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New didactics for university instruction: why and how?

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Abstract

Why should instructors in traditional higher education institutions consider the re-design of their courses? The paper begins with a defense of four compelling reasons for changes in didactics: a review of some key principles of good teaching and learning, the increasing diversity of student characteristics and associated needs, the strategic and educational rationales for five types of flexibility increase in our current courses, and the particular need for instructors in faculties of education to provide leadership and models. Given the why, the next question is how? The remainder of the paper discusses the *how* in terms of a conceptually grounded approach to the *pedagogical re-engineering* of existing courses so that they become more flexible, with more student engagement, more-targetted communication, and more-attuned instructor scaffolding of increased student responsibility for his or her own learning. These concepts are made concrete through the extension of six standard sets of course-related tasks into redesigned sets involving the new didactics and WWW-based course-support functionalities. Examples from current practice at the Faculty of Educational Science and Technology at the University of Twente are used to illustrate the new didactical categories and their use of WWW-based course environments. The paper concludes with a consideration of key challenges that will confront the implementation of such new didactics in practice.

1. Why re-examine our instructional practices in higher education?

From many different sectors—scientific, social, political, and educational—the message that universities are or should be in a process of change is a common theme. But why, and how? For example, the Director of the Information Centre of the International Association of Universities, summarising the results of a Task Force commissioned to study these pressures for change on the university at an international level, has indicated:

> New information techologies, and particularly the Internet, in dramatically transforming access to information, are changing the learning and research process, how we search,

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> discover, teach and learn...Universities must face up to this challenge...The future of universities depends on the capability to adapt to the new information society and meet the needs of an ever more demanding professional market. (Langlois, 1997 p. 7)

But even while accepting such statements at the general level, the individual faculty member in higher education, with probably many year's experience in teaching his or her courses, may not be convinced of the immediate need or feasibility of changing his or her own way of teaching, of organising his or her courses, of lecturing, handling student assignments, or giving examinations. The faculty member quite sensibly may be sceptical of general statements indicating that he or she should change his or her way of teaching. Change for change's sake? Change because of technology push? Change because of metaphor-push? (becoming a "virtual university")? Change because of politicians, who may be using "the need to change" as a pseudonym for reducing funding to the university?

To respond to this scepticism, there do seem to be at least three compelling clusters of reasons why faculties in traditional campus-based universities need to re-examine their instructional practices and change their didactical methods, and a fourth cluster of reasons particularly relevant to faculties of education and educational technology. The three general clusters relate to (a) basic principles of good teaching and learning, (b) pressures related to the increasingly changing demographics of the student population with the corresponding increase in the diversity of their needs, and (c) factors relating to the need to provide more-flexible education. The fourth cluster relates to the particular responsibility of faculties of education to provide leadership in articulating and modeling these new didactics in their own instructional practice.

In the next paragraphs some key aspects of these clusters relating to the motivations for change in one's own teaching practices are elaborated. This elaboration is critical: unless the individual instructor is convinced of some compelling motivation that he or she should change his or her way of teaching, the change will not occur. Or, if forced, will occur in as superficial a way as possible. For example, although there are many anecdotal examples of interesting ways to enrich one's teaching in higher education using technologies such as the WWW and other forms of computer-mediated communication reported at international conferences and in scholarly journals, the majority of university instructors appear to make little or no use of these technologies in their instructional practice (Boon, Jansen & Cox, 1997; Northrup, 1997). Undoubtably these instructors do not feel the personal need to change, nor the relevance or these technologies for their own situations.

1.1. The need to re-affirm some basic principles of good teaching and learning

Probably, the majority of instructors believe that they are following basic principles of effective instruction. However, many (outside of faculties of education) may not be aware that there is an extensive base of theory and research related to the science of teaching and learning in higher education e.g., Somekh & Davies, 1991 and thus can benefit from becoming more aware of certain key principles. Even those in faculties of education can benefit from occasional critical reflection on their own implementation of the theory that many of them are teaching (Laurillard, 1997). Although opinion can vary on what the key principles may be for

good teaching and learning in higher education, the following consistently emerge in the literature (for a current synthesis, see Norman, 1997):

- Learning arises from the *active engagement* of the learner
  This engagement involves cognitively active roles of both instructors and learners, "since knowledge is constructed and reconstructed through heuristic processes of creative thinking and *interaction*, as well as the acquisition of appropriate information" (Norman, 1997, p. 51)
- "The assessment of competence depends on listening, observing, and responding to learners reflecting on their products" (Norman, 1997, p. 51), processes best served by *communication-oriented* pedagogy (Somekh & Davies, 1991)
- Models of good learning should shift from knowledge-based, instructor-transmission models to models which are process-based and learner-oriented (Wright & Cordeaux, 1996). The most teacher-focused method of communication is the lecture; the most learner-focused method is instructor *scaffolding* of learner self-assessment and reflection (Berge, 1997). A consequence of this is that good teaching needs to relate less to transmission in the lecture hall and more to learner-attuned scaffolding (based on modeling how to think about what is to be learned, observation and coaching), and *eliciting articulation* (Shabo, Guzdial & Stasko, 1997).
- A good learning environment maximises meaningful and thoughtful interactions and provides a *variety of types of feedback* (Luft & Tiene, 1997), providing a means for the instructor to observe and coach, to elicit articulation, and to communicate appropriately (Shabo, Guzdial & Stasko, 1997). A well-designed instructional environment involves considerable instructor preparation and monitoring, but is aimed at learner self-regulation and self-responsibility (Luft & Tiene, 1997)
- And there are other less-conceptual but nonetheless important basic principles to consider: Students want to move *efficiently* through their studies, in both time and energy; students do not automatically have good study skills, discipline, or motivation (Collis & Meeuwsen, 1998); and instructors in higher education must work within decreasing budgets and higher *demands on their own time* and energy. We must do more with less (Moonen, 1994).

These key principles for good teaching and learning in higher education can be operationalised around the following guidelines:

- Scaffold the learner's increased self-responsibility for learning. Stimulate active engagement. Elicit articulation and reflection. Lecture less and give feedback more. Encourage more-frequent and targetted communication.

1.2. Needs relating to changing student demographics

While principles relating to good teaching and learning in higher education may be constant over time, the characteristics of the students in higher education are not. Students in the normal intake routes, directly from secondary school and resident at or nearby the physical campus, are being joined by increasingly diverse cohorts, diverse in age, educational

backgrounds, experiences, distances in which they live from the campus, and even cultures and native languages (Langlois, 1997). *Lifelong learning* will not only be a desire but a necessity, in a context of increasing career mobility (Krempl, 1997). Students will increasingly require educational programmes and the way of experiencing those programmes tailored to their own situations, rather than fitting a standard model of the young full-time student, living on the campus and needing a full range of courses for a certain degree. There are moral, social, and financial reasons to adjust university programmes to these increasingly diverse cohorts. But how to maintain a commitment to the principles of good teaching and learning described above as students have increasingly different needs and situations? How to do this while retaining respect for students' needs relating to efficiency and clarity, and to instructors' constraints relating to time? The answer is in more-flexible education.

1.3. The need for more flexibility

Flexibility means allowing the learner some critical choices in the learning situation so that it better meets his or her needs and individual situation. While most frequently, flexibility is equated to allowing the learners choice in the location in which they study (for example, allowing them to choose between a course offered on campus or the same course offered at a distance, the traditional "distance education"), there are at least 23 other aspects of flexibility that can be associated with more-individualised instruction (Collis, Vingerhoets & Moonen, 1997). These relate to time flexibility, content flexibility, entry and completion flexibility, instructional-approach flexibility, learning-resource flexibility, technology-use flexibility, interactivity and communication flexibility, course-logistics flexibility, as well as location flexibility. In a recent international research study (the *TeleScopia Project*) relating to the feasibility of these various forms of flexibility in actual practice, it emerged that learners already in the workplace and returning to courses particularly valued (a) not having to move from their homes and work in order to attend required sessions; (b) having flexibility within the pre-determined time frame of a course with respect to completing assignments; (c) being able to omit aspects of a course that were inconvenient or judged not directly relevant to them (particularly group meetings); (d) being able to vary the amount of communication that was required of them with other students or the need to physically get together with other students or the instructor; and (e) flexibility in being able to adapt assignments better related to their workplace duties (Collis, 1996a).

But the TeleScopia Project also demonstrated that there are limits on the degree and types of flexibility that can be offered. Some limits are logistic: instructors only have so much time to give to individual students even if instruction were the instructors' only responsibility. Instructors cannot give good personal feedback on an on-call basis to individual students. An instructor can maintain an intensive focus on a particular class and its students, but only within set time periods, not indefinitely. Some limits are inherent in the types of flexibility themselves: offering the student a choice in when he begins and ends a course limits or excludes offering him the choice of participating in group-oriented collaborative learning activities, as such activities require time synchronisation among the group members. Some limits are financial and practical: we may not have resources to provide students with a range of alternative types of study materials, such as multimedia resources.

Given all the possible permutations on individualisation that can fall under the category of making our instruction more flexible, the following have been accepted by our faculty as most important for combining principles of good teaching and learning with the needs of increasingly diverse student cohorts:

- Improving *flexibility in location* of where the learner can carry out different learning activities associated with a course. Many of the learning activities in a course can be carried out from a location outside of the physical campus, allowing the learner the choice of maintaining his home and work situation. However, we do not offer this flexibility for every aspect of every course. We believe that some learning experiences, such as the first meeting of a course, are best experienced in a face-to-face setting.
- Improving *flexibility in programme*. Assuming the learner has relevant previous experience, subgroups of courses can be chosen in terms of the learner's needs and interests. This implies in turn, that instructors must be more flexible, in terms of specific prior expectations of the students and in providing extra resources and opportunities to compensate for different backgrounds.
- Improving *flexibility in types of interactions* within a course, so that, for example, students who benefit from group interaction and group-based project work can have these opportunities, while other students, perhaps with families and work commitments who benefit more from the freedom to organise their own times and ways of studying, can also be accommodated within the same course. Not all students need to work in groups, and also not all group members need to be in the same place at the same time to work together.
- Improving *flexibility in forms of communication* within a course, so that learners and instructors have a wider variety of ways for more targetted 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. A student at a distance needs the same opportunity to communicate with the instructor when necessary as the local student; a student should be able to ask a question of his instructor from his own location and at his own time, but in turn the instructor should also have flexibility in managing his or her own time in terms of handling communication.
- Improving *flexibility in study materials*, so that the students not only have a wider choice of resources and modalities of study materials from which to choose than only what the instructor has previously selected for them, but also come to share in the responsibility of identifying appropriate additional resources for the course and even contributing to the learning resources in a course. As learners differ in their preferred learning modalities and in their prior knowledge and current situations, one set of reading materials or exercises is not likely to be a good response to the fact of increasingly diverse students in our courses.

1.4. Providing professional and academic leadership

Higher-education faculties, faculties of education and of educational technology face these same three sets of general challenges in terms of needing to improve the flexibility of

instruction. However, we also face an additional challenge: we should be the ones providing leadership to the others on how to maintain good principles of teaching and learning with diverse groups of students via more flexibility in our course offerings. We have the challenge of practicing what we preach: of providing leadership within our universities, of demonstrating how to implement more-flexible learning situations in our own courses, and of evaluating ourselves in the process. We as the professionals in educational science and technology need to provide models, not only in theory but in our own practice, of how this more-flexible course organisation can be done.

In considering these sets of reasons for the need for new didactics in university education, we have been focusing on the "*Why*?" in the title of this paper. But the *How* is harder than the *Why*. In the remainder of the paper, we focus on the "*How*?" While many perspectives can be taken, we focus here on one in particular: the perspective of the instructor in a traditional university, responsible for preparing and delivering a course.

2. How to proceed? *Pedagogical re-engineering* as concept and process

At the Faculty of Educational Science and Technology at the University of Twente, a commitment has been made to improve the flexibility and at the same time enrich the quality of our courses by attention to the five forms of flexibility noted above. We have already, over a period of several years, established a Master of Science Programme in Educational and Training Systems Design which has brought a diverse group of students to our faculty, and has stimulated us to adapt a great number of our senior courses to the needs (and the common English language) of these students. Many of the students in this new cohort come to the campus for only the first three or four months of the one-year programme, and then complete their work at home, via a combination of WWW-based courses and intensive e-mail contact. Some of them now attend entirely at a distance. But this Masters Programme has evolved parallel to our regular education, with a certain amount of voluntary aspect as to whether an instructor chooses to get involved, and the extent to which if he or she does get involved that a systematic adaptation of his course has occurred.

However, beginning in September 1998, we are building increased flexibility into our regular programme, as a full-scale commitment throughout our faculty. We are offering all of our first-year regular programme so that flexibility of location, of programme, and of some aspects of instructional methods are available, but within limits. Students can choose to live on campus, or stay at their homes; the only requirement is that once every two weeks they spend one day on the campus. Students can participate in the full programme, or in a reduced programme of first-year required courses, based on their previous study experiences. Students can attend full- or part-time. Students, even those living away from the campus, can have the benefit of different forms of communication and interaction among themselves and with their instructors, and there is flexibility in the times and places in which this communication and interaction occurs. Students who benefit from group-oriented interactions and students who benefit more from the efficiencies of self-study will both be accommodated. Furthermore, all of this is occuring with a serious concern for the engagement level and workload of the instructor. Good teaching is important to us, but it cannot be an overwhelming task. As much as possible, we

are more flexible in our instructional practices but without disproportionally increasing our workload and without expecting that our institution will be able to employ more instructors to take on additional variations of our courses.

Is this feasible? Yes, but it has required a re-examination of our current instructional practices, via what we call "pedadogical re-engineering" (Collis, 1997a), and our most well-informed combination of new didactics, new technologies, instructional and technology-design skills, and staff-engagement strategies. A high degree of support from our administration is critical, and a valuation of our efforts both within the faculty and across the university. It is also critical that funding has been provided to support the implementation activities. A team of five instructional designers has been formed, called the TeleTOP project team, which is chaired by the author and responsible for the implementation of this change. We are within the 1997–98 academic year converting 30 of our courses to more-flexible forms. New didactics, the intelligent use of WWW course environments, new "interactive classrooms" equipped for both room-type and desktop video conferencing and also WWW-based application sharing are making the flexibility possible. Various aspects of this process are discussed elsewhere (see links to a number of papers and presentations via the project site at http://teletop.edte.utwente.nl/).

In this paper, we focus on a core conceptual part of the process: an educationally based method for analysing one's course and making informed decisions about how to re-engineer aspects of that course for more-flexible instruction. We describe this in four parts: (a) an analysis method generic for any course to identify opportunities to increase its flexibility; (b) the introduction of new didactical categories related to increased flexibility, more-diverse students, and principles of good teaching and learning; (c) the concretisation of these via specific examples of the new didactics in practice; and (d) some of the key issues and challenges that face us in making the transition to these new didactics across the faculty.

The process we describe, although innovative as a faculty-wide implementation project, is not proceeding from a starting point of only theory and good intentions. The Faculty of Educational Science and Technology already has extensive experience with pedagogical re-engineering and innovative use of the WWW to support its courses, not only through its Master of Science Programme but also via a number of its regular courses that have made substantial use of the WWW since 1994 (Collis, 1997a,b). For example, one such course, a required course for all of our first-year students, has been extensively studied and evaluated during its three years of using a WWW-based integrated course environment to support all aspects of the theoretical and practical group-based project work in the course and has brought the faculty a considerable amount of experience during its evolution. (For a series of links to papers and reports about this course, several of which relate to the results of five extensive student evaluations, see http://www.edte.utwente.nl/ism/ism1-97/ref.htm).

3. The first step: course decomposition and analysis

The process of pedagogical re-engineering begins by the instructor being guided by the TeleTOP team in thinking of his or her course in terms of six general sets of components. After that, each set of components is individually examined in terms of how to increase its flexibility as well as enrich its instructional quality.

3.1. Profiling course tasks in terms of a standard set of components

Over several years of analysis (Collis, 1996b, 1997a), we have found that the amount of time an instructor spends on a course can be roughly expressed in terms of percentage allocations among the following six general categories of tasks:

1. Tasks related to the *general organisational aspects of the course:* Before the course, identifying the objectives, choosing the study materials, planning the time and tasks of the course in terms of contact sessions, student activities, evaluation criteria and procedures, etc. For courses with practical components (laboratory sessions, practica, etc.), planning these sessions and the materials needed for them. Making all this information available via a syllabus of some form. Answering questions from prospective students. During the course, maintaining overall administrative records relating to the students. At the end of the course combining all marks into the final grades of the students and making the final grades available to the students as well as the administration. When necessary, letting the students know about changes in the planning of the course or clarifying organisational aspects.
2. Tasks related to lectures and other forms of *instructor presentations:* Before the course, blocking out the lectures over the available time periods. Before each lecture, planning the contents and organisation. During the lecture, responding to student questions. After the lecture, responding to students' questions, including requests from students who missed the lecture for the lecture notes.
3. Tasks related to the students' *on-going study:* Selecting the study materials and indicating what should be studied during what time periods. For some courses, these tasks may involve monitoring work done in a laboratory or other practical sessions, and collecting, marking, and giving feedback on occasional study assignments. As these activities proceed, the instructor may be approached by the students for help or explanation of the marks received or requests for extensions of time. Generally the instructor assumes the students are studying the pre-set textbook material at the rate specified in the syllabus and does not have a direct way of knowing if this self-study is on tempo, until assignments are handed in or examinations are taken.
4. Tasks relating to *more-complex assignments* in a course: In many courses, students must work progressively over some or all of the course on a major final assignment. This assignment may be a report or essay or project, and it may be carried out individually or as part of a group. These are different from on-going activities in that they typically represent some sort of creative or constructive activity whose intention is that the student integrates many aspects of the course in some multi-phase task. While the assignment is in development, the instructor may have a method for giving feedback on the as-yet not finished work. Also, the instructor may be approached by the students for clarification, feedback or extensions or to handle personal problems in managing the task. When the more-complex assignments are submitted, the instructor needs considerable time to evaluate them, and return them with a mark and some level of feedback. Occasionally the student may be asked to redo some aspect of the assignment, leading to another loop of submission, marking, and feedback. On other occasions, students may contact the instructor to discuss

or debate the final mark on the assignment, which in turn can lead to further loops of submission and marking.

5. Tasks relating to *examinations:* The questions to be asked must be constructed, organised, and prepared for distribution; the students must be monitored during the examinations; and the examinations must be marked with results made available to the students. Students will approach the instructor before the examination for help or to request some form of personalised adjustment. Students who do not succeed generally require extra time and communication, and may require an additional testing opportunity. All marks must be maintained.
6. Tasks relating to general *communication* within the course: In all of the above categories, the instructor may be informally approached by the students with questions or requests. But instructors may also more specifically organise communication within a course, such as by offering set times (''office hours'') when students can come for extra help or contact, or by organising discussions among the students as part of the course activities.

Instructors vary considerably in the percentages of time spent on a course across these categories. In some courses, a category may not be relevant, for example, a course without an examination or without a final project or complex activity. However, the instructor does spend a finite amount of time on a course, and this time can be generally expressed in terms of these categories. We have found that the process of re-designing one's course for more flexibility can conveniently begin by starting with the current way that the course is being handled, expressed in terms of these six categories.

3.2. Examining each component for flexibility and enrichment possibilities

Given this first phase of analysis, the question of how to make a course more flexible and at the same time to enrich the communication and interaction within a course can be more-systematically addressed. How might each of these components be revised, via a combination of new or adapted didactics supported by functionalities that can be integrated in a WWW site? How can the communication and engagement necessary for good teaching and learning be supported?

In the approach used by the TeleTOP team, we began by having a series of faculty workshops, in which this way of thinking about a course was demonstrated and examples were discussed and shown from current courses in the faculty in which increased flexibility and/or enhanced communication and engagement were made possible via didactical changes and the use of various WWW functionalities. Table 1 shows some of the ideas. A WWW site was created for the instructors so that each idea was immediately demonstrated by a link to its implementation in the WWW site of one of the 12 courses in the faculty that had been already redesigned and were making use of WWW environments. A version of this matrix is always available to the instructors, and can be visited via the TeleTOP site whose URL was given above.

After several months of this orientation across the faculty via weekly voluntary faculty workshops and other activities, each instructor to be involved in the 1997–1998 phase of TeleTOP had a personal one-hour interview with members of the TeleTOP team and the

Table 1
Increasing the flexibility of a course, some examples involving WWW support

Component	To increase flexibility:	To increase effective communication and engagement:
1. General course organisation	—Post all announcements about course procedures on a course WWW site	—Make a calendar available on the WWW site via which relevant dates and times highlighted
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 WWW site, • (b) particularly important comments by the instructor are captured as digital audio and/or video and linked to the course WWW 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 synchronised to the text notes), and can review the materials created and posted by the students who were present at the sessions • (d) The WWW and its communication tools allow students to enter their reflections about the lecture from where ever they have network access, at whatever time they wish. The instructor can similarly prepare and send his comments at his own time and place. Students can read his comments via their email or the WWW site at times and places convenient to them.	—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. These summaries 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 WWW page —The instructor reads these comments, and gives some return feedback either via the WWW page and/or e-mail; and builds these comments into preparatory work before the next contact session
3. Self-study and exercises; practical sessions	—See the above; exercises and guided self-study are now integrated with the contact sessions; all can be engaged in from where ever the instructor and student have network connections	—Students can use each other's submissions as learning resources once these are available as part of the WWW environment

	—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 —For activities not possible to handle away from the campus, use some time during the common periods when all students do come together for these	—Communication and interaction can be structured via the WWW site so that students are guided as to how to respond productively to each other's work and questions —Personal questions can easily be addressed and answered via e-mail and other methods of capturing communication
4. Multi-session projects or activities	—Shared workspace tools along with other communication and reporting tools in the WWW site allow group members to work collaboratively on complex projects without needing to be physically together —Students in different locations who wish to meet and discuss can use real-time communication tools via the Internet	—Regular reporting of on-going planning, work in progress, etc., can increase the feedback and effectiveness of project work —Students can be guided to provide constructive on-going feedback to each other, through the use of structured communication forms and by having their partial products accessable via the course WWW site
5. Testing	—Test items can be presented at a certain time, under secure conditions, so that students can write a test if not in the physical testing location —Feedback from the instructor can come quickly and in a targetted manner, without the student needing to wait to see the instructor face to face	—Immediate feedback can be given to test items with pre-sent answers —Instructor feedback can be posted on the WWW about aspects on the test where difficulties were encountered —Instructor feedback can be sent to different groups of students, based on their needs as shown by the test
6. General communication	—Add a communication centre to the course WWW site so that groups of students, or individuals, can be easily contacted via e-mail	—Add a WWW board for discussion about course topics —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

author, in which a WWW-based decision support tool specially developed by the team was used to systematically guide the instructor in terms of considering more than 50 possibilities of features in a WWW site that can be used for increasing flexibility, effective communication, and student engagement, as well as efficiency in course management for the instructor. This decision-support tool and the process used for the dialogue with the instructors is described elsewhere (Fisser et al., 1998; Collis, 1998; De Boer, 1998; Peters, 1998). All instructors teaching first-year courses were required to be involved (16 courses); the remaining 14 courses were volunteered by their instructors. In the 1998–99 academic year, all second-year courses will be required to participate in the next cycle, and similarly for the third-year and elective courses during the following two years (if not before).

An examination of Table 1 shows that the standard six sets of course components are not really adequate to describe the instructor's or the students' activities when these sorts of adaptations are involved. For example, the distinction between lectures and self-study blurs when the orientation changes from lectures toward more scaffolding of self-study, coaching, and stimulation of student articulation as the primary communication method of the instructor. Gradually we are coming to think of these changes as our new didactics. In the next section we identify some of differences in these new didactics compared to the our previous ways of carrying out our instructional tasks.

4. The second step: extending our current didactics

How might an instructor's time be described in terms of these new didactics? Based on four years' of working on these changes in my own teaching (Collis & Meeuwsen, 1998; Collis, 1997a) as well as the experiences of many others aiming for new didactics integrated with new uses of WWW-based course environments (see for example Takle and Taber (1996), Juge et al., (1997) and Collis (1997c), a recent special issue of the *International Journal for Telecommunications of Telecommunications in Education*), the following contrasts can be made:

1. Traditional: Course organisational aspects. New: Course + WWW site organisation:

   Before the course, the planning tasks include many of those carried out traditionally. However, now there is the addition of planning the course WWW environment (Eekma & Collis, 1996). This type of planning involves aspects such as: Making design decisions about the basic navigational and structural aspects of the course WWW site; preparing the course WWW site and the materials in it so that the site is ready for operation before the first contact session; include help or "guided tour" type features in the site so students can find what they need and if necessary can get extra help with handling the new environment; add links to appropriate outside readings available via the WWW to supplement the preset course texts. During the course, monitor all aspects of use of the site, add information to the site to indicate to students how to get technical help as needs arise; post regular messages to the site to help students keep track of new material in the site; communicate with the technical person (the *Webmaster*) in one's organisation in terms of adding new students to the course, increasing the access and space needed on the

server for the course, and other technical demands of the course, particularly in terms of helping students with their problems in working with the course site from a distance and in terms of problems such as access to printers and connectivity interruptions.

2. Traditional: Lectures. New: Contact sessions:

Instead of preparing a lecture, prepare a *contact session* in which students will be interacting and active. Also, prepare this session so that students who are not physically present can also participate, either at the same time but at a distance or at a later time. This requires new forms of preparation compared to how an instructor traditionally prepares to give a lecture. It also requires new ideas about getting important ideas across, not by telling them to the students but by setting up activities so that the students can be coached and guided as they carry out the activities and reflect upon them. Steps that might be involved include the following for preparation:

Devise and post on the course WWW site some preparatory task or questions to guide the students' preparation for the next contact session. Prepare for the contact session itself so that (a) the preparatory task is built upon in the session, reinforcing student preparation; (b) any content material to be elaborated in the contact session by the instructor is prepared in note form in advance and made available on the WWW site for students who will not be present; (c) an interactive activity (a discussion, a short analysis task, a problem to work out, etc.) is devised that can involve the students attending the contact session at the same time but in different locations so that the students are actively engaged in some sort of articulation and collaborative learning; (d) support materials to guide this interactive work, to be used by the students to report on their work, are devised and put on the WWW site; (e) a follow-up activity to structure students' reflection on the contact session and how it integrates with their self-study materials and their other course activities is also planned; (f) the instructions for this activity and the reporting form for the students to use are entered into the WWW site before the contact session.

During the contact session (for students participating at the time of the session):

(a) Present a limited amount of introductory comment, using the WWW-based notes, and if the facilities are convenient (as they are in our *Interactive Classrooms*), capture via digitised audio and/or video anything needed to make the notes more effective for the students who will study the materials later and were not participating in the contact session as it occurred; (b) informally monitor and interact with the students as they work on their interactive activities, noting where points of follow-up clarification would be most useful; (c) conclude the contact session with a selected review of some of the reports submitted by the groups as a result of their interaction, asking students to explain a little more about what they meant and taking care to call on the students in the remote location who participated in the group activities via telematics support; (d) go over with the students who are participating in the contact session what your expectations are for the follow-up activity, to see if the instructions that were posted in the WWW site are going to be clear enough for the students who will read them at a later time, such as

part-time students who are working during the day and thus not involved in the contact session.

Following up the contact sessions:
(a) Clarify anything in the instructions in the WWW site for the follow-up activities so that the students reading those instructions at a later time will have clear and simple instructions; (b) Indicate a cut-off time for the submission of the follow-up activities from the students, and after this time, look at their submitted comments and post a feedback response on the WWW site or by email (for example, a different comment may be appropriate to the part-time students than to the local students); (c) keep track of each student's submissions, and send a message to students who did not submit to find out if they are having particular problems (this message can be pre-structured, so the time and effort needed to send it can be small).

3. Traditional: Specifying on-going study. New: Integrating study, communication, and activities related to the contact sessions

The key change here is the integration of guided self study with reflection and communication related to the activities that go on in the contact sessions. Another change is that students are actively contributing to the study materials, in that they are reading and reflecting upon each other's contributions and comments. They may also add resources to the course site, to increase the study resources for the course.

4. Traditional: Project or final assignment. New: Adding collaboration and feedback loops

Expand the communication and feedback loops in a project, and add more peer-evaluation and feedback by: (a) providing instructions for a number of in-between steps for a complex project, and making these available via the WWW site; (b) for each in-between step devising and making available some sort of reporting form via the WWW site to make the communication about the in-between steps as explicit and simple as possible for the students (both at a distance and local); (c) as much as possible, asking students to make their current planning or partially finished work available via the WWW site so that they can be guided to provide feedback to each other via the WWW site; (d) providing in advance an evaluation form indicating the criteria and weighting you will use to assign a grade to the major project, so that students are clear on your expectations; (e) when possible, providing examples of the sort of work you are expecting via the WWW site, so that students can use previous students' work as study resources; (f) when students do not submit these interim reports and peer-evaluation comments, contacting them to find out what is the problem or delay.

5. Traditional: Testing + Communicating results. New: Distance-independent

Same as before, but find ways to allow students working during the day to sit a test at a time and place that does not require them to come to the campus. Post results of

student performance via email or the WWW site, so that students at a distance from the campus can see their results via the site. Make practice tests, with feedback, and examples of good answers available through the WWW site.

6. Traditional: General communication via office hours or in the hallways. New: Time- and location-independent communication

   In addition to traditional forms of communication, add extra communication opportunities such as: (a) making it convenient for all students to contact each other and the instructor via the *e-mail centre* of the WWW site (or using other tools such as a shared workspace), encouraging students to ask each other for help and clarification before they contact you; (b) posting messages and clarifications to all students via a ''newsflash'' area clearly visible on the homepage of the WWW site if you notice that students need some extra comments rather than responding to them individually; (c) announcing times via a calendar of some sort in the WWW site when you will be available for direct contact so that students if they feel it really useful can contact you by paying a visit, by telephoning, by faxing a question, or by e-mail; (d) indicating when you are available for direct contact and how long students can expect before you reply to email.

These types of new didactics require a new discipline from both students and instructors. Instructors will need to develop their skills and ideas gradually; fortunately not all the new didactics need be incorporated in every course or at the same time. Communicating by targetted writing (posted via email or on the WWW site) in response to student submissions comes to replace much of the communicating-by-giving-a-lecture that the instructor is familiar with; this in particular takes time and practice to develop. Improving course organisation and general communication (Categories 1 and 6 above) seem to be the easiest for the instructor to adopt. There is no mistaking the fact that these new didactics will involve new time investments by the instructor. Anderson (1997) indicates that the best way to handle the time involved is to consider it within a re-balancing of the use of time in a course, away from lectures-as-usual and toward a fewer number of lectures-as-usual plus a larger number of tutorials, small-group study sessions, and better support for self-study.

It is particularly helpful for the instructors to be able to see models and examples of these new didactics and their associated WWW-based support. In the next section, one such particular example is illustrated. For our instructors, there are many models available among our own courses.

5. The third step: making the new didactics concrete via examples

The following is one example of our new didactics. The example refers to the fourth-year elective course called *Tele-Learning*. This course involves 27 students, eight of whom are working full time. It is the fifth year that the course has made use of a WWW environment and new didactics (Collis, 1997a). During the 1997–98 year of TeleTOP, the course has

functioned as an example for the other TeleTOP instructors, giving them a close look at the dynamics and management aspects of teaching the course. The course environment used is generated in the same way as the other TeleTOP courses.

Fig. 1 shows the general organisation of the WWW site to support this course. The navigation frame at the left indicates entries to main areas of the overall course site. The page and site are generated from and maintained within an underlying database environment (Stijker, 1998). The Course Organisation link goes to a WWW-based version of the course syllabus, but with the addition of external links and an overview of student-administration data. the Newsflash portion of the homepage is updated regularly by the instructor, at least once a week, but sometimes several times a week. Part of our TeleTOP approach involves making it as easy as possible for the instructor to do this updating; all that needs to be done is to click on *Edit*, and a form is made available so that all the instructor has to do is type and then click a Submit link. The new entry is immediately posted on the WWW site. The instructor can do this from any location where there is WWW access; he or she does not need direct access to the server nor does he or she need to know any HTML code.

Fig. 2 shows the *Roster* of the course site. Again, this Roster is easily edited by the instructor via the *Edit* link. Only the instructor has access to this Edit link; it does not show up

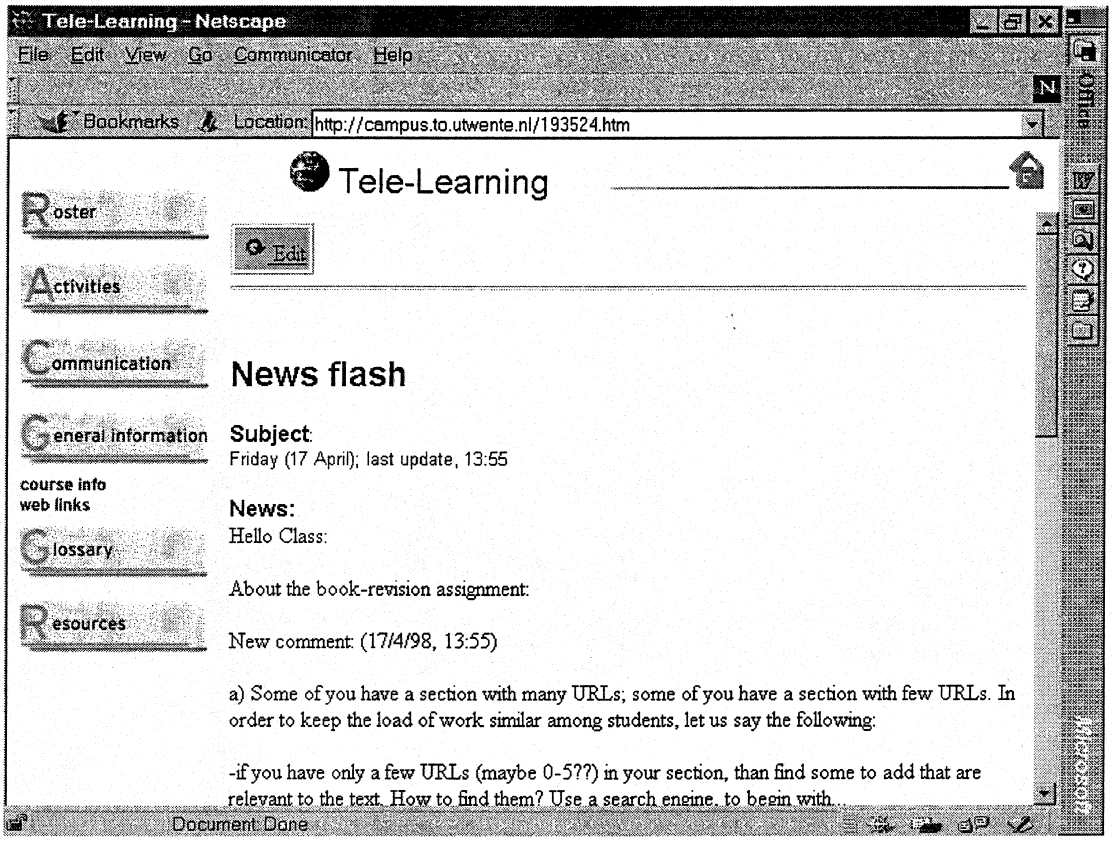

Fig. 1. Organisation of the *Tele-Learning* course WWW site.

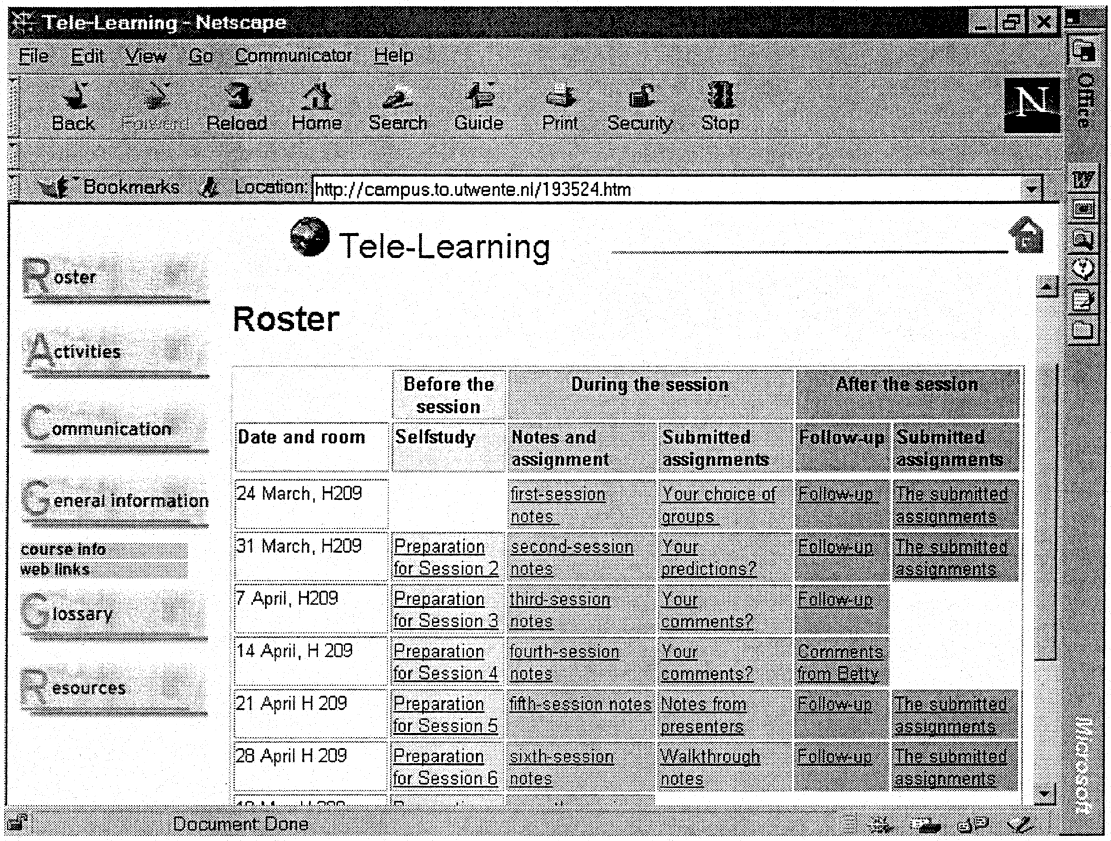

Fig. 2. Instructor-edited Roster; students' submissions during the contact sessions, or after, are also entered via the WWW site and immediately posted.

on the students' versions. The links in the Roster clearly indicate the on-going provision for guided self-study (Preparation), for active contact sessions (with direct storage of student work), and of instructions for follow-up activities and submissions after the contact sessions.

There are two multi-week projects in the course as well as the weekly on-going submissions. Both of the multi-week projects make use of a *shared-workspace* environment directly linked to the course site. One of the projects involves the students working in collaborative groups while the other is an individual assignment. The shared workspace environment, called *BSCW* (GMD, 1997), a product of the German GMD National Research Centre for Information Technology and available freely for educational purposes, supports an extensive range of collaborative work and learning activities including document sharing, conferencing, and shared annotation. Fig. 3 shows the main folders organising the shared workspace for this course. All student work is available for comment in the workspace, and students are directed to regularly give peer feedback to each other, via notes associated with documents in the workspace. The final versions of the assignments will also be available in the workspace and also from the course site itself (as the workspace requires an additional password).

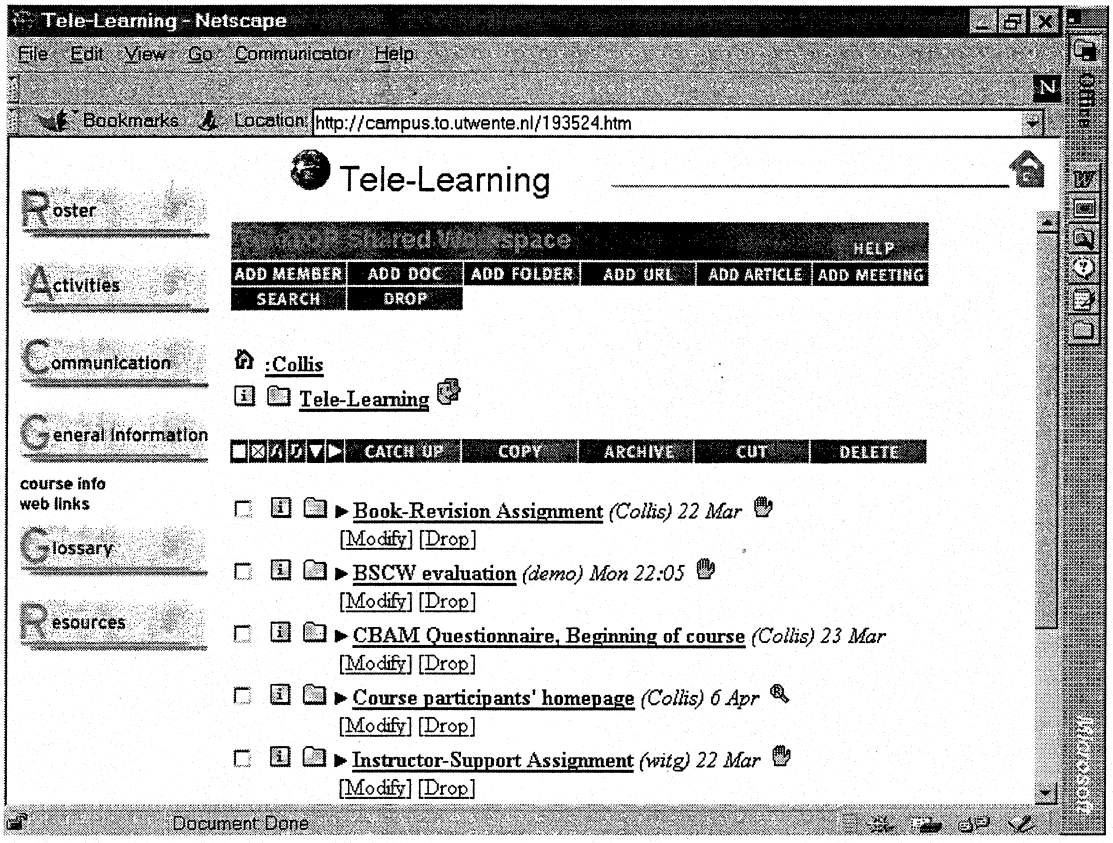

Fig. 3. BSCW shared workspace for the Tele-Learning course.

Another important feature of the Tele-Learning course site is the *Communication Centre*. Each student entered his or her name and email address; anyone can use the links identified with envelopes to directly send emails via the course site. The *Resource area* allows all participants to enter links to additional course resources, directly into the WWW site, along with a description of why the entry has been made.

In order to capture certain moments of communication and allow them to be available for review or for those who were not physically present when the particular communication occurred, there are video segments (via streaming video) synchronised with presentation-support materials available for interactive access in the course site. Fig. 4 shows an example, in which the instructor introduced the course textbook and explained some of her reasons for writing the book.

This example gives the flavour of the combination of new didactics and new uses of the WWW that is characteristic of our TeleTOP approach. It is by no means the only pedagogical approach represented in our courses. Some of the courses emphasise group-based projects and collaborative learning, others are more directed toward skill development, others to statistics and research methods, and others representing a spectrum of more theoretically oriented courses. Some instructors are already making deep changes in their instructional beliefs and

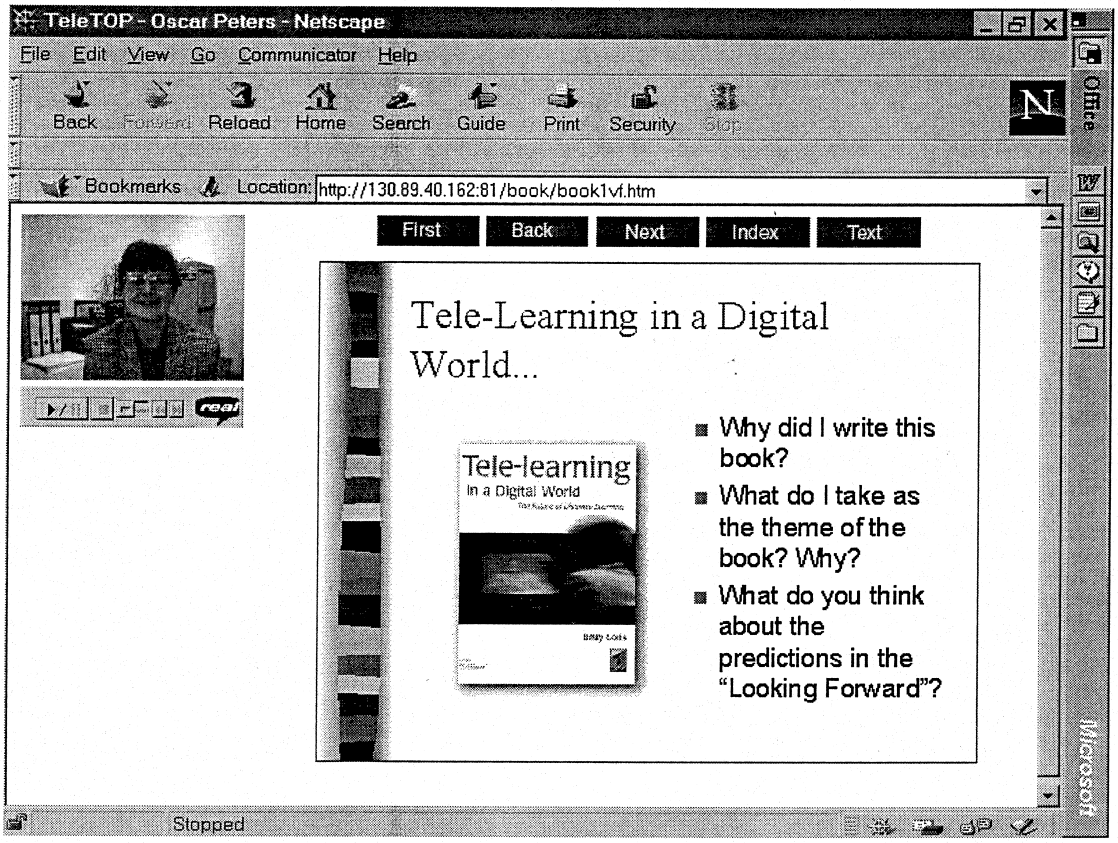

Fig. 4. Synchronised digital presentation, for review or for those who were not present. The Index link allows the user to select any frame in any order, and further to decide if he or she wishes to hear and see the speaker as well as see the associated slide, or to only hear the speaker while viewing the slide, or to only see the slide.

course objectives, while others are less imaginative. However, common to all of our work is our awareness of the challenges facing any initiative involving faculty-wide changes in the way we teach.

6. The fourth step: anticipating the challenges in making the transition to the new didactics

Good teaching is never easy. Changing one's way of teaching is never easy. Handling new technologies is never easy. Finding the time to do new things is never easy. Doing things differently than the traditional ways of the university is never easy (Langlois, 1997). Being rewarded and appropriately supported (in terms of human and financial support) for putting effort into one's teaching in higher education is unfortunately often not easy (Langlois, 1997; Seminoff & Wepner, 1997). But in counterbalance to all these difficulties, the art and science of implementation of change in higher education has been carefully studied, and many insights are available to help the transition to change in one's way of organisation of instruction and of

carrying out one's role as an instructor. For example, Rogers' work in understanding factors that facilitate or impede the diffusion of an innovation in an organisation (Rogers, 1983) has served as a valuable theoretical framework in a number of implementation projects (for example, Northrup (1997) and Abou-Dagga and Huba (1997). Rogers' model indicates that the main attributes that influence an instructor's response and uptake of an innovation in his or her teaching include

- advantage—being convinced of its relative advantage compared to the current practice;
- trailability—having a non-threatening way to gain experience before actual course usage;
- observability—that the results of one's efforts to change will be noticed, and appreciated;
- complexity reduction—that the complexity of the innovation be broken down and supported as much as possible (instructors benefit from scaffolded support, too, just as their students); and
- compatibility with current practices—instructors can retain control over the intellectual ownership of their courses and as much as possible extend what they already do well, but over time and distance.

Within the TeleTOP project, each of Rogers' five attributes is being given careful attention. The analysis in the first section of this paper serves as part of the response to the advantage attribute. The methods we are using with pedagogical profiling and re-engineering as described in the second section of this paper are part of the response to the complexity reduction and compatibility with current practices attributes, as well as also to the advantage attributes. The trialability attribute is also part of our implementation approach (Collis, 1998; Peters, 1998), with our weekly instructors' sessions, and the invitation to instructors to participate and/or observe in a course being taught using these new didactics and new technologies. The observability attribute, and the valuing of the observability, is supported by our administration in the way it is highlighting, with pride, our collective efforts in providing our instruction in new and more-flexible ways, and also providing the financial resources to support these efforts in a generous way.

But we know many problems will confront the individual instructor, despite all these attribute enhancements. It will be the professionalism and dedication of each instructor that will be the key to the new didactics (Collis, 1998). But this was also the case with the old didactics as well.

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