evaluation studies (see Mioduser & Nachmais, 2001) the rote-learning pedagogies are more often seen that more interactive types of learning with the support of Web technology.

3. **The Classroom Model:** An on-campus setting based on individual contribution activities. When students are more active and learning is more contribution based, the Active Classroom Model is relevant as long as students attend the face-to-face sessions. This model is a very common model within most universities, and especially within universities that follow certain pedagogies such as action-based learning, and contribution-based learning (See Section 2.2).

4. **The Flexible Classroom Model:** A (partially) flexible setting in terms of location based on individual contribution activities**.** Within the Flexible Classroom Model not all students attend face-to-face meetings, and learning is based on contribution. De Boer (2001) discusses flexibility in a particular course where different ‘sorts’ of students attend the same course. Some students are regular students that are on-campus, some attend from a distance. Through a contribution-oriented pedagogical model students cooperate (through distances) and learn from each other and each others' cases (submitted materials).

5. **The Classroom Project Model:** An on-campus setting based on based on contribution activities through group work. Within the Classroom Project Model students attend the face-to-face meetings and students collaborate in their activities. This model was discussed by Collis and Winnips (2002). Students could choose from a more-active approach where contribution was asked, or an approach where the study materials were determined. The different approaches did not led to differences in the learning results.

6. **The Flexible Classroom with Project(s):** A partially flexible setting in terms of location based on contribution activities through group work. The Flexible Classroom Model is relevant when individual students are contributing through activities, but are not always, or even never, attending meetings face to face. This model is relevant for those courses that deal with students from different programs. In Chapter 4 the motivations and backgrounds for the TeleTOP project were discussed and the model that was discussed there is based on this Flexible Classroom with Projects approach. The flexibility approach is being used in practice now at the University of Twente, although students that are most in need for flexibility are still not satisfied with the ways instructors carry out this approach (Biesheuvel, 2001; Janssen-Reinen, 2003).

7. **Project-Oriented Distance Course Model:** A full flexible setting in terms of location based on contribution activities through group work. Within the Project-Oriented Distance Course Model students never attend face to face, but students collaborate in their activities. Van der Veen (2001a) and Winnips (2000) describe examples from the masters programs at the University of Twente where students from all over The Netherlands and students from Africa and Asia participate collaboratively in a course.

5.4.2.2 Design and description of the template tool

For defining what template would best fit the particular course for the instructor dealing with the (re)design of that course a number of questions could be asked that relate to the axes of Table 50. The instructor should indicate what kinds of students and what kinds of activities would be most appropriate for his course. In Figure 44 the questions that are the start of the FST support to define the template within the *General Roster & Menu Support Tool* are shown.

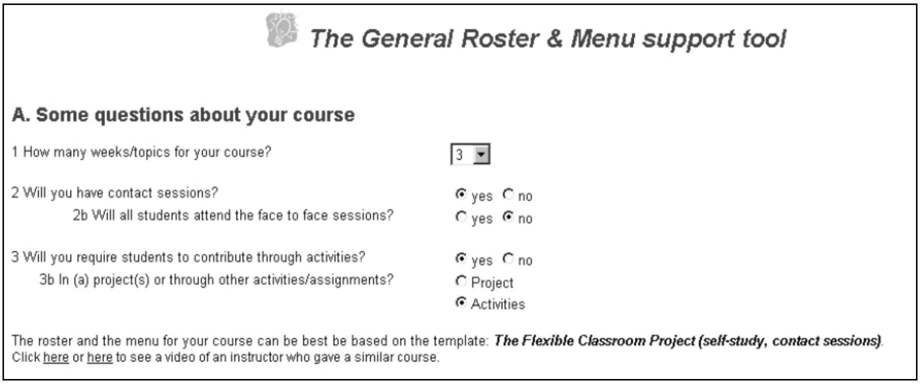


Figure 44. In the General Roster & Menu Support Tool the answers to the questions define the template.

Following this, a general impression from another instructor that used the TeleTOP CMS in a similar way is offered to the instructor. This way of peer support is valuable, as the instructor can see a set of examples and relate them to his own situation. The way this was implemented in the FST was through the use of a short video for each of the seven templates. Within each video, an instructor explains his setting and approach, and makes clear how he or she organized flexibility within the course, given one of the seven models in Table 54. The instructor talks about the way TeleTOP was used and how the course was organized: i.e., how sessions were organized was discussed, and what was done when distance students were not able to attend face-to-face sessions. The interaction via the TeleTOP CMS was discussed, as were the ways instructors organized smaller and larger assignments, feedback, group-work and other activities. Instructors on the seven videos explained what sorts of resources were used in the environment and whether students contributed to the resource collections. All examples were supported within the video through screen dumps of the CMS examples. Figure 45 shows how the instructor in the FST based on the chosen course-model template sees an example of another courses that fits the template that is suggested for his course.

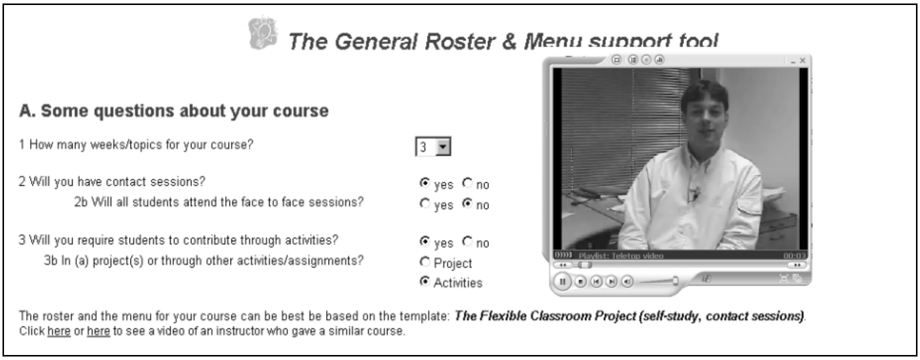


Figure 45. An example of the videos that are presented to the instructor in the FST, based on the chosen course-model template.

Next, the relation between the chosen course setting and the main components of the General Roster & Menu Support Tool will be discussed, first the Menu tool.

5.4.3 The Menu Tool

In Section 5.4.3.1 the general structure of the Menu Tool will be described. In Section 5.4.3.2 the design and description of the Menu Tool will be given and in Section 5.4.3.3 the more specific design of the support will be described.

5.4.3.1 General structure of the Menu Tool

In Section 2.4 the tools that are included in CMSs were discussed. These tools relate to what an instructor intends to do with regards to course organization, communication, use of resources and activities. The course planning of a course depends on the course setting as has been discussed in Section 5.3.1. From the available tools that support an instructor with the organization, the communication, and the content of a course a selection based on the chosen course setting could be made:

- The main CMS tools, identified in Section 2.4, can be organized around the organization, the communication and the content within a course. Within TeleTOP there is one additional category, which is “group work”.

- All templates benefit from the most general tools of the CMS TeleTOP related to the organization of the course. These are the News, the Roster, and the Course Info. With these tools an instructor is able to give a general introduction, a planning of the course, and has the ability to provide course updates.

- For the communication tools, for all course settings (templates), the Email/Group option is suggested, as this gives the instructor an overview of which students attend the course.

- Other tools, such as the Participants option that gives more detailed info about attendees or the Discussion function that enables asynchronous communication via the TeleTOP system, are more valuable for those templates of courses that have some or all students that attend at a distance (see Table 50).

- Within the content or resources section there are a number of choices an instructor can make. It really depends on what an instructor has planned as resources, but some suggestions are related to the type of course are applicable, i.e., the courses that have face-to-face sessions could make use of PowerPoint files, end upload these in the TeleTOP CMS. All templates also have the Web-links as a suggested option, to emphasize the use of the Web as a resource.

- Finally, within the “Group work” category, those course templates that relate to these kinds of activities have a suggestion to include the Workplace tool within their course menu.

Thus for the instructor a suggestion for the menu could be made based on the course model chosen and related template that has been suggested within the Template Tool. The support is an advisor type of support that makes a suggestion, but the instructor is still in control and makes the final decisions as he can change what the advisor suggests. Table 51 shows the options in CMS tools that relate to the seven templates that have been introduced. Per template suggestions for options are made based on these starting-point/principles.

Table 51. CMS tools related to the course models.

Templates: / CMS Category & tools	1 Self-study	2 Flexible Self-study	3 Class-room model	4 Flexible Classroom	5 Classroom Project model	6 Flexible Classroom with Project	7 Project-Oriented Distance Course
Organization							
News	Y	Y	Y	Y	Y	Y	Y
Course info	Y	Y	Y	Y	Y	Y	Y
Roster	Y	Y	Y	Y	Y	Y	Y
Email	Y	Y	Y	Y	Y	Y	Y
Administration	N	N	N	N	Y	Y	Y
Feedback	N	N	N	N	Y	Y	Y
Communication							
Email	Y	Y	Y	Y	Y	Y	Y
Participants	N	Y	N	Y	N	Y	Y
Discussion	N	Y	N	Y	N	Y	Y
Question & answer	Y	Y	N	Y	N	Y	Y
Chat	N	N	N	N	N	N	N
Resources							
Category	Y	Y	Y	Y	Y	Y	Y
Glossary	N	N	N	N	N	N	N
Archive	Y	Y	N	N	N	Y	Y
Web-links	Y	Y	Y	Y	Y	Y	Y
Multimedia	N	N	N	N	N	N	N
Publications	N	N	N	N	N	N	N
Sheets	N	N	Y	Y	Y	Y	N
Page	N	N	N	N	N	N	N
Poll	N	N	N	N	N	N	N
Quiz	N	N	N	N	N	N	N
Group work							
Workspace	N	N	N	N	Y	Y	Y
Presentation	N	N	N	N	Y	Y	Y

Where Y=yes and N=no for the suggestion.

The table shows how the suggestions for the tools are related to the template that is suggested for a course. For example, within the Flexible Classroom template the menu items (CMS tool options) that are suggested are News, Course info, Roster, Email, Email, Participants, Discussion, Question & answer, Category, Web-links, and Sheets.

5.4.3.2 Design and description of the Menu Tool

Instructors have a number of options to choose from, but suggestions are made based on the model and template that has been suggested. Instructors are invited to review the suggestions, as well as those options that are originally not suggested (marked in Table 51 by "N"). Figure 46 shows how the suggestions for CMS tools related to the course models that were presented in Table 51 are presented to the instructor.

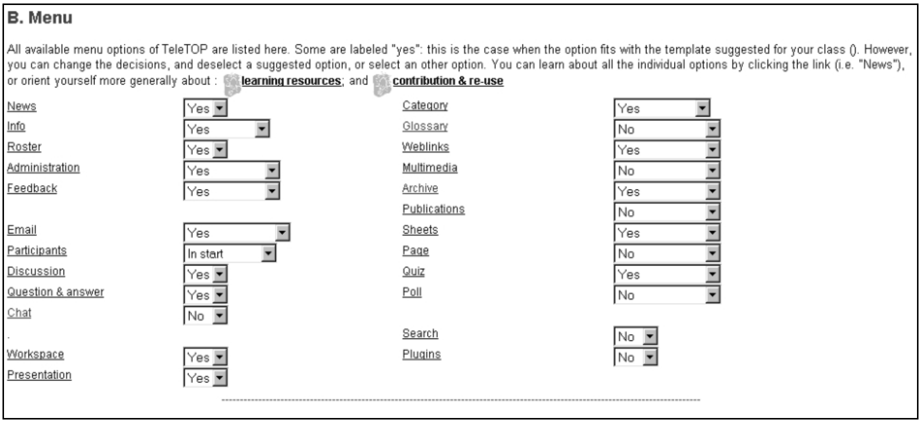


Figure 46. The choices of the instructor are represented in the Menu.

Based upon the answers and the template, the choices of the instructor are represented in the Menu. Suggestions are made and instructors can view videos read guidelines, see examples, and find technical support related to each suggestion. The decisions that an instructor makes are represented in the design of the course environment. For example: an instructor decides to integrate a discussion list for his distance and on-campus students for a cooperative activity. This option will be part of the menu of the generated course environment. The support is designed in such a way that it is easy available and accessible, as well as easy for the instructor to alter based on his own wishes if these are different from the suggestions made by the Menu Tool.

5.4.3.3 Support elements

Figure 46 shows that the extra support materials are linked and available through the embedded support. These types of support provide dynamic hints and tips, quick tours and tutorials, and demos and practices, sometimes through video. These different forms of performance support should support the way instructors can make their ‘final’ decisions about the options in tools. From the number of possibilities that performance support can offer (see Sections 2.6 & 5.1) the main types of support that best benefit the instructor were chosen and are summarized in Table 52.

Table 52. Types of support for the menu choices.

Support	Type	Description
Coach	General info	An introduction of the category & tool
	Tips and guidelines	Ideas and suggestions for how functionality could be used
	Examples	Screen dumps and descriptions of use in practice
Tutorial	Technical info	How to use it…
	Video	Video walkthrough of how to use the functionality

The different types of support are based on several media and are based on minimal instruction (Carroll, 1998). They build upon the learner's experience and use the experiences of peers to show examples. Figure 47 is an example of one of the over 50 support documents within the performance support tools. The full set is given in Appendix 6.

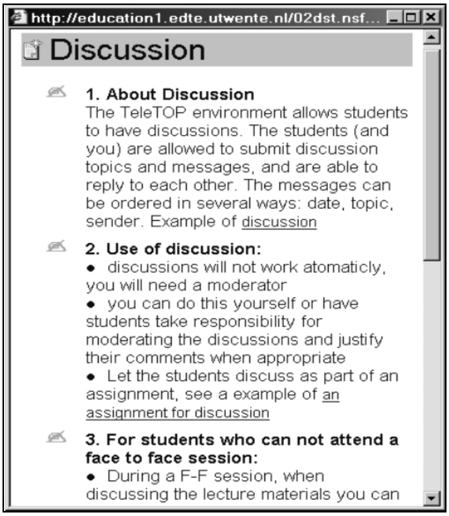


Figure 47. An example of the Discussion support documents that contain general info, tips & guidelines, examples, technical info, and a tutorial video of the tool.

For each of the content options (the resources) it was furthermore possible to choose whether the instructor liked students to be able to add to the specific resource. This option is particularly interesting for those courses that deal with contributing students. Within the examples and guidelines of the support these options were mentioned and were elaborated.

5.4.4 The Roster Tool

In Section 5.4.4.1 the general structure of the Roster tool will be described. In Section 5.4.4.2 the design and description of the Roster tool will be given, and in Section 5.4.4.3 the more specific design of the support will be described.

5.4.4.1 General structure of the Roster Tool

Within the TeleTOP CMS the organization of the course also is strongly related to the use of the Roster tool. This part of the CMS not only deals with organizational matters, but also deals with structured communication (i.e., through assignments and feedback) and structured presentation of information (or content or resources). In Sections 4.1.3 and 4.4 examples of TeleTOP Rosters were shown and discussed.

The Roster is the most-commonly used component within environments of courses that use the TeleTOP CMS (Section 4.4). In the tool for designing the Roster, based on the template selected for a course, column headings for the Roster will be suggested based on the model and template chosen. These column headings can be seen as the general design of a course, and therefore an important design issue.

A Roster design that would be applicable for a course reflecting a flexible course template with contributing students could include an activity for the session (before), the session description (during), and a follow-up activity (after) (Collis & Moonen, 2001; also see Section 4.1.3 and Figure 17). The type of activity relates to the degree of flexibility. For the templates of the performance-support tool within the TeleTOP CMS the possible Roster column headings are given in Table 53.

Table 53. Possible Roster headings related to course templates.

Roster structure:		Before	During	Follow-up	
Possible Roster headings:	Week/Topic	Self-study/ assignment	Contact sessions - Notes/tasks	Follow-up activities	Project(s)
Self study course		X		X	
Self study distance course			X	X	
Classroom model	X	X	X	X	
Classroom model Project	X	X	X		X
Flexible Classroom	X	X	X	X	
Flexible Classroom: Project	X	X	X		X
Project-oriented distance course		X			X

5.4.4.2 Design and description of the Roster

As an example, based on Table 53 the Roster headings for the Flexible Classroom Project Model would contain Self-study/ assignment, Contact sessions - Notes/tasks, Week/Topic, and Project(s) as column headings for the Roster for a course. The decisions that an instructor can make about how to organize the Roster column heading based on the suggested template is demonstrated in Figure 48.

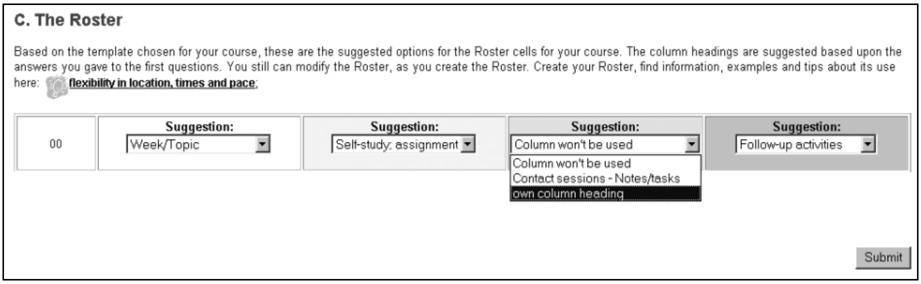


Figure 48. The FST gives suggestions for the Roster structure of a course.

5.4.4.3 Support elements

To make the ‘final’ decisions with regards to the Roster headings there is also support that helps the instructor with his choice (Table 54).

Table 54. Types of support for the Roster choices.

Support	Type	Description
Coach	General info	An introduction of the category & tool
	Tips and guidelines	Ideas and suggestions for how functionality could be used
	Examples	Screen dumps and descriptions of use in practice
Tutorial	Technical info	How to use it…
	Video	Video walkthrough of how to use the functionality

Figure 49 is an example of one of the Roster support documents within the performance-support tools that provides different kinds of support for the instructor.

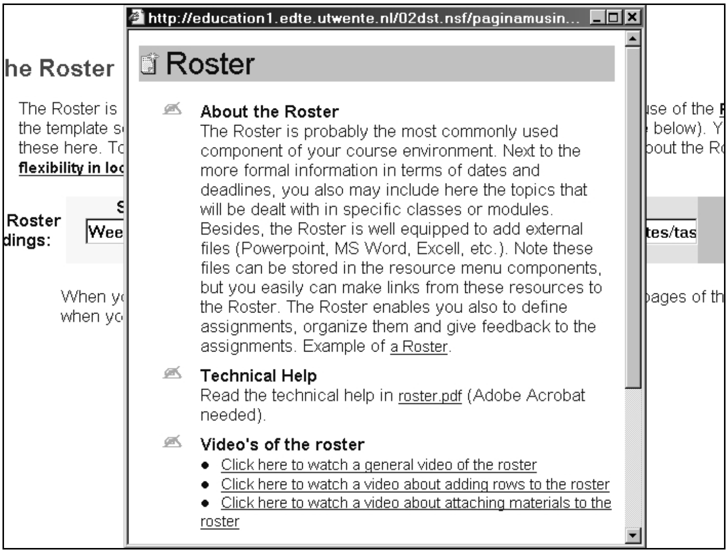


Figure 49. An example of a Roster support document.

As can be noted, the support is very similar to the support that was organized for the Menu choices, and fits the design guidelines that were mentioned in Section 5.2; the support is based on minimal instruction, it is multimedia support that has tutor and advisor roles, and it is user initiated and controlled.

5.4.5 Roster Page Support Tool

In Section 5.4.5.1 the general structure of the Roster Page Support Tool will be described. In Section 5.4.5.2 the design and description of the Roster Page Support Tool will be given, and in Section 5.4.5.3 the more specific design of the support will be described.

5.4.5.1 General structure of the Roster Page Support Tool

The Roster Page Support Tool could be seen as a tutor for course activities. When a general design has been made with the use of the template tool, the Menu design tool, and the Roster design tool, the more-specific design of activities within the course can be made. Therefore the support should build upon the course template that has been chosen. Within this more-specific design the content, communication, and more-specific organization of activities can be done. The support builds upon the framework or Roster headings that the instructor has defined. Table 55 gives an overview of the topics of the Roster Page Support Tool.

Table 55. Overview of course activity design and related support.

	Before	**During**	**Follow-up**	
Model:	Self-study/ assignment	Contact sessions Notes/tasks	Follow-up activities	Project(s)
Self-study models	X			
Contact sessions models		X		
Use of discussion		X		
Assignments & feedback	X	X	X	X
Projects			X	X
Contribution & re-use	X	X	X	X
Learning resources	X	X	X	X
Flexibility in time and pace	X	X	X	X

5.4.5.2 Design and description of the Roster Page Support Tool

Within the more detailed set-up of the course (again also based upon the template) are suggestions for sessions, activities, for group-work and for feedback. Figure 50 shows an example of how the Roster Page Support Tool could help an instructor in the design for a face-to-face session.

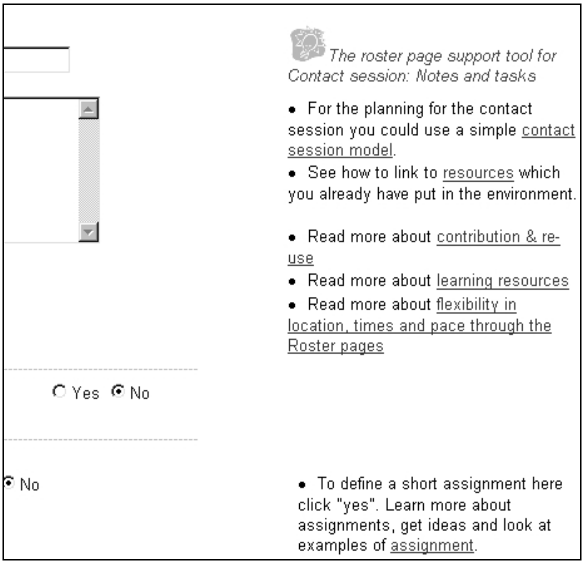


Figure 50. Example of the Roster Page Support Tool.

Within this support that is aimed at individual course sessions and/or activities and/or readings, alternatives for students who cannot attend; activities; assignments and feedback are available. Important is that instructors can easily find valuable information, guidelines, and examples as they create their courses and need to make design decisions after visiting the available support links.

5.4.5.3 Support elements

Within the types of support again the model that was earlier introduced was followed. Table 56 summarizes the main types of support for the instructor within course activity design.

Table 56. Types of support for the Roster Page Support Tool.

Support	Type	Description
Coach	General info	An introduction of the category & tool
	Tips and guidelines	Ideas and suggestions for how functionality could be used
	Examples	Screen dumps and descriptions of use in practice
Tutorial	Technical info	How to use it…
	Video	Video walkthrough of how to use the functionality

For each of the items within the support where instructors can find support, there are hyperlinks available that lead to an uniform support document. Figure 51 shows how the support is provided.

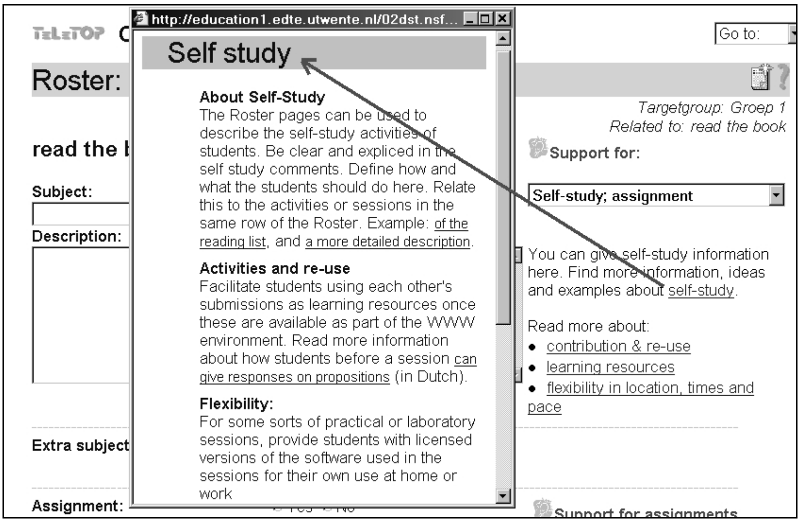


Figure 51 . Support document via the Roster Page Support Tool.

Also for the support that is given through the Roster Page Support Tool is based on minimal instruction and full multimedia, and is user initiated and controlled.

5.5 Usability Evaluation of the Flexibility Support Tool

Within the rapid prototype design of the FST several formative evaluations were organized. Flagg (1990) as cited in Reeves and Hedberg (2003) defines formative evaluation as the systematic collection of information for the purpose of informing decisions to design and improve the product (pp. 139). In this section the formative usability evaluation will be described. In Section 5.5.1 the research questions for this evaluation will be presented, after that the experimental design and procedure will be given (Section 5.5.2) In Section 5.5.3 the subjects that were used for the experiment will be described and in Section 5.5.4 the design and description of the instruments will be given. This section will conclude with the results of this formative evaluation (Section 5.5.5).

5.5.1 Research questions for the usability evaluation

The Flexibility Support tool was first studied in an experimental setting, that is, not in a practical setting with actual courses. In the first experiment with the Flexibility Support Tool the usability of the tool--its user friendliness and use--was the subject for research. The purpose of this research was to see how the design of the Flexibility Support Tool was experienced, and how the design could be improved. It can therefore be seen as a formative evaluation of the tool.

5.5.2 Experimental design and procedure of the usability evaluation

Sweeny, Maguire, and Schakel (1993) have indicated nine categories of indicators that can serve as usability measures. From their indicated options (p. 695) the user-based approach in a laboratory setting is an appropriate design for the prototype of the FST. The phase of the prototype however does seem more like “almost finished” than an early prototype. For this level Sweeny, Maguire, and Schakel (1993) recommend a user-based approach in a field setting. This user-based evaluation also can give diagnostic, summative, and certification feedback about the prototype.

For the user-based approach that was chosen, the respondents were given instructions in a set-up meeting. After that meeting they got one week to do a task related to using the FST in course design. The respondents had to go through a specified task sheet, taking the role of instructors. A TeleTOP environment with the FST was prepared for each respondent. All respondents needed to set up the same course according to the description on the task sheet (see Appendix 7). The context was hypothetical, in that the subject of the course task was similar to all respondents. A course design needed to be made, and the FST that was embedded in TeleTOP should be used to fulfill this task. The respondents worked on the experiment at the available student computers at the faculty or at their own desktop computers at home. Computers needed a Web-browser and audio speakers.

The experiment was based on the Posttest Only Design (Campbell & Stanley, 1963, p. 25), therefore a questionnaire was given to the respondents one week after the start of the experiment.

5.5.3 Subjects of the usability evaluation

From an elective course about the use of course-management systems in education (taught by the researcher), 25 graduate students of the Faculty of Educational Science and Technology were asked to participate in the research. Twenty agreed to take part. Although not themselves instructors in the faculty, all had studied instructional design and all were familiar with the TeleTOP system (as learners). Many had instructor backgrounds themselves. Of the 16 respondents that eventually participated in the research were five men and 11 women (four did not choose to participate because of time limitations). Table 57 summarizes the respondents in the usability evaluation.

Table 57. Characteristics of the subjects of the evaluation.

Sex	Age	Nationality	Instructor experience
Male	43	Dutch	yes
Female	28	German	no
Female	30	French	yes
Female	25	Dutch	no
Female	28	Ethiopia	yes
Female	25	German	no
Female	23	Spanish	no
Female	22	Spanish	no
Male	34	Chinese	no
Male	28	Indonesia	yes
Female	27	Chinese	no
Male	30	Libya	yes
Female	28	Bulgaria	yes
Male	31	Libya	no
Female	30	German	yes
Female	28	Chinese	no

The age of the respondents was average 29, 44% had experience as a teacher, and 70% are female.

5.5.4 Instrument for the usability evaluation

For the usability evaluation a questionnaire was chosen. The questionnaire instrument has some advantages, such as the speed of answering and the standardized way data can be collected (Harvey, 1998). Disadvantages can be a low response rate, the gap between the experiment and the return of the responses to the questions, and superficial answers when a questionnaire takes too much time

(Harvey, 1998). Despite these disadvantages the questionnaire seems a good instrument to get formative feedback on the design of the FST prototype, because of the fast and uniform way data can be collected. The questionnaire gives all respondents an equal opportunity to answer a set of closed and/or open-ended questions. It can be done anonymously and without interference from or influence by others. The questionnaire should be short and focused and thus an efficient way of obtaining information. When the results are collated they can be analyzed quite easily and can be presented in a way that is relatively easy to interpret.

The questionnaire consisted mainly of closed questions. It was important to choose appropriate scales so that respondents could indicate their responses. A Likert-type scale was mainly used (i.e., a five-point scale ranging from Strongly Disagree (1) and Disagree (2) through Uncertain (3) to Agree (4) and Strongly Agree (5)). There were some questions that were open-ended questions. These may require considerable time to process, but they provide respondents with the opportunity to raise issues and concerns not addressed in the closed questions.

In Appendix 8 the full questionnaire for this first experiment can be found; here, some of the questions and the different categories will be presented. The questionnaire contained questions about the utility, use, user-friendliness, and usability of the Flexibility support Tool.

The questionnaire started with some general questions about the FST. Table 58 demonstrates one of the eight questions within this section.

Table 58. Example of a general question about the FST.

	Very negative		neutral		Very positive
What is your general impression of these support tools within TeleTOP?	0	0	0	0	0

The next section of the questionnaire dealt with the user-friendliness of the Flexibility Support Tool. Table 59 demonstrates one of the 14 questions within this section.

Table 59. Example of a user-friendliness question about the FST.

	Not at all clear		Neutral		Very clear
How clear were the input procedures in these support tools?	0	0	0	0	0

The following questions were about the General Roster & Menu Support Tool and the Roster Page Support Tool, each considered separately. The same sort of questions for these two parts of the Flexibility Support Tool were repeated. Table 60 demonstrates some of the questions within this section.

Table 60. Example of questions about the General Roster & Menu Support Tool and the Roster Page Support Tool.

Approximately how many times did you look at the following kinds of support?					
	Never	Looked once	Looked at several items	Looked at most items	Looked at all items
Video	0	0	0	0	0
Guidelines	0	0	0	0	0
Examples	0	0	0	0	0

Other aspects that were questioned in the utility section focused on extent that the FST helped the respondents make design and flexibility decisions, as well as how the support was valued.

The last section of the questionnaire contained questions about the (intended) design of the course. Respondents were asked if they had time to complete the design of this course and to what extent a number of flexibility design choices would be available to students in the course. An example of two of the 16 questions is shown in Table 61.

Table 61. Example of the 2S-t-M questions**.**

To what extent do you make the following kinds of choices available to students in your own courses?	
	1= No flexibility - Extensive flexibility = 5
Times (for starting and finishing a course)	0 0 0 0 0
Times for submitting assignments and interacting within the course	0 0 0 0 0

5.5.5 Results of the usability evaluation

After a week 16 of 20 questionnaires were returned. Following are the results of the responses to the questions and the interpretations. First the general reactions on the electronic performance support tool, the Flexibility Support Tool, are given in Table 62.

Table 62. General reactions to the Flexibility Support Tool (N=16).

	Mean	SD
What is your general impression of these support tools within TeleTOP? (1= Very negative; 3= neutral; 5= Very positive)	4.13	0.81
How difficult or easy was it to work with these support tools? (1= Very difficult; 3= neutral; 5= Very easy)	3.88	0.81
What was your personal feeling about working with these support tools? (1= Very Frustrating; 3= neutral; 5= Very Satisfying)	3.38	1.02
How would you rate the power of these support tools to for making decisions about the design and use of TeleTOP? (1= Not at all powerful; 3= neutral; 5= Very powerful)	3.53	1.09
To what extent do you think these support tools can help the instructor making a stimulating course? (1= Very poor influence; 3= neutral; 5= Good influence)	3.56	1.09
To what extent do you think there were enough options offered by these support tools? (1= Definitely not enough options; 3= neutral; 5= Very good range of options)	3.88	0.96
How would you rate the content within these support tools? (1= Very poor content; 3= neutral; 5= Very good content)	3.50	0.89
How would you rate the approach used within these support tools? (1= Very poor approach; 3= neutral; 5= Very good approach)	3.94	0.77

The overall impression of the respondents about the electronic performance support tool is positive. They do not feel that it is too difficult to work with the electronic performance support tool and indicate that there are enough options offered by the tool. Respondents indicate that they see that the approach used within this support tool is appreciated. Probably the electronic performance support tool will need some more attention with regards to the content. Perhaps that this will have a positive influence on the personal feeling about working with the tools and the power of the FST.

Next, the user-friendliness of the electronic performance support tools was questioned. Table 63 shows the results on this part of the formative evaluation.

Table 63. User-friendliness of the Flexibility Support Tool (N=16).

	Mean	SD
How would you rate the size of the characters used on the screen? (1= Very poor choice of size; 3=neutral; 5= Very good choice of size)	4.33	0.94
How would you rate the readability of the characters used on the screen? (1= Not very readable; 3=neutral; 5= Very good readable)	4.38	1.09
How would you rate the use of icons on the screen? (1= Not very useful; 3=neutral; 5= Very Useful)	3.88	1.09
How would you rate the lay-out of the screen elements? (1= Very Confusing; 3=neutral; 5= Very Logical)	3.69	1.01
How would you rate the effectiveness of how the screen elements were marked or highlighted to get the user’s attention? (1= Not al all effective; 3=neutral; 5= Very effective)	3.63	1.02
How clear was the input procedures in these support tools? (1= Not at all clear; 3=neutral; 5= Very clear)	3.44	1.21
How easy were the input procedures for the support questions and options to use? (1= Not at all easy to use; 3=neutral; 5= Very easy to use)	3.60	1.08
How would you rate the consistency among the different parts of the support tools? (1= Very inconsistent; 3=neutral; 5= Very consistent)	3.94	0.85
How would you rate the consistency in procedures needed to use the support tools? (1= Very inconsistent; 3=neutral; 5= Very consistent)	3.80	0.75
How easy was it to understand what is meant by the text on the screens? (1= Very hard to understand; 3=neutral; 5= Very easy to understand)	4.06	0.77
How easy was it to understand what was meant in the videos? (1= Very hard to understand; 3=neutral; 5= Very easy to understand)	3.64	1.19
How easy was it to understand what was meant by the examples/screen dumps? (1= Very hard to understand; 3=neutral; 5= Very easy to understand)	4.00	1.15
How appropriate was the language used in the support tools? (1= Very inappropriate; 3=neutral; 5= Very appropriate)	4.19	0.75
How easy was it to interpret the suggestions given by the support tools? (1= Very difficult; 3=neutral; 5= Very easy)	3.75	1.00

The user-friendly analysis showed some interesting data. Most respondents are satisfied with the chosen text fonts and their readability. However, although the respondents were not negative about the use of icons and the screen layout, these show a lower average score. Respondents did not always know what was expected, as the clarity of the input procedures in the support tools shows a ‘neutral’ score, with a high standard deviation. This means that there were some respondents that did not find the input procedures as clear as they should be. The layout of the user interfaces probably needs to be revised in such a way that users do not have problems interpreting what is expected and how to deal with the suggestions that are given.

The utility of the FST for flexible (re)design within the General Roster & Menu Support Tool was questioned. Table 64 shows the results.

Table 64. Flexible (re)design within the General Roster & Menu Support Tool.

To what extent did the General Roster & Menu Support Tool help you make decisions about flexibility in (where 1=Not at all; 3=Neutral; 5=Very much):	Mean	SD
The choice of a learning model	3.69	1.14
The design of the menu	3.94	1.24
The design of the roster	4.00	1.10
Options for contribution & re-use	3.31	1.49
Options in resources	3.44	1.15
Activities at different times	3.13	1.20
Students at different locations	3.31	1.30
Students with different backgrounds	2.31	1.20

The data show that the respondents found that the General Roster & Menu Support Tool was helping them to make decisions about flexibility and thus had a positive utility. Most help was experienced with the choice of a design of a learning model, the menu, and the roster, the three most important elements within this part of the FST. Some help was experienced in the options for contribution & re-use, in resources, activities, and for students at different locations. Only limited ideas were found about students with different backgrounds. An explanation could be that the more-specific design aspects are more represented in the Roster Page Support Tool. The data show relatively high standard deviations. The way respondents value the utility of the General Roster & Menu Support Tool is thus per respondent different. This is explained through the fact that the respondents have different backgrounds and needs. The need for different types of support could differ per FST component and design question.

The Roster Page Support Tool also offered support in the flexible (re)design of the course. Table 65 shows the results.

Table 65. Support in the Roster Page Support Tool.

To what extent did the Roster Page Support Tool help you make decisions about: (1=Not at all, 3=Neutral, 5=Very much)		
	Mean	SD
Flexibility in time	3.75	1.24
Flexibility in location	3.75	1.29
Flexibility in pace	3.56	1.32
Flexibility in content	3.27	1.44
Flexibility in activities	3.44	1.36
The design of the roster-pages	3.63	1.31
The design of assignments	3.67	1.14
The design of feedback	3.19	1.28
The use of learning resources	3.63	1.20
Options for contribution & re-use	3.38	1.15

The respondents indicated that the support was valuable for the flexibility decisions that related to time, location, and pace. The support within the FST for the roster pages, the design of the assignments, and the use of learning resources was perceived as useful within the decision-making process. Some decisions in the course design were not really influenced through the Roster Page Support Tool, such as decisions concerning flexibility in content, activities, and feedback.

Here also the standard deviations are relatively high which means that respondents value the utility per topic or component differently. This is not a problem, as the tool is designed for options in its use.

The other questions that relate to the utility of the FST were asked for both the General Roster & Menu Support Tool and the Roster Page Support Tool separately. Table 66 shows the results on this part of the formative evaluation.

Table 66. Use of support.

Approximately how many times did you look at the following kinds of support: (1= Never, 2= Looked once, 3= Looked at several items, 4= Looked at most items, 5= Looked at all items)				
	General Roster & Menu Support Tool		Roster Page Support Tool	
	Mean	SD	Mean	SD
Video	2.25	1.24	2.06	1.24
Guidelines	3.19	1.33	3.13	1.36
Examples	3.31	1.30	2.87	1.50
Technical manuals	1.94	1.44	2.13	1.59
Other comments	2.50	1.37	2.19	1.38

Of the offered support, the guidelines and examples are looked at several times. Within this experiment this is a good score, as the respondents only designed a part of an artificial course. The relatively limited use of the video and manuals can be interpreted according to this fact. It is interesting to see that all types of support are less used in the Roster Page Support Tool than they were in the General Roster & Menu Support Tool.

The standard deviations are here also high, and respondents use the support each in a personal way. This is supported by the fact that sometimes support is used in a very limited way, but valued as good, as can be seen in Table 67, that shows how the offered support was valued.

Table 67. How valuable is the support:

How valuable did you find each of these kinds of support? (1=Not at all valuable, 3=Neutral, 5=Very valuable)

	General Roster & Menu Support Tool		Roster Page Support Tool	
	Mean	SD	Mean	SD
Video	3.08	1.06	3.31	1.12
Guidelines	3.86	0.88	4.08	0.77
Examples	4.38	0.58	4.00	0.89
Technical manuals	3.36	1.28	3.91	0.68
Other comments	3.21	0.98	3.17	1.02

In general the support is valued. The guidelines and the examples, that were also used most, are valued highest in both the General Roster & Menu Support Tool and in the Roster Page Support Tool. The standard deviations are less high here, and in particular uniformity about the examples is shown.

The general conclusion of this formative evaluation is that the support tools can assist the ‘instructors’ in their decision-making process when (re)designing a course and using a TeleTOP CMS environment. There are elements that need extra attention. The content of the support document was rated between neutral and good. By improving the quality the way users experience the power of the FST could increase. Another attention point is the use of icons and the screen layout. Although not valued negatively, a lower average score indicates that these aspects might be improved, especially because users do have to some degree problems interpreting what is expected. The main results form this experiment is summarized in Table 68.

Table 68. Results of the questionnaire and implications for the FST design.

Results	Implications for the design
Some respondents that did not find the input procedures as clear as they should be.	User interfaces layout needs to be revised; users do not have problems interpreting what is expected and how to deal with the suggestions that are given.
	More clarity in the announcement of the template.
	More consistent use of icons and the screen layout
Respondents didn't use the options very much in the Roster Page tool, but valued them nonetheless.	The support that is available should be better known, and should be announced. The way it is organized is fixed now, it could be made more flexible, so instructors can choose what type of support they like (See Table 55).

Because of the potential limitations in the representativeness of the sample for the usability evaluation, it was concluded that an expert walk-through and a real-instructor think-aloud walk-through experiment could gather new and valuable information for the design of the FST. The conclusions of the usability study described in this section would be used as starting point to see whether the attention points were also experienced in the walk-through evaluations. In the next sections these evaluations will be described.

5.6 Expert Walk-Through Evaluation of the Flexibility Support Tool

Based on the formative evaluation that was focused on the utility and user friendliness of the FST (Section 5.5) another formative evaluation was organized: an expert evaluation. Section 5.6.1 starts with the goals of the expert evaluation. Section 5.6.2 describes the method and procedures of the expert evaluation, and in Section 5.6.3 the subject for the expert evaluations will be described. Section 5.6.4 will give a description of the instrument and in Section 5.6.5 the results of the expert evaluation will be described.

5.6.1 Goals of the expert evaluation

The expert review may be the most-frequently used formative evaluation strategy (Reeves & Hedberg, 2003). According to Reeves and Hedberg (2003) experts are able to provide different perspectives on the important aspects of the program that is going to be evaluated, e.g., its accuracy, completeness, user-friendliness, motivational strategies, aesthetics, instructional validity, effectiveness, efficiency, and feasibility.

During the design and development process of the FST an expert evaluation was organized. The evaluation output of the evaluation of the prototype can be used for revisions in the second prototype. The goal of the expert evaluations was to find out if the program suited the requirements as defined in Section 5.3.4, and how the expert thought about how users would like the program in terms of effectiveness, functionality, and usability. The expert evaluation was planed after the first validation study that was described in the previous section. The FST version was improved in terms of content, the general structure was the same. More about the improvements and adjustments is described in Section 5.8.

5.6.2 Experimental design and procedure of the expert evaluation

According to Sweeney, Maguire, and Shackel (1993) an effective way to obtain the opinion of experts is by registering their reactions during or after a walk-through of the system, letting the experts comment on the things they observe on the screen, as well as by asking them questions. Therefore an expert walk-through evaluation for the prototype of the decision support tool for instructors was organized. The formative evaluation was held to evaluate the user-interface aspects and the functionality as a whole.

A date and time was arranged with the expert, by email. The expert was asked to (formatively) evaluate the prototype of the FST. The expected time the session would take was approximately one hour. For the evaluation the expert sat behind a computer together with the researcher. After starting and introducing the program, the expert could navigate freely through the program. The comments the expert made were written down. The comments made by the expert concerned the structure of the program, as well as the interface aspects of the program.

5.6.3 Subject for the expert evaluation

For the expert evaluation, the Shell Professor of Networked Learning in the Faculty of Behavioral Sciences was asked to serve. The expert has extensive experiences in creating Web-based courses, implementation projects, and the design of CMSs, and can therefore also place herself in the situation of both users of the tool, the instructors and the designer.

5.6.4 Instrument for the expert evaluation

For the second formative evaluation a TeleTOP environment with a FST within was set up. During the experiment the expert and the evaluator were working at the desktop computer of the expert that had a Web-browser and audio speakers. A recorder was used to capture the comments that the expert made while interacting with the tool. Table 69 shows the question framework for the formative expert evaluation.

Table 69. The question framework for the formative expert evaluation.

Elements	Evaluation in respect to:
Functionality	Is the instrument performing in accordance with its requirements, in respect to the task to be accomplished? Is the instrument performing in accordance with the functional specifications? Is the instrument performing in accordance with the users’ perception in respect to what is to be accomplished?
Usability	Is the instrument performing in accordance to instrument requirements with respect to users?
	Is the instrument performing according to the interface specifications?
	Is the instrument user friendly as perceived by users?
Effectiveness for the instructors	Does the instrument solve the problem it has been designed to solve?

5.6.5 Results of the expert evaluation

The different interfaces of the FST were evaluated, by testing and reviewing during the walkthrough. The comments that the evaluator made will be described here briefly. The following comments blend the remarks made by the expert during the evaluation:

- A comment from the expert was that it was important to introduce the first screen of the FST, the General Roster & Menu Support Tool. Define precisely what steps the instructor can expect and how this works.
- The videos are interesting, but the instructor does not know what to expect. Provide a short overview of the structure of the video and what is demonstrated/told.
- Another comment was that the user couldn’t see clearly what component the Menu items are related to. The use of colors would make this clearer.
- Also the number of examples could be expanded and the examples could show more specific examples. Some examples did not work.

The next paragraphs will give an overview of the expert’s answers to the questions regarding the functionality, usability of the program, and the effectiveness for the instructor for the (re)design of a course, based on the framework presented in Table 69.

Functionality:

- As far as the expert can predict now, the instrument will be a strong support tool for the situation where instructors do need to make decisions concerning Web-based tools, referring to its basic plan and structure. The instrument is performing in accordance with the users' perception in respect to what is to be accomplished.
- The instructors will find the FST helpful. A few of the example links need to changed, so that a more-direct example of the intended functionality is shown. The tool follows the functional guidelines that were given in Section 5.2 very well. In addition, the way that it is linked to a database in order to generate the design decisions immediate to the instructor through the actual design of the Roster and Menu is very strong.

Usability:

- In terms of ease of use, the basic design is good, although some of the steps in the questions may not be clear. The user should be helped with the overall structure of the Roster and Menu-design part of the FST. The interface of the prototype is very consistent. The users will perceive it as friendly. They will appreciate that it does not have a crowded and complicated feeling, and that all options are available on the screen in a businesslike manner.
- The instrument is performing according to the interface specifications, because of its consistency. It is pleasant but businesslike, easy to read. It also makes

good use of white space; it should be a good user interface, at least for the intended purposes, of using it in a university setting where instructors have initial experience with a CMS. The instrument is probably user friendly as perceived by users. For the introduction of the videos that reflect the template model for a course, a summary of what the user can expect within the video would be convenient.

Effectiveness for the instructor:

- The FST should be able to assist instructors in a more-considered design of their course and course environments. The instrument will be a key tool in setting up and designing activities in the course environment. Without it, there is substantially less support for instructors to help them with their flexible design choices in the course design.
- The expert thinks it is a major step forward, and eventually could form a part of every TeleTOP CMS.

The general conclusion from the expert evaluation walkthrough is that the FST could serve as an important instrument for the (re)design of courses with the use of CMS to increase 2 S-t-M flexibility. Improvements that could be made are summarized in Table 70, where also the results from the first usability evaluation (Section 5.5) are repeated.

Table 70. Results of the questionnaire and walk-through and implications for the FST design.

Evaluation	Comments	Implications for the design
Expert	There is no introduction to the FST	A new part that introduces the first screen of the FST, the General Roster & Menu Support Tool, where the steps the instructor can expect and how this works, will be added.
	Support the videos with text	Next to the videos a supportive text will be given.
	Improve the design and utility	Optimize the interface design, through better use of colors.
		Optimize and expand the examples
1st Usability evaluation	Some respondents that did not find the input procedures as clear as they should be.	User interfaces layout needs to be revised; users do not have problems interpreting what is expected and how to deal with the suggestions that are given.
		More clarity in the announcement of the template.
		More consistent use of icons and the screen layout
	Respondents didn't use the options very much in the Roster Page tool, but valued them nonetheless.	The support that is available should be better known, and should be announced. The way it is organized is fixed now, it could be made more flexible, so instructors can choose what type of support they like (See Table 55).

Table 70 shows that some of the comments overlap. The conclusions that were made about the input procedures in the first evaluation were also made by the expert, with some more-specific suggestions. In Section 5.8 the way the suggested revisions were utilized are described. These revisions were made before the final formative evaluation, a think-aloud walk-through with the Flexibility Support Tool. This evaluation will be described in the next section.

5.7 Think-Aloud Walk-Through with the Flexibility Support Tool

In Section 5.6.1 the research questions will be presented, after that the experimental design and procedure will be given (Section 5.6.2) In Section 5.6.3 the subjects that were used for the experiments will be described, and in Section 5.6.4 the design and description of the instruments will be given. This section will conclude with the results of this formative evaluation (Section 5.6.5) and the results of the questionnaire after the think-aloud walkthrough (Section 5.6.6).

5.7.1 Research questions of the think-aloud walk-through

Reeves and Hedberg (2003) mention that ‘the overall purpose of formative evaluation is to provide information to guide decisions about 'debugging' or enhancing an interactive learning system at various stages of its development" (p. 137). The think-aloud walk-through validation study build upon the previous formative studies. Based on the findings (See Section 5.5.5) the main attention points emphasized the chosen structure of the FTS and how clear it was, and how the content was experienced by actual teachers setting up a course. The main question therefore was: How do the instructors experience the FST and how do they value the content of the support?

5.7.2 Experimental design and procedure of the think-aloud walk-through

The user-based approach in a field setting that Sweeny, Maguire, and Schakel (1993) suggest for a “almost finished” prototype is also applicable for this experiment. The design of the experiment differs however from those of the usability evaluation and the expert walk-through. According to Reeves and Hedberg (2003) the approach that was used in Sections 5.4 and 5.5 was focused on usability. The other type of evaluation focuses on users of a particular product and aims to determine usability by studying users while they interact with a product. This approach is referred to as user review (p. 144). With a user review the user behavior during the use of the product can be evaluated. When conducting the experiment, the setting of the experiment should be comparable to the situation in which the user otherwise would work (Reeves & Hedberg, 2003).

Reeves and Hedberg (2003) give a detailed description of how a user-review observation can be organized. Within a Think-Aloud Method the respondents verbalize their thoughts while interacting with a product. “The purpose of this method is to show what the users are doing and why they are doing it while they are doing it, in order to avoid later rationalizations” (p. 163). Reeves and Hedberg (2003) give a protocol that was based upon the Apple HCI Group Protocol, and served for the procedure of this experiment as well. The main steps are summarized in Table 71.

Table 71. Activities in a “think-aloud” user review (from Reeves & Hedberg, 2003, p. 149).

Activity	Description
Introduction	Session and task as welcoming as possible.
General purpose of the observation is described.	Goal is to find problems in the product.
Use of equipment is explained.	Use of the own computer for the FST test, use of a sound recorder for capturing the notes.
“Think aloud” approach is explained.	Respondent are asked to think aloud during the observation, saying what comes to mind as they work.
Observer cannot assist is explained.	Respondent should work with the FST without any interference or extra help.
FST and Tasks is introduced	The (structure of the) task is given.
Possibility for questions.	Respondent knows what to do, then the observation can start.
Observation is concluded when the test is over	Questions are answered, discussions can be made.

For the third validation of the FST the steps that are given in Table 71 were followed. The task was to set up an actual course in which the respondent was involved that was to start in the following months. The first four steps were summarized in an email and sent to the respondents. These steps were repeated during the session. Within the 1.5-hour session all steps in Table 71 were handled.

5.7.3 Subjects of the think-aloud walkthrough

Important when conducting a user review is that the sample is representative of the final intended users (Reeves & Hedberg, 2003). For this reason three instructors that are of different ages and levels of TeleTOP experience were chosen for the experiment. All instructors were men and teach several courses at the Faculty of Behavioral Sciences. One instructor is a professor at around the age of 60, with a long teaching experience and extensive experience with TeleTOP. He is very experienced with the use of technology. The second instructor is aged 42. He has a PhD in the subject of return on investment, but has taught a limited number of courses. His experience with the use of technology such as a CMS in courses is still rather restricted. The third subject is 31 years of age and earned a PhD two years previously. In his still-young career he has been involved in many courses with many different kinds of students, i.e., on-campus and distance students. He is an experienced TeleTOP user.

5.7.4 Instrument of the think-aloud walk-through

For the third formative evaluation the instrument was a TeleTOP environment for every respondent with a FST embedded within. The experiments were observed as they were working at their own desktop computers that had Web-browsers and audio speakers. A recorder was used to capture the comments that the respondents made as 'thinking-aloud'. After the walk-through, the same questionnaire that was used in the first formative usability study (Section 5.5.4) was given to the respondents.

5.7.5 Results of the think-aloud walk-through

The sessions were planned after instructors agreed to participate. In an email the general purpose and procedure of the walkthrough was explained. Instructors were asked to prepare and see what course they were involved in that could be used for the experiment.

The sessions took on average a little more then one hour per respondent. The evaluation could start rather fast, as the instructors had experience in working with TeleTOP for their courses, and the interface of TeleTOP was familiar to the instructors. In general the instructors were able to use the FST, and make a set up for the particular course that was chosen for the evaluation. All the comments that the respondents made and the observations of the evaluator are gathered in Table 72. It also shows the actions that were taken after the experiments.

Table 72. Comments of the respondents and observation and implications for the FST design (the respondents are coded as S1, S2 and S3).

Observed	Implications for the design
Confused after submitting the questions, what next? What is the 'template'? (S1)	Be more clear and specific in the announcement of the template.
Wondering what to do with the videos (S1)	State that the videos are optional and the user can continue without first looking at them. A more clear description of the videos is needed.
User is uncertain if all support is gone after submitting the results of the Roster and Menu Design Tool. (S1)	Announce the types of support that will stay available within TeleTOP at the end of the Roster and Menu Design Tool.
Some supportive texts were experienced as confusing. (S2)	Adaptation of the texts.
Some examples of feedback were announced, however could not be easily found. (S2)	Examples should be moved to a more-convenient place.
It takes some time before the user understands the Roster column-heading principle (S3).	Place "Roster headings" within the Roster Design Tool
The pull-down list that represents the Roster heading suggestions confuses the user. He is not sure how to adjust the Roster headings. (S3)	Change the pull-down list in the Roster headings and enable the users to modify the headings right away.
The user wonders if he is able to review the videos after deciding Menu and Roster options (S3)	Make clear at the start that the videos can be seen along the way.
The user is confused by the supporting images within the Roster Design Tool (S3)	Remove the supportive images.

The comments and implications for the design were used to improve the FST for the second time. An overview of the revisions made is given in Section 5.8.

5.7.6 Results of the questionnaire after the think-aloud walk-through

After the walkthrough the subjects of the think-aloud walkthrough were asked to fill in the same questionnaire that was also used for the first usability study. The results that are given next were compared with those of the first formative evaluation study. In each table with results the last column will repeat the means of that first study (Section 5.5). Table 73 summarizes the general reactions.

Table 73. General reactions to the Flexibility Support Tool(N=3).

	S1	S2	S3	Mean	1st ev. Mean (n=16)
What is your general impression of these support tools within TeleTOP? (1= Very negative; 3= neutral; 5= Very positive)	4	4	4	4.0	4.13
How difficult or easy was it to work with these support tools? (1= Very difficult; 3= neutral; 5= Very easy)	4	4	4	4.0	3.88
What was your personal feeling about working with these support tools? (1= Very Frustrating; 3= neutral; 5= Very Satisfying)	3	4	3	3.3	3.38
How would you rate the power of these support tools to for making decisions about the design and use of TeleTOP? (1= Not at all powerful; 3= neutral; 5= Very powerful)	3	4	4	3.7	3.53
To what extent do you think these support tools can help the instructor making a stimulating course? (1= Very poor influence; 3= neutral; 5= Good influence)	2	4	5	3.7	3.56
To what extent do you think there were enough options offered by these support tools? (1= Definitely not enough options; 3= neutral; 5= Very good range of options)	5	3	4	4.0	3.88
How would you rate the content within these support tools? (1= Very poor content; 3= neutral; 5= Very good content)	5	4	4	4.3	3.50
How would you rate the approach used within these support tools? (1= Very poor approach; 3= neutral; 5= Very good approach)	4	3	4	3.7	3.94

The overall impression of the respondents about the electronic performance support tool is positive. The instructors do not find it difficult to work with the tool and think there are enough options offered by the tool. The results can be compared to the results of the first evaluation study and show similar data, but where the content is appreciated higher by the three experienced instructors compared to the first evaluation. The results on the user-friendliness of the electronic performance support tool are given in Table 74.

Table 74. User-friendliness of the Flexibility Support Tool (N=3).

	S1	S2	S3	Mean	1st ev. Mean (n=16)
How would you rate the size of the characters used on the screen? (1= Very poor choice of size; 3=neutral; 5= Very good choice of size)	5	4	3	4.0	4.33
How would you rate the readability of the characters used on the screen? (1= Not very readable; 3=neutral; 5= Very good readable)	4	4	4	4.0	4.38
How would you rate the use of icons on the screen? (1= Not very useful; 3=neutral; 5= Very Useful)	4	3	2	3.0	3.88
How would you rate the lay-out of the screen elements? (1= Very Confusing; 3=neutral; 5= Very Logical)	4	3	3	3.3	3.69
How would you rate the effectiveness of how the screen elements were marked or highlighted to get the user's attention? (1= Not al all effective; 3=neutral; 5= Very effective)	4	4	4	4.0	3.63
How clear was the input procedures in these support tools? (1= Not at all clear; 3=neutral; 5= Very clear)	3	2	5	3.3	3.44
How easy were the input procedures for the support questions and options to use? (1= Not at all easy to use; 3=neutral; 5= Very easy to use)	4	3	5	4.0	3.60
How would you rate the consistency among the different parts of the support tools? (1= Very inconsistent; 3=neutral; 5= Very consistent	3	3	2	2.7	3.94
How would you rate the consistency in procedures needed to use the support tools? (1= Very inconsistent; 3=neutral; 5= Very consistent)	3	3	2	2.7	3.80
How easy was it to understand what is meant by the text on the screens? (1= Very hard to understand; 3=neutral; 5= Very easy to understand)	2	2	4	2.7	4.06
How easy was it to understand what was meant in the videos? (1= Very hard to understand; 3=neutral; 5= Very easy to understand)	3	2	5	3.3	3.64
How easy was it to understand what was meant by the examples/screen dumps? (1= Very hard to understand; 3=neutral; 5= Very easy to understand)	3	3	5	3.7	4.00
How appropriate was the language used in the support tools? (1= Very inappropriate; 3=neutral; 5= Very appropriate)	3	4	4	3.7	4.19
How easy was it to interpret the suggestions given by the support tools? (1= Very difficult; 3=neutral; 5= Very easy)	5	4	3	4.0	3.75

The instructors are satisfied about the user-friendliness of the FST. The instructors on average knew what to do and how to interpret the tool and suggestions. Some interface aspects that were also mentioned in the first formative evaluation were also mentioned here, but there is an increase in clarity on input procedures and interpretation. The consistency among the different parts and in procedures could be improved and some texts were not always clear. These data support the comments that the instructors made when doing the think-aloud walk-through, although some differences were found. The consistency aspects within the FST were seem to be rated lower by the walk-through instructors compared with the first validation. The suggestions made in Table 72 need to be followed up in order to improve these aspects.

Table 75 shows how the flexible (re)design within the General Roster & Menu Support Tool was experienced.

Table 75. Flexible (re)design within the General Roster & Menu Support Tool.

To what extent did the General Roster & Menu Support Tool help you make decisions about flexibility in (Where 1=Not at all; 3=Neutral; 5=Very much.):					
	S1	S2	S3	Mean	1st ev. Mean (n=16)
The choice of a learning model	1	4	2	2.3	3.69
The design of the menu	4	3	4	3.7	3.94
The design of the roster	4	2	4	3.3	4.00
Options for contribution & re-use	1	2	3	2.0	3.31
Options in resources	2	3	4	3.0	3.44
Activities at different times	3	3	4	3.3	3.13
Students at different locations	2	3	3	2.7	3.31
Students with different backgrounds	1	3	3	2.3	2.31

The data show that the instructors think that the General Roster & Menu Support Tool was helping them to make decisions about flexibility, although S1 was less convinced and gave a "1" on three occasions. It is interesting to see that the respondents have different opinions about the support that was experienced in choosing a learning model. One instructor did not value it at all, another did. Most help was experienced with the design of the menu and the roster, which was also seen in the first validation study. Some help was experienced in the options relating to resources, activities, and students at different locations. Only limited ideas were found about students with different backgrounds and options for contribution & re-use. The data are comparable with that of the first evaluation study.

The Roster Page Support Tool also offered support in the flexible (re)design of the course. Table 76 shows the results.

Table 76. Support in the Roster Page Support Tool.

To what extent did the Roster Page Support Tool help you make decisions about: (1=Not at all, 3=Neutral, 5=Very much)	S1	S2	S3	Mean	1st ev. Mean (n=16)
Flexibility in time	3	3	4	3.3	3.75
Flexibility in location	3	3	1	2.3	3.75
Flexibility in pace	3	3	4	3.3	3.56
Flexibility in content	4	3	4	3.7	3.27
Flexibility in activities	3	3	5	3.7	3.44
The design of the roster-pages	4	4	4	4.0	3.63
The design of assignments	4	4	2	3.3	3.67
The design of feedback	3	2	3	2.7	3.19
The use of learning resources	3	4	3	3.3	3.63
Options for contribution & re-use	3	2	2	2.3	3.38

The respondents indicated that the support was valuable for the flexibility decisions that related to content and activities. In the usability study it was more focused on time, location, and pace. The support within the FST for the roster pages seems useful within the decision-making process. The options for contribution & re-use are not really used in the design. On average the extent to what the Roster Page Support Tool did help the respondents make decisions about the design seems more limited than was measured within the first evaluation.

The other questions that relate to the utility of the FST were asked for both the General Roster & Menu Support Tool and the Roster Page Support Tool separately. Table 77 shows the results.

Table 77. Use of support.

Approximately how many times did you look at the following kinds of support: (1= Never, 2= Looked once, 3= Looked at several items, 4= Looked at most items, 5= Looked at all items)	General Roster & Menu Support Tool		Roster Page Support Tool	
	Mean (n=3)	1st ev. Mean (n=16)	Mean (n=3)	1st ev. Mean N=16)
Video	2.0	2.25	3.3	2.06
Guidelines	3.0	3.19	3.7	3.13
Examples	3.0	3.31	4.3	2.87
Technical manuals	1.0	1.94	3.0 (N=1)	2.13
Other comments	2.0 (N=2)	2.50	4.0 (N=1)	2.19

The way the instructors use the FST can be compared with what was found in the first validation study (Section 5.5). Here the guidelines and examples were looked at several items and score highest. An important difference is that the types of support in the Roster Page Support Tool are more used that those in the General Roster & Menu Support Tool, also compared to the use in the first evaluation. Table 78 shows how the offered support was valued.

Table 78. How valuable is the support?

How valuable did you find each of these kinds of support? (1=Not at all valuable, 3=Neutral, 5=Very valuable)

	General Roster & Menu Support Tool		Roster Page Support Tool	
	Mean (n=3)	1st ev. Mean (n=16)	Mean (n=3)	1st ev. Mean (n=16)
Video	2.3	3.08	4.5	3.31
Guidelines	3.0	3.86	3.5	4.08
Examples	3.0	4.38	4.0	4.00
Technical manuals	1.0	3.36	1.0 (N=1)	3.91
Other comments	3.0 (N=1)	3.21	4.0 (N=1)	3.17

The support in general is positively valued. Here the guidelines and the examples that were also used the most are valued highest in both the General Roster & Menu Support Tool and in the Roster Page Support Tool. On average the way the subject valued the support shows limited differences, which is hard to interpret because sometimes not even all walkthrough instructors answered all questions. The first evaluation data showed higher means for the General Roster & Menu Support Tool. Instructors seemed a little more critical than the respondents (students) in the first usability study.

The last questions concerned the intended design of the course. The instructors were asked that if they were to complete the design of this course, to what extent would the following kinds of choices (Table 79) be available to students in the course.

Table 79. Choices for students.

(1=no flexibility, 3=some, 5= Extensive flexibility)	S1	S2	S3	Mean
Options for contribution & re-use	4	4	5	4.3
Times (for starting and finishing a course)	3	1	2	2.0
Times for submitting assignments and interacting within the course	2	1	3	2.0
Times for assessment in the course	2	2	3	2.3
Topics of the course	4	3	2	3.0
Orientation of the course (theoretical, practical)	3	1	3	2.3
Assessment standards and completion requirements	1	1	2	1.3

Table 79 continues…

Table 79 continued

Ways in which the course is experienced (face-to-face; group, individual, combinations)	3	3	4	3.3
Language to be used during the course	1	3	3	2.3
Learning resources: (Modality, origin (instructor, learners, library, WWW), etc)	5	3	5	4.3
Assignments required for the course	2	1	2	1.7
Flexibility in location of learning	5	5	4	4.7
Flexibility in times of learning events	5	3	2	3.3
Flexibility in pace of learning	3	3	3	3.0

Instructors indicate that the options for contribution & re-use, the way the course deals with learning resources, and flexibility in location of learning are the most likely to be used. Other types of flexibility related to planning where some choices are given are options within the topics of the course and flexibility in times of learning events. There are also options offered that relate to the interpersonal type of flexibility, i.e., the ways in which the course is experienced. However, there are also a number of flexibility options that are not expected to be very flexible. Especially within activities such as assignments required for the course, assessment standards and completion requirements, and times for submitting assignments not much flexibility is likely to be offered.

Thus, the questionnaire that was used for the first and the third usability evaluations showed that after some revisions the FST would be ready to use in practice. The data also indicate that different types of users see and experience the FST in similar ways and also confirm the validity of the questionnaire as a tool to measure the user friendliness and FST utility. In the next section the main general conclusions that reflect on this chapter and the evaluations will be made. Some suggestions for the revision of the FST will be described.

5.8 Revisions and Conclusions

In this chapter the rationale, and the design and development of the Flexibility Support Tool was described. Three evaluations were made. The general conclusion that can be derived from the formative evaluations is that the FST integrated in TeleTOP could serve as a support tool that could increase 2S-t-M flexibility. The general impression is that the tool is useful and contains valuable support. However, some revisions would be necessary to improve the instrument. In the next paragraphs the main revisions will be summarized and illustrated with a before-and-after illustration of the FST.

Figure 52 shows how the prototype looked when it was used for the first evaluation.

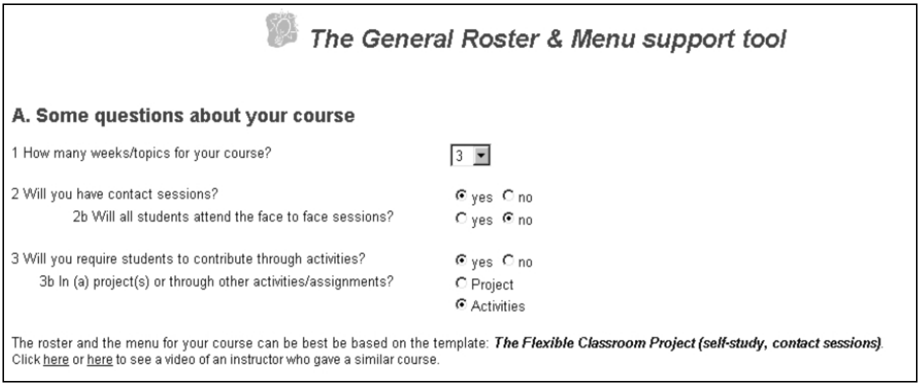


Figure 52. First interface of the FST.

The comments that were made in the expert evaluation as well as the conclusions form the first evaluation resulted in a introduction screen for the FST as is demonstrated in Figure 53.

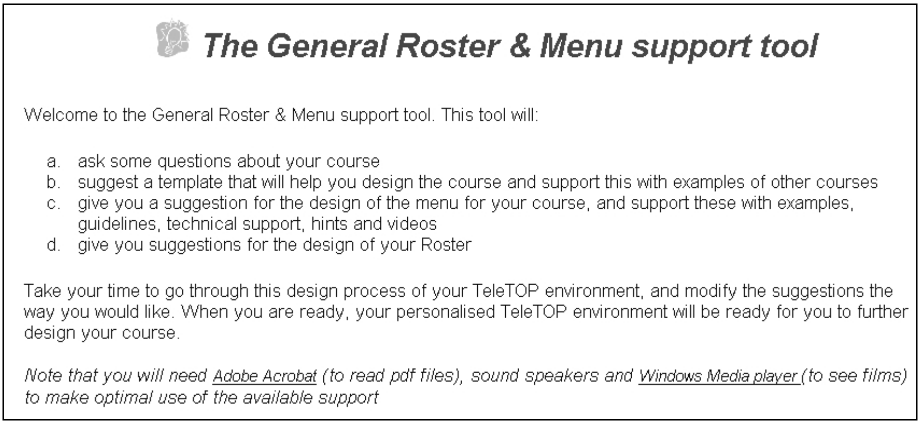


Figure 53. An introduction to the FST was added.

Within the first prototype the videos of the instructor that did a similar course and fitted the suggested template was only announced, as can be seen in Figure 53. The revision that was made based on several comments is demonstrated in Figure 54.

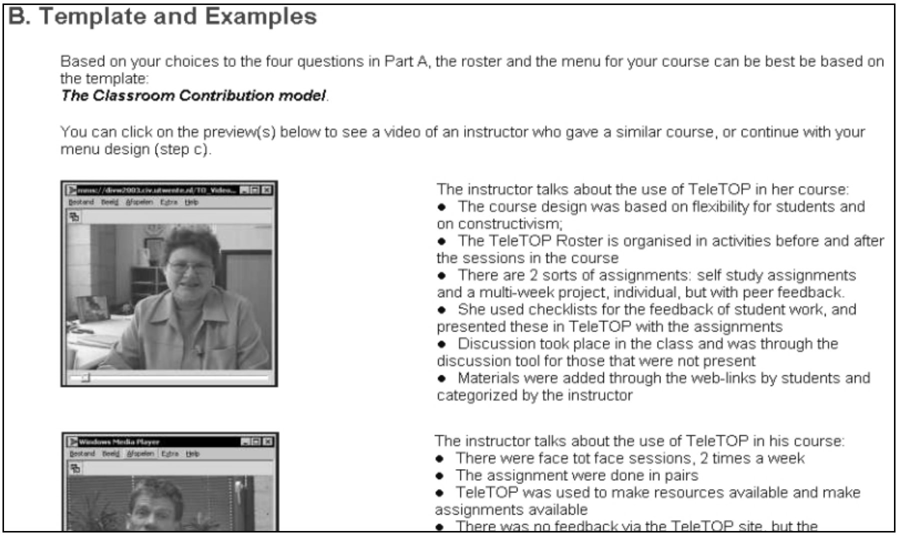


Figure 54. Example of how videos are presented in the revised version.

The videos are presented to the instructors in a more-clear way. The summary of what is being told is given and it is made clear that the videos are optional and can be reviewed at a later stage as well.

A number of comments dealt with the use of icons and the clarity of the tools. Especially for the Menu part this was important. Figure 55 shows the interface as it looked within the first prototype.

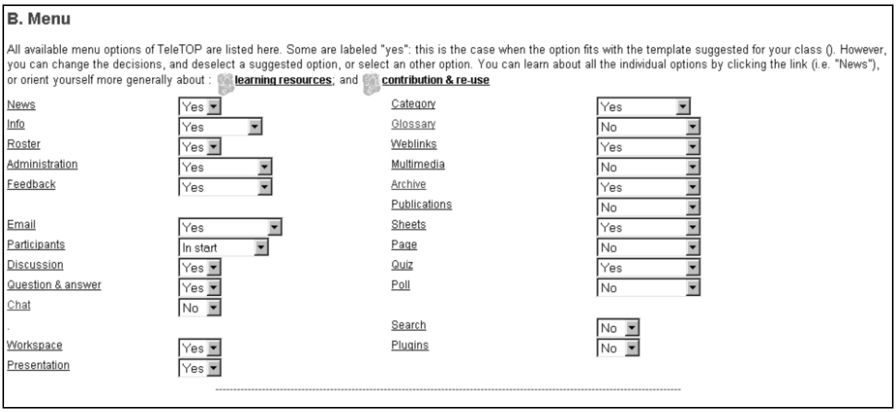


Figure 55. First prototype design of the FST Menu Tool.

The new layout is demonstrated in Figure 56. The use of colors and images has changed, the groups of menu items become clearer now.

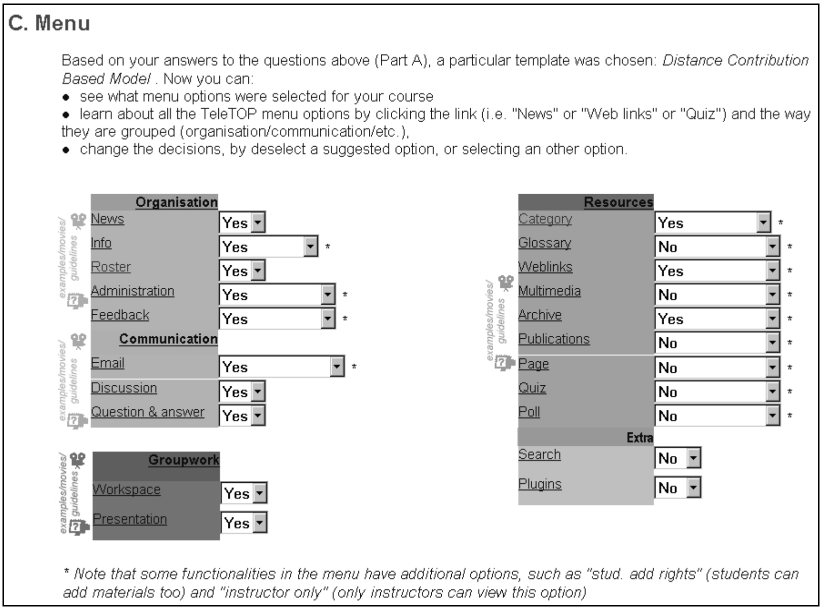


Figure 56. Improved design for the menu.

Within the Menu tool the colors that are also represented within the TeleTOP menu of a course environment were used here. The categories, that each have a different color, were introduced, whereas in the first design these were not available.

The Roster Tool also needed some revisions. Several comments were used to improve the Roster Tool, Figure 57 and Figure 58 show the old and the new versions.

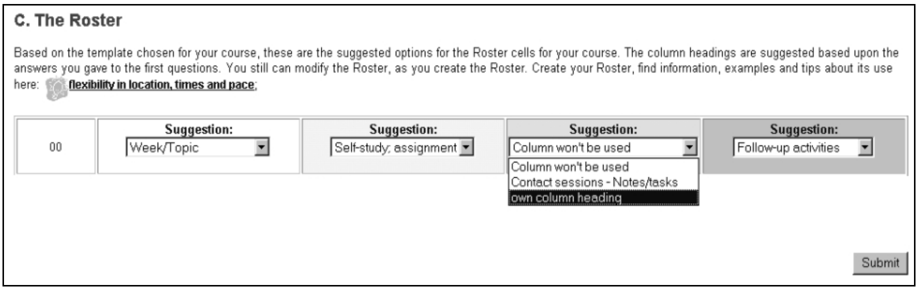


Figure 57. Earlier design of the Roster Tool.

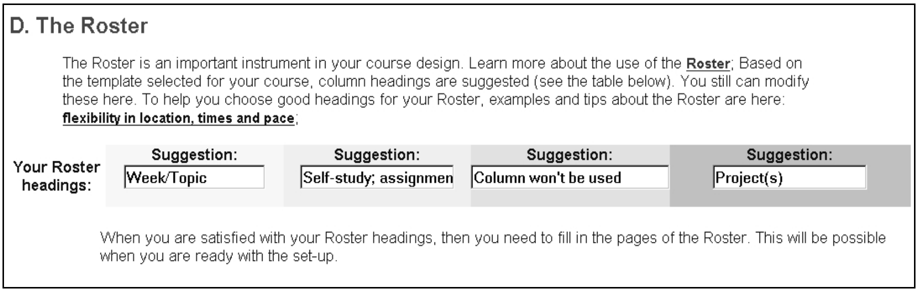


Figure 58. Improved design of the Roster Tool.

The main differences are that the 'supporting' images that only confused the users are left out. The option to define one's own column headings or to improve the ones suggested by the FST is much easier in the new design, and there is a possibility to edit right away. There is also more-descriptive support available.

Another major comment that was used to improve the design concerned the overview of the support available. Also, after finishing the set up instructors should be informed about what to expect next. These comments were used to improve the design. Figure 59 shows support and how the next steps were announced in the redesigned version of the FST.

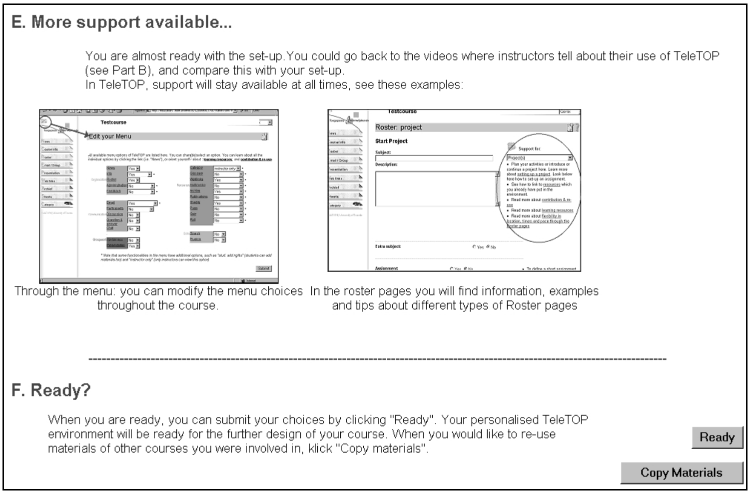


Figure 59. Announcement that more support is available and next steps.

Within the Roster Page Support Tool some minor revisions were made. One revision dealt with the option for users to choose the kind of support they would like to have. In the first design only the suggested design was available in a particular Roster page. In the improved design the user could choose. Figure 60 shows the differences.

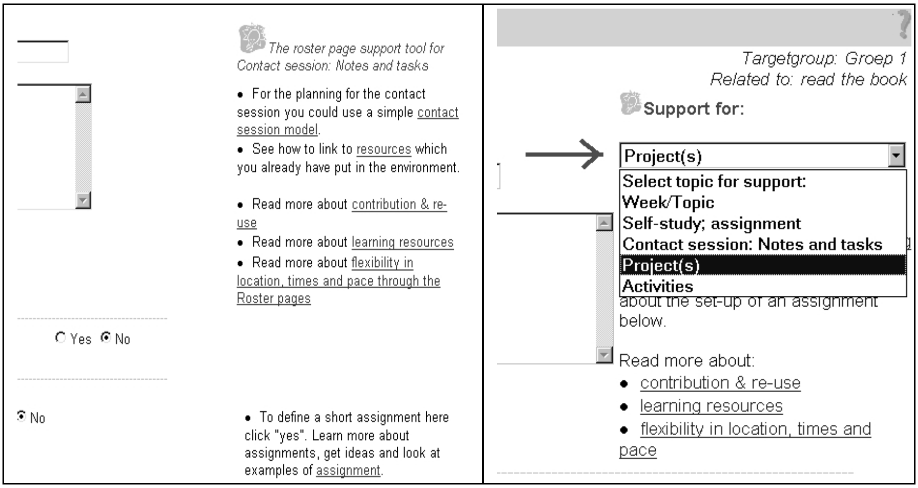


Figure 60. In the left is the old design, the right shows the new design of the Roster Page Support Tool.

The most important revisions of the FST have been demonstrated in this last section of the chapter. In the next chapter an experiment with the improved FST will be described.

6 THE FST EXPERIMENT

In this chapter the experiment with the Flexibility Support Tool (FST) will be described. In Chapter 5 the methodology for development research (Reeves, 2000) was used to visualize the FST research approach. The step that is taken in this chapter is that of the "Evaluation and testing of solutions in practice" (box 3 in Figure 61).

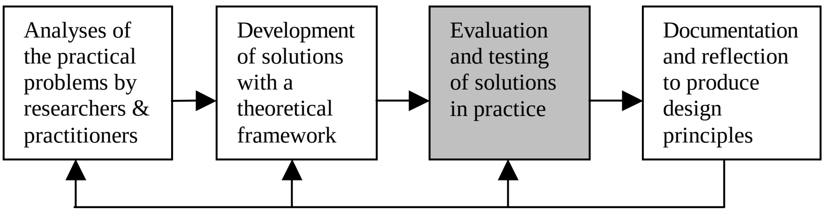


Figure 61. Development research approach (Reeves, 2000, p. 25).

In Section 6.1 the context of the experiment and the research questions will be presented. Then the experimental design will be given (Section 6.2) and in Section 6.3 the design and description of the instruments will be explained. In Section 6.4 the subjects that were involved in the experiment will be described, as will be the procedure in Section 6.5. This section will conclude with the results of the experiment (Section 6.6), the results of the instructor interviews (Section 6.7), and a summary (Section 6.8).

6.1 Context of the Experiment and Research Questions

The general research questions that stood central for this dissertation were given in Section 1.2. The first two research questions focused upon a flexibility framework wich was identified and recognized in practice. The third research question focused on how internal performance support (through the CMS) could support instructors in offering more flexibility through better CMS use. This third question is the central question for this chapter and experiment.

The FST experiment was organized to deal with a number of sub questions. In Chapter 3 it became clear that the use of CMS relates to 2S-t-M flexibility in higher education. However, before the FST embedded in a CMS can have this sort of impact, instructors must use it. Thus, the likelihood of this use is a particular focus of the FST experiment. According to the 4-E Model, the use of the FST and of its associated CMS relates to the ease of use, the environment, the educational pay-off, and the personal engagement (Collis, Peters, & Pals, 2000), as discussed in Section 2.4. The FST is an instrument that will make it more easy to use a particular CMS. The first question for the FST experiment therefore is:

1. Will instructors use the FST embedded in the TeleTOP CMS and when they do use the FST, will they also show more use of the CMS in terms of types of options available?

The use of a CMS relates to the flexibility that instructors could offer within their courses. The pedagogical models that relate to flexibility can be seen as an educational pay-off. The second question for the FST experiment therefore is:

2. After using the FST, to what degree do instructors experience changes in their strategy in offering flexibility in a particular course that they had offered the year before and how does this compare to instructors not using the FST?

The two questions relate to each other. In Section 3.4 the 2S-t-M flexibility dimensions were set out against CMS characteristics. The analysis showed that CMS use, especially the use of certain tools, relate to the 2S-t-M flexibility types. The intervention within this experiment could show the degree to which instructors change their strategy towards offering flexibility in their courses following use of the FST. However, to change instructional practices takes time. Fullan (1991) and De Boer and Collis (1999) among others have noted that the time between initiation and institutitionalisation often takes more than five years. Because of the limited period in time for the experiment (one year) the changes that instructors experience in their strategies for offering flexibility in their courses could be marginal. A precondition for change relating to offering more flexibility is that instructors are aware of and can use different approaches and options in their teaching and in their use of the CMS. The way instructors would choose and use CMS tools in a more-thoughtful manner within their courses could however show some more changes when the FST is used for support. The results of this experiment could give more insight into the flexibility preconditions and indicators that emerge when the FST is used.

The experiment was organized at the University of Twente. As described in Chapter 4 the university is a traditional university that could stand as a model for many higher educational institutions within the western world. The TeleTOP CMS has been implemented and is in many faculties being used for a number of years (see Chapter 4).

6.2 Experimental Design and Procedure

To test the effect of the FST on the use of TeleTOP and how instructors experience flexibility in courses a Pretest- Posttest Control Group Design (Campbell & Stanley, 1963, pp. 13) was chosen. Within this design the experimental group that uses the FST with the TeleTOP CMS can be compared with a control group that does not use the FST. Also, within this design two versions of the same course can be compared for both groups. Figure 62 gives an overview of activities, where “R” is randomization, “O” is measurement through the 2S-T-M Framework instrument and “X” is the experimental group, using the FST.

R	O^1	X	O^2
R	O^1		O^2

Figure 62. Experimental design.

This design reduces important internal and external validation threats. The numbers in the measurement through the 2S-T-M instrument (O) stand for the time of measurement. The object being measured was a course taught by the instructor in the 2001-2002 using TeleTOP and the same course re-taught by the same instructor in 2002-2003 also using TeleTOP. The subjects were randomly assigned to the experimental and the control group.

For the experiment real courses and instructors were selected from four departments at the University of Twente: two behavioral studies, a business administration department and a physics department. The courses should be given in 2001/2002 and 2002/2003. The courses that were selected started in December – March, and all ended before the summer of 2003. The courses were senior as well as foundation courses for on-campus and in some cases distance and life-long learning students.

For those instructors in the experimental group, the FST was embedded within the setup tools in TeleTOP while for the control group the previously used DST (see Chapter 4) was embedded within the setup tools. Thus a TeleTOP environment with the FST was prepared for each course in the experimental group and a TeleTOP environment with the earlier DST was prepared for each course in the control group. As is usual practice at the university, all instructors had to set up their own courses and their TeleTOP environments. The course-design process with the FST that was embedded in TeleTOP was thus available to be used for all the courses in the experimental group. The instructors worked on their courses at their own computers at the department or at their own desktop computers or at home, in all cases with computers with a Web-browser and audio speakers and media-player tools. The experiment was carried out in a natural context integrated within the course-setup process that instructors had to go through as part of their teaching duties.

For the two groups, the experimental group that used the FST and the control group that used the DST in TeleTOP 4.0, a 2S-t-M questionnaire (see Section 6.3) was used to measure the 2S-t-M flexibility for the 2001/2002 courses (where no FST was used in either group) and the 2002/2003 courses (were the FST was used in the experimental group). For all courses a log analysis was used to measure the use of TeleTOP. An overview of the research procedure that includes how the two ways measurement was organized is given in Figure 63.

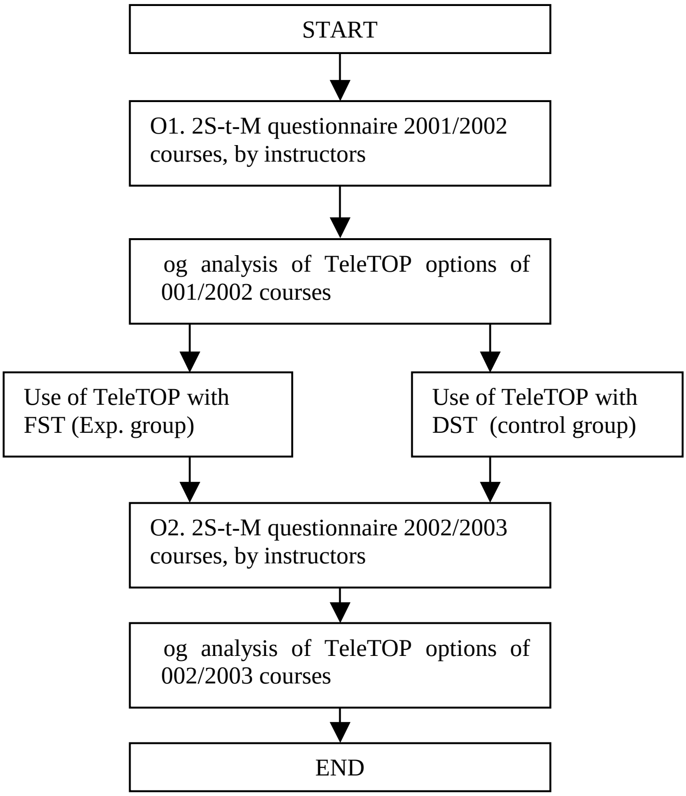


Figure 63. Research procedure.

After the courses were selected based on the conditions mentioned, the instructors of the courses got the first 2S-t-M questionnaire in August to November 2002 in which they were questioned about the flexibility in their 2001/2002 course (see Figure 63).

For the FST experiment the group of courses was randomly divided into the two groups. The experimental group got the FST in their TeleTOP course environment. Within TeleTOP the availability of a course environment setup was announced by a message from the TeleTOP administrator. He notified the instructor that a course environment was ready to start using. From that point on the instructor could start with the design of the CMS environment for his course. The setup procedure for the TeleTOP 4.0 and the DST is described in Section 4.4.1. The FST version of TeleTOP is described in Section 5.8. The instructors in the experimental group started with the introduction page of the FST that explained the steps of the FST and the support that they could expect. These instructions for the experiment were sufficient for the instructors to get started.

After the second cycle of the courses were given the instructors received the second 2S-t-M questionnaire (the post-test, see Figure 62 and Figure 63) with the questions described in Section 6.3. The questionnaires were sent out between March and July 2003, depending on the date the course was finished. The log data in TeleTOP for the 2001/2002 and 2002/2003 courses was gathered by running a script that was especially designed for this purpose. The procedure and data are similar to the data that were gathered and discussed in Section 4.5, an example of the data gathered is shown in Table 82.

All instructors that cooperated with the 2S-t-M questionnaire were told that the data that were gathered in this research were used to research the use of TeleTOP and to improve instructor support. They were told that information and data would be used confidentially. Instructors were invited to contact the research team with questions.

The experimental design and procedure can be demonstrated through an example. A course at the Department of Educational Science and Technology[7] has been given in November 2001 (2001/2002 academic year) and was given again in November 2002 (2002/2003 academic year) by the same instructor. The instructor was asked to evaluate his 2001/2002 course with the 2S-T-M flexibility questionnaire. The use of the TeleTOP environment for the 2001/2002 course was evaluated through the log analysis. When the new course for the 2002/2003 academic year was ready to prepare for the experimental group, the instructor used the TeleTOP FST to set-up his course. For the control group the previous DST was used to set-up the course. Afterwards 2S-T-M flexibility questionnaire evaluation for the course by the instructor was used. Also the TeleTOP environment for the 2002/2003 course was evaluated with the use of the log analysis.

After analyzing the data (In Section 6.5 and 6.6) a number of interviews with instructors were organized in order to get more insight in the flexibility ideas and experiences in relation to the TeleTOP CMS and the FST support (see Section 6.7). In the next section these instruments will be discussed.

[7] At the beginning of the experiment the university has be reorganized. The faculty has become an department, and will be called as such from now on.

6.3 Instruments

For the measurement of the 2S-T-M flexibility score the same 2S-T-M evaluation instrument was used as had been used in the preliminary experiments described in Chapter 5. The form of the instrument was a questionnaire that instructors were able to fill in themselves. The questionnaire-instrument type was chosen because of the speed of answering, the limited time needed for the respondents, and the standardized way data were collected (Harvey, 1998), although the disadvantages such as a possible low response rate and the gap between the experiment and the return of the questions were acknowledged. To incorporate these threats and the threat of superficial answers, the questionnaire was made in a way that did not take too much time in terms of format and in terms of only including a limited number of questions (Harvey, 1998). The questionnaire had a limited number of closed-response questions but also did include room for open-ended comments. A Likert-type scale was used with a five-point scale ranging from No flexibility (1) to Some (3) to Extensive flexibility (5).

The questionnaire contained questions about the nine FST flexibility dimensions. Table 80 gives the questions within the questionnaire.

Table 80. The 2S-t-M questions in the questionnaire for the experiment.

To what extent do you make the following kinds of choices available to students in your own courses?	
	1 2 3 4 5
Planning 2S-t-M	
Times (for starting and finishing a course)	0 0 0 0 0
Times for submitting assignments and interacting within the course	0 0 0 0 0
Topics of the course	0 0 0 0 0
Orientation of the course (theoretical, practical)	0 0 0 0 0
Assessment standards and completion requirements	0 0 0 0 0
Assignments required for the course	0 0 0 0 0
Inter personal 2S-t-M	
Ways in which the course is experienced (face-to-face; group, individual, combinations)	0 0 0 0 0
Language to be used during the course	0 0 0 0 0
Modality and origin of learning resources (instructor, learners, library, WWW, etc)	0 0 0 0 0

Where 1= no flexibility, 3=some and 5=extensive flexibility

In the post-test (see Figure 62) the same questionnaire was used, with a number of additional questions. Questions about the support and about how instructors thought of the changes in higher education in the near future and the role of TeleTOP were added. Table 81 indicates the questions about how the instructors experienced the support and questions about the future and the role of TeleTOP.

Table 81. The additional questions in the post-test questionnaire.

Can you tell how satisfied you are with TeleTOP?	
	1 2 3 4 5
Are you in general satisfied about TeleTOP?	0 0 0 0 0
Are you in general satisfied about the human support for TeleTOP?	0 0 0 0 0
Are you in general satisfied about the support within TeleTOP?	0 0 0 0 0
Are you in satisfied about the menu support?	0 0 0 0 0
Are you in satisfied about the setup-up support?	0 0 0 0 0
Are you in satisfied about the roster-page support? *	0 0 0 0 0
Are you in satisfied about the examples that were used? *	0 0 0 0 0
Are you in satisfied about the guidelines that were provided? *	0 0 0 0 0
Are you satisfied about the videos? *	0 0 0 0 0
Where 1= very dissatisfied, 3=neutral and 5= very satisfied	
Could you respond to the following propositions?	
	1 2 3 4 5
My courses have become more flexible because of TeleTOP use.	0 0 0 0 0
TeleTOP gives me possibilities to offer flexibility to students in my course.	0 0 0 0 0
In the future the groups of students in my courses will become more heterogeneous.	0 0 0 0 0
In the future education will become student centered, with more individual options for students	0 0 0 0 0
TeleTOP plays an important role in making courses more flexible	0 0 0 0 0
Where 1= disagree, 3=neutral and 5= agree	

*The questions with * were only for the experimental group.*

Another way of gathering the relevant data was through the examination of the course environments. The procedure that was described in Section 4.5.1 was used to gather the data that shows what menu items were chosen and how they were used. For each TeleTOP environment in both the experimental and control groups, the menu choices and the number of documents were gathered from a Log-script. Also, the way instructors had used the FST set up in their course environments was captured, both for the experimental as for the control group. Table 82 shows a part of the extensive data that were gathered.

Table 82. Example of the log data.

Group	Departm.	Database	Phase	Stud.	Dist. stud.	News	#	Course info	#	Rooster	#
1	to	021xxx.nsf	D3	3	1	yes	1	yes	5	yes	37
1	to	01xx01.nsf	D1	24	12	yes	6	yes	5	yes	37
1	to	021x01.nsf	P	35	9	yes	7	yes	6	yes	34
1	to	021xx1.nsf	D3	0	1	yes	1	yes	5	yes	25
1	to	02xx81.nsf	Other	6	0	yes	6	yes	6	yes	25
1	to	021xx1.nsf	D3	11	1	yes	2	yes	1	yes	25

Where # stands for the number of documents

Through the use of interviews more-detailed information could be gathered. The results that were found in the experiment were used to structure the interviews. The design of the questions for the interview is given in Section 6.7.

6.4 Subjects

The subjects in this experiment were instructors that teach courses at the University of Twente. The instructors that were selected for the research work in four different departments. Two departments are behavioral sciences, one department is within business administration, and one is in applied physics. The subjects all have experience in teaching within higher education, and also with the use of TeleTOP.

The total groups of instructors were divided in the experimental and control group. Table 83 shows the number of instructors in each group per department that were selected for the experiment. The instructors that cooperated in the experiment were randomly assigned to the two groups.

Table 83. Number of instructors in control and experimental groups.

Group	Frequency	Percent
Control	26	45%
Experimental	32	55%
Total	58	100.0%

Table 84 shows the characteristics of the instructors in the experiment, the average age, sex, professional degree, teaching experience, TeleTOP experience in number of environments, and when the instructor started using TeleTOP.

Table 84. Instructors selected for the experiment.

Group	Control			Experimental					
	Mean	N	SD	Mean	N	SD	t	df	Sig. (2-tailed)
Age	44.23	26	7.67	42.44	29	9.17	0.75	53	0.46
Sex (1=male, 2=female	1.09	26	0.29	1.16	29	0.37	-0.69	53	0.49
PhD (0=no, 1=yes)	0.82	26	0.39	0.69	29	0.47	1.07	53	0.29
Teaching experience	13.05	26	6.18	13.09	29	8.05	-0.02	53	0.98
TeleTOP experience (in number of environments)	13.05	26	6.77	11.44	29	6.93	0.85	53	0.40
Started using TeleTOP	1999.68	26	1.09	2000.06	29	1.16	-1.21	53	0.23

The t-tests in Table 84 show that the instructors in the experimental and control group were equally assigned, there are no significant differences.

The instructors were sent a letter to indicate that research would be done via examination of their course environments and requesting them to fill in questionnaires. Instructors could indicate if they did not wish their courses to be included. Table 85 shows the percentage of returned 2S-t-M questionnaires for each the experimental and the control group in the pre and post-test.

Table 85. Returned 2S-t-M questionnaires in the pre and post-test.

		Control	Experi-	Total
1st 2S-t-M	Not returned	6	3	9
	Returned	20	26	46
Total		26	29	55
2nd 2S-t-M	Not returned	12	4	16
	Returned	14	25	39
Total		26	29	55

The subjects for the follow-up interviews (Section 6.7) were selected based on key indicators that had an influence on how instructors valued TeleTOP and the FST and their attitudes towards flexibility in teaching and learning that emerged in the data analysis reported in Section 6.6.

6.5 Results

In this section the results of the experiment will be described. In Section 6.5.1 the use of the TeleTOP CMS will be discussed, in response to the first research question for the experiment. In Section 6.5.2 the second research question for the experiment will be answered by noting ways that instructors experience changes in flexibility. Section 6.5.3 describes how instructors value the FST and TeleTOP support and in Section 6.5.4 the way instructors see changes in higher education in the near future and the role of TeleTOP in those changes will be discussed. In Section 6.5.5 the results will be summarized and reflected against the third research question as given in Section 1.2.

6.5.1 Use of TeleTOP and the FST

The first research question for the experiment (as given in Section 6.1) focused on the use of the TeleTOP CMS. In Section 6.5.1.1 the choices of instructors in the set-up of the FST will be described. In Section 6.5.1.2 the use of TeleTOP for both groups will be compared.

6.5.1.1 Instructors' choices in the set-up

If instructors will actually make courses more flexible, a precondition is that the CMS that would support this needs to be used. The FST supports the use of the CMS, but also first needs to be used itself. The first set of research questions for the experiment (see Section 6.1) were thus: Will instructors use the FST embedded in the TeleTOP CMS, and when they do use the FST, will they also show more use of the CMS in terms of types of options available? Next the results will be discussed.

The FST was offered within the experimental group to 29 courses, but 3 dropped out because of not returning the first 2S-t-M questionnaire (See Table 85). For 25 of the 26 courses in the experimental group the FST was used. For these 25, instructors went through the questions and suggestions the FST offered. These were described in Section 5.4. In Table 86 the answers to the questions relating to instructional setting that were asked at the start of the FST use are given.

Table 86. Answers to the first three FST questions

	Contact sessions?		Distance students?		Activity-based course?	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
No	2	8.0	17	70.8	5	20.0
Yes	23	92.0	7	29.2	20	80.0
Total	25	100.0	24	100.0	25	100.0

Most instructors (92%) still have contact sessions, and a number of courses deal with distance students (29%). A majority of instructors indicate that their courses are activity based. These activities in the courses were in 33% of the courses through projects, and in 67% of the courses through activities and/or assignments. The answers to these questions led to the suggestions for the CMS design made by the FST. These are given in Table 87.

Table 87. Suggested FST templates and frequencies.

Template model	Frequency	Percent
Classroom model	4	16.0
The Classroom Contribution model	13	52.0
The Flexible Classroom model	0	0.0
The Flexible Classroom Contribution model	6	24.0
Self-study model	1	4.0
Distance Contribution Based model	1	4.0
Total	25	100.0

For most instructors the classroom model was most applicable, in most cases with a contributing approach. The flexible models that could offer more flexibility in location were less suggested, as most instructors dealt only with on-campus students (see Table 86).

6.5.1.2 The use of TeleTOP

Within the 26 courses in the experimental group (that returned the first 2S-t-M questionnaire, see Table 85) two courses did not make use of TeleTOP according to the definition for TeleTOP use that was introduced in Section 4.5.1. For the control group, two of the 20 courses that returned the first 2S-t-M questionnaire (see Table 85) did not make use of TeleTOP according to that same definition for TeleTOP use, and therefore were left out of the analyses. The options that were chosen for the TeleTOP menu for those who remained in the two groups are given in Table 88.

Table 88. Options chosen by the instructors in the two groups for 2001/2 and 2002/3 courses.

TT option	Control 2001/2	Control 2002/3	Experimental 2001/2	Experimental 2002/3
	% of instructors	% of instructors	% of instructors	% of instructors
News	100.0%	100.0%	100.0%	100.0%
Course info	100.0%	100.0%	96.0%	100.0%
Roster	100.0%	100.0%	92.0%	92.0%
Administration	44.0%	44.4%	33.0%	58.3%
Email	100.0%	100.0%	96.0%	100.0%
Participants*	43.0%	43.0%	25.0%	38.0%
Discussion	5.6%	0.0%	17.0%	8.3%
Q&A	17.0%	11.0%	8.3%	25.0%
Chat*	0.0%	0.0%	13.0%	0.0%
Workplace	22.0%	22.0%	29.0%	33.0%
Presentation	11.0%	5.6%	4.2%	8.3%
Glossary	11.0%	5.6%	4.2%	4.2%
Web-links	44.0%	44.0%	29.0%	63.0%
Multi-media	11.0%	11.0%	8.3%	8.3%
Archive	33.0%	44.0%	38.0%	33.0%
Publications	18.0%	12.0%	8.3%	21.0%
Sheets*	29.0%	29.0%	63.0%	75.0%
Html Pages	11.0%	11.0%	4.2%	0.0%
Quizzes	5.6%	5.6%	0.0%	0.0%
Poll	0.0%	0.0%	0.0%	0.0%
Categories	5.6%	5.6%	4.2%	50.0%
Feedback-tool	11.0%	0.0%	0.0%	29.0%

For the Control: N=18, for *N=7; Experimental: N=24, for *N=8 (Starred items relate to the different version of TeleTOP within one department where these extra options were available)

Table 88 shows that for the control group there are no major differences between the options that instructors have chosen. Of the 22 options, 15 stayed the same, six dropped slightly, and only one (Archive) increased in choice. The McNemar Test for the significance of changes for a before-and-after design in which each person is used as his own control (Siegel, 1956) showed no significant changes for the control group.

Some interesting changes however can be found in the experimental group that used the FST. Only seven of the options stayed the same, while four decreased and 11 increased. The McNemar Test for the significance of changes was again used. There are significant differences in the experimental group between the 2001/2 and the 2002/3 course environments for Web-links (p=0.039), the categories option (p=0.002), and the feedback option (p=0.004), with an increase in all cases.

In Section 2.3 the use of CMSs was described with a focus on the three main functionalities of CMSs: organization, communication, and resources. The average number of documents for the experimental and the control groups based on this categorization (that was also used in Section 4.5) are given in Table 89.

Table 89. Overview of documents in TeleTOP by instructors, changes within course environments over time

	CMS functionalities	Year	Mean	SD	t	df	Sig. (2-tailed)
Control group (N=18)	Organization	2001/2	59.28	20.52	0.87	17	0.40
		2002/3	66.61	42.72			
	Communication	2001/2	1.39	2.70	2.03	17	0.06
		2002/3	3.00	5.49			
	Group work	2001/2	0.17	0.51	1.65	17	0.12
		2002/3	0.83	1.89			
	Resources	2001/2	11.22	24.86	1.974	17	0.07
		2002/3	13.22	25.18			
Experimental group (N=24)	Organization	2001/2	58.17	39.33	0.90	23	0.38
		2002/3	72.08	67.59			
	Communication	2001/2	9.54	18.53	1.10	23	0.28
		2002/3	13.71	15.12			
	Group work	2001/2	4.96	11.59	-2.28	23	0.03
		2002/3	1.96	6.96			
	Resources	2001/2	7.08	10.41	1.48	23	0.15
		2002/3	9.63	13.69			

The number of documents in TeleTOP increased for the control group for each category, but none significantly. The number of group-work documents decreased significantly for the experimental group, whereas the number of documents for the other three types of purposes increased, although not significantly. It is interesting to see that the standard deviations are relatively high in both groups. This indicates that there may be important differences between instructors within both the experimental group and control group.

To see if there are differences between the control and experimenatal groups in the use of TeleTOP for the 2001/2 and 2002/3 courses another set of t-tests was made (Table 90).

Table 90. Differences in the use of TeleTOP by the instructors comparing the control and experimental groups for the 2001/2 and the 2002/3 courses.

	2001/2				2002/3			
	Mean Difference*	t	df	Sig. (2-tailed)	Mean Difference*	t	df	Sig. (2-tailed)
Organization	-1.11	-0.11	40	0.91	5.47	0.30	40	0.77
Communication	8.15	1.85	40	0.07	10.71	2.86	40	0.01
Group work	4.79	1.75	40	0.09	1.13	0.67	40	0.51
Resources	-4.14	-0.86	40	0.39	-3.59	-0.75	40	0.46

**Experimental – control*

Table 90 shows that there were no significant changes between the experimental and control groups for the 2001/2 courses. There is however a significant difference for the use of communication functionalities within TeleTOP for the 2002/3 courses. The instructors in the experimental group have used these options significantly more than the instructors of the control group (t=-2.860, df=40, p=0.007). There were no significant changes for the other CMS functionalities.

In conclusion most instructors that could use the FST did use it, and instructors in the experimental group showed a significant increase in choice of three of the CMS tools in terms of types of options available (See Table 88). When comparing the CMS functionalities in terms of four main categories (Table 89) the use of options between the control and the experimental group is harder to summarize. In terms of actual means, the control group was more active in the use of resources while the experimental group was significantly more active in terms of documents submitted for communication. Both groups increased substantially on the number of documents placed in organizational options.

6.5.2 2S-t-M flexibility in courses

The second question for the FST experiment as given in Section 6.1 was: After using the FST, to what degree do instructors experience changes in their strategy in offering flexibility in a particular course that they had offered the year before and how does this compare to instructors not using the FST?

This section thus gives the results on the pre and post versions of the 2S-t-M questionnaires that were used to measure how the instructors experience the flexibility in their courses. In Section 6.5.2.1 the data from the international survey (described in Chapters 2 and 3) will be compared and analyzed with the data from the pre-test for 46 instructors in the total group (before divided into control and experimental) in order to see how the University of Twente instructors were similar to the instructors in the international survey. In Section 6.5.2.2 the control and the experimental (FST) group will be compared on pre-test scores, and in Section 6.5.2.3 the results with the post-test, for both the control and the experimental (FST) groups will be compared. Section 6.5.2.4 compares instructors with themselves over time.

6.5.2.1 *Comparing the UT sample with the international survey*

The data from the pre-test were compared with the data from the international survey (Collis & Van der Wende, 2002, discussed in Chapters 2 and 3), in order to see if the experimental setting within the university of Twente could be representative for other higher-educational institutes. In both settings the same questions and answer scales were used. Table 91 shows the overview of the 2S-t-M flexibility results.

Table 91. The 2S-t-M flexibility dimensions of the pre-test at the UT compared with the international survey.

		Mean	SD	t	df	Sig. (2-tailed)
Planning S-t-M						
Times for starting and finishing a course	International	1.82	1.02	-0.03	392	0.98
	UT	1.83	1.24			
Times for submitting assignments and interacting within the course	International	2.76	1.21	1.75	390	0.08
	UT	2.42	1.25			
Topics of the course	International	2.76	1.16	1.33	392	0.18
	UT	2.51	1.33			
Orientation of the course (theoretical, practical)	International	2.26	1.05	0.88	390	0.38
	UT	2.11	1.13			
Assessment standards and completion requirements	International	2.15	.97	-0.29	390	0.77
	UT	2.20	1.27			
Assignments required for the course	International	2.47	1.10	-0.97	390	0.33
	UT	2.64	1.35			
Interpersonal S-t-M						
Ways in which the course is experienced (face-to-face; group, individual, combinations)	International	2.68	1.23	2.01	390	0.05
	UT	2.29	1.32			
Language to be used during the course	International	1.80	1.09	-2.21	390	0.03
	UT	2.20	1.53			
Modality and origin of learning resources: ((instructor, learners, library, WWW), etc)	International	3.40	1.07	3.49	392	0.00
	UT	2.81	1.19			

1= no flexibility, 3= some flexibility, 5 = extensive flexibility; For UT N=46, for International N=347

For the planning dimension, the results of the pre-test at the University of Twente can be seen as similar to those of the international survey. Within the interpersonal dimensions, all comparisons were significantly different, but with no consistent pattern. These results show that some caution should be taken in generalizing the results in terms of interpersonal flexibility of the University of Twente to other higher-education institutes.

The data show that the most flexibility at the University of Twente can be found within the learning resources, the assignments required for the course, and the topics within the course, although all are lower than the score of 3 (some flexibility). In general, some options for students are being offered, although the amount is modest in both the University of Twente and other higher-education samples.

6.5.2.2 Comparing control and experimental groups, pre-test

Within the second part of the FST experiment the levels of 2S-t-M flexibility within two groups were compared. To see whether the instructors in the two different groups, the experimental and the control group, were equally assigned, a t-test based on pre-test scores was used. No significant differences should be found between scores of the experimental and the control group on the pre-test before the FST experiment started. The means for the 2S-t-M flexibility types and the results of the t-tests that were used to compare the differences are given in Table 92.

Table 92. Means and differences control and experimental groups for the 2S-t-M flexibility types in the pre-test.

	Group	N	Mean	SD	t	df	Sig. (2-tailed)
Planning S-t-M							
Times for starting and finishing a course	Control	20	1.85	1.39	.11	44	0.91
	Experimental	26	1.81	1.17			
Times for submitting assignments and interacting within the course	Control	18	2.28	1.07	-.67	42	0.51
	Experimental	26	2.54	1.39			
Topics of the course	Control	20	2.75	1.52	1.11	44	0.27
	Experimental	26	2.31	1.19			
Orientation of the course (theoretical, practical)	Control	19	2.05	1.22	-.19	42	0.85
	Experimental	25	2.12	1.09			
Assessment standards and completion requirements	Control	19	1.74	.99	-2.01	42	0.051
	Experimental	25	2.48	1.36			
Assignments required for the course	Control	20	2.80	1.51	.83	42	0.41
	Experimental	24	2.46	1.22			
Interpersonal S-t-M							
Ways in which the course is experienced (face-to-face; group, individual, combinations)	Control	20	2.10	1.21	-.88	42	0.38
	Experimental	24	2.46	1.44			
Language to be used during the course	Control	20	2.15	1.60	-.30	42	0.77
	Experimental	24	2.29	1.52			
Modality and origin of learning resources ((instructor, learners, library, WWW), etc)	Control	20	2.50	1.19	-1.43	44	0.16
	Experimental	26	3.00	1.17			

1= no flexibility, 3= some flexibility, 5 = extensive flexibility

Table 92 shows that there are differences between the two groups, but not significant ($p < 0.05$). Differences are on both sides, in three cases the control group has a higher mean, while in six cases the experimental group has a higher mean, but all not significant.

6.5.2.3 *Comparing control and experimental group, post tests*

After the FST experiments (see Section 6.2), the same 2S-tM questions as in the pre-test were used to question the instructors about the 2S-t-M flexibility dimensions. To see whether the instructors in the two different groups, the experimental and the control group, significantly differed after the FST experiment, t-tests based on post-test scores were used. The results of the t-tests that were used to compare the differences are given in Table 93.

Table 93. T-test on post-test scores.

	Group	N	Mean	SD	t	df	Sig. (2-tailed)
Planning S-t-M							
Times for starting and finishing a course	Control	14	2.57	1.45	0.50	36	0.62
	Experimental	24	2.33	1.40			
Times for submitting assignments and interacting within the course	Control	13	2.77	1.42	-0.05	35	0.96
	Experimental	24	2.79	1.14			
Topics of the course	Control	14	2.93	1.77	2.05	37	0.052
	Experimental	25	1.96	1.17			
Orientation of the course (theoretical, practical)	Control	13	2.23	1.30	-0.02	36	0.98
	Experimental	25	2.24	1.16			
Assessment standards and completion requirements	Control	13	2.23	1.30	-0.41	35	0.68
	Experimental	24	2.42	1.32			
Assignments required for the course	Control	13	2.77	1.48			
	Experimental	24	2.50	1.29	0.58	35	0.57
Interpersonal S-t-M							
Ways in which the course is experienced (face-to-face; group, individual, combinations)	Control	13	2.69	1.44	0.21	36	0.84
	Experimental	25	2.60	1.22			
Language to be used during the course	Control	12	2.17	1.47	-0.40	34	0.70
	Experimental	24	2.38	1.50			
Modality and origin of learning resources ((instructor, learners, library, WWW), etc)	Control	13	2.69	1.44	0.35	36	0.73
	Experimental	25	2.52	1.42			

1= no flexibility, 3= some flexibility, 5 = extensive flexibility

There are no significant differences ($p< 0.05$) between the two groups. For four variables the experimental group is higher, while for five variables the control group is higher. The difference in topics of the course in favour of the control group is nearly significant, none of the other differences are significant. No clear explanation can be given.

6.5.2.4 *Comparing instructors with themselves, over time*

Another set of t-tests was done to measure the differences in the 2S-t-M flexibility within the instructors with themselves, over time. Table 94 shows the results of the t-tests of the differences between the experienced flexibility offered in the 2001/2 and 2002/3 versions of the course for both the experimental and the control groups.

Table 94. Differences of the 2S-t-M flexibility in the pre and post test within instructors, control and experimental groups.

	Control group				Experimental group			
	Paired Diffe-rences*	t	df	Sig. (2-tailed)	Paired Diffe-rences*	t	df	Sig. (2-tailed)
Planning S-t-M								
Times (for starting and finishing a course)	0.72	2.55	13	0.02	0.52	1.23	23	0.23
Times for submitting assignments and interacting within the course	0.49	1.43	12	0.18	0.25	0.23	23	0.82
Topics of the course	0.18	0.97	13	0.35	-0.35	-1.26	24	0.22
Orientation of the course (theoretical, practical)	0.18	0.82	12	0.43	0.12	0.34	24	0.74
Assessment standards and completion requirements	0.49	0.97	12	0.35	-0.06	-0.13	23	0.90
Assignments required for the course	-0.03	-0.20	12	0.84	0.04	0.37	23	0.71
Interpersonal S-t-M								
Ways in which the course is experienced (face-to-face; group, individual, combinations)	0.59	1.40	12	0.19	0.14	0.24	24	0.81
Language to be used during the course	0.02	0.46	11	0.65	0.09	0.87	23	0.39
Modality and origin of learning resources (instructor, learners, library, WWW, etc)	0.19	0.59	12	0.57	-0.48	-1.52	24	0.14

**Post test (Table 93) - pretest (Table 92)*

The data in Table 94 show that within the control group a significant increase in the 2S-t-M types of flexibility was found for one variable: The times for starting and finishing a course. Within the experimental group there are no significant changes in how instructors experience the flexibility within their courses. In general the flexibility in both groups increased, for eight of the nine variables within the control group and for six out of nine variables within the experimental group, but significantly only in one case.

Despite the fact that the within the experimental group the instructors used the FST in their course design, their overall flexibility did not significantly increase. The reason why might be that the intervention was only for one course per instructor in a limited time interval. Also the high standard deviations as given in Table 92 and Table 93 show that instructors do differ a lot within both the experimental and control groups. There are instructors that offer options, but on average changes are not significant.

In general the data show that differences in the amount of planning and interpersonal flexibility can vary within one year, but the change is limited. Because of the limited change in the 2S-t-M flexibility as experienced by instructors between course versions given in the 2001/2002 and the 2002/2003 academic years, no further analysis to see what independent variables relate to that change can be made. However, to see what factors relate to the degree of 2S-t-M flexibility in total, and not looking at the small differences within one year, would still be interesting. The factors that relate to the degree of 2S-t-M flexibility in general could be used to find out how flexibility relates to other variables such as instructor characteristics and course settings. This analysis is described in Section 6.6.

Before that, the way(s) instructors value the FST and support and how the instructors see changes in higher education in the near future and the role of TeleTOP will be described.

6.5.3 How instructors value the FST and other support

In the 2S-t-M questionnaire post-test a number of questions about the support (both internal to TeleTOP and by humans outside of TeleTOP) that was offered to instructors were added in order to measure how instructors valued this support. Table 95 shows the results of the questions about how the instructors experienced the support and also TeleTOP in general (not all respondents of the experimental group responded to all the questions).

Table 95. How instructors value support for the control and experimental group.

	Group	N	Mean	SD	t	df	Sig. (2-tailed)
Are you in general satisfied about TeleTOP?	Control	14	3.57	.94	1.10	37	0.28
	Experimental	25	3.16	1.21			
Are you in general satisfied about the support outside of TeleTOP?	Control	14	3.36	.93	-0.14	37	0.89
	Experimental	25	3.40	.87			
Are you in general satisfied about the support within TeleTOP?	Control	14	2.93	.62	-1.39	37	0.17
	Experimental	25	3.32	.95			
Are you in satisfied about the menu support?	Control	14	3.21	.80	-0.41	37	0.68
	Experimental	25	3.32	.75			
Are you in satisfied about the setup support?*		22	3.23	.87			
Are you in satisfied about the roster page support?*		23	3.22	.85			
Are you in satisfied about the examples that were used?*		22	3.23	.75			
Are you in satisfied about the guidelines that were provided?*		23	3.26	.81			
Are you in satisfied about the videos? *		21	3.14	.57			

*Where 1= very dissatisfied, 3= neutral, 5= very satisfied; * questions only in the experimental group*

Table 95 shows that there are differences between the experimental and the control group, although not significant. The instructors are in general satisfied about TeleTOP, but the control group gives a higher appreciation (however not significantly higher). The standard deviation within this question is for the experimental group high. This indicates that there are important differences within this group. For the other types of support, the experimental group gives higher scores (but not significant). The internal support is valued higher for the experimental group. The difference was not found to be significant. Explanations for the results will be reflected upon in Chapter 7; it may be that limited number of respondents and high standard deviations within the groups are reasons.

The instructors that used the FST within TeleTOP in general have an ‘above neutral’ attitude towards the FST support offered within TeleTOP. The standard deviations are much lower than they were in the questions about TeleTOP and support outside of TeleTOP. Instructors do not seem to vary in their opinions about the support in TeleTOP as much as they vary in their appreciation of TeleTOP in general.

6.5.4 How instructors see changes in higher education in the near future and the role of TeleTOP

In the 2S-t-M questionnaire post-test another set of questions had been added (see Section 6.3). The instructors were asked about the changes in higher education in the near future and the role of TeleTOP within these changes. In Table 96 the results are shown.

Table 96. Experienced and expected changes in higher education and the role of TeleTOP.

	Group	N	Mean	SD	t	df	Sig. (2-t)
My courses have become more flexible because of TeleTOP use.	Control	14	2.43	1.28	-0.62	37	0.54
	Experi-mental	25	2.72	1.46			
TeleTOP gives me possibilities to offer flexibility to students in my course.	Control	14	3.21	1.25	-0.45	37	0.66
	Experi-mental	25	3.40	1.22			
In the future the groups of students in my courses will become more heterogeneous.	Control	13	4.00	1.29	1.53	36	0.13
	Experi-mental	25	3.36	1.19			
In the future education will become student centered, with more individual options for students	Control	14	3.50	1.09	0.77	37	0.45
	Experi-mental	25	3.24	.97			
TeleTOP plays an important role within making courses more flexible	Control	14	3.36	.84	0.20	37	0.84
	Experi-mental	25	3.28	1.28			

Where 1= disagree, 3= to a certain extent, 5= agree

The data in Table 96 show that to a certain extent instructors think that in the future students in courses will change. They indicate that to more than a certain extent TeleTOP will play a role within this process, with the experimental group showing a lower mean than the control group, although not significant. Also not significant, but interesting to see is that the control group gives higher scores on the questions that deal with the future. On the question that relates to the more-heterogeneous students there is a difference in means of 0.64 with the experimental group. For the question that deals with a more student-centered approach this is 0.26. The standard deviations in both groups are again high; there are important differences between instructors.

6.5.5 Results and next steps in the FST experiment

The third general research question within this dissertation research (see Section 1.2) focuses on how internal performance support (through the CMS) can support instructors in offering more flexibility through better CMS use. The more-specific questions for the FST experiment as introduced in Section 6.1 were:

1. Will instructors use the FST embedded in the TeleTOP CMS? When they do use the FST, will they also show more use of the CMS in terms of types of options available?
2. After using the FST, to what degree do instructors experience changes in their strategy in offering flexibility in a particular course that they had offered the year before and how does this compare to instructors not using the FST?

In conclusion to the first question: Most instructors that had the FST available to them did use it. Instructors showed an increase in the CMS use in terms of types of options selected within the TeleTOP menu. The use of options by the control and the experimental group did differ significantly for one of the four CMS categories (see Table 90). In both these cases, there were more significant increases for the experimental group than for the control group. However, in conclusion to the second question it was found that despite the fact that the within the experimental group the instructors used the FST in their course design, their experienced 2S-t-M flexibility did not significantly increase within one year.

It is encouraging that the FST is being used, and its use seems to relate to the use of TeleTOP. Instructors that used the FST are more positive about the internal TeleTOP support than instructors that ‘only’ had the TeleTOP DST. However, overall the experienced 2S-t-M flexibility did not significantly increase, and this needs to be understood. Thus it is valuable to look at possible factors that do relate to the degree of 2S-t-M flexibility. Other variables whose influence may be more powerful than that of an embedded tool should be considered. The other factors that may relate to the degree of 2S-t-M flexibility can be used to find out more about how flexibility relates to instructor characteristics and course settings.

6.6 Exploratory Analysis of Other Factors that Influence Flexibility

An explorative analysis of other factors besides the FST that influence the level of 2S-t-M flexibility in the overall sample could offer valuable insights. In Section 6.6.1 an introduction to the additional analysis will be given. Section 6.6.2 indicates new independent variables. In Section 6.6.3 the differences related to departments will be examined and in Section 6.6.4 explorative analyses of other factors will be described. In Section 6.6.5 the main conclusions will be given.

6.6.1 Variables that could serve as predictors

To find out what other factors might have an influence on the degree of 2S-t-M flexibility possible independent variables were selected based on the variables that were derived in Section 4.5. There it was concluded that characteristics of the course such as the percentage of “lifelong learning” students and the number of students in a course related to the use of TeleTOP. The phase of a course in terms of the phases of the study program was not of influence, but it would be also interesting to see if this had an impact in the experienced flexibility. Also, characteristics such as courses that do not have contact sessions within a course may relate to 2S-t-M flexibility. The characteristics of the instructor, such as age, experience as a teacher, and experience with CMSs could also relate to the degree of 2S-t-M. So, two clusters of potential independent variables can be identified that relate to the characteristics of the course and of the instructor.

Table 97 shows the selection of variables (outside the DST/FST) that could have an influence on the degree of flexibility and the descriptive data that relate to these variables for the overall sample (control and experimental groups combined).

Table 97. Possible predictors for the degree of 2StM flexibility (N=36).

	Minimum	Maximum	Mean	SD
Characteristics of the course				
Percentage LLL students	0	100	7.00	19.26
Class size	4.00	139.00	56.20	43.84
Phase (first year =1 to senior course=4)	1	4	2.69	1.22
Use of contact sessions (0=no, 1=contact sessions)	0	1	.95	.22
Characteristics of the instructor				
Number of TT environments over the years	2	35	12.20	6.73
Started with TT	1998	2001	1999.96	1.13
Teaching experience (in years)	2	32	12.87	7.44

In addition, organizational context is likely to have an impact (see Section 2.4). Four different university departments were included within the experiment. As described in Section 6.4 there are differences between the disciplines within the departments (two are behavioral sciences, one department is in business administration, and one is in applied physics), but also when and how TeleTOP was introduced. Another independent variable that could have an influence on the dependent 2S-tM variables is therefore the department.

6.6.2 Dependent variables

The dependent variables are the scores on the 2S-t-M questions, now combined for the control and experimental group. Table 98 gives the descriptive data.

Table 98. Descriptive data for the 2St-tM variables (N=36)

	Minimum	Maximum	Mean	SD
2S-t-M Planning				
Times for starting and finishing a course	1	5	2.45	1.21
Times for submitting assignments and interacting within the course	1	5	2.87	1.02
Topics of the course	1	5	2.43	1.32
Orientation of the course (theoretical, practical)	1	5	2.43	1.15
Assessment standards and completion requirements	1	5	2.42	1.14
Assignments required for the course	1	5	2.74	1.13
2S-t-M Interpersonal				
Ways in which the course is experienced (face-to-face; group, individual, combinations)	1	5	2.71	1.07
Language to be used during the course	1	5	2.39	1.35
Modality and origin of learning resources (instructor, learners, library, WWW, etc)	1	5	2.70	1.29

Because of a high reliability score for the six planning 2St-tM questions (Alpha =0.83) and for the three interpersonal 2St-tM questions (Alpha = 0.6), the sums of the two sets of 2S-t-M variables could be used as two dependent variables and therefore the variables in each set could be added together. Table 99 shows the descriptive data thus obtained.

Table 99. Descriptive data for the calculated 2St-tM dependent variables.

	Minimum	Maximum	Mean	SD
Planning 2St-tM	6.00	26.00	14.98	5.69
Interpersonal 2St-tM	3.00	15.00	7.59	3.13

The calculated 2St-tM variables will serve as the dependent variables for the explorative backwards regression analyses. First an ANOVA analysis was done to measure the influence that the departments have on the 2S-t-M flexibility. After that the analyses relating the course and instructor variables to the planning and the interpersonal 2S-t-M flexibility dimensions will be described.

6.6.3 Influence of departments

In Section 6.4 the four departments that were involved within this research were introduced. Because the variable 'department' is nominal, it cannot be part of the backwards regressions that will be described in Section 6.6.4. Therefore, an ANOVA was done. Table 100 shows the means for the departments.

Table 100. Means of the 2S-t-M dimensions per department.

	Department	Mean	SD	N
Planning 2S-t-M flexibility	Educational Science	18.23	4.78	13
	Applied Physics	15.93	2.15	7
	Business Administration	12.83	4.26	9
	Applied Communication Sciences	12.36	4.53	7
	Total	15.29	4.78	36
Interpersonal 2S-t-M flexibility	Educational Science	8.92	2.78	13
	Applied Physics	7.68	2.12	7
	Business Administration	7.17	2.52	9
	Applied Communication Sciences	6.50	2.43	7
	Total	7.77	2.61	36

The ANOVA shows that there is a significant F within the tests of between-subjects effects for the planning 2S-t-M flexibility (F=4.295, p=0.012); this is not the case for the interpersonal 2S-t-M flexibility (F=1.651, p=0.197). Thus for planning 2S-t-M flexibility the departments significantly differ. The multiple-comparisons tests in Table 101 shows the overview of significant differences for the planning 2S-t-M flexibility dimension between the departments.

Table 101. Multiple comparisons between the departments for the planning 2S-t-M flexibility dimension

(I) Department	(J) Department	Mean Difference (I-J)	Std. Error	Sig.
Educational Science and Technology	Applied Physics	2.21	1.91	0.25
	Business Administration	5.31	1.76	0.01
	Applied Communication Sciences	4.98	1.76	0.01
Applied Physics	Business Administration	3.10	2.07	0.15
	Applied Communication Sciences	2.76	2.07	0.19
Business Administration	Applied Communication Sciences	-0.33	1.94	0.87

It becomes clear in Table 101 that the Department of Educational Science and Technology significantly differs from two of the three other departments, whereas the others do not differ from each other. Instructors within the Educational Science and Technology department provide a higher planning flexibility than colleagues in other departments. This might relate to the composition of the group of students for this department. This department has the highest percentage of distance and LLL students. The interpersonal flexibility does not significantly differ between departments.

6.6.4 Explorative analysis of the planning 2S-t-M flexibility dimension

An explorative backward regression analysis was done to see how the characteristics of the course and instructor have an influence on the 2S-t-M flexibility dimensions as measured by the post-test questionnaires. The first dependent variable was the average score on the six variables that related to the planning 2S-t-M flexibility dimension (See Table 99). All the predictors in Table 97 were entered as possible predictors. The results of the analysis are significant (F=8.203, p=0.001). The explained variance within this model is rather high (R Square=0.646), and therefore the model seems strong. Table 102 shows the strongest predictors for the backward regression.

Table 102. Possible predictors for the planning 2S-t-M flexibility dimension

Predictors	B	Std. Error	Beta	t	Sig.
Constant	24.26	1.94		12.51	0.00
Class size	-0.04	0.01	-0.52	-3.41	0.00
Phase	-0.81	0.43	-0.30	-1.91	0.07
Number of TT environments over the years	-0.17	0.07	-0.37	-2.27	0.04
Teaching experience	-0.19	0.07	-0.47	-2.88	0.01
Excluded:					
Use of contact sessions			0.13	0.87	0.40
Percentage LLL students			0.12	0.62	0.54
Started with TT			-0.25	-1.28	0.22

For the characteristics of the course, the number of students has the strongest relation with planning flexibility. The lower the number of students, the more planning flexibility can be expected. The percentage of distance students however does not influence the planning flexibility, which would have been logical.

For the characteristics of the instructor the independent variables that are in the model show that that instructors provide more planning flexibility when they have used fewer TeleTOP environments over the years then when they are more experienced. Instructors with limited teaching experience also provide more planning flexibility than colleagues with more teaching experience. The number of years ago that instructors started with TeleTOP does not seem to be of influence.

For the interpersonal type of flexibility as expressed by the sum of scores on the three items of the interpersonal 2S-t-M dimensions (See Table 99) the explorative backward regression (R Square = 0.165) was not significant (F=4.147, p=0.055). Further analysis was therefore not made.

6.6.5 Conclusions: Factors that relate to the degree of 2S-t-M flexibility

In Section 6.6.3 it became clear that the instructors within the Educational Science and Technology department provide a higher amount of 2S-t-M flexibility than colleagues in other departments. For the 2S-t-M types of flexibility the most important course and instructor variables that relate to the degree of flexibility are summarized in Table 103.

Table 103. Variables that relate to 2S-t-M flexibility

	Planning dimension predictors ($p < 0.05$)
Characteristics of the course:	
Percentage LLL students	
Class size	Lower predicts higher
Phase (first year =1 to senior course=4)	
Use of contact sessions (0=no, 1=contact sessions)	
Characteristics of the instructor:	
Number of TT environments over the years	Lower predicts higher
Started with TT	
Teaching experience	Lower predicts higher

It seems that 2S-t-M flexibility depends on a number of variables that relate to the characteristics of courses and of the instructors. Important is that for the two Stretching-the-Mold types of flexibility it was only for the planning flexibility that predictors were found. The interpersonal 2S-t-M flexibility dimension seems more difficult to relate to course and instructor variables.

For the course characteristics the courses with less students relate to a higher level of planning S-t-M flexibility. The characteristics of instructors relates also to planning flexibility. Instructors with less teaching experience and not too many courses to teach in a year provide the highest flexibility. More discussion will follow in Chapter 7.

To go more deeply than the questionnaire data, this chapter will conclude with a qualitative analysis of the use of TeleTOP and the FST, the degree of flexibility, and how the independent variables that were found in the section relate to flexibility, through interviews.

6.7 User Experiences About Flexibility and FST Support: Insights from Interviews

In Section 6.5.2 it became clear that the FST did not significantly change instructors' ideas about the provided 2St-tM flexibility within their courses. The results of Section 6.6 show that other factors also relate to at least the planning type of 2S-tM flexibility. In order to gain more insights into this a follow-up series of interviews was carried out. In this section follow-up interviews that were organized will be described. In Section 6.7.1 the context of the experiment and the research questions will be presented. In Section 6.7.2 the design and description of the instrument will be given. In Section 6.7.3 the subjects that were used for the interviews will be described, and in Section 6.7.4 the procedure will be described. Section 6.7.5 gives the results of the interviews, and this section will conclude with the conclusions (Section 6.7.6).

6.7.1 Context of the follow-up interviews and the research questions

User interviews were organized in order to learn more in depth about what a number of "more flexible" and "less-flexible" instructors think of TeleTOP and the FST and how instructors that valued the FST highly or lowly think of flexibility in education. The important standard deviations in several areas that represent differences amongst instructors, described in the previous sections, were used as starting points for the selection of respondents for this final part of the FST experiment.

Important findings from the previous sections are that the FST itself does not seem to change the 2S-t-M flexibility. There are some changes in the use of TeleTOP, but these are limited as well. Section 6.6 showed that there are other factors that do relate to the degree of 2S-t-M flexibility within the total group of instructors. To see how concerns, experiences, and support (See Sections 2.4 and 2.5) relate to these, the questions for this qualitative user investigation focus upon the following questions:

1. Under what conditions can the FST help instructors to increase TeleTOP use and flexibility?
2. Are other factors of bigger influence? If yes: what, why, and how?

Next, the design and description of the instrument for the qualitative data gathering will be described.

6.7.2 Design and description of the instrument for the qualitative data-gathering

There are several methods for the gathering of qualitative data for follow-up investigations. An often-used method is the interview. Interviews are according Kvale (1996) cited in McAteer (1998) ‘conversations where the outcome is a co-production of the interviewer and the interviewee’ (p. 40). Interviews can be used for retro-perspective insights. McAteer (1998) mentions a number of approaches that vary in degree of structure. The open-ended interview uses the same questions for the whole sample population. The structure is given through the questions, but there is a risk of losing unanticipated important information. The guided or structured interview also has clear structure through the questions, but also allows individual experiences from respondents to emerge. This approach is preferred above the informal, conversational approach, that allows the evaluator to respond quickly to individual differences but makes it harder to systematically interpret the information.

The questions that structure the guided or structured interview for this follow up should relate to aspects that deal with flexibility on one hand, and the use of the CMS and the FST on the other. In Section 2.4 the concerns and problems that instructors experience when using a CMS were described. These may have influenced the instructors’ response to the DST or FST. Important elements in Chapter 2 were the need for a clear educational goal for the use of a CMS and the need for the CMS to fit with the familiar educational approach and climate in the institution. Furthermore CMSs should be flexible and have a high quality to keep the instructor’s concerns limited. Concerns of instructors with regards to their new roles and about time-management issues were found to be important as well as the problems and concerns instructors face as they deal with new cohorts of students, new pedagogies, CMSs, and stretching the mold. These concerns should be discussed in the interviews.

In Section 2.5 support for CMSs was also discussed. The conclusions of that analysis pointed out that instructors need to be supported in such a way that they have sufficient technical skills and that there is a fit with their educational practices, and they need to become familiar with the pedagogical and technical options and possibilities of the CMS. However, the general opinion of instructors with regard to how support is provided to them and the experiences they have had with the support is not high. Instructors noticed a lack of direction, resources, knowledge, and tools within the support. They have a general feeling that they are responsible for providing their own support, although they not really complaining about this (Collis & Van der Wende, 2002). Each of these perspectives will be included in the interviews.

In Section 2.2 it was concluded that flexible learning is the underlying but not always clear paradigm for the use of CMSs in courses. It will be interesting to further explore how the use of the FST has contributed towards a change in the opinion of instructors in this sense and the need for technical and pedagogical support. This will also be done in the interviews. The questions in the interview that cover these elements are given in Table 104.

Table 104. Overview of questions for the interview

Topics	**Questions**
Clarity	What is the goal of TeleTOP? Is it a communicated goal or obtained through your own insights? When and how did you realize this?
Flexibility	Are you familiar with the situation of your students concerning their age, goals, background, experience, etc.?
	Do you differentiate between students concerning these differences?
	How? How do you use TeleTOP?
Ease of use	Is TeleTOP of high quality, easy to use and perceived as practical?
	Which advantages, which problems have you had?
Implementation, support and management	Did the management provide time and money and support for the use of TeleTOP?
	Did TeleTOP build upon your earlier teaching approach?
	Did you change your pedagogical model since the use of TeleTOP?
	Do you feel that you could organize your courses without TeleTOP?
	What support was provided/available? Technical/pedagogical/didactical? Are you satisfied?
Use of the FST	Did you use the FST? How? What are strong and weak aspects? Do you have other comments?

6.7.3 Subjects for the interviews

The subjects in this experiment were chosen from the subjects that are described in Section 6.4. From both the experimental and control groups a selection of instructors was made. Reflecting the main questions for this evaluation (as given in Section 6.7.1) the instructors were selected based on the degree in which they have opinions about the FST in TeleTOP. It is interesting whether the FST has/can change(d) their teaching or if the characteristics of instructors as seen in the regression analysis (Section 6.6) are of bigger influence. The criteria for choosing instructors for the interviews related to the availability of the FST on one hand, and on the other hand to the degree in which instructors are flexible in their courses. The mean of total 2S-t-M flexibility was 22.5 (SD=8.1). Table 105 shows the main elements for the selection of subjects based on the degree of flexibility within the course and the groups, and the show the number of instructors for each group.

Table 105. Numbers of subjects for the interview based on the criteria.

		Group	
		Control	Exp.
2S-t-M	Lower then mean	A (N= 5)	C (N= 9)
	Higher then mean	B (N= 8)	D (N= 14)

To get answers on the main questions it is important to interview at least one instructor for each cell. However, it would be valuable to gather some more qualitative data and therefore interview two instructors for Cells C and D as the reaction to the FST is of particular importance to the research. Therefore one instructor for A and B were randomly selected. For C N=2, and for D N=3. In Table 106 an overview of the course and instructors characteristics and opinions that were derived in Section 6.6 is given.

Table 106. Characteristics of instructors selected for the interviews.

	A	B	C1	C2	D1	D2	D3
Group (1=experimental, 0=control)	0	0	1	1	1	1	1
Department***	2	1	3	4	1	1	4
Percentage LLL students	10%	0	0	0	10%	25%	0
Class size	14	12	50	36	27	7	138
Phase (first year =1 to senior course=4)	4	4	1	2	4	4	2
Number of instructors	2	1	2	3	1	2	4
Use of contact sessions (0=no, 1=contact sessions)	1	1	1	1	1	1	1
Number of TT environments over the years	13	18	15	16	22	6	9
Started with TT	2000	2000	2001	1999	1998	2001	2001
Age	61	55	57	37	48	35	25
Sex (1=male, 2=female)	1	1	1	1	1	2	1
Degree (1=PDH, 0=no PhD)	1	1	0	1	1	1	0
Teaching experience (in years)	9	15	32	10	15	8	3
TeleTOP made learning more flexible in my courses*	4	4	1	1	4	1	4
TeleTOP gives options for flexible learning*	4	4	4	4	4	1	3
In the future the groups of students in courses will become more heterogeneous.*	4	5	4	2	4	4	2
Education is becoming more student centered, with more individual options for students*	4	4	4	2	4	3	2
Appreciation of TeleTOP**	4	4	3	1	4	2	1
Appreciation of human support **	3	4	4	4	3	2	2
Appreciation of internal support **	3	3	4	2	4	2	2

For: 1= disagree, 3= to a certain extent, 5= agree; For**: 1= very dissatisfied, 3= neutral, 5= very satisfied; For***: 1= Educational Science, 2= Applied Physics, 3= Business Administration, 4= Applied Communication Sciences*

6.7.4 Procedure for the interviews

The instructors that were selected based on the criteria were asked via email to participate in a one-hour interview session in their own office. Of the eight instructors, seven responded positively and agreed to participate. One instructor had personal reasons to indicate that his time was very limited. It was agreed that this instructor was not interviewed.

The interview sessions were planned after instructors agreed to participate. In follow-up email the general purpose and procedure of the interview was explained. Five interviews took place in the offices of the instructors, two were in the office of the evaluator. The sessions took on average one hour. After a short introduction, in which the instructor was reminded of the earlier responses to the Web-based questionnaire, the interview started. All the comments that the instructors made were recorded for subsequent analysis.

6.7.5 Data analysis and results

In the following sections (6.7.5.1-6.7.5.5) the result on the seven interviews that were structured around the questions as shown in Table 104 will be discussed. Per category the main findings and remarks of instructors will be summarized, illustrated by quotes of the instructors. For the full responses on all questions see Appendix 10.

6.7.5.1 Goal of TeleTOP

The first questions related to the clarity of TeleTOP. It seems that the goal of TeleTOP is in two of the seven cases communicated, however instructors do not remember these goals anymore. All instructors do have their own ideas however, and it seems that these emerge after some use of TeleTOP. The TeleTOP goal of the instructors could be more than one. Five instructors (A, B, C1, D1 & D2) think that support of communication is an important goal. One instructor said: "*I think TeleTOP is a fast medium to organize and have contact with students around sessions*" (A). Two instructors mention flexibility (C2 & D1) and two mention "*distribution of information*" (D1 & D2). One instructor sees TeleTOP as a "*learning environment for group work*" (B), for one the goal is a "*medium to organize*" (A) and one mentioned the "*ease of use and efficiency, and therefore safe time*" (D3). Although ideas differ, most do agree on the supportive mean of TeleTOP as an important goal.

There are no clear patterns or differences in the quadrant of instructors or between the seven instructors (as categorized in Table 105).

6.7.5.2 Flexibility

The questions that related to flexibility started with a discussion about the perceived differences between students. Three of the seven instructors said that in their courses students are more or less homogeneous (A, C1 & D3). Although "*there are some differences in motivation and interest*" (D3). The other four instructors have to deal with different cohorts of students. One instructor said "*Some years ago the group of students was very homogeneous. The past years this has changed, there are several cohorts of students such as those form the Bachelor, from the professional colleges,* *those that do it from a distance and those from the international Master program. There is a world of change*” (D1).

There are some major differences between the instructors and the students they have to deal with. Three of the instructors indicate that they have a very homogeneous group of students, whereas the other four deal with a much more heterogeneous group of students. The same three instructors that have the homogeneous group of students do not provide much options for students, other than personalized feedback in “*personal contact and guidance in practical sessions*” (D3), as one instructor mentioned. Three of the four instructors (B, C2 & D2) with the more heterogeneous group of students provide the most options through activities: “*Most flexibility is in activities/assignments. Students can build upon their own interests and experiences when selecting or defining the context of an assignment*” (D2), an example of more interpersonal options. Two of these instructors (B & D1) added upon that and provided flexibility in “*communication and organization*”, or as one instructor told: “*I provide give a lot of options to the students in the choice and work out of assignments; time for meetings, submissions; ways to submit; less contact sessions and more communication via the Web”* (D1), some typical planning options thus.

It seems that the flexibility relates to the demand students put to the instructor, or the way the instructor experiences the differences and deals with these. From the regression analyses (Section 6.6.5) the size of classes also seemed to be of influence. For example, one instructor in the interviews said “*different programs for three different sorts of cohorts were not possible anymore because of high costs, next year I have to start teaching these students within one course*” (A). One instructor that did not provide many options said “*in general there is one structure for the course. This also relates to the high number of students in a course and time limitations*” (D3). Another instructor that does provide options said about providing these: “*All of this takes more time compared to earlier approaches*” (D1). One instructor also mentioned: “*students in senior courses do get more options to choose from then students from first year courses*” (D2).

Most flexibility seems to be provided by those instructors that also had a high score on 2S-t-M flexibility (see Table 105). Interesting to see is that a number of characteristics of the course that relate to the degree of 2S-t-M flexibility as derived from Section 6.6 (See Table 103) can be seen here. Instructors in the interviews mentioned class sizes, differences in students, and phase of the course. When looking more closely to how the characteristics of the instructor have an influence on flexibility the relation is less clear. The conclusions from the regression analysis as summarized in Table 103 do not match the respondents’ comments, comparing their characteristics with the data from Table 106. However, the department does seem of influence. The three instructors from the department of Educational Science and Technology all are in the higher 2S-t-M group, and their comments also reflect that they are more flexible-minded, where it is interesting to notice that their ideas about flexibility not only are based on the planning options, but also more on student contributions and inputs, thus the interpersonal options.

6.7.5.3 Quality, ease of use, use and problems with TeleTOP

The seven instructors all found that TeleTOP was an easy-to-use system. Four of the seven instructors (A, B, C1 & D2) also found that the perceived quality was high. One instructor put it like this: "*For the goals I use TeleTOP for it is of good quality, with a good internal constancy, usability (for communication and distribution) and efficiency*" (D2). Three instructors had some objections. One instructor thought that the quality is "*increasing as more possibilities are being offered*" (C2), another said that "*the quality is of acceptable level, as the system only seems to support the class-room approach and not many other pedagogies*" (D1) and one said "*although it is a 'handy' system I find the pattern sometimes too inflexible*" (D3).

The way TeleTOP is used by all instructors seems similar for the basic parts. All instructors mention "*communication and updates, and new resources can be easily added when the courses is running*". Also, the way to make and communicate the structure (organization) of the course is mentioned by all. One instructor said: "*TeleTOP stimulates me to make the structure for the course more clear on forehand*" (B). Other main advantages that were mentioned were the way TeleTOP "*is flexible and accessible from all locations, I am in full control of the system*" (B).

Instructors do all but one experience sometimes more then one problem. Three (C1, D1 & D3) mention the way attachments should be added to the system, and the time it takes. Two mention problems within functionalities such as the administration (C2) and the work place (D2). Two mentioned the "*limitations in giving it an own look and feel*" (C2 & D2).

When looking at the quality aspects of instructors there are no clear patterns or differences in the quadrant of instructors or between the seven instructors (as categorized in Table 105).

6.7.5.4 Implementation

The implementation of TeleTOP showed some differences amongst instructors. All instructors had more than one type of support, such as the availability of a manual (A, B, C1 & D3); a personal introduction session (A, B, C2, D1 & D3); workshops (B, C2 & D1); or the support of a helpdesk (C1 & D2). Three instructors are satisfied about support (C1, C2 & D1). Two indicate to be "more or less" satisfied (B & D3). The instructors that were not satisfied indicated that "*my problems and questions were self-solved*" (A) and "*sometimes support was requested to assist in technical solutions for new didactical ideas, but no satisfying answers were provided*" (D2). Thus the external support for TeleTOP is not for all instructors very satisfying, where two instructors also feel that they have to find their own solutions when they want do something special.

According to three instructors (A, D1 & D3) the management provided time and money and external support for the use of TeleTOP through the availability of support people. According to the other four the management did not do anything. All instructors agreed that there were no extra personal means in time or money for the instructors.

All instructors also indicated that TeleTOP builds upon their earlier teaching approaches. Four instructors (A, C1, D1 & D2) already used the Web to support their courses. Five instructors (A, C1, C2, D2 & D3) said that TeleTOP did not change their pedagogical model since they started using TeleTOP, although some changes occurred. Those instructors mentioned "*more use of the flexible possibilities of TeleTOP*" (C2) and "*more clear structure of the course organization before the start, through the use of the Roster*" (D2). Two instructors (B & D1) indicated that TeleTOP has changed their teaching, as one instructor said "*Since the use of TeleTOP many things have changed, although these relate to TeleTOP, these not necessarily are because of TeleTOP*" (D1). The same instructor thought that there were "*changes in more flexibility, more student centered approach, less contact sessions, new cohorts of students, more international (English courses), more interactivity in courses and use of TeleTOP in sessions*". The other instructor mentioned: "*teaching is changed towards a community of practice… Learning has become more active, but this approach is possible because of the limited number of students and courses per year*" (B). It seems that TeleTOP has some influence in change, but other factors are also of major importance. These findings build upon the conclusions from the regression analyses in Section 6.6.5.

TeleTOP has found a place within the common practice of the instructor however. No instructors wanted to miss TeleTOP for their courses, four of them indicated that if so, they would build their own sites again.

TeleTOP was of influence for the change in the teaching approach for the instructors of the B and of the D quadrants (Table 105). These are also the most flexible instructors as indicated by Table 105, and from their comments in Section 6.7.5.2. It seems that TeleTOP is possible to support instructors that feel the need for change and to support them to a higher level of 2S-t-M flexibility, however, the way internal and human support relates to that is not clear.

6.7.5.5 FST use and experiences

Of the five instructors that could have used the FST, four (C1, D1, D2 & D3) did use the FST and made comments about it in the interview. All four did look at several of the examples and guidelines of the FST. Although three (D1, D2 & D3) said that the support was interesting (one said "*it is an interesting and bright new aspect in the design*" (D2)), none of these three instructors actually changed their approaches. One instructor indicated that "*for an experienced TeleTOP user with a clear model for the use of the system the support is only limited needed*" (C1) and "*the support is* *welcome however, and especially interesting for new instructors and instructors that set-up a new course*". And one said "*I find it useful, but probably because of my extensive own experience it is not valid for my own use*" (D1). Another said something similar: "*influence of this support is limited, also because I had a strong sense of what I wanted with the course, I copy my materials from last year course, so not much new design decisions are made*" (D2). So "*less experienced users could benefit from it*" (D1) and "*within a new or changed course didactic support would be higher valued*" (D2). An other instructor mentioned that "*it was valuable that examples were easily available"* (D3).

Instructors found that within a course if a changing pedagogy is needed, or if there are not-experienced instructors or a new course the FST could help, and would be of greater value. The instructors also were asked about the nature of the support. One though that "*examples should based on practices (of colleagues), to form and implement new teaching ideas*" (D3), as could be found in the FST. Another instructor thought that the technical "how to" support was more needed (D1).

From the interviews it seems that instructors feel that when they should have a more clear reason to change, the FST support could make a more clear difference. These and other results will be used in the conclusions from the interviews.

6.7.6 Conclusions from the interviews

In Section 6.7.5 the main findings of the interviews were summarized. Within the Sections that dealt with the flexibility (6.7.5.2), and the implementation (6.7.5.4) some interesting differences that related to the degree of flexibility within the course for the experimental or control group (Table 105) emerged. It is interesting to notice that the comments of the instructors showed that a number of the characteristics of the course (see Table 103) related to the degree of 2S-t-M flexibility. The class size (not too large), differences in students (more differences, higher need for options), and phase of the course (student within senior course get more options than students in first year courses) reflected some of the main outcomes as summarized in Table 103, and relate to a higher 2S-t-M flexibility. Also the three instructors from the department of Educational Science and Technology were in the group that provided most 2S-t-M flexibility, as also could be seen within their comments. The department therefore seems to be of influence. Those same instructors indicated that TeleTOP changed their teaching and made approaches more student-centered and flexible. They perceived a need to change, which probably is a difference with the other instructors from other departments. TeleTOP was found to be the tool that supported the three instructors from the department of Educational Science and Technology to realize and organize change.

For the questions about the goal (6.7.5.1) and the quality (6.7.5.3) of TeleTOP the categorization of instructors within the quadrants of Table 105 seemed of no real influence. The goal of why TeleTOP is being used throughout the university is not clearly communicated. Instructors do feel that TeleTOP is a strong supportive tool, but no straight-forward informed goal is known. The instructors experience TeleTOP in general as an easy-to-use tool which is (in general) of good quality. Still instructors experience problems within its use, where the problems with attachments were most often mentioned. There was no real difference between the high or low 2S-t-M groups of instructors.

The instructors that used the FST are positive about this kind of support, but in the analysis earlier in this chapter (Section 6.5.2.3) the conclusion was made that the FST did not make a significant difference in the increase of 2S-t-M flexibility as perceived by instructors. It would therefore be interesting to see whether the internal support could make a difference when the 'need for change' is more significant. Instructors themselves feel this could be the case, and those instructors that earlier felt that change was needed do provide most 2S-t-M flexibility at this moment.

6.8 Conclusions

The conclusions form this chapter can be given for the third research questions as given in Section 1.2, repeated in Table 107.

Table 107. Research questions and main conclusions for Chapter 6.

Research question:	Conclusions
3. How can an instructor be helped to choose a blend of Web-based course tools to achieve the flexibility targets for a given course? How can this approach be implemented in a support system?	Performance support can be integrated within a CMS, instructors do use it.
	An integrated Web-based decision and performance support system (EPSS) does not have a significant effect on the increase of flexibility for instructors.
	Important factors that relate to (the degree or increase of) flexibility also relate to instructors and course characteristics, the 'environment'.

In terms of this main theme:

Performance support can be integrated within a CMS, instructors do use it.
The FST tool was used by most instructors in the experimental group. Instructors in the experimental group showed an increase in the CMS use in 11 of the types of options selected within the TeleTOP menu. Three options were significantly more chosen in 2002/3 than in 2001/2. For the control group there was only one option that increased in choice, the increase was not significant. The use of options between the control and the experimental group did significantly differ for one of the four CMS categories, also in favour of the experimental group. The instructors within the experimental group that used the FST appreciate the support within TeleTOP higher than the instructors within the control group that had a different version of this support, however this difference was not significant.

From the interviews it became clear that instructors in the experimental group had used the tool to a certain extent and were positive about the support it provided. They did however not feel a direct need for the kind of support offered. The role of the FST could very well be important to change instructors' opinions about TeleTOP, and show them how TeleTOP can relate to more flexibility when a need to change is present. From the interviews it became clear the instructors cannot change easily just because of better internal support. Support would be more likely to make an impact when the support was offered when the 'need for change' was clearer. Also here the need for more clear communication (a goal) could help instructors to understand more clearly how TeleTOP could assist them in a changing (university) world with increasingly diverse students.

An integrated Web-based decision and performance support system (EPSS) does not have a significant effect on the increase within flexibility for instructors.
Despite the care put into the design of the FST, its use did not lead to a significant overall increase in flexibility. This is the major, and disappointing, result of the FST experiment. In order to understand why this expected impact did not occur, regression analyses and interviews were used for further insights. Emerging from these, other 'independent variables' seem of bigger influence to the degree of 2S-t-M than the FST.

Important factors that relate to (the degree or increase of) flexibility also relate to instructors and course characteristics and the 'environment'.
The 2S-t-M flexibility depends on variables that relate to the characteristics of courses and of the instructors. There are differences between the planning and the interpersonal flexibility, as only for planning flexibility were significant relations found. The number of courses per year relates to the degree of 2S-t-M flexibility, which was also recognized within the interviews: less courses means more flexibility For the course characteristics it was found that courses with fewer students are likely to show higher levels of planning S-t-M flexibility. Lower amounts of teaching experience of instructors also relate to higher planning S-t-M flexibility

The instructors from the Department of Educational Science and Technology provide the highest levels of planning 2S-t-M flexibility, as the need for this is more present for them compared to other departments as there are more life-long learning students. Interpersonal flexibility does not per se relate to the amount of life-long learning students but on having a stimulus for a pedagogical, interpersonal change in teaching approach. This apparently is missing in all of the departments

Further reflection occurs in Chapter 7.

7 CONCLUSIONS AND DISCUSSION

This final chapter will draw together the main conclusions of this research for discussion and reflection. Again, the development research approach of Reeves (2000) can be used to visualize this step, see Figure 64.

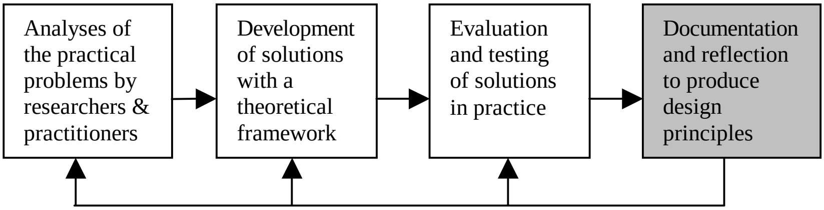


Figure 64. Development research approach (Reeves, 2000, p. 25).

This dissertation started with an analysis of practical problems related to flexibility and the changing university, as described in Chapters 2 and 4. In Chapter 3 a theoretical framework for flexibility was developed, which was validated in terms of recognizability and use (also in Section 4.5). In Chapter 5 the methodology for development research (Reeves, 2000) was used for the FST development, and in the previous chapter (6) the experiment with the FST was described; the *evaluation and testing of solutions in practice* (Box 3). Chapter 7 will be used for the *documentation and reflection to produce design principles* (Box 4), where design should be seen in a broad sense, focusing on the design of a new and improved flexible-learning setting within higher education.

This chapter will start with the summary of the main findings organized around the research questions (Section 7.1). Then an interpretation of the research in its context (Section 7.2) and an interpretation of the research with the 4-E Model (Section 7.3) will be given. The implications for the use of the 2S-t-M flexibility framework in practice will be discussed in Section 7.4, and in Section 7.5 suggestions about new variables within the 2S-t-M flexibility framework will be discussed. This chapter will conclude with a future outlook and some suggestions for further research (Section 7.6).

7.1 Summary of the Main Findings

This research was focused on identifying a framework for flexibility and applying it in practice. In an experiment the way internal performance support offered through the course-management system (CMS) could support instructors in offering more flexibility through better CMS use was studied. An extensive summary of the whole research is in the Summary section of the dissertation. The summary of the main findings will be given here in terms of reflections on the research questions. The main questions for this dissertation were presented in Chapter 1. The questions were:

1. What are key types of flexibility involving Web-supported learning in higher education and what framework best expresses these in terms of course design?

2. What combinations of Web-based tools, functionalities, and systems coupled with what instructional strategies best support these types of flexibility in course design?

3. How can an instructor be helped to choose a blend of Web-based course tools to achieve the flexibility targets for a given course? How can this approach be implemented in a support system?

Research Question 1

Flexibility was first in general (Chapter 2) and then more specifically (Chapter 3) defined. It was found that a Stretching the Mold Model can serve as a key scenario for most traditional higher-educational institutions. In Chapter 3 a framework that showed two types of flexibility was defined and validated through an international study. The nine flexibility types within the two dimensions are given in Table 108.

Table 108. 2S-t-M flexibility dimensions.

Planning flexibility:
Times for starting and finishing a course
Times for submitting assignments and interacting within the course
Topics of the course
Orientation of the course (theoretical, practical)
Assessment standards and completion requirements
Assignments required for the course
Interpersonal flexibility:
Ways in which the course is experienced (group/individual; sessions)
Language to be used during the course
Types and sources of learning resources

Instructors recognized the dimensions, and in general they indicated they expected increase of flexibility in both dimension within five years. The flexibility framework was called the 2S-t-M framework, representing the planning and the interpersonal types of feedback within the framework. It became clear that both flexibility types have their own scope and approach. Planning flexibility focuses more on the flexibility that offers options for both on- and off- campus students primarily with regards to time, whereas interpersonal flexibility implies a new pedagogy in which students are encouraged to contribute to courses based on their own experience, needs, and settings. In Chapter 3 it was shown that the 2S-t-M flexibility types could be used in the course design when a CMS was used for a course. Chapter 4 (Section 4.7) also gave examples of how the 2S-t-M flexibility types were implemented within a particular CMS, the TeleTOP CMS.

Research Question 2

This research question dealt with Web-based tools, functionalities, and systems for Web-supported learning. In Chapter 2 course-management systems (CMSs) were found to be supportive in the creation of information/educational content, the delivery of information/educational content, for communication, and for course organization, all of which can be related to flexibility. CMSs, if appropriately designed, are very flexible for educational use and good tools within a "Stretching-the-Mold' scenario. The new pedagogies that seem to be particularly appropriate for Web-supported learning were authentic task-based learning, active learning, discussion-based learning, and collaborative learning (See Section 2.2); all of these could be related to interpersonal flexibility.

Research Question 3

In Chapter 2 it was shown that support available to instructors for CMS use seems generally limited to technical aspects, whereas instructors do feel a need for more instructional support. However, human support is time consuming and expensive. In Chapter 2 the needs and concerns of instructors were summarized. The problems that were found in Chapter 2 could also be recognized within the experiences within one higher-education institution, the University of Twente. Chapter 4 describes the TeleTOP CMS and experiences in that institution. Based on earlier experiences with integrated support a new support option was discussed: Performance support integrated in the CMS itself. This relates to the last research question that dealt with how an instructor can be helped to choose a blend of tools and options within the CMS to achieve flexibility targets for a given course. In Chapter 5 therefore a new performance-support tool that focused on the 2S-t-M flexibility options was described, created, and formatively evaluated. The tool was called the Flexibility Support Tool (FST). In Chapter 6 the effect of the FST was tested through an experiment with an experimental and a control group. Instructors that used the FST did chose more TeleTOP options within their TeleTOP course environment. The experiment however showed that the degree of 2S-t-M flexibility that an instructor provides within a course does not significantly increase within one year of FST use.

In the analyses and interviews that followed this experiment it became clear that the instructors and course and department characteristics also play a very important role in the degree in which instructors provide 2S-t-M flexibility.

The next section will elaborate on these findings and implications.

7.2 Interpreting the Research in its Context

This research focused on flexibility as a main and emerging concept within higher education on one hand, and the more practical support of instructors within this process on the other. In this section some theoretical and methodological considerations will be discussed.

- Stretching the Mold Scenario: There are many dimensions in flexibility of which a number have been discussed within this dissertation. In Chapter 2 there first was a discussion about flexible scenarios within higher education. The choice was made to focus on a particular scenario, that of “Stretching the Mold”, in which the campus and the university campus in the local setting stayed central, and flexibility was provided in means of options within these settings for students, primarily regular students but also new groups of students such as life-long learners and working people. Other types of flexible scenarios in which the student could be anywhere and still follow a set program (the Global Campus scenario), or even define their own learning in a very flexible way when and wherever they would like (the New Economy scenario) were not chosen as the main focus of this research, as argued in Section 2.1. However, these scenarios are valid for higher education as well, and are being recognized and adapted within higher education according to data in the international survey, but not yet as recognizable as Stretching the Mold (Section 2.1). The focus of this research therefore is limited to the more-or-less traditional universities that start with “stretching”, which in the end can be followed by the other scenarios. The “Stretching the Mold” scenario is seen as a logical and recognizable starting point for universities, but as said may not be valid for the whole higher-education field.

- Expressing the flexibility dimensions: Another line of discussion about flexibility in Chapter 3 had more of a practical character. The way instructors could look at flexibility within a Stretching-the-Mold setting was analyzed. The flexibility dimensions that were derived from that analysis were subsequently used within the international ICT survey (Collis & Van der Wende, 2002). A number of choices for variables related to flexibility based on literature reviews were made within this process, but the number of flexibility dimensions could also have become less or more depending on different interpretations from this analysis. In this research the two flexibility dimensions, called here Planning and Interpersonal, were primarily based on the survey results which in turn were based on a particular set of questions from the literature review. Different questions might have led to different dimensions. However the 2S-t-M dimensions have different scopes and implications, and can be recognized by instructors in practice (Section 3.3.1) and thus seem justified as a set for further analysis. Section 7.5 will further reflect on this.

- Focus: Another constraint of the research was its focus on instructors. The main target group within this research was instructors within higher education. What types of flexibility higher-education students themselves feel they need and how they deal with flexibility was not directly studied. The exploration of how students think about the types of flexibility would have been an interesting addition to this research, however this was beyond the scope and means available.

- Experimental sample and CMS used: For the experiment an experimental and a control group were formed. It would have increased the generalizebility of the research to have an even larger number of departments and instructors with their courses, however the number of instructors that now participated within this experiment is still a good sample for the whole university. However, a large sample would be valuable when the results of the experiment are to be generalized to other higher-education institutions.

- The general conclusions that were based on the TeleTOP CMS with the built-in Decision Support Tool (DST) and Flexibility Support Tool (FST), whereas there are a large number of other CMSs that other institutions use. None however appear to have integrated support tools; this too limits the generalizability.

Given these limitations the results of the research still can be useful, conceptually and practically, beyond the setting of the University of Twente. In the following section, the 4-E Model, introduced in Section 2.4, is used as a way to make this extension.

7.3 Interpreting the Research with the 4-E Model

Within this research the way instructors used ICT, and more particular CMSs, had a central place. In higher education CMSs have been implemented rather quickly in the past few years. At the same time higher education is changing. The variety of students that want to get degrees or want to follow only particular programs or courses is increasing. CMSs offer great opportunities to help instructors to deal with these new cohorts of students that do not only come from high school, but also from a professional environment, or from abroad. The characteristics of the students differ not only in background knowledge or motivation, but also can differ in the locations where they take the course. Blended-learning approaches within a ‘stretching the mold' scenario can be seen as useful strategies within higher education to offer more flexibility and options to students.

But, whereas the possibilities within CMSs are increasing and student populations and needs are changing, the flexibility that is offered seems to be limited to 'some options'. Collis and Van der Wende (2002) among others conclude that changes in teaching and learning with ICT use in higher education are still very modest. Important findings in the research were that CMSs are present but in general used in a limited way. The full range of options is not being used, as was concluded in Chapter 2 (Sections 2.2 and 2.3). Also for the University of Twente, with the TeleTOP CMS it was shown in Chapter 4 (Section 4.5) that use and flexibility were limited. How come? Do instructors not get enough support, and are they not familiar with the options in ICT? Within this research it became clear that support is not the only aspect that has an influence on the use of CMSs and options that instructors provide in their courses. Already in Chapter 2 it was discussed that there is more than support needed for good implementation of educational changes. Could it be that there is a problem within the 'environment', one of the 4-E's (Collis, Peters, & Pals, 2000) that relates to a limited use? A clear need as perceived by the instructors is essential and relates to both the "Environment" and Effectiveness" vectors of the 4-E Model. From the interviews that were held (Section 6.7) it became clear that every instructor at the University of Twente has his or her own ideas about the use of a CMS, and no clearly communicated goal from a higher level was known. Would this be one of the problems? In Chapter 6 it also became clear that some instructors did perceive a need from their students to make their teaching more student centered. These instructors provided the most flexibility within their courses, and all were in the Department of Educational Science and Technology, where at least three different cohorts of students can be in the same course. Here also the need for flexibility was more clear and present.

With the use of the 4-E model (Collis, Peters, & Pals, 2000), the situation for the Department of Educational Science and Technology can be drawn as it was in 1998, when an important group of new students were integrated within the educational program.

Figure 65 shows how the environment was creating good possibilities for the instructors at the department to use TeleTOP as a tool to deal with the new groups of students. The environment vector can be expressed as relatively close to the baseline because of the policy of the Department to allow new students that would continue their work, and thus would have to follow parts of the program from a distance. Every instructor had to respond to this clear goal.

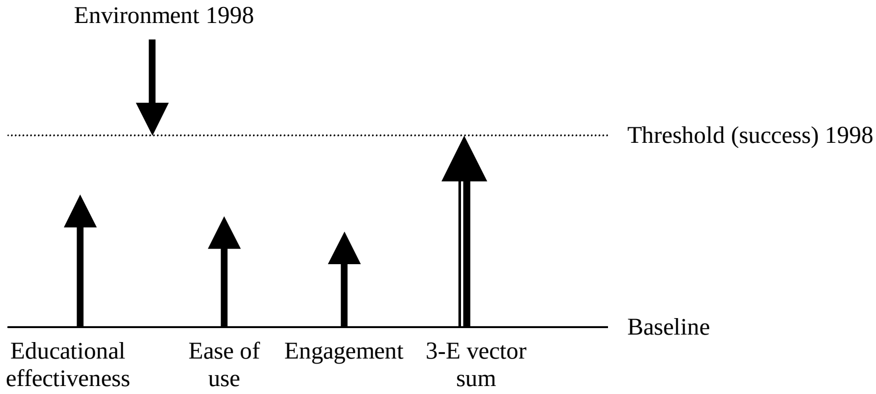


Figure 65. 4-E Model for the start of TeleTOP at the Department of Educational Science and Technology in 1998.

The 3-E vector sum that (conceptually) adds up the vectors related to educational effectiveness, the ease of use, and the personal engagement reaches beyond the threshold that determines the success of the innovation, thus the use of TeleTOP, to make learning more flexible. Contradicting this is the current situation at the University of Twente. Figure 66 shows how the environment in the University is not as optimal now as it has been in the Department of Educational Science and Technology earlier, so that the 3-E vector sum does not reach the threshold anymore.

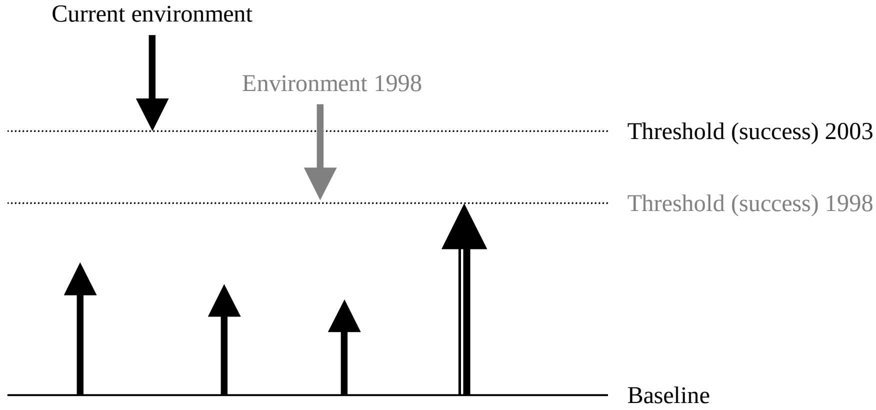


Figure 66. 4-E Model for TeleTOP at the UT in 2003 compared to 1998.

The main difference between the situation in Figure 65 and Figure 66 is that the environmental factor for the UT is, compared to that of the Department of Educational Science and Technology in 1998, much less close to the baseline in that no goal or intention is stated that involves the use of the CMS. When the goal and the need are not clear, the success of the innovation is not likely to be derived by only increasing the ease of use, or by extra demonstration of the educational effectiveness, the main items the FST focused upon. There also needs to be an environment that will “bump the threshold on the head” of instructors (freely quoted from Pals in internal conversations, 2001). This “bumping” will occur (again) when instructors not only in an abstract way recognize the need for flexibility, but are made aware of a present change in their own higher-education situation and how it will influence their particular daily teaching. For example, one instructor in the interviews (described in Section 6.7) said that different programs for three different sorts of cohorts were not possible anymore because of high costs, and that the instructor would have to start teaching these students through one course from next year on, so a real need has originated for him.

7.4 Implications for the use of the 2S-t-M Flexibility Dimensions

The 2S-t-M flexibility types differ from each other, and this needs to be taken in account in application of the research. A higher-education institution can choose to focus upon the planning type of flexibility. This implies more-or less the same teaching and learning program within a course, but more flexibility in terms of time and place. When interpersonal flexibility is also adapted, this implies more student options and contributions that relate to the goals and input of students. It is probably harder to make this change to interpersonal flexibility, because instructors need to rethink their courses in terms of the activities within the course.

When the environment is able to change, and the university is ready to welcome flexible students in a more-flexible environment, the results that relate to the degree of flexibility that were derived from this research should be taken into account. Chapter 6 concluded that there are many factors that have an influence on the degree of 2S-t-M flexibility. The course and instructors’ characteristics are of influence on the degree of flexibility instructors provide, but with differences between the planning and interpersonal flexibility for the course characteristics, as was confirmed within the interviews, described in Section 6.7. Amongst others class size and group composition have a relation with planning flexibility. Instructor characteristics such as the number of courses an instructor has during one year have a negative influence on the amount of planning 2S-t-M flexibility, and also instructors that have a lot of teaching experience cannot easily change.

Support for instructors therefore is very important. This research showed several times that support can and needs to be improved. Once a clear goal from the management is communicated, the means to support instructors should not only be focused on the start period of an innovation, and disappear after some years. Support needs to be near to help instructors with more-complicated instructional problems over time. In the interviews a few instructors indicated sometimes to want to do something new within TeleTOP, but the human support available was not satisfying, and thus then ideas were not followed up. This is not a good environment to innovate and to get an increase in use and 2S-t-M flexibility with instructors. On one hand they should work within an institutional environment that is encouraging them to try new ideas and respond to the needs of their students, on the other hand the institutional environment should be able to respond quickly to the needs and questions of instructors. Therefore the FST probably should be a part of a larger picture and a new situation.

7.5 Reflection to the S-t-M Framework

The Stretching the Mold Model was introduced and used as the most important scenario for flexibility and flexibility support within this research. Within this scenario for higher education nine practical dimensions were organized around the two categories of stretching the mold flexibility, the 2S-t-M flexibility framework. From the international survey data (see Collis & Van der Wende, 2002) and within this research it became clear that instructors are showing a gradual change towards providing more flexibility. However, it could very well be that the limited or non-occurring results relevant to the effect of the FST could be explained by limitations in the set of nine variables that were used for the 2S-t-M dimensions. Maybe there is a need for different variables to express and measure the two dimensions, as the changes that were measured within the experimental group were very limited and did not really differ from the changes in the degree of 2S-t-M within the control group. Especially, there is a need for an adapted set of variables to measure the interpersonal 2S-t-M category, as it was especially hard to measure with the three variables in the interpersonal category.

It became clear that the interpersonal dimension was related to a stretch of course flexibility in which students could have more possibilities to contribute and actively learn. Section 2.2.1 summarized that a blend of traditional teaching delivery and the use of Web technology, as well as a blend between traditional teaching pedagogies and new pedagogies, would integrate the best of two worlds. The new pedagogies that seem to be particularly appropriate for Web-supported learning in this context include authentic task-based learning, active learning, discussion-based learning, and collaborative learning. Perhaps these key pedagogies should be integrated within the dimensions of the interpersonal 2S-t-M framework, in order to get better insight within this dimension? Table 108 gives suggestions for new variables for the pedagogical dimension.

Table 109. New suggestions for the interpersonal pedagogical dimension.

Ways in which the course is experienced (group/individual; sessions) *
Language to be used during the course*
Focus on activities rather than content
Learning by doing
Focus on task-based and authentic activities
Focus on group-based activities and collaborative learning
Variety of resources to reflect individual differences
Resources contributed by learners themselves

* *As used in the 2S-t-M Model.*

These new variables within the interpersonal category could be used in further research. It would be useful to build upon the results of this research and see if and how instructors recognize these new variables.

7.6 Future Outlook and Further Research

In this research the broad definition of ICT was focused on the use of CMSs in education. However, there are important developments within this field. Strijker (2003) for example looks at more systematic reuse of content and the exchange of content and meaningful structures between different CMSs related to rapid advances in metatagging and system technology. Furthermore the possibilities for Internet and therefore for CMSs are continually increasing. For one thing bandwidth increases every year, more people are connected, and computer power also increases. Most CMS companies bring out new versions of their systems that can be connected through middleware or other techniques with other educational databases (at the University of Twente there are over 20). The functionalities in these new versions also are evolving. There are more-advanced tools for communication, conferencing tools with the use of whiteboards, desktop sharing, and new features for video and audio communication. Also advanced testing tools, digital portfolios, and project environments (all related to education) are being connected or integrated within the CMS. On the other hand the ‘student’ will change, as was discussed within this research. The groups of students that instructors have to deal with will become more diverse in terms of background, location, motivation, goals, and time.

Thus the number of options and decisions for an instructor will increase, and the overview will stay a problem. One way to deal with this is specialization, where instructors only are responsible for a part of the technology used. However, instructors still should be the ones that make the pedagogical decisions. And when these instructors do not have a clear sense of control within an environment, they are less motivated to work with, or invest effort in the system. Therefore support will stay very important, and its value might become even more important as the CMS (or the ICT environment) expands and becomes more complicated. It will be easier for instructors when there is a helping hand. This help should preferably be based on certain proven pedagogical models that instructors themselves would recognize.

This was for TeleTOP always a starting point, as well for the DST and FST. When new advanced tools are being offered to instructors, the instructor should be able to make a quick estimation of what they offer, how they should be used, and what benefits there will be. Otherwise new beautiful ideas could be thrown over the fence and never be used at all, as instructors would not see their proposed value.

Based on the 2S-t-M and flexibility research and the new developments that build upon it, the main follow-up questions for further research should focus upon the rationale for using CMSs within higher education. Within this research the clear rationale was flexibility. The area of flexibility in learning and teaching is still rather new. Further research on models of flexibility (as discussed in Sections 7.4 and 7.5) and the way students deal with them will increase knowledge about them, and help make better models. It would be interesting to relate the way instructors perceive flexibility with the way students perceive flexibility within a Stretching the Mold setting, or within the other scenarios of higher education.

The problem of the instructor within higher-education institutes is that (s)he has a lot to do, has a lot of responsibilities, and no time to change. We have to be careful with these important people, and help them as much as possible. How this ‘picture of best support’ needs to be drawn will stay a topic of research, within the rapidly changing technological environment of ICT and CMSs, in which integrated performance support and human support probably both will have an important role.

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SUMMARY

The research project Flexibility Support for a Changing University focused on the problem of how to identify underlying dimensions for change in higher education and how to help instructors via their use of technology for teaching and learning to respond to the change. Using a design-experiment approach to the research (Reeves, 2000), a set of scenarios for flexibility in higher education (Back to the Basics, the Global Campus, Stretching the Mold, and the New Economy) based on the literature and previous research was described, and validated through an analysis of responses to an international survey. Stretching the Mold was shown to be the scenario that was perceived as most likely to become realized in the period 2000-2005. From this, two dimensions of flexibility associated with a "Stretching the Mold" evolution in higher education were identified and indicated as appropriate to use with instructors to lead to more systematic provision of flexibility in their instructional practice. Technology, particularly course-management systems, were shown to be important for operationalizing these two dimensions, but for this to happen, instructors need support. The provision of electronic performance support integrated directly within the CMS was identified as a valuable strategy. Parallel with the literature and survey analyses, design experiments at the University of Twente took place in the context of the development and four years of use of the TeleTOP CMS, with two evolutions of integrated electronic performance-support tools, and a series of investigations of user actions and reactions. As a step forward towards more flexibility in courses, a third integrated performance support tool called the Flexibility Support Tool (FST) and also part of the TeleTOP CMS, was designed and developed to reflect the two flexibility dimensions associated with Stretching the Mold that were identified and validated earlier in the research. The FST was used in an experiment in which 58 instructors from four departments of the university, all of whom were teaching a course supported by TeleTOP two times over a two-year period, were randomly divided into a group that used the previous integrated performance support tool and a group that used the new FST to set up the second cycle of their courses. However, despite the fact that the instructors were positive about the potential value of the FST, a comparison of the second cycle of courses of the two groups showed little difference in terms of increased flexibility when the experimental group using the FST was compared to the control group using the previous decision-support tool for course set up. Interviews followed to gain insight into this result, with the conclusion emerging that unless there is institutional pressure and incentive to change one's teaching approach, for example to systematically offer more flexibility, instructors do not have the time or motivation to change their teaching practices. Also when flexibility does occur, it is more likely to be related to the logistical planning dimensions that the pedagogical interpersonal dimension. Each of these aspects is more fully described in this summary.

The Context of Change in Higher Education

The field of higher education is rapidly changing in terms of the use of information and communication technology (ICT) and in new cohorts of students. Traditional and distance universities are in the process of providing quality education for rapidly diversifying student cohorts (Middlehurst, 2003, WRR, 2002; Observatory of Borderless Education, 2002). This change process is multi-faceted: broader and more diverse students, changing roles of instructors, more-flexible curricula, new delivery methods, new contacts between universities and other partners, and the globalization of higher education (Guri-Rosenblit, 1998). Bates (2001) argues that a mix of on-campus and flexible learning is an ideal mode of delivery for many of the new types of learners. He estimates that the lifelong learning market for formal university and college courses in knowledge-based economies is at least as great as the market for students leaving high school.

There have been many studies of how and why higher-education institutions are reacting to these changes and new types of students. One such study was an international comparative study (Collis &Van der Wende, 2002) in which the major conclusions were that (a) change is occurring although slowly; (b) technology, particularly course-management systems (CMSs) are in common use as part of campus-based settings as well as to support students who are off campus; and (c) that instructors have more work because of this technology but in general without extra support or incentives. An important conclusion of the Collis and Van der Wende research, as well as studies before it, was that four key scenarios for change could be identified, but that one of them, a "Stretching-the-Mold" model, was found to show the strongest prediction of growth over the next five years. In this model, institutions still emphasize the campus setting with face-to-face contact and the traditional (18-24 year old) student groups. However, gradually more and more new types of students such as international students and lifelong learners are part of the scene, and gradually more and more flexibility is being offered to students in the ways that they can attend courses and interact within courses. "Stretching" in one way means that borders become less important and education can be taken (partially) from a distance; this is a logistical stretch that can be planned ahead of time. "Stretching" within the campus situation means that traditional courses will stay campus-based within higher education, but through pedagogical stretching the student can have more options to define his own ways and paths through and within programs and courses. Thus "stretching" can also mean gradually offering more pedagogical and interpersonal options, even if students are campus-based. Figure 1 shows the Stretching the Mold (S-t-M) scenario in terms of two main dimensions for change in higher education, with the S-t-M scenario highlighted.

Scenarios of the future in which flexible learning will be part of a setting …

	Where local and face-to-face transactions are highly valued	*Where global and network-mediated transactions are the norm*
In which the institution offers a program and ensures its quality	**Scenario A** Quality control of a cohesive curriculum, experienced in the local setting (current situation) ***Back to the basics***	**Scenario B** Quality control of a cohesive local curriculum, available globally: ***The Global Campus***
In which the learner chooses what he wants and thus takes more responsibility for quality assurance	**Scenario C** Individualization in the local institution: ***Stretching the Mold***	**Scenario D** Individualization and globalization ***The New Economy***

Figure 1. Four scenarios for educational delivery (Collis & Moonen, 2001, p. 199).

Change in higher education also relates to technology. A type of technology system now familiar in higher education is the course management system. Course-management systems (CMSs) are Web-based database-driven systems that enable or support learning. The tools within a CMS can be used for the creation of information/ educational content, the delivery of information/educational content, for communication, and for course organization. These options within CMSs should be clear for a user, fit within his or her educational practices, and should be easy to use. Learning to work with the CMS should not take instructors much time, and the system should be easy to integrate into existing courses. It is important that the system can adapt to the way that an individual instructor wants to work, even as the instructor too will need to make some adaptation in his or her typical teaching practices as he or she comes to make use of the CMS. CMSs in general are flexible for educational use and therefore good tools for a "Stretching-the-Mold’ scenario.

When attempting to design courses for the “Stretch the Mold” model it should be noted that the instructor-rooted classroom-orientation model (Gustafson & Branch, 1997, p. 30) is currently the dominant approach to course design and delivery within higher education. The instructor as content expert fully responsible for the course can mentor, stimulate, scaffold, and personally interact with his or her students so that the course is much more than a systemic way to meet pre-defined objectives but also can be a framework for an apprenticeship-type mentoring relationship between instructor and learner (Sfard, 1998). Instructors can also monitor and adapt during the instruction; tasks that are often difficult to accomplish with technology based instruction. Pedagogy options and approaches can be identified that seem well suited for the use of CMSs for stretching the mold, such as authentic task-based learning or problem-based learning, discussion-based learning, active learning, and group-based (problem) learning.

Instructors need to be supported in such a way that they have sufficient technical skills and that there is a fit with their educational practices. There are different sorts of support that can be structured around different dimensions, in particular: direct fit vs. structured support and human vs. computer support. These dimensions distinguish four main types of support: workshops, personalized help, Web-based support, and integrated support. However, the general opinion of instructors with regard to how support is provided to them and the experiences they have had with the support is not high. Instructors notice a lack of direction, resources, knowledge, and tools within the support. They have a general feeling that they are responsible for providing their own support, although they not really complaining about it (Gervedink Nijhuis, 2002).

Instructors have all sorts of problems with regards to the use of CMSs in their courses. Pedagogy support is often not provided nor conveniently available. In order to make a significant step forward to a Stretching-the-Mold Model in higher education, integrated and timely support should increase. An emphasis on the types of pedagogy that are available, their relationship to flexibility, and how instructors can use the technologies and pedagogies in their educational practices could improve support. A way to serve a significant number of instructors in a very flexible and not-expensive way is through integrated decision and performance support within the CMS.

Flexibility in Higher Education: a Framework

Whereas the instructor could "stretch the mold" and use a CMS in his daily practices, the forms of flexibility that can be given and supported through these systems and related new pedagogies are still unfamiliar and how to systematically operationalize them is not well understood; (Collis & Moonen, 2001; De Boer & Collis, 2003). It is therefore important to analyze the concept of flexibility as it relates to a stretching-the-mold evolution in order to guide subsequent choices about options for students and better assess the progress of an institution in terms of offering flexibility in learning. While institutions can make system-wide decisions about flexibility in admission and program requirements, the individual instructor is the key player in offering flexibility within the course itself.

Many researchers have focused on dimensions within flexible learning (Carleer & Collis, 1998; Collis, Vingerhoets & Moonen, 1996; Ling, Arger, Smallwood, Toomey, Kirkpatrick & Barnard, 2001; Moran & Myringer, 1999; Van den Brande, 1993; Sachsse, 1994; Zimitat, 2002). Although instructors may not use the term flexibility as to describe their instructional practices (Ling, Arger, Smallwood, Toomey, Kirkpatrick & Barnard, 2001), within the literature there is some consensus about what flexibility implies. From an analysis of literature such as just noted, main dimensions within flexibility can be seen as:

- Flexibility related to time
- Flexibility related to content
- Flexibility related to instructional approach (pedagogy and resources)

Analyzing these more closely, nine flexibility indicators, organized around the categories related to time, content, and instructional approach were extracted, as shown in Table 1.

Table 1. Instructor choices in flexibility, grouped according to three main categories.

1 Flexibility related to time:
Times (for starting and finishing a course)
Times for submitting assignments and interacting within the course
2 Flexibility related to content:
Topics of the course
Orientation of the course (theoretical, practical)
Assessment standards and completion requirements
3: Flexibility related to instructional approach and resources:
Ways in which the course is experienced (face-to-face; group, individual, combinations)
Language to be used during the course
Learning resources (Modality, origin (instructor, learners, library, WWW), etc)
Assignments required for the course

The international survey related to models of change in higher-education (Collis & Van der Wende, 2002) that demonstrated the Stretching-the-Mold evolution also asked respondents a number of questions relating to their practices in terms of these nine flexibility indicators. The sample consisted of 347 higher-education instructors from nine western counties. (The survey also involved decision makers and support staff, thus a total sample of 697 respondents). For each of the nine items in Table 1, instructors were first asked “To what extent do you currently offer options relating to each of the following to students in your own courses?” and then secondly they were asked to predict the extent to which they would offer the options in the future. Response options varied between (1) no- to (3) some- to (5) extensive flexibility. The results showed that seven of the nine responses were within one standard deviation of the response of (3) “Some flexibility”. Further analyses showed that now and in the future the most flexibility could be found within the options relating to learning resources (See Table 1). Six of the flexibility indicators are expected to significantly increase. Significant decreases were expected however, for the topics of the course and the modalities and origin of learning resources. To interpret this, it may be that instructions and students are now making heavy use of the World Wide Web to locate additional learning resources, but perhaps the instructors feel that this tendency will stabilize once its novelty value wears out.

Thus, the data relating to the nine indicators also show that there is a start toward stretching the mold within course flexibility. In this context, the original nine flexibility dimensions can be said to be recognizable in practice. However, to serve as a tool for decision making and quality/progress assessment, it is desirable to see if the dimensions should continue to be grouped as suggested in Table 1, or if they can even be reduced to a smaller set of components. To examine this, a principle components analysis was carried out on the responses to the nine items, using Varimax rotation with Kaiser normalization, converging after nine iterations.

Two factors with eigenvalues greater than 1.00 were retained for interpretation. The two factors explain 45,95% of the variance. Table 2 shows the loadings of the nine flexibility-dimension variables on the two retained factors. The loadings in bold indicate the factor related to each variable for subsequent interpretation. For convenience, loadings less than 0.200 are not shown.

Table 2. Rotated component matrix.

Flexibility dimensions	Factors, eigenvalues, and per-centage of variance accounted for	
	Factor 1, eigenvalue = 3.085, 34.28%	Factor 2, eigenvalue = 1.051, 11.67%
Times for starting and finishing a course	**.326**	.263
Times for submitting assignments and interacting within the course	**.601**	
Topics of the course	**.686**	
Orientation of the course (theoretical, practical)	**.775**	
Assessment standards and completion requirements	**.695**	.204
Assignments required for the course	**.633**	.252
Modality and origin of learning resources (instructor, learners, library, WWW)	.350	**.544**
Ways in which the course is experienced	.275	**.578**
Language to be used during the course		**.816**

Factor 1 relates strongly to five variables all involved with the decisions the instructor makes in setting up a course. What topics will be chosen? Will the orientation be theoretical or practical? What assignments will be carried out, when must they be completed, and how will they be assessed? What needs to occur in order to complete the course? Together, these relate to the “course planning” of the course. For each of these, it is possible to offer some degree of flexibility to the learners. This factor relates to stretching the course logistically, as flexibility can be planned beforehand in terms of options within the course.

Factor 2 relates most closely to the learning setting as experienced within the course: What learning resources are used and to what extent they obtained from the students themselves? How do the learners in terms of group or individual or combinations experience the course? This factor most relates to flexibility for students in an interpersonal way, and stretches the pedagogical experience of the course.

Thus from the factor analysis it seems that from the nine tested dimensions of flexibility as identified in the literature, two important dimensions are seen by the instructor as most recognizable. The dimensions also relate to two different aspects of stretching the mold. The new two-dimensional framework with associated items is shown in Table 3.

Table 3. New flexibility framework for stretching the mold, instructor's perspective.

Factor 1	**Organizational flexibility**
	Times for starting and finishing a course
	Times for submitting assignments and interacting within the course
	Topics of the course
	Orientation of the course (theoretical, practical)
	Assessment standards and completion requirements
	Assignments required for the course
Factor 2	**Interpersonal flexibility**
	Ways in which the course is experienced (group/individual; sessions)
	Language to be used during the course
	Modality and origin of learning resources: (instructor, learners, library, WWW)

These two factors together can be seen as forming a "flexibility framework" that can be used as a guide for instructors for stretching the mold in two main directions. For each of these, flexibility options can range from none (all students treated the same) to some (ad hoc responses to individual students' requests) to substantial (all students offered at least two options). Even offering some (ad hoc) options can lead to a stretching-the-mold effect. The two ways flexibility can be given lead to a new name for the Stretching-the-Mold type of education. A new name that includes the two types of flexibility could be "2 X Stretching the Mold", or shortened: 2S-t-M. The planning dimension of flexibility may be seen as relating more to demands from students for logistic options, as variables such as "increase in numbers of lifelong learner" were seen (using regression analyses) as significant, positive predictors of planning flexibility. The interpersonal flexibility however was related more to a focus on the traditional target group of on-campus students. Again, it seems that the planning flexibility dimension is more for new-target groups, but with the same content of teaching while the interpersonal dimension is for something new in terms of pedagogy with existing campus groups. Figure 2 shows how these two could be visualized within the university-change scenarios.

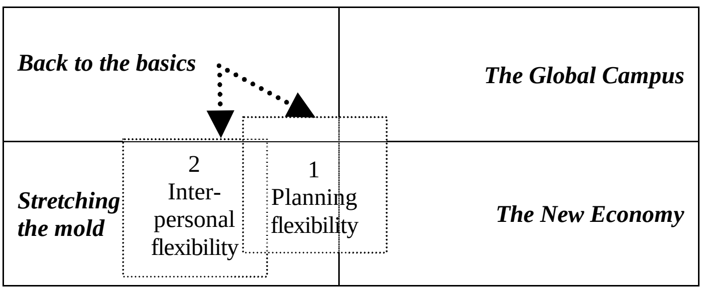


Figure 2. 2S-t-M dimensions within Stretching the Mold

The figure demonstrates how instructors deal with flexibility. The planning flexibility relates to students, within a Stretching the Mold setting, gaining more flexibility towards time and activities. Within the interpersonal 2S-t-M dimensions, a new ‘pedagogy’ emerges that places the student more central in terms of activities. This flexibility within a Stretching the Mold setting is not provided because of international or life-long learning students, but within the known face-to-face campus setting.

There are a number of pedagogies and associated uses of a CMS that are related to the extent of flexibility within a course. The extent of 2S-t-M flexibility is also related to the sorts of students that take a course and to support available. Instructors learn the most about planning flexibility from examples of courses that are on the Web, whereas for interpersonal flexibility support this as well as other types of support have not had any significant influence. Support for the use of tools probably still needs to be defined in order to increase the level of interpersonal flexibility through CMS use. The CMS can be seen as an integrated environment that can be used to support flexibility making use of the options in pedagogy. The 2S-t-M flexibility framework can be used to measure instructor-offered flexibility, but also to organize examples of these types of flexibility within a CMS in order to let instructors learn from these options and relate them to their own contexts.

Preliminary Field Research

Iteratively with the literature research and survey analysis reported above, four years of design processes and user experiences took place at the University of Twente. The introduction of a CMS in the daily practices of instructors and at the same time changing student population in higher education was experienced within the University of Twente. The Faculty of Educational Science and Technology (whose Dutch name was abbreviated "T.O."), was the first faculty at the University of Twente that started thinking about the use of technology in order to make learning more flexible. The faculty operates in a traditional university setting, where course design and delivery takes place predominately in the classroom orientation. In this context, a number of instructors in the faculty had been pioneers in the re-design of their courses involving new technologies.

By the end of the 1996-1997 academic year, the faculty was in a *1,000 flowers blooming stage* (Collis & Moonen, 2001), and the faculty decided to move to a stage of managed change in its instructional practice. The decision was that by September 1998 students entering the program could participate as local students, or as part-time mature students, already in the workplace and maintaining their jobs and home situations while participating in the program. At the same time, new pedagogies would be introduced to enrich the learning experiences for all students. This new flexible stretching-the-mold educational approach for both the regular students and mature students who remain in their homes and jobs while they participate in the faculty's program was called C@mpus+ (Carleer & Collis, 1998). Learning should become more flexible. Carleer and Collis (1998) mentioned the important forms of flexibility for the situation in the faculty such as flexibility in location, in program, in types of interactions, in forms of communication, and in study materials. These types of flexibility all relate to the 2S-t-M flexibility dimensions.

In order to carry out this ambition, the TeleTOP project was formed. TeleTOP, "TeleLearning at T.O. Project", had as overall goals to systematically support the professional development of the faculty in terms of potential CMS applications in their teaching, and to carry out the re-design of approximately 30 courses within the first phase of the program so that the faculty's education would become more efficient, more enriched, and more flexible. In order to steer and manage this complex change process, an instructional-development team, called the *TeleTOP* team, was formed. The task of the TeleTOP team was to lead and carry out a systematic and integrated course re-design initiative. To do this, the team designed and developed a CMS, also called TeleTOP, to reflect its principles relating to flexibility increase and pedagogical change. The team started at one department, but since 2000 all departments within the University of Twente use the TeleTOP CMS.

The TeleTOP CMS is a Web-based environment, and is very easy to use. The templates that enable instructors to easily (re)design courses within the TeleTOP CMS were based upon the elements of a CMS as first categorized by Collis (1997). The categories that were chosen for the TeleTOP CMS were organized around organization, communication, resources, and group activities. A schematic overview of the categories and the functionalities is presented in Figure 3 (Gommer & Visser, 2001).

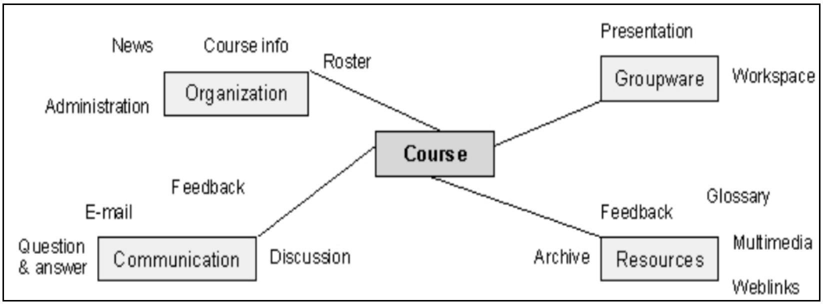


Figure 3. Schematic representation of TeleTOP (Gommer & Visser, 2001).

The menu options could be different in every course, as each instructor chooses his or her own combination. The options lead to templates relating to the different functionalities within the system. The TeleTOP environment was built with the use of forms (templates) for different purposes within the CMS. The forms have a similar design but differ in field and window details as their function defines their purpose. For a more-detailed description of the elements within TeleTOP, see the TeleTOP Technical Guide (Van de Weer, Van Nes, Tappel, & De Boer, 2000) or the

TeleTOP home site at http://www.teletop.nl/index_uk.htm. For examples of how the system is used in practice: Collis & Gervedink Nijhuis, 2003; Collis & Moonen, 2001; De Boer (2001); De Boer & Collis (1999, 2000a & 2000b); De Boer & Fisser, (2002); De Boer & Peters (2000); Collis, De Boer, & Van der Veen (2002); and Tielemans & Collis (1999).

TeleTOP was first faculty wide, and later university wide implemented. Collis and De Boer (1999a) describe how the implementation was organized around six main elements, in which a personal approach was combined with workshops. Within the personal contact with instructors, Web-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) were developed and used (See Collis & De Boer, 1998; De Boer & Collis, 1999b). The tools were directly integrated within the TeleTOP system so that instructors would be able to make CMS decisions for their course design which were reflected within the use and structure of the TeleTOP CMS. For example, options of the categories and the functionalities as presented in Figure 3 were presented to the instructors, guided by examples. The instructor could define his own menu from these.

The use of the first TeleTOP decision support tool resulted in a smooth and promising use of the TeleTOP CMS and of more flexibility in courses. However, the first DST was designed to be used as a tool within an interview approach involving one of the TeleTOP team. This approach was very time consuming for instructors and for the team as well as expensive for the department. The integrated support available through the second TeleTOP DST 2 could be used without the personal assistance of support people but it mainly emphasized the tools within TeleTOP, and not pedagogical support. Analyses of instructors' choices with respect to TeleTOP functionality were carried out over time (De Boer & Collis, 1999; De Boer & Collis, 2000b; Gommer & Visser, 2001; Gervedink Nijhuis, 2001) and showed that instructors reached a certain style of TeleTOP use and then stayed at that form of use, a form that focused most on planning flexibility but did not display much interpersonal flexibility. The main question that came after some years of institutionalization was how to provide a new form of support for instructors in such a way that new models of learning that would enable more of the interpersonal component of 2S-t-M flexibility for students would again be stimulated. The question for the last year of the research became: How could a systematic approach for Stretching the Mold as a main scenario for learning get a new impulse at the University of Twente?

Attempts were regularly made between 1999 and the present (2003) to offer other types of support to instructors in addition to the second TeleTOP DST, such as through workshops where instructors were invited to listen and discuss more-flexible approaches, pedagogies, and new possibilities of active learning, dealing with lifelong learners, and tricks and tips for TeleTOP. At one of the workshops, all of the support materials (such as good-practice examples) were gathered in a map

(De Boer & Manuhuwah, 2000), but also made available through a TeleTOP environment, and instructors were able to look at the examples at their own place, in their own time. Another approach was the introduction of a one-day seminar, called the TeleTOP Best Practice day (Fisser, Gommer & de Boer, 2001). The problem with these types of support was that only a limited percentage of the instructors found them worthwhile, or found the time to visit the support sessions. It seems therefore that instructors do need more or another type of support beyond that offered by the second TeleTOP DST, but not one that requires their attending workshops at a fixed time and place.

Design of the Flexibility Support Tool

Instructors need more pedagogical support. The pedagogies that relate to flexible learning should be presented to the instructors through an integrated (within the CMS) electronic-performance support (EPS) tool in order to reach all instructors. The most important advantages of integrated EPS tools are that intelligent support is always available, especially when instructors are performing the task. The support that an instructor needs when setting up his course should be focused on the design of his course (Menu options, Roster headings) and design of the course organization. From that, flexibility options should be made explicit mainly through the use of examples and guidelines. To support the instructor in his choice-making processes for the design of the CMS environment, a set of templates that would express the 2S-t-M dimensions within the Stretching-the-Mold Scenario could guide the instructor more specifically. Instructors should become more aware of the flexible options that relate to activities, resources, and structured communication such as feedback as a learning tool, and at the same time make use of the TeleTOP system so that the flexibility options stay manageable and become less time-consuming for the instructor (Gervedink Nijhuis, 2003). When planning course activities, such as contact sessions, self-study, group work, and assignments, an instructor should also be supported through a desktop coach, tools, advice, and tutorials when needed.

Thus there was a need for more personalized support for instructors but at the same time this support must be manageable and scalable in practice. This support should emphasize the recognized model within higher education, the stretching-the-mold scenario, and use the 2S-t-M flexibility dimensions as a rationale for the (re)design of courses by instructors. This support could be best built in an integrated performance support tool within the CMS. There was a need to organize support through the use of guidelines and examples and relate them to the decisions to be made when (re)designing courses with the use of a CMS. Electronic performance support potentially gives powerful options to offer integrated help, tutorials, and advice, and can be offered on the job, just in time for reasonable costs (Gery, 1995; Reeves & Raven, 2001). Therefore a new TeleTOP DST or EPSS was chosen to serve as the basis within the TeleTOP CMS that focused on the 2S-t-M flexibility dimensions.

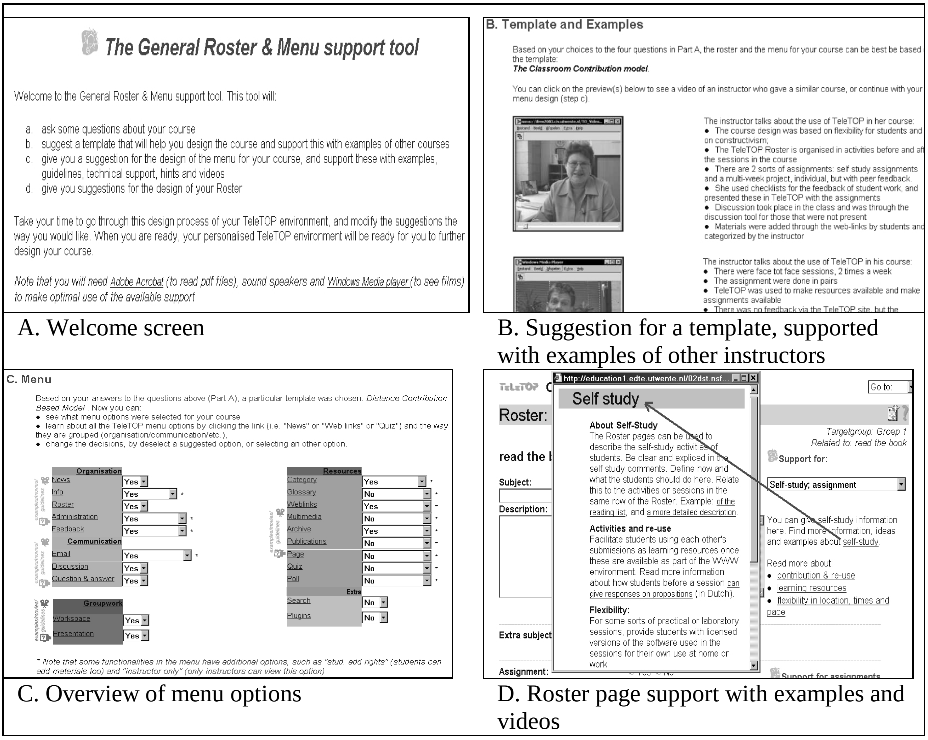
The name for the new support tool became the TeleTOP Flexibility Support Tool, or the FST. The method that reflects the design of the FST best is rapid prototyping (Prestera, 2002; Van den Akker, Branch, Gustafson, Nieveen, & Plomp, 1999). The rapid-prototyping method was used for the design and test, evaluation, and revision phases of the FST. Within an iterative rapid-prototyping process a series of cycles were included, each involving an evaluation process. The design considerations for the FST are summarized in Table 4.

Table 4. Guidelines and implication for the FST design.

Guidelines	Implication for the FST design
Structure of the FST	
The structure of an EPSS should be flexible for different groups of end-users and must reflect their work situation and needs (Collis & Verwijs, 1995; Gery, 1991; Stevens & Stevens, 1995).	The general structure of the FST is based on course set-up and (re)design tasks. Main components in the course set-up and (re)design are the design of the Menu, the Roster and the Roster pages.
Not all information should be directly visible, there is good balance between the structure of the support and the way instructors can choose their own paths (Sherry & Wilson, 1996)	The FST should contain templates to help instructors to choose their 'path'. The structure contains different levels that should be optional, clear, and reflect the needs of the instructor.
Support elements	
Types of support can be based on an advisor that provides dynamic hints and tips, and a tutor with quick tours and tutorials, with demos and practice, i.e., through video (McGraw, 1995; Reeves & Raven, 2001).	In the FST the use of examples is an important support element that builds upon the other types of support. The support will be shaped around an advisor and a tutor.
Design of support	
The interface should be easy to understand and use. It is user initiated and controlled (Gery, 1991; Lazonder, 2001).	For the main components two interfaces will be designed, one for the Set-up (Roster and Menu design), on for the specific design (Roster page design). The interface is orderly and consistent. The instructor has control and many choices.
Support should be easy available and accessible and therefore embedded (Lazonder, 2001; Van der Meij & Carroll, 1995;).	The first interface is embedded in the course environment through the set-up interface. The second component can be embedded in the interface of the Roster pages.
Learners learn better from a multimedia presentation than from words alone (Gellevij, 2002; Mayer, 2001)	Support is provided through a combination of several media. Screen-captures are used to support guidelines and videos with supportive texts will be made.
Support should be based on minimal instruction and build upon the learner's experience (Carroll, 1998; Lazonder, 2001)	Support is user initiated and controlled and builds upon the 'path' an instructor follows and therefore builds upon experience and minimizes the extent to which instructional materials are needed.

The design consideration and implications for the FST design in this table were used for the design of the TeleTOP Flexibility Support Tool. The structure of the FST should reflect the working and thinking patterns of different users, and relate to the instructors' practices. The main design decisions for an instructor when setting up a course in the TeleTOP CMS are the options that should be chosen (reflecting the CMS functionalities) and the way the Roster is structured. Therefore a General Roster & Menu Support Tool should be part of the FST and consists of three parts: a template tool (related to the general setting of the course), a Menu design tool (relating to the functionalities chosen for the CMS), and a Roster design tool. Another element in (re)designing a course is the design of course activities and events. This is also part of the practice of instructors that work with TeleTOP, but is not part of a more-general set up of the course environment. It occurs during the design of the Roster pages. Therefore the FST consists of two main interfaces. A *General Roster & Menu Support Tool* and a *Roster Page Support Tool*. An important difference between these elements of the FST was the function: The first element of the FST was a course global set-up tool, whereas the second FST appears when instructors make their more-specified course designs within Roster pages.

The FST offers the instructors many kinds of support. The FST consists of a set of seven course templates; and 50 help files, all with videos, screen dumps, guidelines, and suggestions for the Menu and Roster options and Roster-page design. Figure 4 gives an impression of some of the main interfaces.



A. Welcome screen

B. Suggestion for a template, supported with examples of other instructors

C. Overview of menu options

D. Roster page support with examples and videos

Figure 4. Some of the interfaces of the flexibility support tool.

Three formative evaluations were organized to get feedback on the design and usability of the FST. An user-based approach in a field setting (Sweeny, Maguire, & Schakel, 1993) was first organized to see how the design of the Flexibility Support Tool was experienced, and how the design could be improved. Although not themselves instructors in the faculty, 20 students who all had studied instructional design and were familiar with the TeleTOP system and of whom 44% had instructor backgrounds participated. The general conclusion of the evaluation was that the support tools can assist the ‘instructors’ in their decision-making process when (re)designing a course and using a TeleTOP CMS environment. Although not valued negatively on any of the criteria in the first formative evaluation, the scores on several variables indicated that some icons and the screen layout aspects needed to be improved, especially because users to some degree had problems interpreting what is expected.

Next the expert evaluation, a frequently used formative evaluation strategy, was organized. It provided insights on the accuracy, completeness, user-friendliness, motivational strategies, aesthetics, instructional validity, effectiveness, efficiency, and feasibility of the FST. From the expert walkthrough evaluation the conclusion was that the FST could serve as an important instrument for the (re)design of courses with the use of CMS to increase 2 S-t-M flexibility. Comments were made about the absence of an introduction to the FST, more support of the videos with text, and suggestions related to design and utility.

Finally a think-aloud walk-through validation study that built upon the previous formative studies was held. Three instructors worked in a user-based approach in a field setting which gave good impressions of how instructors would work with the FST, and problems that could occur. From the evaluations and comments of the instructors specific improvements that mostly dealt with the clarity of human-computer interaction could be made.

The evaluations showed that the FST integrated in TeleTOP could serve as a support tool that could increase 2S-t-M flexibility. The general impression is that the tool is useful and contains valuable support, however the evaluation results also showed that some elements could be improved. Changes after the three formative evaluation studies improved the interface (use of colors and better screen design), use of videos (introducing and guiding them), set-up of the creation of the Roster (more user control), and overview of further upcoming support (which was absent before). This led to a more consistent, usable, and user-based design.

Experiment with the FST: Methodology and Results

An experiment was organized at the University of Twente. Central in this experiment were the questions of whether instructors would use the FST embedded in the TeleTOP CMS and when they did, if they would also show more use of the CMS in terms of the types of CMS options available in their courses. Secondly the degree to which instructors experienced changes in their strategy in offering flexibility in a particular course would be studied. Therefore a Pretest- Posttest Control Group Design (Campbell & Stanley, 1963, pp. 13) was chosen. Within this design an experimental group that used the FST with the TeleTOP CMS was compared with a control group that did not use the FST. Also, within this design two versions of the same course were compared for both groups, comparing two different years. For the experiment 58 courses and instructors were selected from four departments at the university of Twente: two behavioral studies, a business administration faculty, and a physics faculty, and randomly assigned to the groups. The instructors completed the 2S-t-M questionnaire (that was based on the questions given in Table 3) for the 2001/2002 courses. Of the two groups, the experimental group used the FST and the control group used the DST in TeleTOP 4.0 to set up the second cycle of their courses. The same 2S-t-M questionnaire was used to measure the same 2S-t-M flexibility the 2002/2003 courses. For all courses a log analysis was used to measure the use of TeleTOP in both cycles.

With regards to the 2001/2002 versions of their courses, no significant difference was found between the groups in terms of the flexibility dimensions present. The results of the experiment show that most instructors in the experimental group used the FST within TeleTOP. There were three significant changes in the choice of Menu options within TeleTOP (see the options given in Figure 3), and there was significant change in the number of documents the instructor placed within TeleTOP for the communication category. In both of these there were no significant changes for the control group. In addition, no significant change in flexibility was measured within instructors or between groups, although all showed a trend towards more flexibility in 2002/2003. The use of the FST did not influence the way instructors experienced the degree of 2S-t-M flexibility in their courses as measured by the 2S-t-M questionnaire.

Because of the lack of significant differences between the control and experimental group no further group comparisons were made. However, an explorative analysis of factors that influence the level of 2S-t-M flexibility in the overall sample was done. The two dependent variables were the average score on the six variables for planning S-t-M and three variables for interpersonal S-t-M (See Table 3). To see how the four departments that were involved within this research related to the degree of 2S-t-M flexibility an ANOVA was done. For seven other variables explorative backward regression analyses were done, all independent variables were entered as possible predictors.

From these results it was seen that 2S-t-M flexibility could depend on variables that relate to the characteristics of courses and of the instructors. There are differences in how the two Stretching the Mold types of flexibility relate to course and instructor characteristics. For the course characteristics the courses with less students relate to higher planning S-t-M flexibility, but this is not the case for the interpersonal flexibility, none of the independent variables related to the interpersonal flexibility. But instructor characteristics such as the number of courses an instructor has during one year have a negative influence on the amount of planning 2S-t-M flexibility, and also instructors that have a lot of teaching experience do not tend to provide planning as much 2S-t-M flexibility as instructors with less experience. The department also was significantly related to planning flexibility.

User interviews were organized in order to learn more in depth about what a number of “more flexible” and “less-flexible” instructors think of TeleTOP and the FST and how instructors that valued the FST highly or lowly think of flexibility in education. The main questions focused upon the conditions under which the FST could help instructors to increase TeleTOP use and flexibility, and if other factors would be of bigger influence, and if so; what, why, and how? Seven instructors were selected, of which five had used the FST, and four had scored high on 2S-t-M flexibility. The interview focused on the clarity of the introduction of TeleTOP in the organization, how instructors saw flexibility; the ease of use of TeleTOP; the implementation; support, and management roles as experienced by the instructors. The use of the FST was questioned for those instructors who had experienced using it.

The comments of the instructors also showed that a number of the characteristics of the course related to the degree of 2S-t-M flexibility as already seen in the regression analyses. The class size (not too large), differences in students (more differences, higher need for options), and phase of the course (student within senior course get more options than students in first-year courses) reflected some of the main outcomes. The department seems to be of influence. The three instructors from the Department of Educational Science and Technology were in the group that provided most 2S-t-M flexibility. Those same instructors indicated that TeleTOP changed their teaching and made instructional approaches more student-centered and flexible. They perceived a need to change, which probably is a difference with the other instructors from other departments. TeleTOP was found to be the tool that supported them to realize and organize change.

In terms of the goal and the quality of TeleTOP the instructors did not experience real differences. The goal of why TeleTOP is being used throughout the university is not clearly communicated. Instructors do feel that TeleTOP is a strong supportive tool, but no straightforward informed goal is known. The instructors experience TeleTOP in general as an easy-to-use tool which is (in general) of good quality.

The instructors that used the FST were positive about it, but the conclusion was made that the FST did not make a significant difference in the increase of 2S-t-M flexibility as perceived by instructors. It would therefore be interesting to see whether the internal support could make a difference when the ‘need for change’ is more significant. Instructors themselves feel this could be the case, and those instructors that earlier felt that change was needed provide the most 2S-t-M flexibility at the current time.

Discussion

Within this research the way instructors used ICT, and more particular CMSs, to support flexibility in a changing university context had a central place. In higher education the CMSs have been implemented rather quickly. At the same time higher education is changing. The variety in students that want to get degrees or want to follow only particular programs or courses is increasing. CMSs offer great opportunities to help instructors deal with these new cohorts of students that do not only come from high school, but also from a professional environments, or abroad. The characteristics of the students do not only differ in background knowledge or motivation, but also can differ in the locations where they take the course. Blended-learning approaches within a 'stretching the mold' scenario are seen as useful strategies within higher education to offer more flexibility and options to students.

But, whereas the possibilities within CMSs are increasing and student populations and needs are changing, flexibility seems to be limited to 'some options'. Also for the University of Twente, the TeleTOP CMS use and flexibility was limited. How come? Do instructors not get enough support, and are they not familiar with the options in ICT? Within this research it became clear that support is not the only aspect that has an influence on the use of CMSs and options that instructors provide in their courses. A clear need as perceived by the instructors is essential. From the interviews that were held it became clear that every instructor at the University of Twente has his own ideas about the use of a CMS, and no clearly communicated goal from a higher level was communicated. Would this be one of the problems? It also became clear that some instructors did perceived a need from their students to make their teaching more student centered. These instructors provided the most flexibility within their courses, and all were in the Department of Educational Science and Technology, where at least three different cohorts of students can be in the same course.

With the use of the 4-E Model (Collis, Peters, & Pals, 2000), the situation focusing on a CMS to bring more flexibility into courses in higher education can be visualized. In the situation that new groups of students are being integrated within an educational program, within a well-planned institutional approach, the situation in Figure 5 could be the case. The environment should "move" relatively close to the baseline because of the policy of the university to allow new and more flexible students and thus the likelihood of use of the CMS for flexibility enhancement increases.

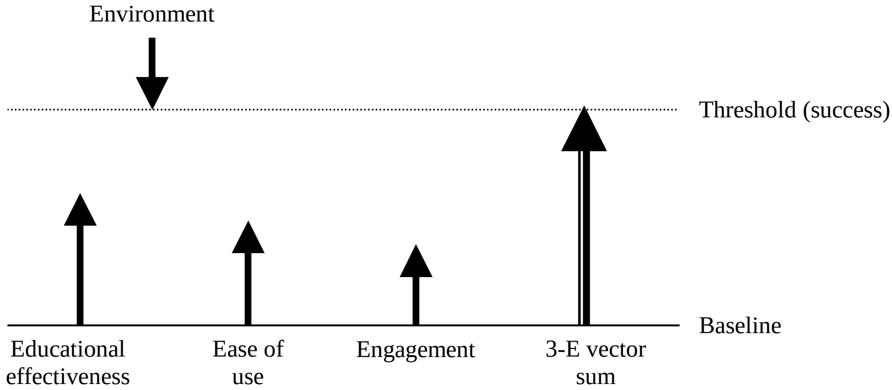


Figure 5. 4-E Model as a new picture in which courses can become more flexible.

The 3-E vector sum that comes from conceptually adding the educational effectiveness, the ease of use, and the engagement vector is beyond the threshold that determines the success of the innovation, thus the use of the CMS (TeleTOP), to make learning more flexible.

The 2S-t-M flexibility types differ from each other, and this needs to be taken in account in further research. A higher-education institution can choose to focus upon the planning type. This implies more-or less the same teaching and learning program within a course, but being more flexible in terms of time and place. When interpersonal flexibility is also adapted, this implies more student options and contributions that relate to the goals and input of students. It is probably harder to make this change, because instructors need to rethink their courses in terms of the activities within the course.

Support therefore is very important. This research showed several times that support can and needs to be improved. Once a clear goal from the management is communicated, the means to support instructors should not only be focused on the start period, but also should not disappear after some years. Support needs to be near to help instructors with more-complicated instructional problems over time. In the interviews a few instructors indicated sometimes to want to do something new within TeleTOP, but the human support available was not satisfying, and ideas were not followed up. This is not a good environment to innovate and get an increase in CMS use and 2S-t-M flexibility with instructors. On one hand they should work within an institutional environment that is encouraging them to try new ideas and respond to the needs of their students, on the other hand the institutional environment should be able to respond quickly to the needs and questions of instructors. Therefore the FST probably should be a part of a larger picture and a new situation.

SAMENVATTING

In dit onderzoeksproject stond het ondersteunen van flexibiliteit binnen een veranderende universiteit centraal. Het onderzoek richte zicht op de vraag hoe onderliggende dimensies voor veranderingen in hoger onderwijs geïdentificeerd konden worden en hoe docenten via gebruik van technologie in hun onderwijspraktijk geholpen konden worden om een antwoord te kunnen geven op de veranderingen. Gebruik makend van een op ontwerp en experiment gerichte onderzoeksbenadering (Reeves, 2000), werden een reeks op literatuur gebaseerde flexibiliteit scenario's voor hoger onderwijs (Back to Basic, Global Campus, Stretching the Mold en New Economy) in een internationaal onderzoek gebruikt. Het Stretching the Mold scenario bleek op basis van de uitkomsten van het internationale onderzoek het meest waarschijnlijke scenario te zijn voor de periode 2000-2005. Vervolgens bleek dat twee dimensies binnen flexibiliteit, gerelateerd aan het “Stretching the Mold” scenario voor het hoger onderwijs, konden worden geïdentificeerd. Deze bleken bruikbaar om tot meer systematische flexibiliteit in de onderwijspraktijk van docenten te komen. De technologie, in het bijzonder de elektronische leeromgeving[8] (CMS), bleek belangrijk te zijn voor het operationaliseren van de twee dimensies, maar om dit te in de praktijk te realiseren hebben de docenten ondersteuning nodig. Elektronische taakondersteuning, geïntegreerd in het CMS, werd geïdentificeerd als een waardevolle mogelijkheid. Parallel met de literatuur en onderzoeksanalyses vonden ontwerpexperimenten bij de Universiteit Twente plaats. Het TeleTOP CMS werd ontwikkeld en wordt sinds 1998 gebruikt. Twee geïntegreerde elektronische beslissing ondersteuningshulpmiddelen[9] (DSTs), en een reeks onderzoeken naar het gebruik van de hulpmiddelen vonden plaats. Vervolgens werd een nieuw elektronisch taakondersteuning instrument ontworpen met als doel meer flexibiliteit in vakken te ondersteunen. Dit instrument werd het Flexibiliteit Ondersteuningsinstrument[10] (FST) genoemd en geïntegreerd in het TeleTOP CMS. Het FST richt zich op de flexibiliteit in de onderwijspraktijk waarbij de twee flexibiliteitsdimensies gebruikt werden om het “Stretching the Mold” scenario meer structureel te ondersteunen. De FST werd gebruikt in een experiment met 58 docenten binnen vier faculteiten van de Universiteit Twente. De docenten gaven twee keer over een periode van twee jaar een vak met behulp van TeleTOP, en werden willekeurig over de groepen verdeeld. De controlegroep gebruikte het eerdere beslissing ondersteunings-instrument (DST) en de experimentele groep gebruikte het nieuwe FST binnen de tweede cyclus van hun vak. Ondanks het feit dat de docenten over de potentiële waarde van FST positief waren, toonde een vergelijking van de tweede cyclus van vakken dat de twee groepen weinig verschil toonden in termen van verhoogde flexibiliteit. Interviews volgden om meer inzicht te verschaffen in deze uitkomsten. Het bleek dat er zonder meer institutionele druk om de onderwijsbenadering te richten op meer

[8] In het Engels Course Management System, vanaf hier afgekort als CMS
[9] In het Engels Decision Support Tool, vanaf hier afgekort als DST
[10] In het Engels Flexibility Support Tool, vanaf hier afgekort als FST

flexibiliteit, docenten niet de tijd of de motivatie hebben om de onderwijspraktijk te veranderen. Wanneer flexibiliteit voorkomt zal het zich eerder richten op de logistieke planningsdimensie dan de pedagogische interpersoonlijke dimensie. Elk van deze aspecten worden meer uitgebreid beschreven in deze samenvatting.

Context: Veranderingen in Hoger onderwijs

Het hoger onderwijs verandert snel in termen van het gebruik van informatie- en communicatietechnolgie (ICT) en in termen van nieuwe groepen studenten. De traditionele en afstandsuniversiteiten richten zich op het verstrekken kwaliteits-onderwijs voor een snel veranderende groep studenten (Middlehurst, 2003, WRR, 2002; Observatory of Borderless Education, 2002). Dit veranderingsproces is veelzijdig: bredere en meer diverse groepen studenten, veranderende rollen van docenten, meer-flexibele leerplannen, nieuwe leveringsmethodes, nieuwe contacten tussen universiteiten en andere partners, en de globalisering van hoger onderwijs (Guri-Rosenblit, 1998). Bates (2001) merkt op dat een mix van onderwijs op de campus en flexibel onderwijs een ideale manier voor het verzorgen van onderwijs voor veel van de nieuwe groepen studenten is. Hij denkt dat de markt voor *levenslang leren* (studenten die vanuit een werkcontext instromen) in een op kennis gebaseerde economie tenminste zo groot zal worden zoals de markt voor studenten die vanuit het middelbaar onderwijs instromen.

Er zijn meerdere studies geweest die gericht waren op hoe en waarom de hoger onderwijsinstellingen op deze veranderingen en nieuwe soorten studenten reageren. Eén specifieke studie was een internationale vergelijkende studie (Collis & Van der Wende, 2002) waarin de belangrijkste conclusies waren dat (a) de verandering zichtbaar is, maar langzaam verloopt; (b) de technologie, in het bijzonder het CMS, gebruikt wordt voor studenten op en buiten de campus; en (c) dat de docenten meer tijd door het gebruikt van deze technologie kwijt zijn, maar dat er in het algemeen geen extra ondersteuning of externe motivatie is. Een belangrijke conclusie van het onderzoek van Collis en Van der Wende bouwt verder op andere studies. Er zijn vier zeer belangrijke scenario’s in het hoger onderwijs geïdentificeerd, maar één van deze bleek een sterke voorspeller met betrekking tot het scenario voor de volgende vijf jaar: het "Stretching the Mold" scenario (Collis &Van der Wende, 2002). In dit scenario ligt de nadruk van de instellingen op de campus en het persoonlijk contact met de traditionele (18-24 jarige) studenten. Geleidelijk aan maken meer en meer nieuwe soorten studenten zoals internationale studenten en levenslang leren studenten deel uit van de studentengroep, en geleidelijk aan wordt meer en meer flexibiliteit aangeboden aan studenten zodat zij vakken kunnen volgen en binnen vakken kunnen samenwerken. Het “stretchen” (oprekken) aan de ene kant betekent dat de grenzen minder belangrijk worden en het onderwijs (gedeeltelijk) op afstand kan worden gevolgd; dit is een logistieke “stretch” die vooraf kan worden gepland. Het “oprekken” aan de andere kant betekent dat binnen de campussituatie de traditionele hoger onderwijs vakken uit zullen gaan van de logistieke campus, maar door meer pedagogische opties aan te bieden kan de student meer kiezen en zo zijn eigen leren en leerwegen door en binnen programma's en vakken bepalen. Dus het "oprekken" kan betekenen dat docenten geleidelijk aan studenten pedagogische en inter-persoonlijke opties aanbieden, zelfs als de studenten op de campus studeren. Figuur 1 toont het Stretching the Mold scenario (S-t-M) in termen van de twee belangrijke dimensies voor verandering in hoger onderwijs.

Toekomst scenario's waarin het flexibele leren deel zal uitmaken van een situatie...

	Waar de lokale en persoonlijke contacten het meest gewaardeerd worden	*Waar de globale en netwerk ondersteunende contacten de norm zijn*
Waarin de instelling een programma aanbiedt en de kwaliteit garandeert	A. Kwaliteit door een samenhangend leerplan, ervaring in de lokale setting (huidige situatie): Back to the Basics	B. Kwaliteit van een samenhangend leerplan, maar wereldwijd beschikbaar: Global Campus
Waar de lerende keuzes maakt en meer verantwoordelijk-heid draagt	C. Individualisatie in de lokale instelling: Stretching the Mold	D. Individualisatie en globalisatie: New Economy

Figuur 1. Vier scenario's voor onderwijslevering wil (Collis & Moonen, 2001, p. 199).

De veranderingen in hoger onderwijs hebben een relatie met het gebruik van technologie in onderwijs. Een specifiek instrument in hoger onderwijs is de elektrische leeromgeving (CMS). Het CMS is een op het Web gebaseerd systeem dat leren mogelijk maakt of ondersteunt. De functionaliteiten binnen een CMS zijn gericht op het verstrekken van informatie/onderwijsinhoud, het (aan)maken van informatie/ onderwijsinhoud, het maken van mededelingen, en voor de organisatie van het onderwijs. Deze opties binnen CMSen zouden voor een gebruiker duidelijk moeten zijn, binnen zijn of haar onderwijspraktijk passen en eenvoudig in gebruik zijn. Het leren omgaan met een CMS zou docenten niet te veel tijd moeten kosten, en eenvoudig in bestaande vakken te integreren. Het is belangrijk dat het systeem zich kan aanpassen aan de manier waarop een individuele docent wil werken, zelfs wanneer de docent ook enkele aanpassingen in zijn of haar typische onderwijspraktijken zal moeten maken aangezien hij of zij van CMS gebruik gaat maken. Over het algemeen zijn CMSen flexibel voor gebruik in het onderwijs en daarom in principe goede instrumenten voor gebruik binnen een "Stretching the Mold" scenario.

Wanneer er wordt geprobeerd om vakken te (her)ontwerpen volgens het "Stretching the Mold" scenario is het van belang te weten dat onderwijs docent georiënteerd is en dat binnen het binnen hoger onderwijs uitgegaan moet worden van een klaslokaal georiënteerd model (Gustafson & de Tak, 1997, p. 30). De docent is als inhoudsdeskundige volledig verantwoordelijk voor het vak en kan overzicht houden, stimuleren, ondersteunen, en persoonlijk met zijn of haar studenten interactie hebben, zodat het vak veel meer is dan een systematische manier is om samen te komen en alleen op vooraf bepaalde doelstellingen te richten. Het vak kan tevens een kader voor een interactieve docent - student relatie zijn, gericht op leren (Sfard, 1998). Docenten kunnen tijdens de instructie controleren en aanpassen, bijvoorbeeld bij taken die moeilijk met op technologie gebaseerde instructie te verwezenlijken zijn. Bepaalde pedagogische opties en de benaderingen zijn beter geschikt voor het CMS gebruik voor "Stretching the Mold", zoals het authentieke op taak gebaseerde leren, het op discussie gebaseerde leren, probleem gebaseerd leren, actief leren en het leren in groepen.

De docenten moeten zodanig ondersteund worden dat ze voldoende technische vaardigheden hebben en dat er een aansluiting is met de onderwijspraktijk. Er zijn verschillende soorten ondersteuning die rond verschillende dimensies kunnen worden gestructureerd, in het bijzonder: directe versus gestructureerde ondersteuning en mens- versus computerondersteuning. Deze dimensies onderscheiden vier belangrijke types van ondersteuning: workshops, persoonlijke ondersteuning, Web gebaseerde ondersteuning, en geïntegreerde ondersteuning. Uit onderzoek blijkt dat wanneer docenten ondersteuning hebben gehad, ze dit niet hoog waarderen. De docenten ervaren een gebrek aan richting, middelen, kennis, en hulpmiddelen binnen de ondersteuning. Docenten hebben het gevoel dat ze de eigen ondersteuning moeten organiseren, maar vinden dat niet bezwaarlijk (Gervedink Nijhuis, 2002).

Docenten hebben echter allerlei soorten problemen in relatie met het gebruik van CMSen in hun vakken. Pedagogische ondersteuning wordt vaak niet verleend of is niet direct beschikbaar. Om een significante stap richting het Stretching the Mold scenario in hoger onderwijs te maken zou er passende ondersteuning beschikbaar moeten zijn, geïntegreerd in het CMS. Door meer nadruk te leggen op de soorten pedagogische mogelijkheden, de relatie tot flexibiliteit en hoe de docenten technologieën kunnen gebruiken, kan ondersteuning worden verbeterd. Een manier om een groot aantal docenten op een zeer flexibele en niet te dure manier hierin te ondersteunen is door middel van geïntegreerde besluit- en prestatiesondersteuning (EPS) binnen het CMS.

Flexibiliteit in Hoger onderwijs: een Kader

Terwijl de docent "de vorm" kan oprekken (meer flexibiliteit) en een CMS in zijn dagelijkse praktijk gebruikt, zijn de vormen van flexibiliteit die door deze systemen kunnen worden ondersteund en de verwante nieuwe pedagogieën nog onbekend en wordt de manier waarop deze systematisch geoperationaliseerd kunnen worden niet goed begrepen (Collis & Moonen, 2001; De Boer & Collis, 2003). Het is daarom belangrijk om het concept flexibiliteit te analyseren, aangezien het betrekking heeft op de toepassing van het S-t-M scenario. Hiermee kunnen verdere keuzes over opties voor studenten bepaald worden en kan er beter gekeken worden of er vooruitgang in de mate van flexibiliteit is binnen een instelling of in een vak. Zoals de instellingen besluiten over flexibiliteit in toelating en programmavereisten nemen, is de individuele docent de belangrijkste speler in het aanbieden van flexibiliteit binnen het vak zelf.

Vele onderzoekers hebben zich op dimensies voor flexibele leren geconcentreerd (Carleer & Collis, 1998; Collis, Vingerhoets & Moonen, 1996; Leng, Arger, Smallwood, Toomey, Kirkpatrick & Barnard, 2001; Moran & Myringer, 1999; Van den Brande, 1993; Sachsse, 1994; Zimitat, 2002). Hoewel de docenten de term flexibiliteit niet kunnen gebruiken om hun educatieve praktijken te beschrijven (Leng, Arger, Smallwood, Toomey, Kirkpatrick & Barnard, 2001), is er binnen de literatuur min of meer consensus over wat flexibiliteit impliceert. Een literatuur-analyse leidde tot drie hoofddimensies voor flexibiliteit:

- Flexibiliteit met betrekking tot tijd
- Flexibiliteit met betrekking tot inhoud
- Flexibiliteit met betrekking tot educatieve benadering (pedagogie en middelen)

Verdere analyse leidde tot negen flexibiliteitsindicatoren, die rond de categorieën met betrekking tot tijd, inhoud, en educatieve benadering kunnen worden georganiseerd, zie Tabel 1.

Tabel 1. De flexibiliteit keuzes van de Docent, gegroepeerd in drie categorieën.

1 Flexibiliteit met betrekking tot tijd:
Tijden voor de aanvang van en het beëindigen van een vak
Tijden voor het inleveren van opdrachten en interacties binnen een vak
2 Flexibiliteit met betrekking tot inhoud:
Onderwerpen van het vak
Oriëntatie binnen het vak (theoretisch, praktisch)
Eisen waaraan activiteiten (bijv. opdrachten) moeten voldoen
3 Flexibiliteit met betrekking tot de instructie aanpak en leermiddelen:
Manieren waarop studenten kunnen deelnemen (face-to-face; in groepen, individueel, combinaties)
De gehanteerde taal tijdens het vak
De educatieve benadering en middelen (verschillende soorten materialen; van wie: docenten , studenten, bibliotheek, WWW, etc.)
De uit te voeren opdrachten binnen het vak

Het internationale onderzoek naar scenario’s in hoger onderwijs (Collis & Van der Wende, 2002), waar het Stretching the Mold scenario door docenten en anderen werd herkend, richtte zich ook op een aantal vragen met betrekking tot de praktijk van deze negen flexibiliteitsindicatoren. De steekproef bestond uit 347 hoger onderwijsdocenten uit negen westerse landen. (In de groep respondenten waren ook besluitvormers en ondersteuners betrokken, met een totale steekproef van 697 ondervraagden). Voor elk van de negen punten in Tabel 1 werden de docenten eerst gevraagd “in welke mate biedt u momenteel opties met betrekking tot de volgende punten aan studenten in uw eigen vakken aan?” Vervolgens werden zij gevraagd om de mate te voorspellen waarin zij de opties in de toekomst zouden aanbieden. De antwoordmogelijkheden varieerden tussen (1) geen – via (3) enige flexibiliteit – tot (5) uitgebreide flexibiliteit. De resultaten toonden aan dat zeven van de negen reacties binnen één standaardafwijking van de reactie van (3) "enige flexibiliteit" waren. De verdere analyses toonden aan dat nu en in de toekomst de meeste flexibiliteit binnen de opties met betrekking tot de leer-middelen zal worden gegeven (zie Tabel 1). Zes van de flexibiliteitsindicatoren zullen stijgen. Significante dalingen werden verwacht voor de opties met betrekking tot de onderwerpen binnen het vak en de modaliteit en oorsprong van de leermiddelen. Een verklaring hiervoor kan zijn dat de docenten en de studenten nu veel gebruik van het Web maken om extra leermiddelen te vinden, maar misschien zijn de docenten van mening dat deze tendens zal stabiliseren zodra het nieuwe er vanaf is.

De resultaten met betrekking tot de negen indicatoren tonen aan dat er een tendens is om vakken flexibeler te maken. De geïdentificeerde negen flexibiliteitsdimensies worden in de praktijk herkend, maar voordat ze als hulpmiddel voor besluitvorming en kwaliteit/vooruitgangsbeoordeling kunnen dienen is het wenselijk om te kijken of de dimensies gegroepeerd kunnen blijven zoals in Tabel 1 werd voorgesteld, of dat ze mogelijk in een kleinere reeks dimensies kunnen worden gegroepeerd. Om dit te onderzoeken werd een factor analyse van de reacties op de negen indicatoren uitgevoerd, gebruik makend van een Varimax rotatie met Kaiser normalisatie.

Twee factoren met eigenwaarden groter dan 1,00 werden gevonden en gebruikt voor verdere interpretatie. De twee factoren verklaren 45.95% van de variantie. Tabel 2 toont de ladingen van de negen flexibiliteitsvariabelen op de twee factoren. De ladingen in dikke letters wijzen op de factor in relatie met de variabelen die gebruikt kunnen worden voor verdere interpretatie. Voor de duidelijkheid worden de ladingen lager dan 0,200 niet getoond.

Tabel 2. Geroteerde component matrix.

Flexibileitsdimensies	Factoren, eigenwaarde, en percentage van de verklaarde variantie	
	Factor 1, eigenwaarde = 3.085, 34.28%	Factor 2, eigenwaarde = 1.051, 11.67%
Tijden (voor de aanvang van en het beëindigen van een vak)	**.326**	.263
Tijden voor het inleveren van opdrachten en interacties binnen een vak	**.601**	
Onderwerpen van het vak	**.686**	
Oriëntatie binnen het vak (theoretisch, praktisch)	**.775**	
Eisen waaraan activiteiten (bijv. opdrachten) moeten voldoen	**.695**	.204
Manieren waarop studenten konden deelnemen (face-to-face; in groepen, individueel, combinaties)	.275	**.578**
Gehanteerde taal tijdens het vak		**.816**
Flexibiliteit met betrekking tot educatieve benadering en middelen (verschillende soorten materialen; van wie: docenten , studenten, bibliotheek, WWW, etc.)	.350	**.544**
De uit te voeren opdrachten binnen het vak	**.633**	.252

Factor 1 heeft een sterke relatie met de vijf variabelen die betrekking hebben op de besluiten die de docent maakt bij het opzetten van zijn vak. Welke onderwerpen worden gekozen? Zal de oriëntatie theoretisch of praktisch zijn? Welke taken zullen wanneer uitgevoerd en afgerond worden, en hoe zullen ze worden beoordeeld? Welke eisen zijn er om het vak te halen? Samen hebben deze betrekking op de planning van het vak. Voor elk van deze is het mogelijk om studenten meer of minder flexibiliteit te bieden. Deze factor heeft betrekking op het logistiek flexibel maken van het vak, aangezien de flexibiliteit vooraf in termen van opties binnen het vak kan worden gepland.

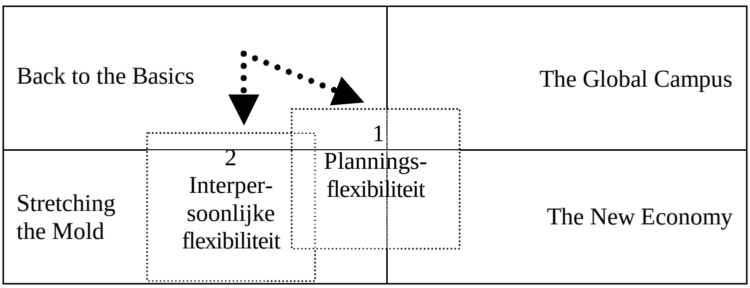
Factor 2 heeft betrekking op hoe de leerzetting wordt ervaren binnen het vak: Welke het leermiddelen worden gebruikt en in welke mate zijn deze verkregen doormiddel van de studenten zelf? Hoe ervaren de studenten het vak in termen van groepsleren of individueel leren of combinaties daarvan binnen het vak? Deze factor heeft het meest betrekking op flexibiliteit voor studenten op een interpersoonlijke manier, en maakt de pedagogische mogelijkheden binnen het vak meer flexibel.

De factoranalyse laat zien dat van de negen geteste indicatoren van flexibiliteit zoals die in de literatuur werden geïdentificeerd, twee belangrijke dimensies door de docent herkend worden. De dimensies hebben ook op twee verschillende aspecten van Stretching the Mold betrekking. Het nieuwe tweedimensionale kader met bijbehorende flexibiliteitsindicatoren wordt getoond in Tabel 3.

Tabel 3. Nieuw flexibiliteitskader voor Stretching the Mold vanuit het perspectief van de docent.

Factor 1	*Organisatorische flexibiliteit*
	Tijden (voor de aanvang van en het beëindigen van een vak)
	Tijden voor het inleveren van opdrachten en interacties binnen een vak
	Onderwerpen van het vak
	Oriëntatie binnen het vak (theoretisch, praktisch)
	De eisen waaraan activiteiten (bijv. opdrachten) moeten voldoen
	De uit te voeren opdrachten binnen het vak
Factor 2	*Interpersoonlijke flexibiliteits*
	Manieren waarop studenten konden deelnemen (face-to-face; in groepen, individueel, combinaties)
	De gehanteerde taal tijdens het vak
	De educatieve benadering en middelen (verschillende soorten materialen; van wie: docenten , studenten, bibliotheek, WWW, etc.)?

Deze twee factoren kunnen samen worden gezien als een “flexibiliteitskader” dat als leidraad voor docenten voor Stretching the Mold kan worden gebruikt in twee belangrijke richtingen. Voor elk van deze kunnen de flexibiliteitsopties variëren van niets (alle studenten behandelden hetzelfde) tot enige (ad hoc reacties op de verzoeken van individuele studenten) tot meerdere keuzes (alle studenten minstens twee opties aanbieden). Het aanbieden van sommige (ad hoc) opties kan tot meer flexibiliteit leiden. De twee flexibiliteitsdimensies leiden tot een nieuwe naam voor het type Stretching the Mold onderwijs. Een nieuwe naam die de twee soorten flexibiliteit dekt zou “2 X de Stretching the Mold”, of verkort: 2S-t-M kunnen zijn. De planningsdimensie van flexibiliteit kan in verband worden gebracht met de eisen van studenten voor logistieke opties. Variabelen als “verhoging van aantallen van levenslang lerenden” (gebruiken makend van regressieanalyses) werden als significante, positieve voorspellers van de planningsflexibiliteit gezien. De interpersoonlijke flexibiliteit heft een sterkere relatie met opties voor de traditionele doelgroep studenten die op de campus studeren. Het schijnt dat de planningsflexibiliteit dimensie zich meer richt op nieuwe doelgroepen, maar met dezelfde inhoud van het onderwijs, terwijl de interpersoonlijke dimensie zich richt op pedagogische opties voor bestaande campusgroepen. Figuur 2 toont hoe deze twee binnen de universitaire veranderingsscenario's kunnen worden gevisualiseerd.



Figuur 2. 2S-t-M dimensies binnen Stretching the Mold.

De cijfers (1 en 2) tonen aan hoe de docenten met flexibiliteit kunnen omgaan. De planningsflexibiliteit heeft betrekking op studenten om meer flexibiliteit in tijd en activiteiten binnen Stretching the Mold te verkrijgen. Binnen de interpersoonlijke 2S-t-M dimensies komen nieuwe pedagogische aanpakken naar voren die de student centraler plaatst wat betreft activiteiten. Deze flexibiliteit binnen S-t-M wordt niet per definitie verstrekt aan internationale of levenslang lerende studenten, maar ook aan de bestaande traditionele, op de campus studerende groepen.

Er zijn een aantal pedagogieën en gerelateerde CMS aanpakken die samenhangen met de mate van flexibiliteit binnen een vak. De omvang van 2S-t-M flexibiliteit is ook verwant met het soort studenten in een vak en de beschikbare ondersteuning. Het blijkt dat docenten ideeën over de planningsflexibiliteit opdoen door middel van voorbeelden op het Web. Voor interpersoonlijke flexibiliteitsondersteuning zou dit ook kunnen, maar evenals andere typen van ondersteuning lijkt deze geen significante relatie te hebben. De manier waarop ondersteuning door het gebruik van hulpmiddelen vormgegeven kan worden om het niveau van interpersoonlijke flexibiliteit te verhogen moet waarschijnlijk nog nader worden bepaald. Het CMS kan gebruikt worden als een geïntegreerde omgeving om flexibiliteit te ondersteunen door middel van het aanbieden van pedagogische opties. Het 2S-t-M flexibiliteits-kader kan gebruikt worden om de door de docent aangeboden flexibiliteit te meten. Tevens kan het gebruikt worden om voorbeelden van de soorten flexibiliteit te organiseren binnen een CMS en zo de docenten te ondersteunen door docenten mogelijkheden aan te bieden en deze te relateren aan hun eigen context.

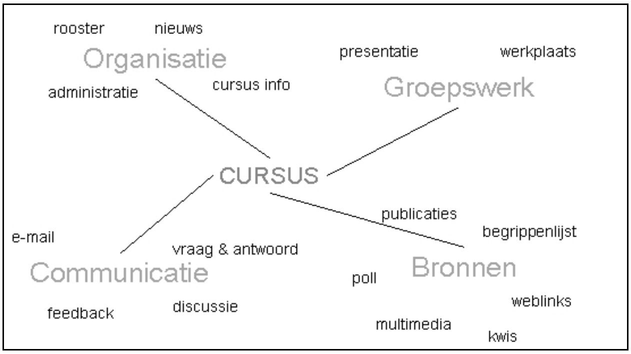
Voorafgaand Onderzoek

Parallel aan het hierboven besproken literatuuronderzoek werd er vier jaar gewerkt aan het ontwerp en de invoering van een CMS in de Universiteit Twente. De introductie van een CMS in de dagelijkse praktijk van docenten en de verandering in de studenten-groepen in hoger onderwijs speelden ook binnen de Universiteit Twente. De Faculteit Toegepaste Onderwijskunde (T.O.) was de eerste faculteit binnen de Universiteit Twente die technologie gebruikte om leren flexibeler te kunnen maken. De faculteit werkt binnen de traditionele universitaire context, waar het onderwijs en leren voornamelijk nog in een op het klaslokaal georiënteerde context plaatsvindt. Binnen deze context waren een aantal docenten in de faculteit pioniers in het herontwerp van hun vakken met behulp van nieuwe technologieën.

Tegen het einde van het academische jaar van 1996-1997 was de faculteit in een “1000 bloemen bloeien” stadium (Collis & Moonen, 2001), en de faculteit besliste tot een volgende stap waarin een geplande verandering in de educatieve praktijk centraal stond. Vanaf september 1998 moesten de traditionele studenten en deeltijd-studenten kunnen deelnemen aan het programma, waarbij vakken gedeeltelijk op een afstand gevolgd moesten kunnen worden. Tegelijkertijd werd er een nieuw pedagogisch model geïntroduceerd met als doel de leerervaringen voor alle studenten te verrijken. Deze nieuwe flexibele “Stretching de Mold” onderwijsbenadering richte zich zowel op de traditionele studenten als op de deeltijdstudenten (Carleer & Collis, 1998). Leren zou flexibeler moeten worden. Carleer en Collis (1998) vermeldden de belangrijke vormen van flexibiliteit voor de situatie in de faculteit, zoals flexibiliteit in plaats, in programma, in soorten interactie, in vormen van mededelingen, en in studiematerialen. Deze soorten flexibiliteit hebben allen betrekking op de 2S-t-M flexibiliteitsdimensies.

Om deze ambitie vorm te geven werd het TeleTOP project gestart. TeleTOP (Teleleren bij T.O. Project) had als algemene doelstelling de professionele ontwikkeling van de faculteit in termen van potentiële toepassingen van het CMS in het onderwijs systematisch te ondersteunen. Het herontwerp van ongeveer 30 vakken binnen de eerste fase van het programma werd gestart om het onderwijs van de faculteit efficiënter, meer verrijkt en flexibeler te maken. Om dit complexe veranderings-proces te sturen en te beheren werd een educatief-ontwikkelingsteam gevormd: het TeleTOP team. De taak van het TeleTOP team was het systematisch onderwijs-ontwerp te leiden en uit te voeren. Het TeleTOP CMS werd ontworpen en ontwikkeld, gericht op principes met betrekking tot flexibiliteits-verhoging en pedagogische verandering. Het team begon bij één faculteit, maar sinds 2000 gebruiken alle faculteiten binnen de UT het TeleTOP CMS.

Het TeleTOP CMS is een Web-gebaseerde omgeving, en is zeer eenvoudig in gebruik. De op templates gebaseerde categorisatie van CMS elementen door Collis (1997) maakt het docenten gemakkelijk vakken binnen het TeleTOP CMS te (her)ontwerpen. De categorieën die voor TeleTOP CMS werden gekozen werden georganiseerd rond organisatie, communicatie, onderwijsleermiddelen (bronnen) en groeps-activiteiten. Een schematisch overzicht van de categorieën en de functionaliteit wordt gegeven in Figuur 3 (Gommer & Visser, 2001).



Figuur 3. Schematische afbeelding van TeleTOP (Gommer & Visser, 2001).

De menuopties kunnen in per vakomgeving verschillen, aangezien elke docent zijn of haar eigen combinatie kan kiezen. De TeleTOP omgeving werd gebouwd met het gebruik van functionaliteiten voor verschillende doeleinden binnen het CMS. De functionaliteiten hebben een vergelijkbaar ontwerp maar verschillen in plaats en opbouw aangezien hun functie het doel bepaalt (een nieuwsbericht vraagt om een andere functionaliteit dan een rooster). Een meer gedetailleerde beschrijving van de elementen binnen TeleTOP kan gevonden worden in de TeleTOP handleiding (Van de Weer, Van Nes, Tappel, & De Boer, 2000) of via de TeleTOP homesite (http://www.teletop.nl/). Zie voor voorbeelden van hoe het systeem in de praktijk wordt gebruikt bij: Collis & Gervedink Nijhuis, 2003; Collis & Moonen, 2001; De Boer (2001); De Boer & Collis (1999, 2000a & 2000b); De Boer & Fisser, (2002); De Boer & Peters (2000); Collis, De Boer, & Van der Veen (2002); en Tielemans & Collis (1999).

TeleTOP werd eerst faculteitsbreed en later universiteitsbreed ingevoerd. Collis en De Boer (1999a) beschrijven hoe de implementatie rond zes belangrijke elementen werd georganiseerd, waarin een persoonlijke benadering met workshops werd gecombineerd. Binnen het persoonlijke contact met docenten werden TeleTOP beslissingsondersteuning-instrumenten ontwikkeld en gebruikt. Eerst de DST versie 1, voor gebruik tijdens aanvankelijke besluitvorming door de docent met betrekking tot functionaliteit voor zijn of haar CMS, vervolgens Versie 2, voor definitieve besluitvorming over de functionaliteit (zie Collis & De Boer, 1998; De Boer & Collis, 1999b). De ondersteuningsinstrumenten werden direct geïntegreerd binnen het TeleTOP systeem zodat de docenten de TeleTOP CMS besluiten over hun ontwerp zouden kunnen nemen die binnen het gebruik en de structuur van TeleTOP CMS werden weerspiegeld. De functionaliteiten, zoals die in Figuur 3, werden bijvoorbeeld ondersteund door voorbeelden gepresenteerd aan de docenten. De docent kon op basis hiervan zijn eigen menu samenstellen.

Het gebruik van het eerste TeleTOP DST resulteerde in een snel en veelbelovend gebruik van het TeleTOP CMS met meer flexibiliteit binnen vakken. Het eerste DST was ontworpen als hulpmiddel voor een gesprek met de docent door iemand van het TeleTOP team. Deze benadering was tijdrovend voor docenten en voor het team, en uiteindelijk te duur voor de faculteit. De geïntegreerde ondersteuning die beschikbaar kwam door het tweede TeleTOP DST kon zonder de persoonlijke hulp van de onder-wijskundige ondersteuners worden gebruikt, maar benadrukte hoofdzakelijk de hulpmiddelen binnen TeleTOP, er was minder aandacht voor de pedagogische elementen. De analyses van de keuzes van docenten met betrekking tot de TeleTOP functionaliteit tonen aan dat de docenten een bepaalde stijl van TeleTOP gebruik bereikten, maar bleven steken bij planningsflexibiliteit, met minder aandacht voor interpersoonlijke flexibiliteit (De Boer & Collis, 1999; De Boer & Collis, 2000b; Gommer & Visser, 2001; Gervedink Nijhuis, 2001). De belangrijkste vraag die na een aantal jaren van institutionalisering centraal stond was hoe een nieuwe vorm van ondersteuning docenten nieuwe leermodellen zouden kunnen bieden, met meer aandacht voor interpersoonlijke flexibiliteit voor studenten. De vraag voor het laatste jaar van het onderzoek werd dus: Hoe kan een systematische benadering met Stretching the Mold als hoofdscenario een nieuwe impuls bij de Universiteit Twente krijgen?

Er werden regelmatig pogingen tussen 1999 en 2003 gedaan om andere types van docentondersteuning naast het tweede TeleTOP DST te organiseren. Er werden onder andere workshops aangeboden waar de docenten met meer-flexibele pedagogische benaderingen en nieuwe mogelijkheden bespraken. De discussies richtten zich op actief leren, afstandsstudenten en tips voor het gebruik van TeleTOP hierbij. Bij één van de workshops werden de ondersteuningmaterialen (zoals goede praktijkvoorbeelden) verzameld in een docentenmap (De Boer & Manuhuwah, 2000), de materialen werden ook ter beschikking gesteld via een TeleTOP omgeving, zodat docenten de voorbeelden op hun eigen plaats en in hun eigen tijd konden bekijken. Een andere aanpak was via een eendaags seminar, getiteld TeleTOP Best-Practices (Fisser, Gommer & De Boer, 2001). Het probleem met deze typen van ondersteuning was dat slechts een beperkt percentage docenten het waardevol vond, of de tijd vond om de bijeenkomsten te bezoeken. Het lijkt daarom dat ander type ondersteuning vereist is naast het gebruik van de tweede versie van het TeleTOP DST, zodat het niet noodzakelijk is aanwezig te zijn op workshops op een vaste tijd en een plaats.

Ontwerp van het FST

Een ondersteuningsinstrument gericht op flexibiliteit is tevens gericht op pedagogische ondersteuning. Pedagogische modellen die betrekking hebben op flexibel leren kunnen door een elektronisch prestatie en taak ondersteuningsinstrument (EPS) geïntegreerd in het CMS worden aangeboden om zo alle docenten te bereiken. Belangrijkste voordelen van een geïntegreerd EPS zijn dat intelligente ondersteuning altijd beschikbaar is wanneer de docenten de taak uitvoeren binnen het CMS. De ondersteuning die de docent bij het opzetten van het vak nodig heeft moet zich richten op het ontwerp van het vak (de opties van het Menu, de rubrieken van het Rooster) en ontwerp van de organisatie van het vak. Daarbij zouden de flexibiliteitsopties hoofdzakelijk door het gebruik van voorbeelden en richtlijnen expliciet moeten worden gemaakt. De docent moet in zijn keuzeproces voor het ontwerp van de CMS omgeving ondersteund worden door een aantal templates waar de 2S-t-M dimensies de docent specifieker begeleiden bij het flexibeler maken van het vak. De docenten moeten bewust worden van de flexibele opties die op activiteiten, middelen en communicatie betrekking hebben, en tegelijkertijd moet de ondersteuning er op gericht zijn dat docenten zo van het TeleTOP systeem gebruik maken dat flexibiliteitsopties minder tijdrovend voor de docent worden (Gervedink Nijhuis, 2003). Bij het plannen van activiteiten zoals contactsessies, zelf-studie activiteiten, groepswerk en taken zou een docent ook door een EPS met behulp van richtlijnen, tips en ondersteuningsmodules kunnen worden ondersteund.

Er bestond een behoefte aan meer gepersonaliseerde ondersteuning voor docenten maar tegelijkertijd moest deze ondersteuning bruikbaar en schaalbaar in de praktijk zijn. De ondersteuning zou moeten uitgaan van het in het hoger onderwijs herkende S-t-M model, en de 2S-t-M flexibiliteitsdimensies gebruiken als richting voor (her)ontwerp van vakken door docenten. De ondersteuning zou het best in een geïntegreerd prestatie-ondersteuningsinstrument binnen het CMS kunnen worden gebouwd. Er was een behoefte om ondersteuning te organiseren door het gebruik van richtlijnen en voorbeelden en deze met elkaar in verband te brengen met de besluiten die genomen moeten worden bij het (her)ontwerp van vakken met het gebruik van een CMS. De elektronische prestatiesondersteuning lijkt krachtige opties om geïntegreerde hulp, leerprogramma's en advies te bieden, en kan in de werksituatie worden aangeboden op het moment waarop de taak uitgevoerd word voor redelijke kosten (Gery, 1995; Reeves & Raven, 2001). Daarom werd besloten een nieuwe TeleTOP DST of EPS gericht op de 2S-t-M flexibiliteitsdimensies binnen het TeleTOP CMS te ontwerpen.

De naam voor het nieuwe ondersteuningsinstrument werd het Flexibiliteits-ondersteuningsinstrument, verkort het FST. De methode die de ontwerpaanpak het beste weergeeft is die van “rapid prototyping” (Prestera, 2002; Van den Akker, Tak, Gustafson, Nieveen, & Plomp, 1999). Rapid prototyping werd gebruikt voor het ontwerp, de test, evaluatie, en revisiefases van FST. Het ontwerpproces werd gekenmerkt door een iteratief rapid prototyping proces met een reeks ontwerpcycli en daarbij horende evaluaties. De ontwerpoverwegingen voor het FST worden samengevat in Tabel 4.

Tabel 4. Richtlijnen en de implicaties voor het FST ontwerp.

Richtlijnen	Implicaties voor het ontwerp van het FST
Structuur van het FST	
De structuur van een EPSS zou voor verschillende groepen eindgebruikers flexibel moeten zijn en betrekking hebben op hun werksituatie en behoeften (Collis & Verwijs, 1995; Gery, 1991; Stevens & Stevens, 1995).	De algemene structuur van FST is gebaseerd op de (her)ontwerp taken van het vak. Belangrijke componenten vormen de opzet van het vak: het (her)ontwerp van het Menu, het Rooster en de pagina's binnen het Rooster.
Informatie zou niet direct al zichtbaar moeten zijn, er moet een goed evenwicht zijn tussen de structuur van de ondersteuning en de manier de docenten hun eigen wegen kunnen kiezen (Sherry & Wilson, 1996)	Het FST zou sjablonen moeten bevatten om docenten te helpen om hun weg te kiezen. De structuur bevat verschillende niveaus die facultatief en duidelijk zouden moeten zijn en betrekking hebben op de behoeften van de docent.
Soorten ondersteuning	
De typen ondersteuning kunnen op een “adviseur” worden gebaseerd door middel van dynamische tips, en op een “docent” met snelle overzichten en leerprogramma's, met demonstraties en praktijkvoorbeelden, bijvoorbeeld m.b.v. video (McGraw, 1995; Reeves & Raven, 2001).	In het FST is het gebruik van voorbeelden een belangrijk ondersteuningelement dat op de andere types van ondersteuning bouwt. De ondersteuning zal rond een adviseur en een docent gestalte worden gegeven.

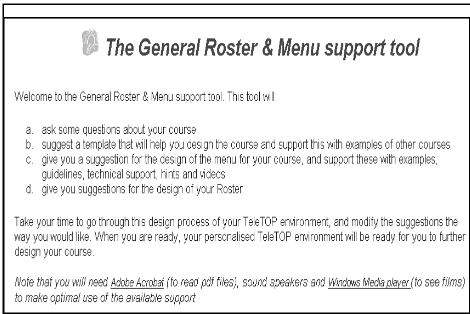
Tabel 4 wordt vervolgd…

Tabel 4 vervolgd

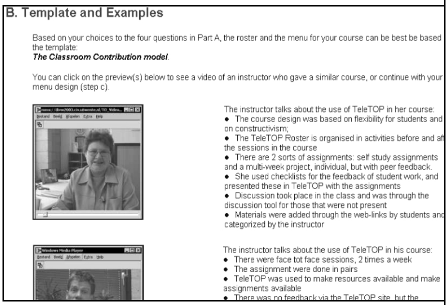
Ontwerp van ondersteuning	
De interface zou gemakkelijk te begrijpen en te gebruiken moeten zijn. Het wordt geïnitieerd en gecontroleerd door de gebruiker (Gery, 1991; Lazonder, 2001).	Voor de belangrijkste componenten zullen twee interfaces ontworpen worden, voor de algemene opzet (het ontwerp van het Rooster en van het Menu), en voor het specifieke ontwerp (het paginaontwerp binnen het Rooster). De interface is ordelijk en consistent. De docent heeft de controle en vele keuzemogelijkheden.
De ondersteuning zou gemakkelijk beschikbaar en toegankelijk moeten zijn en daarom geïntegreerd (Lazonder, 2001; Van der Meij & Carroll, 1995).	De eerste interface wordt geïntegreerd in de omgeving voor de opzet van het vak. De tweede component kan worden ingebed in de pagina's van het Rooster.
Er wordt beter geleerd van een presentatie met verschillende media dan van woorden alleen (Gellevij, 2002; Mayer, 2001).	Ondersteuning wordt verstrekt door een combinatie verscheidene media. De scherm-afbeeldingen worden gebruikt om richtlijnen te ondersteunen. Video's met ondersteunende teksten zullen worden gemaakt.
De ondersteuning zou moeten worden gebaseerd op minimale instructie en op de ervaring van de gebruikers (Carroll, 1998; Lazonder, 2001)	Ondersteuning is gebruiker geïnitieerd en gecontroleerd en gebaseerd op de “route” die een docent volgt. Het gaat uit van de ervaring van de docent waardoor de mate waarin de educatieve materialen nodig zijn gemini-maliseerd kan worden.

De overwegingen en implicaties voor het EPS uit deze tabel werden gebruikt voor het ontwerp van het flexibiliteitsondersteuningsinstrument binnen TeleTOP. De structuur van FST zou de werk- en denkpatronen van verschillende gebruikers moeten weerspiegelen, en dus op de onderwijspraktijk van de docenten betrekking moeten hebben. De belangrijkste ontwerpbesluiten voor een docent bij het opzetten van een vak in TeleTOP met behulp van het CMS zijn de opties die gekozen kunnen worden (voor de functionaliteit van het CMS) en de manier waarop het Rooster gestructureerd kan worden. Daarom zou ondersteuning voor het Rooster en voor het Menu deel moeten uitmaken van het FST. Een dergelijke module bestaat uit drie delen: een instrument om het template voor het vak te bepalen, een het instrument om het TeleTOP Menu vorm te geven (betrekking hebbend op de functionaliteit binnen het CMS), en een het instrument waarbij het TeleTOP Rooster vormgegeven wordt. Een ander element in het (her)ontwerp van een vak is het ontwerp van activiteiten en bijeenkomsten. Dit is ook een deel van de praktijk van docenten die met TeleTOP werken, maar vormt geen onderdeel van de meer algemene opzet van de TeleTOP omgeving, en wordt vooral tijdens het ontwerpen van de pagina's van het Rooster gedaan. Daarom bestaat FST uit twee belangrijke interfaces. Een algemeen ondersteuningsinstrument voor het Rooster en voor het Menu, en een ondersteuningsinstrument voor de pagina’s binnen het Rooster. Een belangrijk verschil tussen deze elementen van FST is de functie: Het eerste onderdeel van FST is een hulpmiddel gericht op het algemeen ontwerp van het vak, terwijl tweede onderdeel docenten ondersteunt bij het meer specifiek maken van de pagina's binnen het TeleTOP Rooster.

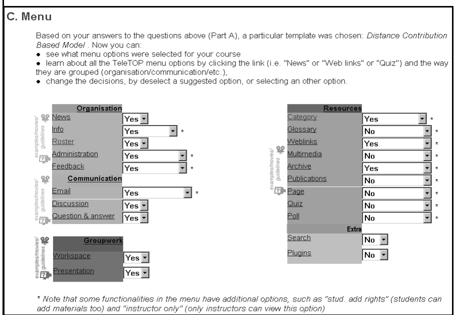
Het FST biedt de docenten vele soorten ondersteuning. Het FST bestaat uit zeven templates; en meer dan 50 helpbestanden, allen met video's, schermafbeeldingen, richtlijnen en suggesties voor de opties van het Menu en van het Rooster en Roosterpagina ontwerp. Figuur 4 geeft een indruk van enkele van de belangrijkste interfaces.



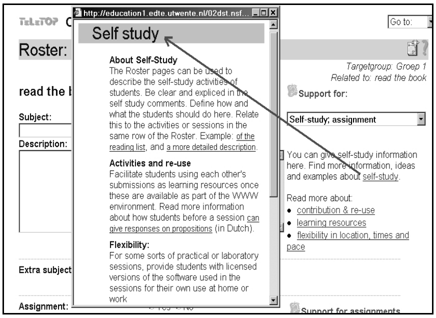
A. Het welkom scherm



B. Suggestie voor een template, dat met voorbeelden van andere docenten wordt ondersteund



C. Menuopties met voorbeelden en video's



D. Overzicht van de paginaondersteuning

Figuur 4. Enkele interfaces van het FST.

Drie formatieve evaluaties werden georganiseerd om terugkoppeling te krijgen over het ontwerp en de bruikbaarheid van FST. Een op de gebruiker gebaseerde benadering (Sweeny, Maguire, & Schakel, 1993) werd eerst gehanteerd om te zien hoe gebruikers het ontwerp van het FST ervaren, en hoe het ontwerp zou kunnen worden verbeterd. Twintig studenten uit het TO Masterprogramma namen deel aan deze evaluatie, ze kenden TeleTOP en 44% had ervaring als docent. De algemene conclusie van de evaluatie was dat het FST de docenten in hun besluitvorming kan bijstaan bij het (her)ontwerp van een vak en het gebruik van TeleTOP hierbij. De scores op verschillende onderdelen in de evaluatie tonen aan dat sommige schermontwerpen konden worden verbeterd, zodat gebruikers bij sommige onderdelen weten hoe te handelen.

Daarna werd een *expert evaluatie*, een vaak gebruikte vormende evaluatiestrategie, georganiseerd. De evaluatie richtte zich op de nauwkeurigheid, de volledigheid, de gebruikersvriendelijkheid, de strategieën, de vormgeving, de educatieve relevantie, de doeltreffendheid, de efficiency, en de haalbaarheid van het FST. Uit de analyse van de deskundige kwam naar voren dat het FST als belangrijk instrument voor (her)ontwerp van vakken met het gebruik van een CMS kon dienen om zo de 2S-t-M flexibiliteit te verhogen. Opmerkingen werden gemaakt over het ontbreken van een inleiding bij het FST en meer ondersteuning van de video's door middel van tekst.

Tot slot werd een *hardop-denken* strategie gebruikt, deze bouwde voort op de eerder gehouden evaluaties. Drie docenten namen deel aan deze op de gebruiker gebaseerde benadering. Door de docenten met het FST te laten werken gaf deze evaluatie-methode een goede indruk van het gebruik en de mogelijke problemen die konden ontstaan. Uit de evaluaties en de commentaren van de docenten kwamen een aantal specifieke verbeteringen wat betreft de duidelijkheid van interactie tussen de docent en het systeem naar voren.

De evaluaties toonden aan dat het FST in TeleTOP geïntegreerd kon worden en als instrument kon dienen om docent te ondersteunen bij het (her)ontwerp, gericht op 2S-t-M flexibiliteit. De algemene indruk is dat het hulpmiddel nuttig is en waardevolle ondersteuning bevat, waarbij de evaluatie-resultaten aantoonden dat sommige elementen zouden kunnen worden verbeterd. Na de drie formatieve evaluatiestudies werd het interface (gebruik van kleuren en beter het schermontwerp), het gebruik van video's (het introduceren van en het leiden van hen), de manier waarop het Rooster ontworpen werd (meer gebruikerscontrole), en het overzicht van verdere ondersteuning allen verbeterd. Dit leidde tot een meer consistent, bruikbaar, en op de gebruiker gebaseerd ontwerp.

FST Experiment: Methodologie en Resultaten

Een experiment werd georganiseerd op de Universiteit Twente. Centraal in dit experiment was de vraag of de docenten het TeleTOP FST zouden gebruiken en of ze ook meer gebruik zouden maken van opties binnen TeleTOP. Verder stond de mate waarin de docenten veranderen in hun strategie in het aanbieden van flexibiliteit centraal. Daarvoor werd het *pre- post test* ontwerp (Campbell & Stanley, 1963, blz. 13) gebruikt. Binnen dit ontwerp werd een experimentele groep, die het FST met TeleTOP gebruikte, vergeleken met een controlegroep die het FST niet gebruikte. Ook werden de versies van de hetzelfde vak vergeleken voor beide groepen door twee verschillende jaren te vergelijken. Voor het experiment werden 58 vakken en docenten geselecteerd uit vier faculteiten, waaronder twee gedragswetenschappen, een beleids-faculteit, en een technische faculteit. De docenten en vakken werden willekeurig toegewezen aan de experimentele en controle groep. De docenten vulden de 2S-t-M vragenlijst in (gebaseerd op de vragen van Tabel 3) voor de 2001/2002 vakken. De experimentele groep gebruikte het FST en de controlegroep gebruikte het DST binnen TeleTOP om de tweede cyclus van het vak op te zetten. Dezelfde 2S-t-M vragenlijst werd gebruikt om dezelfde 2S-t-M flexibiliteit te meten voor de 2002/2003 vakken. Voor alle vakken werd een log-analyse gebruikt om het gebruik van TeleTOP in beide cycli te meten.

Met betrekking tot de 2001/2002 versies van de vakken werd geen significant verschil gevonden tussen de groepen in termen van de flexibiliteitsdimensies. De resultaten van het experiment toonden wel aan dat de meeste docenten in de experimentele groep het FST binnen TeleTOP gebruikten. Er werden drie significante veranderingen in de keuzes van de Menu opties binnen TeleTOP (zie de opties die in Figuur 3) gevonden, en er was een significante verandering in het aantal documenten door de docent in TeleTOP geplaatst voor de communicatie categorie. Er waren geen significante veranderingen voor de controlegroep. Bovendien werd geen significante verandering in flexibiliteit gevonden voor de docenten of tussen groepen, hoewel allen een tendens naar meer flexibiliteit toonden. Het gebruik van het FST beïnvloedde niet de mate van 2S-t-M flexibiliteit zoals die door de 2S-t-M vragenlijst werd gemeten.

Omdat door het gebrek aan significante verschillen tussen de controle en de experimentele groep geen verdere groepsvergelijkingen konden worden gemaakt werd een verkennende analyse gedaan naar factoren die de mate van 2S-t-M flexibiliteit in de gehele steekproef zouden kunnen beïnvloeden. De twee afhankelijke variabelen waren de gemiddelde scores op de zes variabelen voor de planning van S-t-M en drie variabelen voor interpersoonlijke S-t-M (zie Tabel 3). Om te zien hoe de vier faculteiten die binnen dit onderzoek met betrekking tot de mate van 2S-t-M flexibiliteit een invloed hadden werd gebruik gemaakt van een ANOVA analyse. Voor zeven andere variabelen werden verkennende achterwaartse regressieanalyses gedaan, waar de onafhankelijke variabelen werden gebruik als mogelijke voorspellers.

De resultaten laten zien dat de 2S-t-M flexibiliteit relatie heeft met variabelen zoals de kenmerken van vakken en van docenten. Er zijn verschillen in hoe de twee soorten S-t-M flexibiliteit relateren aan de vak- en docentenkenmerken. Wat betreft de kenmerken van een vak hebben vakken die minder studenten hebben een hogere planningsflexibiliteit, maar dit is niet het geval voor de interpersoonlijke flexibiliteit. Geen van de onafhankelijke variabelen heeft een relatie met de interpersoonlijke flexibiliteit. Maar de docentenkenmerken zoals het aantal vakken dat een docent tijdens één jaar geeft hebben een negatieve invloed op de hoeveelheid planningsflexibiliteit. Verder neigen docenten die langere onderwijservaring hebben naar het verstrekken van minder planningsflexibiliteit dan docenten met minder ervaring. Er bleek ook een relatie tussen de faculteit en de mate van plannings-flexibiliteit te zijn.

Interviews met docenten werden georganiseerd om te kijken hoe een aantal "flexibelere" en "minder-flexibele" docenten over TeleTOP en het FST denken. De belangrijkste vragen concentreerden zich op de voorwaarden waarop het FST docenten kon helpen om TeleTOP gebruik en flexibiliteit te verhogen, en of er andere factoren van invloed zouden zijn, en zo ja welke, waarom, en hoe? Zeven docenten werden geselecteerd, waarvan er vijf het FST hadden gebruikt. Vier van de zeven docenten hadden een hoge 2S-t-M flexibiliteit. Het gesprek concentreerde zich op de duidelijkheid van de introductie van TeleTOP in de organisatie, hoe de docenten tegen flexibiliteit aankeken; het gebruiksgemak van TeleTOP; de implementatie; ondersteuning, en managementrollen zoals die door de docenten worden ervaren. Het gebruik van het ST werd besproken met de docenten die het hadden gebruikt.

De commentaren van de docenten toonden aan dat een aantal kenmerken van het vak betrekking hadden op de mate van 2S-t-M flexibiliteit, zoals al reeds in de regressieanalyses gevonden. De studentenaantallen (een niet te grote groep), de verschillen in studenten (meer verschillen, hogere behoefte aan opties), en de fase van het vak (de student binnen een specialisatievak krijgt meer opties dan studenten in eerstejaarsvakken) waren de belangrijkste kenmerken. De afdeling schijnt ook van invloed te zijn. De drie docenten van de onderwijswetenschappen faculteit verstrekten de meeste 2S-t-M flexibiliteit. Diezelfde docenten wezen erop dat TeleTOP hun onderwijs veranderde en educatieve benaderingen meer flexibel en student gecentreerd maakte. Zij hadden een behoefte om te veranderen, wat waarschijnlijk een verschil is met de docenten van andere faculteiten is. TeleTOP bleek een hulpmiddel te zijn dat deze docenten ondersteunde om veranderingen te realiseren en te organiseren.

Wat betreft het doel en de kwaliteit van TeleTOP ervaren docenten geen grote verschillen. Het doel van TeleTOP wordt door de universiteit wordt echter niet duidelijk gecommuniceerd. De docenten zijn van mening dat TeleTOP een sterk ondersteunend hulpmiddel is, maar geen eenduidig gecommuniceerd doel is bekend. De docenten ervaren TeleTOP in het algemeen als een gemakkelijk te gebruiken instrument dat (in het algemeen) van goede kwaliteit is.

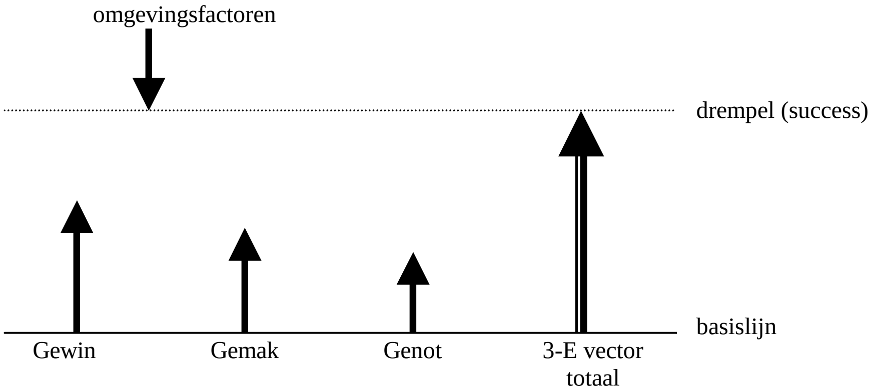
De docenten die het FST gebruikten waren positief, ondanks de conclusie dat het FST geen significant verschil bracht in de 2S-t-M flexibiliteit zoals die door docenten wordt ervaren. Het zou daarom interessant zijn om te zien of de interne ondersteuning een verschil kan maken wanneer de behoefte aan verandering meer significant is. De docenten zelf gaven dit in de interviews aan, docenten die van mening zijn dat verandering nodig is verstrekken ook de meeste 2S-t-M flexibiliteit.

Discussie

Binnen dit onderzoek stond de manier waarop docenten ICT, en in bijzonder CMSen, gebruikten om flexibiliteit in een veranderende universitaire context te ondersteunen centraal. In het hoger onderwijs is de implementatie van CMSen snel gegaan. Tegelijkertijd verandert het hoger onderwijs. De verscheidenheid in studenten die opleidingen willen volgen of enkele programma's of vakken willen volgen stijgt. CMSen bieden goede mogelijkheden voor docenten om te gaan met deze nieuwe cohorten van studenten die niet alleen uit het middelbaar onderwijs, maar ook uit professionele milieus of uit het buitenland komen. De kenmerken van de studenten verschillen niet alleen in achtergrond of motivatie, maar ook in de plaats waar zij programma’s willen volgen. Een mix van traditionele leerbenaderingen met behulp van technologie, passend binnen een Stretching the Mold scenario gericht op meer flexibiliteit en opties voor studenten kan worden gezien als zeer bruikbare strategie binnen het hoger onderwijs.

Maar terwijl de mogelijkheden binnen CMSen toenemen en de studenten-populatie en behoeften veranderen schijnt de flexibiliteit slechts tot enkele opties te worden beperkt. Ook voor de Universiteit Twente zijn het gebruik van het TeleTOP CMS en de flexibiliteit beperkt. Hoe kom dat? Krijgen de docenten niet genoeg ondersteuning en zijn zij niet vertrouwd genoeg met ICT opties? Binnen dit onderzoek werd duidelijk dat ondersteuning niet het enige is wat een invloed heeft op het gebruik van CMSen en opties in vakken. Een duidelijke behoefte zoals die door de docenten wordt waargenomen is essentieel. In de gesprekken met docenten werd duidelijk dat elke docent bij de Universiteit Twente zijn eigen ideeën heeft over het gebruik van een CMS, en er geen duidelijk gecommuniceerd doel is. Zou dit één van de problemen zijn? Het werd ook duidelijk dat sommige docenten een behoefte van hun studenten constateerden om onderwijs meer student gecentreerd te maken. Deze docenten verstrekten de meeste flexibiliteit binnen hun vakken, en allen doceerden aan de faculteit onderwijskunde, waar tenminste drie verschillende cohorten studenten aan een vak kunnen deelnemen.

Met het gebruik van het 4-E Model (Collis, Peters, & Pals, 2000), kan de situatie waarbij een CMS ingevoerd wordt om meer flexibiliteit in onderwijs te brengen worden gevisualiseerd. In de situatie waarbij nieuwe groepen studenten binnen een onderwijsprogramma en een goed geplande institutionele benadering worden geïntegreerd, zou de situatie zoals in Figuur 5 het geval kunnen zijn. De omgevingsfactoren "bewegen" zich richting de basislijn, het beleid van de universiteit is gericht op nieuwe en flexibelere studenten ondersteund door het gebruik van het CMS in vakken, om deze zo flexibeler te maken.



Figuur 5. Het 4-E Model als een nieuwe situatie waarin vakken flexibeler kunnen worden.

De 3-E vectorsom die conceptueel het gewin, gemak en genot optelt moeten voorbij de drempel die het succes van de innovatie en dus het gebruik van het CMS (TeleTOP) komen om leren flexibeler te maken.

De 2S-t-M flexibiliteitsdimensies verschillen van elkaar, en dit is van belang bij vervolgonderzoek. Een onderwijsinstelling kan kiezen om zich op het planningstype te richten. Dit impliceert meer of min hetzelfde het onderwijs en leer-programma binnen vakken met flexibiliteit in termen van tijd en plaats. Wanneer de interpersoonlijke flexibiliteit ook wordt aangepast impliceert dit meer opties en bijdragen voor en door studenten. Het is waarschijnlijk moeilijker om deze verandering uit te voeren, omdat docenten hun vakken in termen van de activiteiten binnen het vak moeten heroverwegen.

Ondersteuning is daarom zeer belangrijk. Dit onderzoek toonde op verschillende manieren aan dat de ondersteuning kan en moet worden verbeterd. Zodra een duidelijk doel vanuit de organisatie wordt gekozen en gecommuniceerd zouden de middelen om docenten te ondersteunen niet alleen op de beginperiode moeten worden geconcentreerd, maar ook aanwezig moeten blijven na de introductie. De ondersteuning voor meer ingewikkelde educatieve problemen moet dicht bij docenten zijn. In de gesprekken gaven enkele docenten aan dat wanneer ze iets nieuws binnen TeleTOP wilden uitproberen, de beschikbare menselijke ondersteuning onvoldoende aanwezig was, en ideeën niet werden opgevolgd. Dit is geen goede omgeving om te vernieuwen en een verhoging van gebruik van het CMS en 2S-t-M flexibiliteit te krijgen. Aan de ene kant zouden docenten een instelling nodig hebben die hen aanmoedigt om nieuwe ideeën uit te proberen, aan de andere kant moet de instelling snel en adequaat met de behoeften en de problemen van de docenten omgaan. Daarbij zou een FST een onderdeel moeten zijn van een geïntegreerde aanpak binnen een veranderende universiteit.

CURRICULUM VITAE

Wim de Boer was born in Friesland and was raised in Makkum. After finishing secondary education (HAVO) at the Bogerman College (Sneek) he completed teacher training for elementary school, at PABO de Him (Sneek). In 1994 he started at the University of Twente in the Faculty of Educational Science and Technology. His specialisation became instrumentation technology. Wim de Boer became a researcher at the University of Twente, and an educational technologist who has taught and supported learning since 1998. In 1998 he worked in the team that developed the TeleTOP CMS environment, a flexible and easy-to-use electric learning environment that has been widely implemented throughout Dutch higher education and corporate training. In his research he focuses on models of flexible learning in higher education, performance support for flexible learning in higher education, the implementation of technology in educational institutions, and the design and adaptability of Web-based course-support systems. For a more-detailed overview of his work and background, see http://users.edte.utwente.nl/boerwf.

APPENDICES

Appendix 1: Questions and examples of the first DST

Component	Questions	Choice	Example
Organization	1a. Do you want to have a roster in the WWW site?	0 Yes 0 No	roster
	1b. Do you want to inform participants about the general organization of your course on the WWW site (i.e. goals, introduction, overview of assignments)?	0 Yes 0 No	organization of course
	1c. Do you want to have an (evolving) glossary in the WWW site?	0 Yes 0 No	glossary
	1d. Do you want to give short updates and announcements via the homepage of the WWW site?	0 Yes 0 No	newsflash
Communication	2a. Do you and your students want to communicate with groups of students via an email center?	0 Yes 0 No	email center .
	2b. Do you want students to communicate with each other:		
	– At the same time ?	0 Yes 0 No	chat tool Internet phone
	– Not at the same time (via a discussion group)?	0 Yes 0 No	WWW board
	2c. Do students have to make an appointment for a specific time to communicate with you?	0 Yes 0 No	calendar
Lectures	3a. Do you want to put your lecture (college) notes in the WWW site:		
	– using PowerPoint?	0 Yes 0 No	PowerPoint slides
	– using existing sheets?	0 Yes 0 No	sheets
	3b. Do you want to find extra information, such as visualizations or up-to-date survey data, to support your lectures:		
	– via an subject specific search tool?	0 Yes 0 No	subject specific search tool
	– via a search engine?	0 Yes 0 No	search engine
	3c. Do you want to put additional information on your lecture (college) notes (for extra clarification)?	0 Yes 0 No	Lecture notes
	3d. Do you want to save (portions of) the lectures (colleges) for further review by using audio and/or video in the WWW site?	0 Yes 0 No	Video and slides

Resources	4a. Do you want to make study materials available on the WWW site:	0		
	– that are currently word processed files?	0 0	Yes No	word processed files
	– that will be available through the WWW, via a fill-in form?	0 0	Yes No	fillin form
	4b. Do you want to put other types of learning materials in the WWW site?	0		.
	– videos?	0 0	Yes No	Video
	– animations?	0 0	Yes No	Animation
	– self study exercises with direct feedback?	0 0	Yes No	exercises with direct feedback
	4c. Do you want to have exercises or short answer questions to be submitted via the WWW site?	0		
	– do students need to send their answers of the exercises or short answer questions to the WWW site?	0 0	Yes No	short answer questions, posted and feedback
	– do you want to have student responses, particularly to short-answer questions, automatically posted on the WWW site?	0 0	Yes No	
	– do you want to respond to the answers of the exercises or short answer questions via the WWW site?	0 0	Yes No	
Activities	5. Do you have a final assignment in your course:	0		.
	– where students need to collaborate in assignment using the WWW site (sharing files)?	0 0	Yes No	collaborative workspace
	– where for example, students need to organize their work via the WWW site?	0 0	Yes No	agenda
	– where you want to have the final assignments presented in the WWW site?	0 0	Yes No	present final assignments
Tests	6. Do you want an overview of the student results in the WWW site:	0		.
	– publicly, available to all students?	0 0	Yes No	overview of the student results
	– password protected, only available to individual students?	0 0	Yes No	....

Appendix 2: Questions and examples of the second DST

Organization

News	0 Yes	When you login in a course environment, the first page on your screen will be the "News" page". Here you are allowed and invited to inform your students about all kinds of changes and new information with respect to the course's organization and delivery.
Info	0 Yes 0 Use own fields	The course info consists of all information the instructors would like to be provided to the students, e.g.: - course goals, objectives, and outcomes - course materials - course organization - assessment and testing
Roster	0 Yes	The roster is probably the most commonly used component of your course environment. Next to the more formal information in terms of dates and deadlines, you also may include here the topics that will be dealt with in specific classes or modules. Besides, the roster is well equipped to add external files (PowerPoint, MS Word, Excel, etc.). Please note these files will be stored in the concerning menu components, but you easily can install links from the roster to these components. The roster enables also to define assignments, organize them and give feedback to the assignments.
Administration	0 Yes 0 No 0 Only visible for the instructor	The Administration gives a clear overview of the name, date, subject, feedback, etc. of all submitted work. Choose this option when assignments are submitted via TeleTOP. This option can be hidden for students.
Feedback	0 Yes 0 No 0 Only visible for the instructor	Choose this option when you want to set-up and re-use certain parts of feedback.

Communication

Email/Groups	0 Yes 0 No 0 Student have add rights	In the Mail-center you are able to communicate with your students via E-mail. In this case you can set-up so-called E-mail groups. This facilitates easy simultaneous communication with a number of students. Students can create email/target groups themselves as well...
Participants	0 Yes 0 No	In the component Participants you and your students may see who else is participating in the course. Each participant may add his/her personal information,

		including a picture.
Discussion	0 Yes 0 No	The TeleTOP environment allows students to have mutual discussions. The students (and you) are allowed to submit discussion topics and messages, and are able to reply to each other. The messages can be ordered in several ways" date, topic, sender.
Question & answer	0 Yes 0 No	In "Questions & Answers" (Q&A) the students may ask the instructor questions that will be visible for all participants. The instructor may want to provide his/her students in this option with a FAQ-list.
Chat	0 Yes 0 No	Chat allows real time text-based communication via the Web.
		.
Group work		
Workplace	0 Yes 0 No	The workspace is the component within the course environment where students may work together on assignments, tasks, reports, etc. You, being the instructor, may determine and create the conditions (e.g. who will have access to which workspace). Besides you may add extra information to the workspace, and you may give feedback to the students in the workspace itself.
Presentation	0 Yes 0 No	The final products of the students, like final reports, web-sites etc., may be presented in a structured way in the component 'Presentation'.
vote	0 Yes 0 No	Use the Vote in a classroom setting with computers. You can ask the students to react on certain propositions.
		.
Resources		
Categories	0 Yes 0 No 0 Only visible for the instructor	In the list of concepts you may define all categories that are closely connected with the course. You will be able to relate the resources (coming next) to these categories.
Glossary	0 Yes 0 No 0 Students can add too	In the Glossary definitions related to the course content can be found. Relations with other areas or courses can be made clear as well.
Web links	0 Yes 0 No 0 Students can add too	Web links to WWW-pages that are interesting for the course will be placed here.
Multimedia	0 Yes 0 No 0 Students can add too	Multimedia files that are interesting for the course can be placed here.

Archive	0 Yes 0 No 0 Students can add too	Use Archive for all sorts of documents.
Publications	0 Yes 0 No 0 Students can add too	Publications gives the possibility to make an overview of interesting literature for the course. You can add links to the publication when it's available on the WWW or put the original document in the list.
Sheets	0 Yes 0 No 0 Students can add too	Here you can put the slides used in this course.
(html) pages	0 Yes 0 No 0 Students can add too	In Page you can add text or HTML pages. You can link these pages to the roster.
Quiz	0 Yes 0 No 0 Students can add too	Choose this option when you want to set-up quizzes within the course (i.e. multiple choice questions)
poll	0 Yes 0 No	Use the Poll in a classroom setting with computers. You can ask the students to react on certain propositions.
Extra		
search	0 Yes 0 No	This tool allows you to search in the course environment. This option also allows you to search the WWW.
Plug-ins	0 Yes 0 No	It may occur that you want your students to use specific software or programs that are not incorporated in the TeleTOP environment. In this case you have to install this program. You can find it under the Plug-ins component.

Appendix 3: Instructors' choices before the start of a course, and use in practice, via use of the second TeleTOP DST

TeleTOP options		Choice	Use
	N	Percentage of instructors	Percentage of instructors
News	1423	100.0%	93.8%
Course info	1423	99.0%	94.2%
Roster	1423	93.0%	89.1%
Administration	1423	39.0%	26.4%
Email	1423	96.0%	43.9%
Participants	275	24.0%	5.1%
Discussion	1423	16.0%	12.8%
Q&A	1423	27.0%	24.4%
Workplace	1423	30.0%	24.5%
Presentation	1423	8.7%	6.4%
Glossary	1423	4.4%	4.0%
Web-links	1423	35.0%	32.5%
Multi-media	1423	2.9%	4.6%
Archive	1423	43.0%	38.9%
Publications	1423	12.0%	9.6%
Sheets	275	49.0%	44.4%
Html Pages	1423	5.1%	6.8%
Quizzes	1423	3.5%	3.6%
Poll	1423	2.4%	2.5%
Feedback-tool	1423	11.0%	7.4%
Categories	1423	13.0%	25.0%
Chat	275	10.0%	*
Plugins	1423	0.8%	*
Search	1423	4.3%	*

** use was not measured*

Appendix 4: Correlations between choice and use of the TeleTOP menu options

	Use with	N	Correlation	Sig.
Pair 1	News	1497	.455	.000
Pair 2	Course info	1497	.200	.000
Pair 3	Roster	1497	.653	.000
Pair 4	Administration	1496	.440	.000
Pair 5	Email	1497	.230	.000
Pair 6	Discussion	1497	.547	.000
Pair 7	Q&A	1497	.684	.000
Pair 8	Workplace	1497	.764	.000
Pair 9	Presentation	1497	.606	.000
Pair 10	Glossary	1497	.536	.000
Pair 11	Web-links	1497	.793	.000
Pair 12	Multi-media	1497	.578	.000
Pair 13	Archive	1497	.799	.000
Pair 14	Publications	1497	.602	.000
Pair 15	Sheets	337	.665	.000
Pair 16	Html Pages	1497	.468	.000
Pair 17	Quizzes	1497	.668	.000
Pair 18	Poll	1465	.067	.010
Pair 19	Categories	1497	.290	.000
Pair 20	Feedback-tool	1497	.256	.000

Appendix 5: Differences in the use of TeleTOP

In general:

	N	Minimum	Maximum	Mean	SD
Organization	1422	5	345	57.76	41.14
Communication	1422	0	381	9.05	26.66
Group work	1422	0	217	3.40	11.21
Activities	1422	0	1598	24.27	85.35
Resources	1422	0	207	10.72	21.61
Valid N (list wise)	1422				

For low, moderate and high TeleTOP use:

Use		N	Minimum	Maximum	Mean	SD
low	Organization	404	5.00	97.00	97	25.02
	Communication	404	.00	40.00	40	1.31
	Group work	404	.00	22.00	22	0.29
	Activities	404	.00	42.00	42	3.51
	Resources	404	.00	263.00	263	2.86
	Valid N (list wise)	404				
moderate	Organization	611	5.00	226.00	226	57.89
	Communication	611	.00	112.00	112	3.84
	Group work	611	.00	63.00	63	1.23
	Activities	611	.00	160.00	160	7.46
	Resources	611	.00	324.00	324	7.47
	Valid N (list wise)	611				
high	Organization	407	5.00	345.00	345	90.05
	Communication	407	.00	381.00	381	24.54
	Group work	407	.00	217.00	217	9.74
	Activities	407	.00	207.00	207	22.78
	Resources	407	.00	1598.00	1598	70.74
	Valid N (list wise)	407				

Low has 5 thru 100 (N=404), moderate 100 thru 250 (N=611), and high use over 250 documents (N=407) in TeleTOP by an instructor

Appendix 6: Overview of the support documents within the Flexibility Support Tool

Administration

About Administration
The Administration gives a clear overview of the name, date, subject, feedback, etc. of all submitted work. Choose this option when assignments are submitted via TeleTOP. This option can be hidden for students. Example of Administration.

Video of Administration: Click here to watch the video

Archive

About Archive
Use Archive for all sorts of documents, such as Word documents, PPT Sheets or Web links. The Archive can be used to organize all the information resources used in a course, in a structured way, when you use "Categories" within the Archive. Example of Archive.

Technical Help
Read the technical help about information_resources.pdf (Adobe Acrobat needed).

Video of Archive: Click here to watch the video

Assignment

1. Flexibility in assignments
The web environment can enable you to make student assessment more flexible by offering choices in
- size: short vs. bigger;
- complexity: simple vs. complex;
- focus: reproduction vs. contribution;
- task orientation: academic vs authentic

You could consider offering students choices in tasks/assignments with regard to:
- orientation: practical vs. theoretical
- execution: alone vs. group
- scaffolding: limited vs. frequent feedback loops

2. Participants' submissions and needs
Design and develop your activities in your environment so that new examples can be easily added based on participants' submissions and needs, needs that are best discovered after the module has been used in practice.

3. Criteria for the assignment
Define criteria for the assignment, used for assessment. You could consider to reduce the deadlines: give one or two deadlines when students should submit their work. Examples:

selecting the criteria options and how to be clear to your students

4. Due dates
Be specific about due dates. Indicate when you will no longer respond to submissions and what the consequences are if submissions are not submitted by this date. Example: of being specific in your assignment description, but also via the Roster

5. How to submit
Define how students should submit work, and how this is available through TeleTOP: "personal or group work"; "only visible for him/them" or "for all participants"? Example: selecting criteria options

Category

About Categories
In the list of concepts you can define all categories that are closely connected with the course. You will be able to relate the resources to these categories. Example of Categories.

Technical help
Read the technical help in Category.pdf (Adobe Acrobat needed).

Video of Category: Click here to watch the video

Chat

About Chat
Chat allows real time text-based communication via the Web. Use real-time collaborative tools so that students can see and hear the instructor or other students during a fixed time appointment, but without being face-to-face.
Video of chat: Click here to watch the video

Communication

1. About communication
Internet makes communication more flexible. The TeleTOP tool supports learning individually as well as in groups. Important for the learner is a "group" feeling. When at a distance, students appreciate knowing who is participating (shown in Email/Group), but also seeing a face (possible in Participants). Communication is possible via mail, a discussion board and chat.

2. Flexibility in location, times and pace? Make use of groups!
When you offer flexibility in location, times and pace, you can setup groups of students (i.e. on campus and off campus students). You can make groups in the Email/Group section, and use them in Workspace, News, Course info and through the Roster.
Examples:
- 3 main groups through Email/Group
- assign groups to certain Course Info items
- See how Roster rows are assigned to certain groups

Contact session

A model to set-up a contact session
1. .. min. Highlights, comments on previous submission
2. .. min. Introduction to the next topic, also based on previous self-study
3. .. min. Discussion of next activity and/or next step in the multi-step project

- Describe what the students should do, how much of an answer is expected.
- For students who are not physically present, indicate if they have any adaptations to the above activity, and when the activity is due to be submitted in the site.
- Discussion: Led by instructor, based on submissions into the Roster (for students who are not present, a summary can be made available via the Roster).

Fewer lectures?
You can have fewer traditional lectures and introduce new forms of contact sessions whose results can be studied by those who were not participating in the contact session directly. Extend the lectures and contact sessions so that:
- the most relevant points are expressed in notes available via the WWW site,
- particularly important comments by the instructor are captured as digital audio and/or video and linked to the course WWW site for later study
- students who were not at the session can review the instructor's notes, listen to or see the instructor explaining particular points (via streaming audio and video synchronized to the text notes), and can review the materials created and posted by the students who were present at the sessions

Flexibility and activity:
- Extend the lecture after the contact time by having all students reflect on some aspect and communicate via some form of structured comment via the WWW pages, or students can add to the lecture materials themselves, or take responsibility for some of the lecture resources:
- The instructor uses the students' input as the basis for the next session or activity
- Capture student debates and discussions, make available as video on demand, and use as basis for asynchronous reflection and further discussion

Contribution & re-use

1. About contribution & re-use
Contribution means that students are active in a course, and by submitting the results of these activities in the TeleTOP environment you can make use of these materials. A simple example is: let the students search for a web-link further as an example of a topic you are dealing with, and submit this to the environment. In web links you then will have a nice collection of examples.

2. Students can add option?
Choose the "Students can add" option within the resources to let students add Web-links, for example. An example of how an instructor has used student materials; and of adding web links by students.

3. Copying and for labeling of resources
Throughout the course, think about re-use and make re-use of everything. Aim to never type

anything twice, including from one cycle of the course to another. Use the TeleTOP features for copying and for labeling of resources, so that objects can be easily found. Label participant submissions as you go along in terms of those that will be good to re-use. Examples: of an archive, linking materials in the roster; and labeling the good work of a student as an example;

4. Think 50%:
Participants will be submitting resources from the workplace such as real data, examples, and reports; from the experiences and contributions of the participants; from contacts with others; and from real events. These will be built upon during the course, and the best examples captured for potential re-use for subsequent cycles. Example of a discussion about a real case

Date and location

Link to a Roster page
When you will put no specified information about the date and location in the Roster page, it is better to deselect this cell via the editing of the Roster row. This way the text will not be hyper linked and. See the example

Discussion

1. About Discussion
The TeleTOP environment allows students to have discussions. The students (and you) are allowed to submit discussion topics and messages, and are able to reply to each other. The messages can be ordered in several ways: date, topic, and sender. Example of discussion

2. Use of discussion:
- Discussions will not work automatically, you will need a moderator
- You can do this yourself or have students take responsibility for moderating the discussions and justify their comments when appropriate
- Let the students discuss as part of an assignment, see a example of an assignment for discussion

3. For students who can not attend a face to face session:
- During a F-F session, when discussing the lecture materials you can ask the students to summarize their ideas
- These new materials are immediately posted on the course site
- Extend the lecture after the contact time by having all students reflect on some aspect and communicate via debates and discussions

4. Technical help
Read the technical help in discussion.pdf (Adobe Acrobat needed).

5. Video of Discussion: Click here to watch the video

Email

About Email/Group
In the Mail center you are able to communicate with your students via E-mail. In this case you can set-up so-called E-mail groups. This facilitates easy simultaneous communication with a

number of students. Students can create email/target groups themselves as well... Example of the Email/Group option

Technical help
Read the technical help in Email.pdf (Adobe Acrobat needed).

Video of Email/Group: Click here to watch the video

Feedback

About the Feedback Tool
Choose the Feedback option in the menu when you want to setup and re-use certain portions of a feedback response. When you are looking at the work of students you can save your comments and re-use them later. Example of Feedback.

1. Moments of feedback
Instead of deadlines plan moments where students can get certain feedback, but this is not obligatory. Students can choose to make use of this "service". You only give feedback to students who require and appreciate this.

2. Options in feedback
Be specific when and what feedback is provided: choose from model feedback; personal feedback (also to groups); peer feedback; automatic generated feedback; model answers; discussion in a session; etc.

3. Highlight examples of good submissions, by giving it a "cup".
Use the student submissions for copying and for labeling of resources, so that objects can be easily found. Label participant submissions as you go along in terms of those that will be good to re-use. Example of labeling the good work of a student as an example.

4. Examples of Feedback
The use of assignments and feedback is a very important way to communicate between the student and the instructor. There are several possibilities in feedback, some will take more time, some are more specific, some are model answers and some can be generated by a tool. Following are a set of examples of how feedback can be provided through TeleTOP.

1. *Personal feedback by the instructor to an individual assignment.*
2. *Model-answer provided by the instructor*
3. *Peer evaluation provided by the student(s)*
4. *Automatic direct feedback provided by the learning system*

Example 1. Personal feedback by the instructor to an individual assignment.
In the distance course *Telematics Applications in Education and Training* students write an essay about a certain topic. The instructor provides individual feedback to the assignment of the student. Look at the example of the good work and how a cup is shown in the TeleTOP environment system. The way to provide personal feedback to all students is rather time-intensive, but students value this personal feedback. Interesting here is that the instructor suggests using the outcome of this assignment as model answer for the other students.

Example 2. *Model-answer provided by the instructor*
In the course *Instruction technology* students worked on a case. The results should be submitted in the TeleTOP environment. After the submission of the group work, the instructor made the model answer he earlier wrote available for that particular group. The students were able to compare their submission with the model answer provided by the instructor.

Example 3. *Peer evaluation provided by the student(s)*
In the *Instrumentatition Technology 2* course students were divided into groups. The groups gave peer-feedback to the other group with one number higher (so, group 6 gave feedback to group 7, etc.). The instructor explained the students that though it would cost time for the groups to write the feedback, giving peer-feedback would help to improve their own products, and the product of the group that they gave feedback to. Look at the example of how the peer-feedback was organized via the roster of the TeleTOP system, where the groups of students could submit their assignments and give feedback to the assignments.

Example 4. *Automatic direct feedback provided by the learning system*
In the course Principles of learning and instructional design the instructor had set-up multiple choice questions. All students had to make the test every week, they wouldn't get feedback directly after they were finished. All students had to submit their answers, after that the feedback that was already generated by the instructor was made available trough the TeleTOP system. See the example of automatic generated feedback after multiple-choice questions.

Flexibility in location, times and pace

1. About flexibility in location, times and pace
The use of Internet in education gives powerful options to be more flexible. Flexibility means that students can choose from options. When talking about flexibility in location (i.e. students are at a distance), times (to be present or active) and pace (not all students do exactly the same at one time), these options relate to the set-up of your general plan for the course, and this is reflected in your Roster.

2. How to show flexibility through the Roster?
When providing flexibility in location, times and pace, this should be generally explained through the Course Info, be made clear in the Roster, and be specified in the Roster pages. Examples of flexibility: flexibility in participation through the general Roster, and options in time and place in the Roster page.

3. Your Roster Plan
Make a plan for the Roster that is simple and clear for you and your students:
1. Choose useful Roster headings for your course (Suggestions are made based on the template). Look at the example of a Roster set-up
2. Use only catchwords in the Roster overview, be more specific in the Roster-pages. See how to provide more detail trough the Roster pages

4. Flexibility in location, times and pace? Make use of groups!
When you offer flexibility in location, times and pace, you can setup groups of students (i.e. on campus and off campus students), you can make groups in the Email/Group section, and use them in Workspace, News, Course Info and through the Roster.

Examples:
– 3 main groups through Email/Group
– assign groups to certain Course Info items
– See how Roster rows are assigned to certain groups

Flexibility in location, times and pace through the Roster pages

1. When students are not present at a session
Provide enough information for these students, such as the PPT slides and additional resources, so that they can participate at a time and a place convenient to themselves. Also, give them a way to participate by asking them to submit a question. Store the developments and results of your face-to-face session in the environment. Example of a detailed descriptions with options in time and place through the Roster page.

2. Preparations
Define what students should prepare for a face-to-face or virtual session. Think of what they should read, prepare questions about, find information about, etc. An example of such a description

Glossary

About Glossary
In the Glossary definitions related to the course content can be found. Relations with other areas or courses can be made clear as well. Note that in the Menu you can select "stud. add rights" what means that students can add materials too. Example of a Glossary.

Technical Help
Read the technical help in Glossary.pdf (Adobe Acrobat needed).

Video of Glossary: Click here to watch the video

Group-work

About group work
The TeleTOP environment can be used for group work. You can create groups in Email/Group, and create workspaces for these groups. When groups are ready they can present their achievements.

Info

About Course Info
The course info consists of all information the instructors would like to be provided to the students, e.g.: - course goals, objectives, and outcomes - course materials - course organization - assessment and testing. Example of Course Info.

General suggestions for set-up:

1. Instructor(s)
– Name, roomnumber and emailaddress. Picture is optional.
– When there are more Instructors for the course, state the division of tasks.

2. Content, a short description of the course, including
- the field of the course
- Which topics, theories and problems will be covered
- The relation to other courses preceding the course (state the courses which are required to participate), and following the course.

3. Objectives
- describe the course objectives in terms of what students should know/can when they've completed the course.
- The objectives should be formulated on an abstract level.

4. Material
- state the books, syllabi, multi media, web resources and other materials which the students should possess at the start of the course.
- Give full title, publisher, edition of the books, and give the full title of the syllabus and its code.
- Describe how students can get other materials (eg copying, handouts)

5. Organisation
- Explain the roster
- Describe very shortly for every lecture/topic its content, some topics and the relation to the whole course. Describe the number and type of every assignment.

6. Assessment
- What does the student have to do to complete the course?
- Is it required to attend lectures, and to participate in seminars?
- How will the students be tested? What kind of exam can they expect?
- How will the final mark be calculated?

Technical help
Read the technical help in courseinfo.pdf (Adobe Acrobat needed).

Video of Course Info: Click here to watch the video

Learning resources

1. About learning resources
There are several options for resources in TeleTOP, i.e. web-links; slides and an archive. You can choose these options via the menu option, and then submit your own materials. Different types of resources can be used. Think of what materials you have, or can find. Are there video's/simulations/papers/pictures that could be used for cases, explanations or activities? Examples: of an archive, of Word documents and a list of different videos in the resources

2. Link your resources
You can put your materials in the environment via the resource options that you can select in the menu. Subsequently you can add short-cuts to the Roster pages.
Example of how to select you resources, and how the short cuts to resources are displayed.
There is also a video about attaching materials to the roster.

3. Students adding materials?
Let students add resources, for example through assignments. You can ask them to find a Web example of the topic you are dealing with. You need to select the "Stud. add rights" (instead of "Yes") option of the particular resource (I.e. Web-links).

4. Different types of resources
Different types of resources can be used. Think of what materials you have, or can find. Are there video's/simulations/papers/pictures that could be used for cases, explanations or activities. Examples: of Word documents and different videos

5. Using Categories to classify your resources
When submitting your different resources into the TeleTOP resources, you could use efficient categories, subject headings, and descriptions. You will have a better overview on your resources, it will be easier for making updates and copying them into different places in the site.

Examples:
- of an archive, where categories are used
- linking materials in the roster, also a video that shows how to do this
- defining categories for resources

Link to resources

Link your resources
You can put your materials in the environment via the resource options that you can select in the menu (i.e. Web-Links, Archive, Poll). Subsequently you can add short-cuts to the Roster pages.
Example of how to select you resources, and how the short cuts to resources are displayed.

Video: Click here to watch a video about attaching materials to the roster

Multimedia

About Multi-Media
Multi-media files that are interesting for the course can be placed here. Note that in the Menu you can select "stud. add rights" what means that students can add materials too. Example of Multi-Media .

Technical Help
Read the technical help in Information_resources.pdf (Adobe Acrobat needed).

Video of Multi-Media: Click here to watch the video

News

About News
When you login in a course environment, the first page on your screen will be the "News" page. Here you are allowed and invited to inform your students about changes and new information with respect to the course's organization and delivery. View an example

Technical help
Read the technical help in news.pdf (Adobe Acrobat needed).

Tips and tricks:
– be specific and to the point in your messages
– announce matters, but do not place a lot of materials in the News
– fill in the expiry date so that your message is only posted for a certain period of time. After the expiry date, the message is automatically moved to "News Archive"

Video of News: Click here to watch the video

Organization

1. About the organizational facilities
These options in TeleTOP are there to give general information about the course, show the course scheme and give updates. It's more than organization when you look at the TeleTOP Roster. There you can design you course and organize activities.

2. Flexibility for your students
The use of internet in education gives powerful options to be more flexible. Flexibility means that students can choose from options. The types of flexibility you offer should be made clear in the Course Info and in the Roster of the course. TeleTOP gives you possibilities to keep track on the different "paths" that students can choose (i.e. with regards to choices in sessions; activities or materials to use). See here an example of a Roster, where different student groups are in one course.

Page

About page
In Page you can add text or HTML pages. You have to fill in whether the text is HTML or binary text. In the case of HTML you only have put in the HTML code. In the overview a link is generated. You can copy and paste the link into the Roster, so the page will be hyper linked from there.

Participants

About Participants
In the component Participants you and your students may see who else is participating in the course. Each participant may add his/her personal information, including a picture. Example of Participants.

Video of Participants: Click here to watch the video

Plug-ins

About Plug-ins:
Choose this option to make the programs available that are needed to view certain documents and media files, such as PDF and movies.

Poll

About the Poll
Use the Poll in a classroom setting with computers, as well as outside the classroom. You can ask the students to react to certain propositions. Example of the Poll.

Video of Poll: Click here to watch the video

Presentation

About Presentation
The final products of the students, like final reports, web-sites etc., may be presented in a structured way in the component 'Presentation'. Example of Presentation.

Technical Help
Read the technical help in Presentation.pdf (Adobe Acrobat needed).

Video of Presentation: Click here to watch the video

Project

Organizing project facilities and support:
When you have project work in your course, here are some guidelines:
- Make shared workspace tools along with other communication and reporting tools available in the WWW site to allow group members to work collaboratively on complex projects without needing to be physically together
- Use real-time communication tools via the Internet for students in different locations who wish to meet and discuss
- Guide students to provide constructive on-going feedback to each other, through the use of structured communication forms and by having their partial products accessible via the course WWW site
- Stimulate reporting of on-going planning, work in progress, etc., to increase the feedback and effectiveness of project work

Communication and interaction:
- Structure communication and interaction via the WWW site so that students are guided as to how to respond productively to each other's work and questions
- Address personal questions via e-mail and other methods of capturing communication;
- Guide students to take responsibility for answering each other's questions through "Discussion" or "Question & Answer" (with monitoring by the instructor)

Publications

About Publications
Publications gives the possibility to make an overview of interesting literature for the course. You can add links to the publication when it's available on the Web or put the original document in the list. Note that in the Menu you can select "stud. add rights" what means that students can add publications too. Example of Publications.

Technical Help
Read the technical help in Publications.pdf (Adobe Acrobat needed).

Video of Publications: Click here to watch the video

Question & answer

About Questions & Answers
In "Questions & Answers" (Q&A) the students may ask the instructor questions that will be visible for all participants. The instructor may want to provide his/her students in this option with a FAQ-list. Example of Questions & Answers.

Technical Help
Read the technical help in Q&A.pdf (Adobe Acrobat needed).

Video of Question & Answer: Click here to watch the video

Quiz

About Quiz
Choose this option when you want to set-up quizzes within the course (i.e. multiple choice questions). Note that in the Menu you can select "stud. add rights" what means that students can add quizzes too. Example of a Quiz.

Video of Quiz: Click here to watch the video

Resources

1. About the Resources
There are several options for resources in TeleTOP, i.e. web-links; slides and an archive. You can select these options and submit your own materials here. Different types of resources can be used. Think of what materials you have, or can find. Are there video's/simulations/papers/pictures that could be used for cases, explanations or activities? Examples: of an archive, of Word documents and a list of different videos in the resources

2. Students adding materials?
Let students add resources, for example through assignments. You can ask them to find a Web example of the topic you are dealing with. You need to select the "Stud. add rights" (instead of "Yes") option of the particular resource (I.e. Web-links).

3. Using Categories to classify your resources
When submitting your different resources into the TeleTOP resources, you should use efficient categories, subject headings, and descriptions. You will have a better overview on your resources and it will be easier for making updates and copying them into different places in the site. See the example of an archive, where categories are used

4. Linking your Resources to the Roster
You can easily place your resources in TeleTOP, and then make short-cuts to them from the Roster pages. Examples:
- linking materials in the roster, also a
- video that shows how to do this

Roster

About the Roster
The Roster is probably the most commonly used component of your course environment. Next to the more formal information in terms of dates and deadlines, you also may include here the topics that will be dealt with in specific classes or modules. Besides, the Roster is well equipped to add external files (PowerPoint, MS Word, Excel, etc.). Note these files can be stored in the resource menu components, but you easily can make links from these resources to the Roster. The Roster enables you also to define assignments, organize them and give feedback to the assignments. Example of a Roster.

Technical Help
Read the technical help in roster.pdf (Adobe Acrobat needed).

Video's of the roster
- Click here to watch a general video of the roster
- Click here to watch a video about adding rows to the roster
- Click here to watch a video about attaching materials to the roster

Search

About Search:
Choose Search to find documents within your environment, as well as searching the Web.

Self study

About Self-Study
The Roster pages can be used to describe the self-study activities of students. Be clear and explicit in the self study comments. Define how and what the students should do here. Relate this to the activities or sessions in the same row of the Roster. Example: of the reading list, and a more detailed description.

Flexibility:
For some sorts of practical or laboratory sessions, provide students with licensed versions of the software used in the sessions for their own use at home or work

Integrate with sessions:
Exercises and guided self-study can be integrated with the contact sessions; all can be engaged in from where ever the instructor and student have network connections

Re-use
Facilitate students using each other's submissions as learning resources once these are available as part of the WWW environment

Slides

About Slides
Here you can put the slides used in this course. Note that in the Menu you can select "stud. add rights" what means that students can add slides too. Example of Slides.

Technical Help
Read the technical help in Information_resources.pdf (Adobe Acrobat needed).

Video of Slides: Click here to watch the video

Web links

About Web-links
Web-links to Web-pages that are interesting for the course can be placed here. You can assign students to submit links as well. Example of Web-links

Technical Help
Read the technical help in Information_resources.pdf (Adobe Acrobat needed).

Video of Web links: Click here to watch the video

Workspace

About the Workspace
The workspace is the component within the course environment where students may work together on assignments, tasks, reports, etc. You can determine and create the conditions (e.g. who will have access to which workspace). Besides that you may add extra information to the workspace, and you may give feedback to the students in the workspace itself. Example of a Workspace.

Technical Help
Read the technical help in Workspace.pdf (Adobe Acrobat needed).

Video of Workspace: Click here to watch the video

Appendix 7: Description of the task within the formative usability evaluation

Activity for the use of TeleTOP as an instructor
Friday, May 31 2002

You are going to use TeleTOP as an instructor. You will learn that the interface is different from that of a student, and that you have to make decisions. These decisions are based upon your course, interests, ways of teaching and skills. Some support elements within TeleTOP can also help you make certain decisions.

Case
You're the instructor of a first year-course, where you are going to teach your students about educational Websites, about design, based upon design guidelines (with regards to structure, lay-out and usability), then learn to design one, applying these guidelines to your own design, to make a prototype of a web-based educational website.
The students in the course differ. Some are Dutch students, of these, some come directly from the secondary education, approximately age 19, while some others are part-time students with working experience, mostly in the field of education. Some students have experience in making Websites, some not; some have experience in making educational materials, others not at all. Some students are on campus all week, some almost never.

Tasks

1. Go through the set-up of your TeleTOP environment for this course. Create a TeleTOP environment that reflects how you, as an instructor could teach your course. The roster and the menu are particularly important.
2. Furthermore, you should also set-up the environment to show how you would handle one topic or one week of the course.
3. Don't forget bout the different groups of students. You should try to present slightly different resources and activities for these different student groups.

Materials
The time to set-up a whole course is of course very limited in this activity. In the environment you will find some resources already available that could be used in your course, such as some Web-links and PowerPoint slides. You can make use of them if you like, or create and use "virtual" materials: put files in TeleTOP, but only a name, not the file itself.

Hands on
After reading this introduction carefully, you will get access to your TeleTOP site. Follow the steps of the set-up, take your time for this, as you will get the change to orient on possibilities and make the right decisions. Take at least a half our to set up your environment (task 1), before beginning with 2 and 3.
Support will be available; Wim de Boer can assist with technical issues. It is important to work alone, use your headphone, when needed. Total time for this activity is 1 our and 15 minutes. After that you will get a feedback form, to collect your experiences.

Appendix 8: Questionnaire used within the formative usability evaluations

Evaluation of the Decision Support Tools in TeleTOP

This questionnaire is set-up to see how you have worked with the Support Tools, and to see how you are going to work with TeleTOP. It will take you less then 15 minutes to complete it, please take your time. We will use the results to improve support through TeleTOP, and information will be used confidential. When you do not understand a question, please put an "X" before that question.

When we say Support Tools we refer to the *General Roster & Menu Support Tool* (figure 1) and the *Roster Page Support Tool* (figure 2).

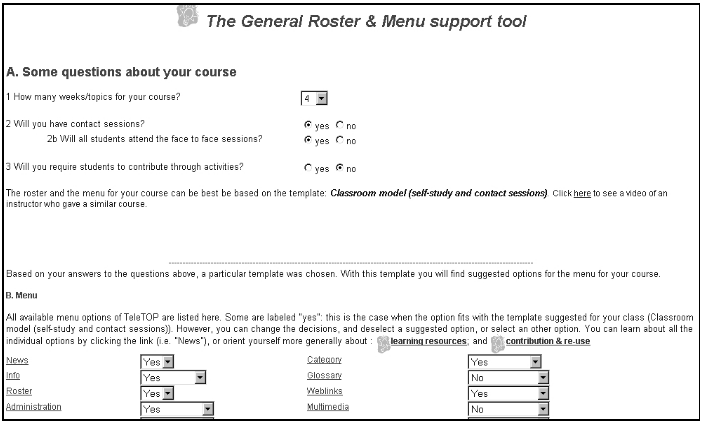


Figure 1. General Roster & Menu Support Tool

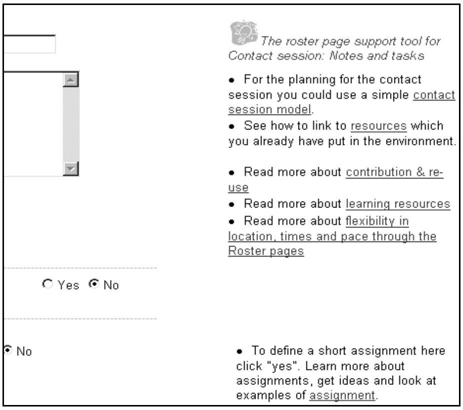


Figure 2. Roster Page Support Tool

Note that we are NOT asking about the whole of TeleTOP, but only these Support Tools.

A. General

Your name:

Email:

	Very negative		neutral			Very positive
What is your general impression of these support tools within TeleTOP?	0	0	0	0	0	
	Very difficult					Very easy
How difficult or easy was it to work with these support tools?	0	0	0	0	0	
	Very Frustrating					Very Satisfying
What was your personal feeling about working with these support tools?	0	0	0	0	0	
	Not at all powerful					Very powerful
How would you rate the power of these support tools to for making decisions about the design and use of TeleTOP?	0	0	0	0	0	
	Very poor influence					Good influence
To what extent do you think these support tools can help the instructor making a stimulating course?	0	0	0	0	0	
	Definitely not enough options					Very good range of options
To what extent do you think there were enough options offered by these support tools?	0	0	0	0	0	
	Very poor content					Very good content
How would you rate the content within these support tools?	0	0	0	0	0	
	Very poor approach					Very good approach
How would you rate the approach used within these support tools?	0	0	0	0	0	

B. User-friendliness of the Support Tools

	Very poor choice of size		neutral		Very good choice of size
How would you rate the size of the characters used on the screen?	0	0	0	0	0
	Not very readable				Very good readable
How would you rate the readability of the characters used on the screen?	0	0	0	0	0
	Not very useful				Very Useful
How would you rate the use of icons on the screen?	0	0	0	0	0
	Very Confusing				Very Logical
How would you rate the lay-out of the screen elements?	0	0	0	0	0
	Not al all effective				Very effective
How would you rate the effectiveness of how the screen elements were marked or highlighted to get the user's attention?	0	0	0	0	0
	Not at all clear				Very clear
How clear were the input procedures in these support tools?	0	0	0	0	0
	Not at all easy to use				Very easy to use
How easy were the input procedures for the support questions and options to use?	0	0	0	0	0
Consistency of the Support Tools					
	Very inconsistent				Very consistent
How would you rate the consistency among the different parts of the support tools?	0	0	0	0	0
How would you rate the consistency in procedures needed to use the support tools?	0	0	0	0	0

Understandability of the Support Tools

	Very hard to understand		neutral		Very easy to understand
How easy was it to understand what is meant by the text on the screens?	0	0	0	0	0
How easy was it to understand what was meant in the videos?	0	0	0	0	0
How easy was it to understand what was meant by the examples/screen dumps?	0	0	0	0	0

	Very inappropriate				Very appropriate
How appropriate was the language used in the support tools?	0	0	0	0	0

	Very difficult				Very easy
How easy was it to interpret the suggestions given by the support tools?	0	0	0	0	0

C. Utility

The next questions are about the General Roster & Menu Support Tool (see Figure 1, page 1) and the Roster Page Support Tool (Figure 2, page 1), each considered separately. We will repeat the same sort of questions for these two parts of the Support Tools.

General Roster & Menu Support Tool *(fig 1)*

C1.1 To what extent did the General Roster & Menu Support Tool (fig 1) help you make decisions about:

	Not at all		Neutral		Very much
The choice of a learning model	0	0	0	0	0
The design of the menu	0	0	0	0	0
The design of the roster	0	0	0	0	0

C1.2 To what extent did the General Roster & Menu Support Tool (fig 1) help you make decisions about flexibility in:

	Not at all		Neutral		Very much
Options for contribution & re-use	0	0	0	0	0
Options in resources	0	0	0	0	0
Activities at different times	0	0	0	0	0
Students at different locations	0	0	0	0	0
Students with different backgrounds	0	0	0	0	0

C1.3 Approximately how many times did you look at the following kinds of support:

	Never	Looked once	Looked at several items	Looked at most items	Looked at all items
Video	0	0	0	0	0
Guidelines	0	0	0	0	0
Examples	0	0	0	0	0
Technical manuals	0	0	0	0	0
Other comments	0	0	0	0	0

C1.4 How valuable did you find each of these kinds of support?

	Not at all valuable		Neutral		Very valuable
Video	0	0	0	0	0
Guidelines	0	0	0	0	0
Examples	0	0	0	0	0
Technical manuals	0	0	0	0	0
Other comments	0	0	0	0	0

C1.5 What kinds of support would you like to be added?

1. …………….
2. …………….
3. …………….

C 2.1 To what extent did the Roster Page Support Tool (figure 2) help you make decisions about:

	Not at all		Neutral		Very much
Flexibility in time	0	0	0	0	0
Flexibility in location	0	0	0	0	0
Flexibility in pace	0	0	0	0	0
Flexibility in content	0	0	0	0	0
Flexibility in activities	0	0	0	0	0
The design of the roster-pages	0	0	0	0	0
The design of assignments	0	0	0	0	0
The design of feedback	0	0	0	0	0
The use of learning resources	0	0	0	0	0
Options for contribution & re-use	0	0	0	0	0

Roster Page Support Tool (fig2)

C 2.2 Approximately how many times did you look at the following kinds of support:

	Never	Looked once	Looked at several items	Looked at most items	Looked at all items
Video	0	0	0	0	0
Guidelines	0	0	0	0	0
Examples	0	0	0	0	0
Technical manuals	0	0	0	0	0
Other comments	0	0	0	0	0

C 2.3 How valuable did you find each of these kinds of support?

	Not at all valuable		Neutral		Very valuable
Video	0	0	0	0	0
Guidelines	0	0	0	0	0
Examples	0	0	0	0	0
Technical manuals	0	0	0	0	0
Other comments	0	0	0	0	0

C 2.4 What kinds of support would you like to be added?

1. …………….
2. …………….
3. …………….

D. About your (intended) design of the course

D 1. If you had time to complete the design of this course, to what extent would the following kinds of choices be available to students in the course?

	No flexibility		Some		Extensive flexibility
Options for contribution & re-use	0	0	0	0	0
Times (for starting and finishing a course)	0	0	0	0	0
Times for submitting assignments and interacting within the course	0	0	0	0	0
Times for assessment in the course	0	0	0	0	0
Topics of the course	0	0	0	0	0
Orientation of the course (theoretical, practical)	0	0	0	0	0

	No flexibility		Some		Extensive flexibility
Assessment standards and completion requirements	0	0	0	0	0
Ways in which the course is experienced (face-to-face; group, individual, combinations)	0	0	0	0	0
Language to be used during the course	0	0	0	0	0
Learning resources: (Modality, origin (instructor, learners, library, WWW), etc)	0	0	0	0	0
Assignments required for the course	0	0	0	0	0
Flexibility in location of learning	0	0	0	0	0
Flexibility in times of learning events	0	0	0	0	0
Flexibility in pace of learning	0	0	0	0	0

	Not at all		Some		Very much
If you had time to complete the design of this course, to what extent would you make use of re-use materials made by someone else or found elsewhere?	0	0	0	0	0

	All by the instructor		By instructor and students		All by the students
If you had time to complete the design of this course, to what extent would the learning materials used in the course be acquired?	0	0	0	0	0

Room for comments:

Thank you. Please return your answers to Wim de Boer, by email (*w.f.deboer@edte.utwente.nl*), or via the green secretary mailbox at L206

Appendix 9: Summary of the responses on the interview questions[11]

A. Clarity: The goal of TeleTOP? Is it a communicated goal or self? When and how did you realize this?

Resp.	Response
A	There was a goal communicated, but the instructor finds it difficult to remember. He thinks TeleTOP is a fast medium to organize and have contact with students around sessions.
B	TeleTOP was there when the instructor started working. There was no introduction where goals were communicated. His own ideas are that TeleTOP is a tool that supports communication and organization within the course. Later he found it to be a rich learning environment for group work.
C1	Own goal: The goal is to improve communication with students. The goal was not communicated, the instructor did not think about it before the question came.
C2	No goal at first, but a notice that it would important. Then the feeling that it would make education more flexible.
D1	The instructor has no clear idea about the communicated goals. He has his own ideas. First, the instructor only thought about the possibility to make all materials that are of relevance for the course available. After working with TeleTOP the options that it provides for interaction and flexibility seem also very strong to focus upon.
D2	Own goal: TeleTOP for communication and distribution of information. The goal was not communicated, became clear after a year use of TeleTOP.
D3	Started with TeleTOP 2 years ago, but no clear goal was communicated. The instructor sees that the goal focused upon uniformity for all faculties at the university, and related ease of use and efficiency. It would safe time because instructors do not need to develop their own sites anymore. The instructor did not have specific expectations.

B. Flexibility: Familiar with the situation of your students concerning their age, goals, background, experience, etc.?

Resp.	Response
A	The group is homogeneous in age and skills. There are some differences in motivation and interest. There are however other students in other programs, but that courses are not integrated jet, but will become one course next year.
B	The instructor sees four groups with different characteristics: bachelors (‘consuming’), older years, international students, and part-time students. There are major differences in motivation, skills and own experiences.
C1	The group of students all come from ‘high school’. There are minor differences in their level of knowledge.
C2	Students come from ‘high school’ and professional colleges. More students from abroad. The approaches and knowledge differ.
D1	Some years ago the group of students was very homogeneous. The past year this has changed, there are several cohorts of students. They are a ‘world of change’ (differ a lot)…

[11] Translated from Dutch

D2	There are differences between the regular and LLL students in all aspects.
D3	There are differences, these mostly relate to motivation and skills.

Do you differentiate between students concerning these differences?

Resp.	Response
A	The instructor does not provide any options. A book is used as the main structure for the course. In active sessions assignments are made. The courses conclude with an exam. In the new courses the instructor expects to modify the program more because of different cohorts.
B	Differentiation can be offered through activities, as well as through communication and organization. Students can focus on certain content, the instructor asks them to select a topic and plan a session around that. Different groups of students sometimes work together, practical cases are subject of assignment. TeleTOP gives the structure, is used for communication and it describes options within the course.
C1	CCO is provided to get students on a certain level. Flexibility is within the speed students can go trough these COO. Students can find all important class materials and additional resources through the Web-site, this is flexible accessible. No real other flexibility or options are provided. TeleTOP is used as the instrument for the organization and some additional resources.
C2	Differentiating is within f-f sessions, not in the course planning. However the approach that students can choose within assignments this is flexible. TeleTOP is used as a tool to give options in activities. Depending on differences in students, differences in assignment can be organized.
D1	The instructor tries to give a lot of options to the students in choice and work out of assignments; time for meetings, submissions; ways to submit; less contact sessions and more communication via the Web… All of this takes more time compared to earlier approaches.
D2	Yes. The goals and themes of the courses are more or less settled, the way these can be reached not. Most flexibility is in activities/assignments. Students can build upon their own interests and experiences when selecting or defining the context of an assignment. Courses are activity based. First year courses need more structure then senior courses: students in senior courses do get more options to choose from then students from first year courses. TeleTOP is used as the instrument for presenting the structure and the options within the course.
D3	Most flexibility comes from personal contact and guidance in practical sessions. Extra resources and suggestions are provided, but in general there is one structure for the course. This also relates to the high number of students in a course and time limitations.

C. Ease of use: Is TeleTOP of high quality, easy to use and perceived as practical?

Resp.	Response
A	TeleTOP is easy to use, and gives little mistakes. The quality therefore is fine.
B	After some troubles with the Roster TeleTOP is clear and not difficult. TeleTOP works well, there is good functionality. It is special build for the university or schools.
C1	TeleTOP is perceived as easy to use and of good quality. Most times it is perceived as practical, the way to deal with attachments is not practical.
C2	TeleTOP is easy, maybe too easy? The quality of the system is increasing as more

	possibilities are being offered. The concept of TeleTOP is very strong.
D1	TeleTOP on average is easy in its use, the interface is clear and consistent. The quality is of acceptable level, as the system only seems to support the class-room approach and not many other pedagogies.
D2	TeleTOP is mostly easy to use. The instructor uses TeleTOP as it is of good quality, with a good internal constancy, usability (for communication and distribution), and efficiency.
D3	TeleTOP is perceived as an easy to use system. Although it is a ‘handy’ system the instructor finds the pattern sometimes to inflexible, whereas this was no problem when he did design his own Web-pages.

Which advantages, which problems?

Resp.	Response
A	TeleTOP gives the instructor possibilities to tell the students what to do. He provides all the resources for the course, as well as links outside the environment. This saves time compared to earlier and is better accessible. Problems occur when courses are ‘closed’ and students can not longer access the TeleTOP course environment.
B	TeleTOP stimulates the instructor to make the structure for the course more clear on forehand. It is flexible and accessible from all locations, and gives good support to just in time update the course or make additional resources available. Another advantage is that the instructor is in full control of the system.
C1	TeleTOP is fast, flexible and easy for communication and updates. New resources can be easily added when the courses is running. Problems are the way the attachments are organized. These should be editable on the server, and not always need to be down- and uploaded.
C2	TeleTOP is used for organization and administration. Also to place resources, which is very easy as the course has started. Problems are the limitations in giving it an own look and feel. Also the administrative section could be improved.
D1	TeleTOP can very well be used for making papers, slides, web links available. Also for the organization of the course with assignments, students submitting these and providing feedback on it, as well as communication and updates options. Problems are experienced when uploading attachments. TeleTOP allows only one at the time, which is very annoying. Other problems are that (other) instructors throughout the course do not use TeleTOP in a consistent way when placing data. This is confusing for students.
D2	TeleTOP is efficient in its way to organize the course and distribute information and organize communication. Problems relate to the complicated structure of the workplace, and the use of own HTML web pages, it is difficult to get a own look and feel….
D3	TeleTOP is a central place where practical matters, assignments, questions and answers, the organization, scores, and overview of the course can be communicated to the students. The instructor sees the system as his communication tool towards the students, students use email to respond to him. The limited flexibility to place attachments on certain places is a problem for the instructor.

D. Implementation and Management: What support was provided/available? Technical/pedagogical/ didactical? Are you satisfied?

Resp.	Response
A	There was a visit from a TeleTOP support person. The support was technical. The instructor indicates that problems and questions were self-solved.
B	A manual, a visit from a TeleTOP support person, and a one-day course for advantage use of video were part of the support. That last one was not very well suited, as the instructor still was a novice. The technical questions that the instructor had were answered through the manual and the TeleTOP support person. The instructor was more or less satisfied.
C1	There was support available (personal and a manual). Not much was needed because of experience. The manual was carefully read. Sometimes technical assistance was provided. The support was valued as good.
C2	Personal support and workshops. Focused on a technical introduction to the system. The instructor is satisfied about the fast and to the point support.
D1	The instructor attended workshops and had individual sessions. The approach was mainly focusing on technical matters, which was fine.
D2	"I don't know", no clear support, TeleTOP was introduced by a colleague. The instructor learned through exploring. Sometimes support was requested, to assist in technical solutions for new didactical ideas, but no satisfying answers were provided.
D3	There was a personal support session and a manual. The support was mainly focused on technical matters which was fine for that time. Later on the instructor would have appreciated more didactical/pedagogical support. This was not organized, the instructor feels that not all TeleTOP options are known.

Did the management provide time and money and support for the use of TeleTOP?

Resp.	Response
A	The management was committed. There was a TeleTOP contact person who could be asked for help. No extra time for learning to work with TeleTOP.
B	No
C1	No
C2	No, they were not committed.
D1	Besides support provided through the faculty no extra personal means.
D2	No, also not requested or thought about.
D3	Besides support provided through the faculty no extra personal means

Did TeleTOP build upon the earlier teaching approach?

Resp.	Response
A	The teaching approach has changed very little. There is more contact via Email now.
B	It did
C1	It did, earlier a course website had similar things.
C2	Yes, the before, during and after strategy that the Roster supports was very similar to his own strategy.
D1	Yes, the instructor already used the web to support teaching.
D2	Not totally. There is more communication via the computer now.
D3	It did to a certain extent. Communication has changed, where TeleTOP as new 'medium' was used.

Did you change your pedagogical model since the use of TeleTOP?

Resp.	Response
A	It did not change the model of the course, and the content and activities have stayed the same.
B	Yes, towards a community of practice… Learning has become more active, but this approach is possible because of the limited number of students and courses per year (4).
C1	It did not change the pedagogical model.
C2	Not really. There still are a lot of contact sessions. However, such as making resources just in time available.
D1	Since the use of TeleTOP many things have changed, although these relate to TeleTOP, these not necessarily are because of TeleTOP. Changes in more flexibility, more student centered approach, less contact sessions, new cohorts of students, more international (English courses), more interactivity in courses and use of TeleTOP in sessions.
D2	Not a new model, some changes however. The activity-based approach was still used. Changes were a more clear structure of the course organization before the start, through the use of the Roster. TeleTOP gave fewer options in giving the web-site a personal touch.
D3	Pedagogical model has not changed.

E. FST: Did you use the FST? How? Strong and weak aspects? Comments?

Resp.	Response
C1	Not much use. Unable to see the movies. The guidelines and examples were sometimes looked at. The instructor feels that as an experienced TeleTOP user with a clear model for the use of the system the support is only limited needed. Options such as deciding what menu items to choose and to define how to use the Roster were already common. The support is welcome however, and especially interesting for new instructors and instructors that set-up a new course.
C2	The instructor did not use the FST
D1	The instructor looked at the examples and guidelines. He found it to be useful, but probably because his extensive own experience not valid for own use. Less experienced users could benefit from it. The focus should be on technical matters that show “how to”. Extra resources from that to more ‘pedagogical’ sources also are worthwhile.
D2	The instructor found it an interesting and bright new aspect in the design. Some videos were looked at. However, the influence of this support is limited, also because the instructor had a strong sense of what she wanted with the course. Technical support should be very nearby, preferably through calling with a specific problem and have a fast answer. Within a new or changed course didactic support would be higher valued.
D3	The FST was used. The instructor found it valuable that examples were easily available. Examples should based on practices (of colleagues), to get and implement new teaching ideas.