

Telematic Tools to Support Group Projects in Higher Education

Jan van der Veen, Centre for Telematics and Information Technology, University of Twente, the Netherlands.
Email: jan.veen@ctit.utwente.nl

Betty Collis, Faculty of Educational Science and Technology, University of Twente, The Netherlands. Email:
collis@edte.utwente.nl

Abstract: We describe ongoing evaluations and new research on the use of telematic tools to support project work in higher education. Practical experience at our University has shown that project work can be implemented using the World Wide Web for many aspects of the project activities. The possibilities will grow with the introduction of groupware facilities in browsers. Among other success factors, the possibility to implement efficient and effective group and course management is essential for a more broad application of WWW supported project work in higher education. We describe a research project aiming at the integration of project management tools in a WWW environment. We will indicate how such educational tools will differ from project management suites for non-educational organisations.

Project Based Tele-Learning

Project-based tele-learning is defined as problem-oriented learning within the framework of a group project that uses telematics support for at least part of the project activities. Project-based tele-learning is an instructional form of considerable value, particularly at the University of Twente with its institutional commitment to the integration of theory and practical applications in high-level technical education. At the University of Twente many courses are project based. In these courses, groups of 5-15 students work on complex problems. In some of these courses the students have a project room available for many hours per week. In those situations only the support of asynchronous telematic tools is needed. In other courses, instructors and students are more frequently distributed in time or place and thus in increasing need of telematic support, to facilitate more interactions and cooperation among participants, apart from a limited number of lectures and infrequent face-to-face meetings with group members.

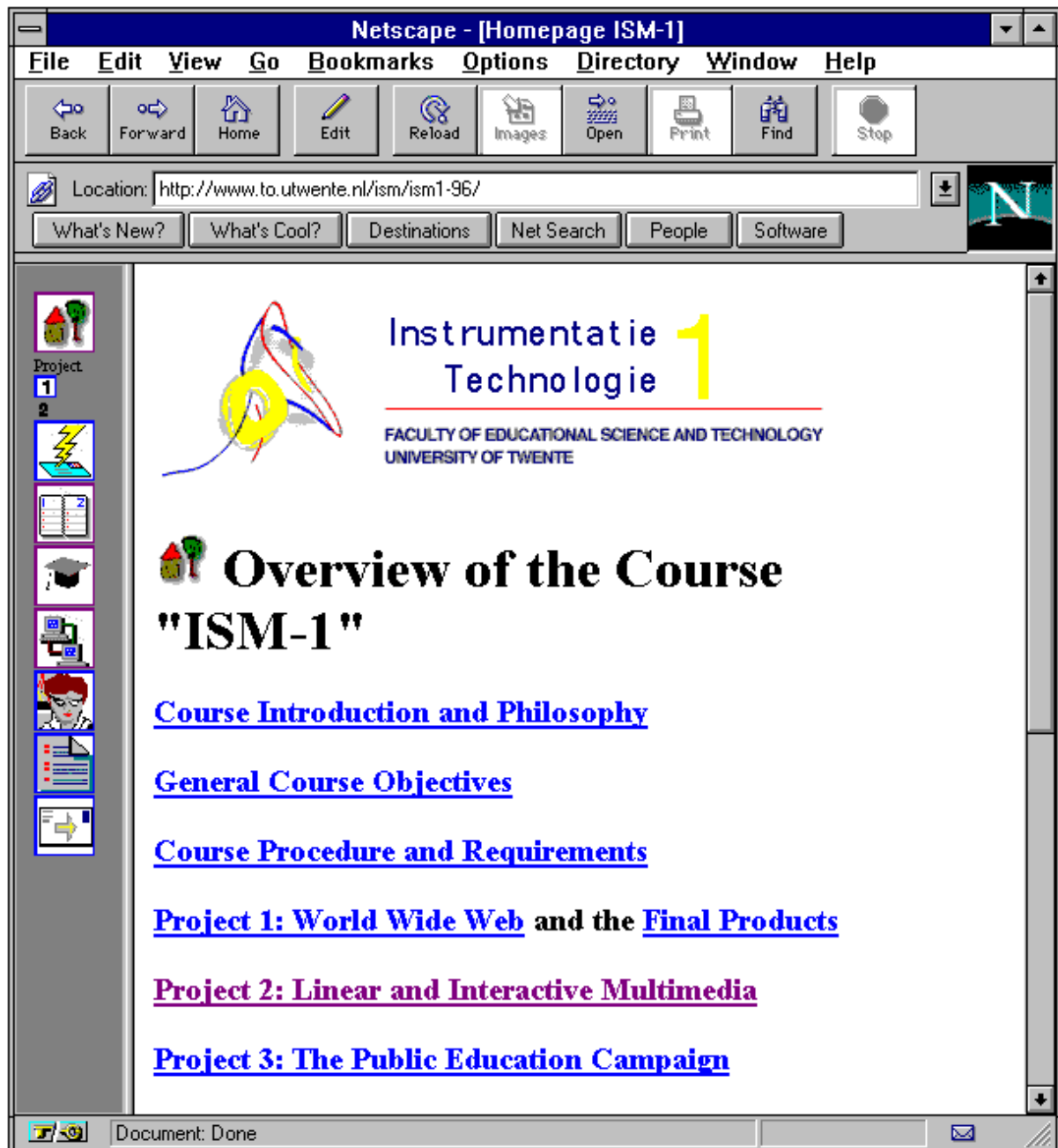


Figure 1: Homepage of the Web supported course

Collaborative Aspects

Collaborative learning in a problem-based context emphasizes interactions, where students actively participate in the learning process while solving a problem as a group. Not only problem-specific learning goals are involved in project-based instruction [Blumenfeld et. al. 1991] but also cognitive and social goals. [Van Woerden 1991], for example, notes that project-based instruction in higher education involves: a problem as a starting point, with the need to select and apply subject-specific knowledge for the solution of the problem; the contextualization of the project situation as preparation for further professional practice; the need for optimisation of group-interaction skills; and the development of self-responsibility for one's own learning process. Collaboration, defined as separate and shared responsibilities harmonized toward the attempted goal, is centered to problem-based project

work. Collaboration requires more than goal orientation: it also involves attention for the social aspects of group process as well as efficient management and coordination of tests and subproducts [Collis and Smith, 1997].

Tele-Projects at the University of Twente

In general, when WWW-based environments [Fig. 1] with starting points for communication, information search, collaborative document processing, presentation and evaluation are integrated, and are used in the support of project work, the results at the University of Twente are positive [Collis 1996]. Evaluations that have been performed [Collis, Andernach and van Diepen, 1996], [Bos, Morgan and Kikstra, 1996] and [Pouw, van der Veen and Andernach, 1997] of the experiences so far at the University of Twente support the positive results but note that there are many needs and improvements in project support that are still required. For example, while students note being satisfied with the close collaboration and interdependency that can occur both within and between project groups, problems occur with respect to the efficient and effective management of project work. Improvements are needed in the management of workflow, the organization of group resources, and the extraction and organization of key materials for a “group memory” in such a way that they can easily be shared not only by each set of group members but also by the instructor and members of other groups. WWW-based environments are valued for project support, but if management and communication tools are not integrated within the WWW environments they will lose much of their potential functional benefit.

Problems and Responses

Based on the analysis of project-based courses at the University of Twente, we have identified six major clusters of problems with respect to group-based project work, and the “tele-project” contributions we have so far identified that are valuable responses to those problems based on our experiences with them [Tab. 1].

Tele-Projects in Other Contexts

There are many other examples of tele-project experiences outside of the University of Twente. [Dirckinck-Holmfeld 1995] reports on the implementation of project work with distributed students in a course conducted at the University of Alborg, Denmark. She notes communication problems in group processes, similar to those we experience in tele-projects with limited or no face-to-face contact among participants [Pouw, van der Veen and Andernach, 1997]. In an engineering context [Chinowsky and Goodman, 1997] report that the quantity of communications rises in WWW-supported team-work. They conclude that project-management coordination is still to be improved via new strategies for collaboration, information sharing and project coordination. Michailidis and Rada [1996] give an overview of tools available for the support of collaborative authoring tools with a focus on substantive and annotative group-writing activities. [Spengelink and Vliem 1997] report about the educational use of the shared workspace BSCW, initially set up for research communities. The shared workspace functions well as a group memory, if the workspace is under control of the group, the structure is kept simple and emotionally loaded comments are directed through more private channels such as Email or telephone, thus protecting the addressed from ‘public’ exposure to criticism. In contrast [Rada 1996] reports limited use by students of shared workspaces. He finds that students seem to prefer to use plain HTML-pages for an overview of the work to be done.

From a review of experiences in the literature as well as our own, we have come to the conclusion that project-management aspects of group work are a relatively weak aspect in both practice and literature. We are thus focusing particular attention in this direction.

<i>Persistent Problems in Group-Based Project Work</i>	<i>"Tele-project" Responses</i>
Problems in maintaining course cohesion and momentum as students become immersed in their respective projects	A course WWW site that integrates study materials, project-work support and communication tools, and through which each groups planning and progress can be visible to all.
Problems in motivating and structuring collaboration	Choice of a task (communal development of a common product) and instructional strategy, the "Jigsaw Methodology", whereby each group member has clear and separate contributions to the group, see for example [McManus and Aiken, 1995]. Choice of the strategy of combining local and distant members in each group.
Problems in motivating and structuring communication	Strategy of having a rapporteur in each group responsible for responding to the instructor during weekly "on-line activities" structured by the instructor. Use of an mail archive derived from newsgroup tools integrated in the course WWW site.
Problems in maintaining a "group memory"	Use of shared workspace functionality integrated in the course WWW site (in particular, the tool "BSCW" made available by GMD, Darmstadt, Germany)
Problems relating to instructor workload	Use of graphic tools to produce WWW pages, and the development of the "Milestone Suite" (described in this article) facilitating the preparation of course planning and automatic status reporting.
Problems in organizing and executing self- and intergroup evaluation	Use of a WWW site as the product as well as the process environment. This allows for inter-group comparisons as well as evaluations based on overall collaborative results. Use of an evaluation tool integrated in the WWW site. This allows efficient registration of student feedback, immediate comparison among subgroups of students, and visualization to the students of the similarities or differences in their impressions of the course from those of their coursemates.

Table 1: Improving the efficiency and effectiveness of group-based project work: Problems and tele-project responses at the University of Twente.

Project Management in Project Based Tele-Learning

The management aspect of project based group work is especially important when distributed instructors and/or students are involved in the collaboration. Many combinations of remote and co-present participants exist, for example, a number of distant guest lecturers can be involved in the tutoring of a course. Some students might be involved in projects performed by campus based project groups elsewhere. Other forms are bilocated groups of students in international university cooperation projects. In any of these combinations, project management is important.

Project Management and Tools

From the instructor's point of view the management aspects in project-based group work includes having a good and convenient overview of the progress of all groups, and having effective channels for giving content feedback and remarks with respect to the group's progress. For the project groups, management of the group's interrelated processes is important, especially with larger groups. All group members should have a clear common overview

of tasks, deadlines and who is responsible for what. If process-related tasks in the groups are assigned to group members, those responsible for management will, like the instructor, feel the need for an overview of the group process and progress.

For both instructors and group members, management of group (partial) products, and easy access to these products is also important in facilitating their work. Altogether, it appears that a combination of a shared workspace, a workflow tool and integrated communication facilities would facilitate group work best. Convenient ways to link group progress indicators with relevant course study materials, and lecture notes would also enrich the project group virtual work environment.

Examples of Project Management in Tele-Projects at the University of Twente

In the Educational Science and Technology course “Instrumentation Technology 1” for first-year students at the University of Twente, extensive use of WWW functions is made to support the project work of the course and, to link this project work to other course elements [Collis 1996]. The planning for the groups is set by the instructor and visualised in tables with columns for *task*, *person responsible*, *deadline* and *status*. As most deliverables are in HTML-format, they are linked from this table when completed, thus facilitating group memory and, both instructor and intergroup evaluation. The “Applications of Information Technology” course [Fig. 2], part of the Business and Information Technology curriculum, offers first-year students project work in groups composed of Dutch and Finnish students [Pouw, van der Veen and Andernach, 1997]. In this course the groups have to do their own planning, to be commented upon by the instructor. The planning is captured in HTML-format and available through a link from the so-called GroupCentre table in the course WWW site. In the “Working in Project Teams” course, groups of third-year students of all disciplines work on a design project, using a shared workspace as group memory. The student management of the group uses the software product MS Project to produce a Gantt chart indicating tasks and their interrelations. As part of a Word document this chart is available from the shared workspace for all students and instructors.



Project Groups				
<i>Members</i>	<u><i>Tutors</i></u>	<i>Planning</i>	<i>Discussion</i>	<i>Home page</i>
Group 01	Veijo Pitkänen David Spelt	Planning group 01	Newsgroup 01	Home Page group 01
Group 02	Veijo Pitkänen David Spelt	Planning group 02	Newsgroup 02	Home Page group 02
Group 03	Veijo Pitkänen David Spelt	Planning group 03	Newsgroup 03	Home Page group 03
Group 04	Veijo Pitkänen David Spelt	Planning group 04	Newsgroup 04	Home Page group 04
Group 05	Veijo Pitkänen David Spelt	Planning group 05	Newsgroup 05	Home Page group 05
Group 06	Veijo Pitkänen David Spelt	Planning group 06	Newsgroup 06	Home Page group 06
Group 07	Kalevi Kolehmainen Nico van Diepen Mike Boldy	Planning group 07	Newsgroup 07	Home Page group 07

Figure 2: WWW Group Center of the “Applications of Information Technology” course.

“Project Support” and “Milestone Suite”

Based on the particular analysis of the experiences and needs associated with project management in courses in Web-based environments, it has become clear that an integrated support is needed, combining the different needs for telematic support. This integrated design, called Project Support, will try to fulfill this need. In the development of Project Support new available functionalities can and will be incorporated. The Milestone Suite will fill in the need for project management both as a support for the instructor and the student members of the project group.

Project Support

In this section, we briefly describe the functionalities of the Suite, the design approach and the architecture. In “Project Support” we are giving particular attention to the efficient support of high-speed communication, efficient and effective access to appropriate (multi-media) information, and management of group processes and group memory. The Project Support environment will integrate the contributions identified in [Tab.1] with new developments made possible by improved network technology and emerging WWW-based possibilities. In particular we are studying the integration of support for real-time communication during group work when group members are in different locations, and the integration of multimedia databases to link the theory and practice of the courses via examples and other resources.

The approach of the research is one of rapid prototyping, incorporating systematic modelling at several abstraction levels, intertwined and advanced by on-going evaluation. In this evaluation we will work to find out how learners and instructors use telematic support tools. Questions we are asking include: Do advanced telematic tools have an added value for the educational process or will they lead to loss of efficiency due to the number of telematic-based facilities that are difficult to control? A set of modules for project management is being prototyped. We call this the “Milestone Suite”.

Design approach for Milestone Suite

In our research project we are focusing on the group management aspects. Our idea is that a ‘Milestone Suite’ can make life easier for both instructor and student group management. The final implementation will be closely related to the other elements of Project Support, as described in the previous paragraph. Issues to be addressed by the ‘Milestone Suite’ are:

- How can the instructor easily set up a “milestone planning”, to be refined by the project groups?
- How can status reports be generated automatically giving an overview of the progress to both instructors and group management?
- How can instructors and group managers give educationally relevant feedback directly to those involved in tasks that require intervention?

Giving these requirements, it is clear that in our project we will be modeling and testing tools for a distributed tele-learning community. We will do so, from three different viewpoints:

- From the educational science point of view we will use instructional strategies to give us directions on the design of this sort of tele-project education [Collis 1996].
- The formal description techniques available from computer science will be used to model the distributed environment and services needed [Moonen, Michiels, Collis, Widya, 1996], [Volman et al., 1996].
- From the university ‘workfloor’ we will use the outcomes of ongoing evaluations of tele-learning courses, especially from those courses with distributed learners involved.

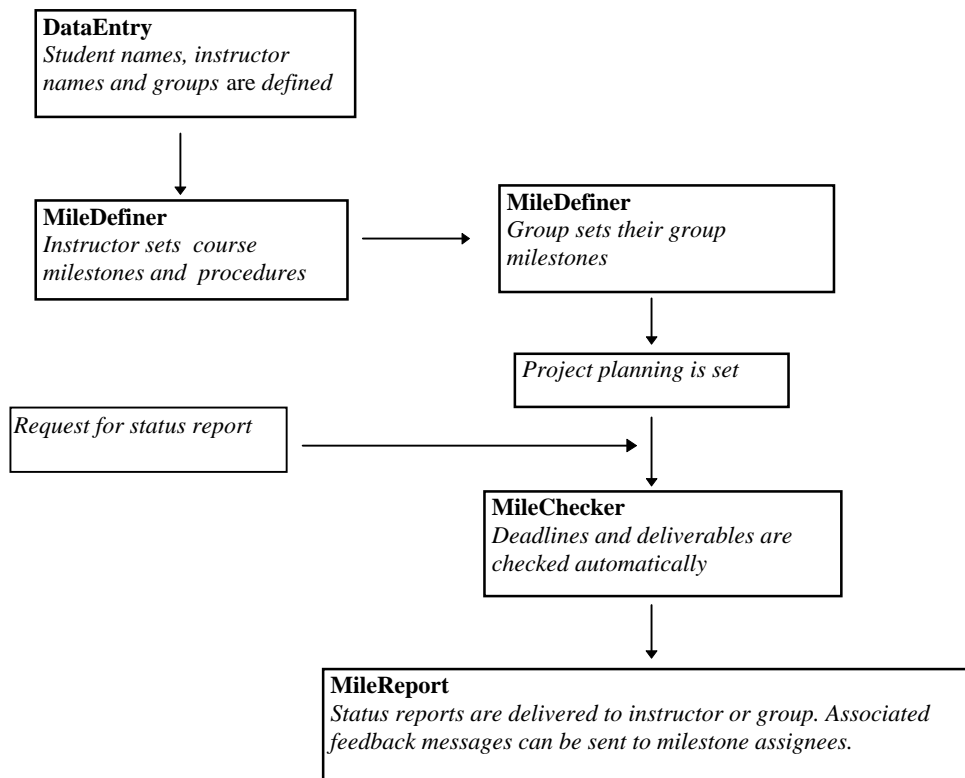


Figure 3: Global architecture of the Milestone Suite modules.

Global Architecture

The main modules of the milestone suite are, see also [Fig. 3]:

- **DataEntry:** Student, group, and instructor data are entered from data sources delivered by the departmental office.
- **MileDefiner:** The fixed course deadlines, and milestones such as main aspects of a workplan and presentation deadlines are set on a timeline by the instructor. The instructor specifies attributes like EndDate, DeliverableType, DeliverableName, Assignees, etcetera. Also procedural guidance can be made available behind icons on the same timeline. On a second timeline the group can visualise its own group planning, see also [Fig 4] for a prototype user interface.
- **MileChecker:** When the instructor or the group manager wants an overview of the progress sofar, MileChecker can automatically check if the deliverables are indeed delivered.
- **MileReport:** The status reports are made to give the instructor an overview of the progress of all groups, as well as an entry point for easy access to the deliverables to be commented upon or assessed. Default feedback texts can be tailored to suit the instructor's needs when sending a message to a group.

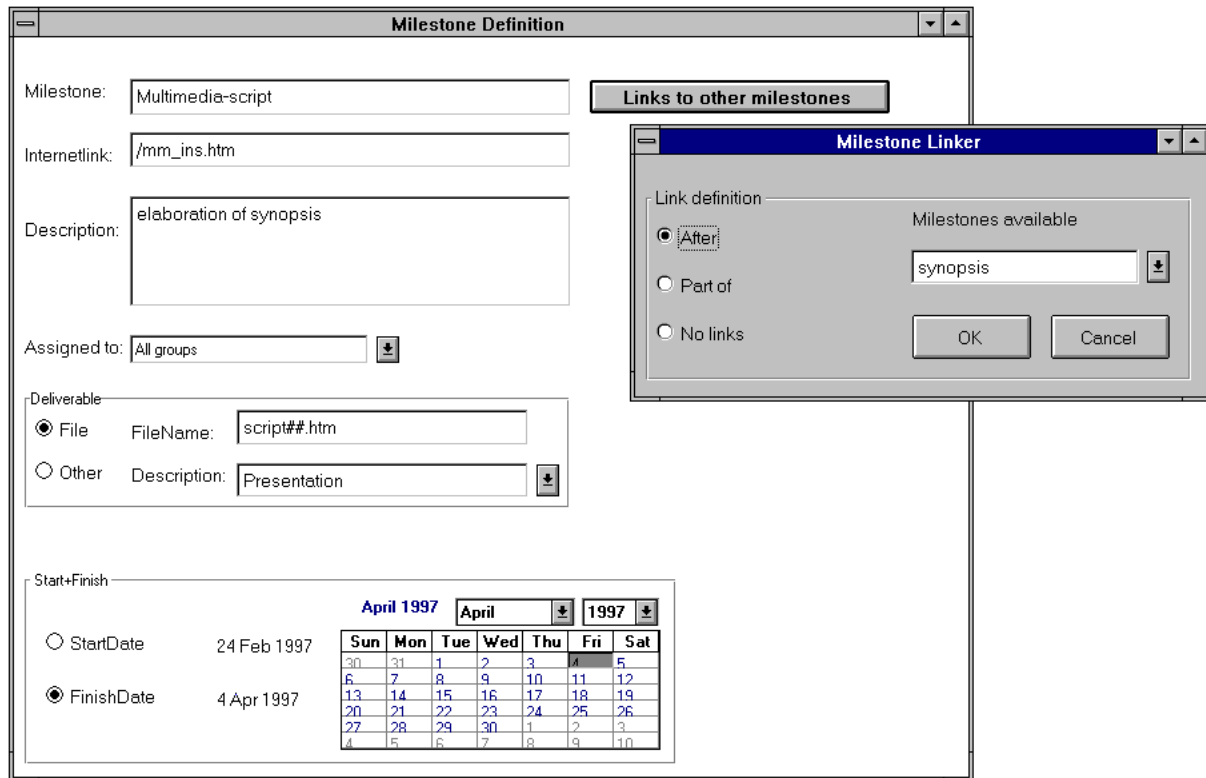


Figure 4: Prototype user interface of the MileDefiner module in “Milestone Suite”.

Discussion : Project Management in the Workplace and the Learning Setting

In preparing students for professional careers, we think it is important that students get experience in working together with fellow students using telematic support. For project-based tele-learning we are giving particular attention to how telematic support can facilitate the collaborative work of distributed learners. We have shown that project work can benefit when supported by a Web-site. Integration of the telematic support functions, communication, memory, workflow and group management will give tele-project education a strong tool. When implementing these functions we will be using mainstream Web-browser technology, combined with tailored software in an integrated, for the users transparent way. Finally, a good educational strategy and a good communication protocol will remain essential ingredients for successful courses using such tools.

References

- [Blumenfeld, Soloway, Marx, Krajcik, Guzdial and Palincsar, 1991]. Blumenfeld, P., Soloway, E., Marx, R., Krajcik, J., Guzdial, M. and Palincsar, A. (1991). Motivating project-based learning: Sustaining the doing, supporting the learning. *Educational Psychologist*, 26, 369-398.
- [Bos, Morgan and Kikstra, 1996]. Bos, E., Morgan, C. and Kikstra, A. (1996). Multiple levels of the use of the Web as a learning tool. *Proceedings of ED-TELECOM '96*. AACE, Charlottesville, VA, USA, 31-36.
- [Chinowsky and Goodman, 1997]. Chinowsky, P.S. and Goodman, R.E. (1997). The World Wide Web in Engineering Team Projects. Georgia Institute of Technology, USA. To be published in special issue of *IJET*.
- [Collis 1996]. Collis, B. (1996). Pedagogical re-engineering: Design issues and implementation experiences with the WWW as a learning environment. Invited paper presented at *ED-MEDIA/ED-TELECOM '96*. AACE, Charlottesville, VA, USA.

[Collis, Andernach and van Diepen, 1996]. Collis, B., Andernach, T. , Diepen, N. van ,(1996). The Web as process tool and product environment for group-based project work in higher education. WebNet '96, the First World Conference of the Web Society. AACE, Charlottesville, VA, USA, 109-114.

[Collis and Smith, 1997]. Collis, B. and Smith, C., (1997). Desktop Multimedia Environments to Support Collaborative Distance Learning. Paper accepted for "Instructional Science".

[Dirckinck-Holmfeld 1995]. Dirckinck-Holmfeld, L. (1995). Project pedagogy as the foundation for computer supported collaborative learning. In B. Collis and G. Davies (Eds.), *Innovating adult learning with innovative technologies*, Elsevier Science B.V. , Amsterdam, 183-190.

[McManus and Aiken, 1995]. McManus, M., and Aiken, R. (1995). Using an intelligent tutor to facilitate collaborative learning. In B. Collis and G. Davies (Eds.), *Innovating adult learning with innovative technologies*, Elsevier Science B.V., Amsterdam, 49-64.

[Michailidis and Rada, 1996]. Michailidis, A., Rada, R. (1996). A review of collaborative authoring tools. In: R. Rada (Ed.). *Groupware authoring*, Academic Press Ltd, London, 9-44.

[Moonen, Michiels, Collis and Widya, 1996]. Moonen, J.C.M.M. , Michiels, E. , Collis, B., Widya, I. ,(1996). Project Based Tele-learning: Analysis, Modelling, Design and Evaluation. CTIT Research Proposal, University of Twente, The Netherlands.

[Pouw, van der Veen and Andernach, 1997]. Pouw, C.L.M., Veen, J.T. van der, Andernach, J.A. (1997). *International Tele-Project Groups in Higher Education*. Internal Report. Educational Centre, University of Twente, The Netherlands.

[Rada 1996]. Rada, R. (1996). Coordination and reuse. In: R. Rada (Ed.). *Groupware authoring*, Academic Press Ltd, London, 85-102.

[Spenkeliink and Vliem 1997]. Spenkeliink, G.P.J. and Vliem, M.E. (1997). Teaching Ergonomical Design Using Internet. *Proceedings of the International Ergonomics Association, IEA'97*, Tampere, Finland.

[Volman, Jones, van Sinderen, Widya and Michiels, 1996]. Volman, C., Jones, V., Van Sinderen, M., Widya, I., and Michiels, E. (1996). An Application of the ODP Enterprise Viewpoint in the Field of Tele-Education. *The International Conference on Open Distributed Processing (ICODP97)*, May 1997, Toronto, Canada.

[van Woerden 1991]. Woerden, W. van (1991). *Research on the Project Method of Teaching*, PhD dissertation, University of Twente, The Netherlands.