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Approaching the Groupware Challenge in Higher Education

- The UniTeach 2000 Framework:
Visions about the Redesign of Teaching and Learning Processes -

Ludwig Nastansky

Summary

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Summary

This paper is about current weaknesses in higher education which have to be resolved. The author is suggesting that there are remarkable similarities between the nature of these shortcomings and the concepts underlying a new type of application software being marketed as *groupware*. Groupware seems to be especially efficient in enabling new options for (re-) designing teaching and learning processes. This process-centric fashion allows one to enact an education scenario which integrates the dynamics of knowledge creation outside the university with the very core of information management and communication specifics inside the university. This is especially valuable for disciplines having a teaching focus on vocational preparation like Business Computing, Business Management, or Business Administration.

The groupware model recently having gained exceptional attention in larger organizations all over the world has been the underlying and unifying approach of the *UniTeach 2000* project framework within the school of Business Computing at the University of Paderborn. Groupware is acting as catalyst within *UniTeach 2000*. One side of this approach is a design paradigm focused on support of university members interacting and communicating in groups during their various perpetual processes of knowledge creation on campus. The other side of this approach is a concise computer based platform delivering the numerous services necessary for mundane daily information management and communication tasks in an efficient as well as affordable way.

The paper profiles some significant contradictory experiences involving the current higher education scenario. Then, consequences of these contradictions are reflected against the visions of teaching process design as approached by the *UniTeach 2000* project framework. Concepts like the 'virtual classroom' or multimedia support are drafted. Finally, some of the project phases already in operation using *Lotus Notes* groupware are outlined.

Zusammenfassung

In diesem Beitrag werden derzeitige Schwachstellen der Hochschulausbildung aufgegriffen, die einer Lösung bedürfen. Der Autor macht deutlich, daß dabei bemerkenswerte Ähnlichkeiten zwischen den grundlegenden Merkmalen dieser Schwachstellen und den Leistungsmerkmalen bestehen, die von sog. *Groupware,* einer neuen Art von Anwendungssoftware, angeboten werden. Groupware erweist sich dabei als besonders leistungsstark in seinen Optionen für die (Neu-) Gestaltung und laufende Unterstützung von Lehr- und Lernprozessen. Diese prozessorientierte Ausrichtung erlaubt die Realisierung eines Ausbildungssystems, in welchem die Dynamik der vielfältigen Wissensgenerierung außerhalb der Universität mit den grundlegenden Prozessen hochschulinternen Informationsmanagements und campusbezogener Kommunikation integriert werden. Dies ist besonders wichtig für Ausbildungsgänge, die Schwerpunkte im Bereich der Berufsvorbereitung setzen wie etwa Wirtschaftsinformatik oder Betriebswirtschaftslehre.

Der Groupware-Ansatz, der in jüngster Zeit weltweit hohe Beachtung in größeren Organisationen gewonnen hat, bildet das grundlegende Architekturmodell für das *UniTeach 2000* Projekt im Studiengang Wirtschaftsinformatik an der Universität Gesamthochschule Paderborn. Groupware ist als Katalysator innerhalb von *UniTeach 2000* anzusehen. Die eine Seite dieses Ansatzes ist dabei ein Designparadigma, dessen Fokus in einer gruppenzentrierten Unterstützung von Interaktions- und Kommunikationsprozessen der Universitätsmitglieder untereinander bei ihren laufenden Wissensgenerierungsprozessen liegt. Die andere Seite des Ansatzes besteht aus einer umfassenden computergestützten Anwendungsplattform, auf der die vielfältigen Anwendungsdienste zur Bewältigung der Alltagsaufgaben von Informationsmanagement und Kommunikation auf dem Campus in einer effizienten wie erschwinglichen Weise bereitgestellt werden.

Im Beitrag werden zunächst einige Schwerpunkte von Widersprüchen und Schwachstellen in der aktuellen Hochschulausbildung herausgestellt. Die aus diesen Problemkreisen zu ziehenden Konsequenzen werden dann in der Diskussion der Leitvisionen bei *UniTeach 2000* für Gestaltungsoptionen neuartiger Ausbildungsprozesse aufgegriffen. Akzente liegen bei Konzepten wie etwa des 'virtuellen Hörsaals' oder grundlegender Unterstützung multimedialer Informations- und Kommunikationstechnologien. Zum Abschluß werden einige Anwendungsfelder skizziert, die bereits auf Basis der Groupwareplattform *Lotus Notes* realisiert wurden oder in der Einführungsphase stehen.

1.   About nightmares and contradictions in higher education

The encouragement of the author's team in setting up the groupware-enabled *UniTeach 2000* project framework in the School of Business Computing at the University of Paderborn has many roots in technology. We try especially to exploit the challenging options new computer based information management and communication environments offer for higher education. *Groupware* is such a new kind of new technology that it seems to finally help in our difficult and ceaseless efforts of optimal education process design which we have been waiting for a long time.

But, as quite often with projects considered compelling, at least by their originators, part of the motivation arises as well out of the very individualities of a person's past. In the author's case, they originate in experiences, nightmares, embarrassment, contradictions, unresolved problems, and absurdities during his career in the academic world. Thus, part of the motivation emerges from university politics. And in principle, everything is about groupware, because groupware deals with people and their interaction in complex knowledge creation environments [Greif 1988; Holtham 1993; Johansen 1991; Schrage 1990].

(1) *The Problem of new disciplines*. The author of this paper has been professor at universities in Germany, Canada, and Switzerland for about twenty years. His education happened to be in areas commonly referred to as *Business Administration* and *Management Science*. Presently, he is occupying a chair of *Business Computing*. Thus, he is responsible for educating and training students in an area he never had a chance to profoundly learn, involving information content as well as structure dynamics he is not controlling whatsoever.

(2) *The problem of academic inbreeding*. The author's current niche of knowledge, to, well, some extent, is in science subjects dubbed *enduser computing*, *groupware,* and *hypermedia*. These are just some limited science, teaching, research, and project subjects out of the all too fast growing myriad of areas of computerized information and communications systems. They are only set apart in that they have came about to gain a certain amount of awareness in the specific

academic environment the professor is responsible for. This awareness was triggered *after* these subjects experienced a substantial deployment in organizations all over the world. Part of these organizations have *developed* these computer based technologies within their well funded research laboratories a couple of years ago. Most of these outside organizations have only been *using* applications generated from these new technologies within their complex information and communication systems for performing their daily business. Thus, the author is a professor preparing students for their future jobs where the future, after some unfortunate delays caused by reality, has been relayed back into the academy as the history of real life happenings.

(3) *The problem of competence and knowledge creation.* Having jumped on this trendy new bandwagon, he tries to radiate competence to the degree which keeps students from the states of free floating thoughts during class hours. This competence involves specifics he has often only learned the night before. His learning process was supported either by manuals, tutorials, examples, case studies, interactive instruction guides, interactive video, help systems, or hypermedia demos often found bundled with commercial software packages all abundant these days. The lecture notes having been well crafted during the past decade reflect to a negligible degree only the latest revision of the 50 pp. industry standard definitions around the *OLE VS-2.0 alpha* [(tm) Microsoft Corp., Redmont, 1993] object embedding model, unfortunately. Or, last night's learning process involving all these annoying technical particularities and factual details was supported by studying students' works. These works, like lab reports, seminar papers, master theses, computerized slide shows, hypercard type knowledge presentation tools, or prototype software, all have that brilliant shine and challenging quality class only a professor is entitled to create. Thus, the author is a professor trying hard. He is up to date in class, the morning after, in his teaching process following the *one-to-many one-way classroom communication paradigm* currently widely in use for disseminating cloned knowledge in higher education institutions.

(4) *The problem of teaching the basics.* In addition to this really interesting new substance, mentioned above, academic teaching involves some eternal and stable knowledge components, even in *Business Computing* classes. Here, the ripened lecture notes and mellowed text books shine. What does not shine is the teacher's motivation. Well, he has been teaching for twenty years. And, the anticipated thrill in anticipating the students' anticipated reaction to the unexpected, nevertheless anticipated result of *lemma Y* derived from *proposition X* is fading. Thus, the

author is a professor caught in the drudgery of processing and delivery of a repetitive intellectual material.

(5) *The problem of culture vs. high-tech*. If it were not only that intrusive piece of discord which remains nagging about his true academic ambitions being buried all too deeply: *Socrates* surely must have had a different approach as a true teacher of wisdom, or, in the German university tradition, *Humboldt* is (still) looming with his approach of unifying education and cultural tradition, not to mention *Einstein* and his genius in understanding complexity and delivering uncanned accuracy in predicting nature's hidden secrets. All these faithful, wisdom seeking teachers founded out of themselves their knowledge as well as influence on their concentrated and impatiently *listening* or *reading* disciples. They definitely had been using different knowledge gathering and teaching paradigms as compared to the approach the author feels to be obliged to use. Otherwise they would not have been empowered, as they obviously were, to define the knowledge content and direction of their fields.

And, most of them did not only write *real* books, truly different and much more tangible than the ToolBook ones within the author's competency [ToolBook 1994]. But also, these esteemed masters went into *real* libraries the author has been physically expelled from during his last decade *interacting* in cyberspace [CompuServe 1994]. Thus, the author is a professor more or less completely deprived from the value set, behavioral intuition, political reasoning, and educational concepts which are supposedly defining the mainstream in university education he is living in - that very academic environment he is motivated to continue teaching in, and the only one for which he has any educational training, if any.

The scenario sketched around these five patterns pertinent to academic teaching cannot be generalized, of course. It is true only for the very individual teaching approach this paper's author is undertaking for his classes in the new (inter-) discipline of *Business Computing*. For teaching in most other academic disciplines, however, these experiences definitely do not hold.

Sure it can only be contributed to the author's abstruse and sadistic fantasy that some fellow faculty colleagues responsible for academic education in disciplines like, say, *Business Management* or *Business Administration*, might face similar experiences - but with *doubled* pain. On the one hand, for their very own respectful scientific teaching area they might well have been exposed to experiences along the same lines. Maybe, in their field the *negative-future-lag-syndrome* [see (2)] is more in effect, amountwise in span. But, the basic point is that in addition some of them might be fearful that their very knowledge base is

more and more emptied in substance by the overwhelming impact of computerized information and communication technologies - this possibly hollowing trend taking place with respect to building blocks in organizations as well as processes between these infrastructure defining blocks. But, the colleagues in the other disciplines will probably never admit it. Nor will the author ever admit in public his five embarrassing secret thoughts sketched above, or, that *Algol 60* is not one of the finest programming languages and the only one ultimately necessary. *Algol 60* is the one computer language he has had a chance to learn in school, after all.

2.   A groupware-enabled vision of university education processes

It is the author's intention to reflect the particularities outlined above with weights more than zero value in (re-) designing appropriate teaching process infrastructures in his university. The result is, that many of the current defining cornerstones in academic education appear to have much too high a weight.

Thus, *UniTeach 2000* education processes have been modeled along lines which quite often sound as if they are just reversing the respective weights of building blocks underlying current academic education (at least in Germany). And, again, everything is more or less focused around the groupware paradigm:

(1)   *Working on the problem of new disciplines: network model*

In some academic teaching areas, especially evolving areas such as *Business Computing,* there seems to be a basic underlying structure clash. This friction is between an elaborated classical faculty, school, or discipline structure on the teaching supply side of learning. It is in dissonance to the shaping content dynamics of new disciplines to be taken into account on the students' demand side of learning. This conflict has to be focused upon structurally.

Thus, the basic underlying discipline model within the *UniTeach 2000* framework is an open *network of related subjects*. This neither depicts a tree-structured organizational chart suggesting stable structures, nor does it portray a matrix organization implying cross references between solid elements in a two dimensional space. Nodes in this network represent subjects, arcs describe structuring properties, like sequencing in learning steps, paths of alternative options, or agent layers. This concept is pictured in *Fig. 1*. Converging centers of gravity around subjects distributed in this network are happily welcome, should they occur. They will form subject clusters of (former) singular subjects representing nodes in the network. Maybe, these clusters will finally portray new

faculties, like the various subjects of mathematics have done for forming mathematics as a well distinguished discipline of its own in the past three millennia.

The basis of the network is perpetual change. This continuous change property holds for the number and content of the subject nodes as well as their interrelation. The network model is much more complex than hierarchy or matrix models for teaching blocks, the latter representing most of the current educational structures in academic schools. But it only reflects the knowledge, communication, and agent network of the underlying reality.
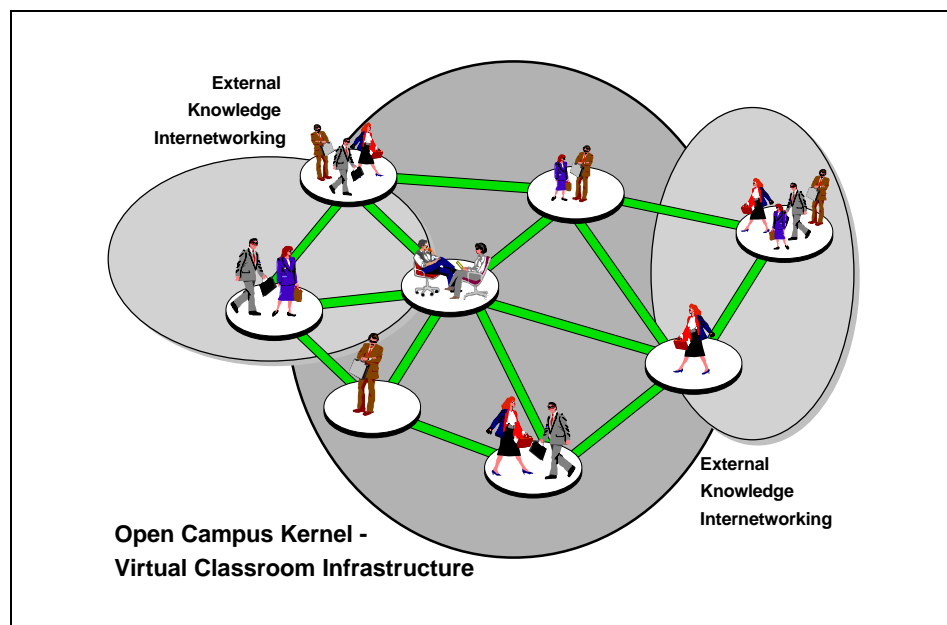

Fig. 1: *Network Model of Education Infrastructure*

(2)   *Working on the problem of academic incest: include the outside world*

The approach that knowledge valuable for teaching is basically created within the scientific community of the university culture has to be doubted for many disciplines. It definitely does not hold for disciplines like *Business Computing*, *Business Management*, or *Business Administration*. Even insular procedures of enriching the university owned information content by tapping external information sources, such as case studies, invited lectures, participation in software beta test cycles, project cooperation, or vocational training periods, do not solve the principal problems. Some of these principal problems are: (a) To close the classical gap between knowledge base and trained skills at academy, and, on the other hand, the competence pattern necessary for a professional position

(including, of course, positions in the university itself). (b) To heavily draw upon the knowledge base created outside of the universities.

Thus, the gathering and dissemination principles of knowledge content for the subjects in the *UniTeach 2000* framework imply no *structural* or *qualifying* difference between inside or outside information sources (as well as sinks). Rather, concepts are developed, deployed and maintained to efficiently identify, filter and deliver appropriate information streams of high quality standards existing somewhere in the world and channel them into the university infrastructure in a timely fashion. Hence, group members in their roles of teachers and/or learners may well be part of university external organizations (*Fig. 1*).

(3)   *Paradigm shift for competence and knowledge creation: virtual classrooms*

The structures of the teaching processes being in widespread use at higher education institutions reflect one-to-many communication principles (the [physical] 'classroom' paradigm) to a high degree. Sure, there is academic fascination (and [supposed] power) around this approach. But, as we follow outside reality by starting to teach about costs and benefits of worldwide already existing *virtual companies* or *virtual offices* in Business Management classes, the *virtual classroom* is already there too. This unfolding virtual classroom notion is far from being a well recognized infrastructure concept worthwhile to be strategically focused upon, though.

In the *UniTeach 2000* framework the *virtual classroom* is the underlying principle. Thus, it easily includes the incarnation of the 'real' classroom as just one option (unfortunately, the logic does not work the other way around). In this virtual classroom *many-to-many* communication processes are the building infrastructure components between students, teachers, and other knowledge providers. Thus it easily includes the one-to-many knowledge dissemination model typical for the 'real' classroom as just one special case.

The individuals communicating during their teaching and learning processes form ever varying *groups* of teachers and learners. These alterations are based on specifics of the subjects and organization of the respective virtual classes. Being learner or teacher is a *role,* derived from the intention of a specific teaching and learning step. This implies that both, students as well as professors, can assume *teacher* or *learner* roles. Thus, the options of the professors' influence and directing power are dramatically increased in the virtual classroom. The professors are integrated in the very core of continuously ongoing learning and teaching processes, i.e. around information gathering, information evaluation, knowledge creation, or moderator phases, to give just some examples.

This network model is democratic and competition oriented. Compared to 'real' classrooms it penalizes professors who are not willing or capable of assuming a learner's role. It makes life more difficult for professors who do not continuously generate competence layers, be it as knowledge providers on the factual sides of the subjects worked upon, or, be it as moderators. This reflects the same type of phenomenon to be dealt with by redefining a managers' position in team-centric organizations, after having flattened hierarchical levels, and after having imposed principles enabling lean management. Passive students are penalized as well as compared to the (classical) classroom approach, basically, because their lack of input and interaction can be made obvious to the group. This networking into the very core of students' knowledge creation might as well be perceived as a scheme out of an aging professors bag of subtle tricks to rejuvenate his creativity. It certainly has some aspects around this. But, knowledge networking works the other way around as well. And, finally, to have employable technologies which support this inter-networking of thoughts in groups has been the dream of many a scientist working on hypertext [Engelbart 1963, and his vision of the 'Bootstrap' Institute; Kuhlen 1991].

It is naive to assume that this type of profound networking model works in reality without careful and sophisticated layers assuring security and privacy concepts. Hence, *UniTeach 2000* includes many kinds of mechanisms to guarantee and control subtle security and secrecy demands. These can be modeled right along the experiences and preferences the individuals are expressing in their working together in a current paper based world as well. From a technology point of view, the parameters and procedures controlling these security aspects are based on methods like access control lists, filtering mechanisms, or RSA public-key cryptology. Hence, they create a much more flexible set of control parameters than the trivial *user-id & password* approach typical for host based communication on campus.

Part of the virtual classroom concept is that it permits *distance learning* options. Information travels in distance learning, people do not. There are many more important aspects about the virtual classroom and its group dynamics. The virtual classroom is more *gender neutral*, and, certain personality types who are reserved in a classroom find more license to express themselves electronically. The virtual classroom opens the flexibility to more swiftly make members of outside organizations partially involved partners or integrated members of campus controlled teaching and learning processes. This includes options to control the time dimension as well: The ingoing process into full campus life may be a gradual road from parttime vocational positions in companies to full student

membership, the same options being given for teachers. Or, continued education programs or technology transfer programs can be maintained at the outgoing sides at the end of education cycles to gradually lead into vocational positions.

(4)   *Teaching the basics: new media, teachware, education process enacting tools*

The bulk of learning and teaching subjects around a more or less stable knowledge base is currently being carried in very restricted information dissemination and communication channels. Widely in use are information presentation media like lecture notes, text books, lab materials, or overhead slides. These media have to be compared to media having been commercially successful on highly competitive consumer markets outside the academic world.

The very nature of these consumer market driven media meets (or invokes?) an individual's apparently unlimited appetite for information consummation. This, in spite of the fact that much of the content is questionable with respect to many of society's value systems, and, that the content is highly redundant (ever repeating TV commercials, ever repeating plots in movies). Whatever the criticism to this one-way communication, the facts are that in Western societies we have to cope with students who are said to have consumed some 1200 hours TV when they start school, and some 15,000 hours (= two years) before they come to university. Reading a textbook does not provoke that degree of unlimited appetite in most students, unfortunately. In addition, we are currently facing the apparently even much more forceful desires for information consummation including interactive options. Interactive video, adventure games, or communicating in the cyberspaces of value added network services are opening up an individual's communication from one-way channels to a partner, though in most cases of games and cyberspace a virtual one.

The author's contention is that there is no positive or negative value impact on information presentation options as well as in communication channels in themselves. A lot has to be discussed and corrected about how these media options should be *used* in the long run, though. Quite often they are currently portrayed as frightening social and individual phenomena.

Thus, the *UniTeach 2000* framework assumes multimedia (i.e. 'natural') data types as being the default characteristics of information to be maintained on campus. *UniTeach 2000* includes *knowledge content* oriented methods for learning and teaching processes supporting activities like: storing and archiving, communication, cross platform rendering, value added processing and enhancement, duplication and personalization, and, especially, information

sharing and context management. In most systems, the real bottleneck in functionality is the lack of: (a) a set of rich options supporting direct manipulation of information being rendered in various data types, (b) the seamless embedding of these functions in a communication driven environment, and (c) the availability of flexible context management procedures. The typical PC environment with its collection of coexisting tools, its program - data paradigm, and its data model on file directory basis does not offer the synergetic knowledge management functions outlined above whatsoever, even if networked. So far, paper has assumed the role to resolve these complex demands on flexibility, performance and communication. *UniTeach 2000* is about to drastically replace paperwork on campus by direct electronic manipulation and communication.

Definition and creation of computer based interactive *teachware* or *computer based training* modules (CBT) itself are not part of the *UniTeach 2000* framework. Rather, *UniTeach 2000* offers a cross-platform container environment for embedding multimedia supporting teachware or CBT objects. This environment maintains the delivery and usage enacting infrastructure. It also includes group centric tools to channel user feedback seamlessly into perpetual teachware enhancements and supports mechanisms of team responsibility for CBT quality control. Teachware does define an important part of the *UniTeach 2000* framework. Within the *UniTeach 2000* electronic campus environment teachware and CBT-objects are obvious and all abundant and seamlessly integrated concepts, from a technology point of view as well as from an educational standpoint. Thus their value has to be regarded much higher as compared to most current structure-break inclined, scattered, artificial, cumbersome, or intermixed uses.
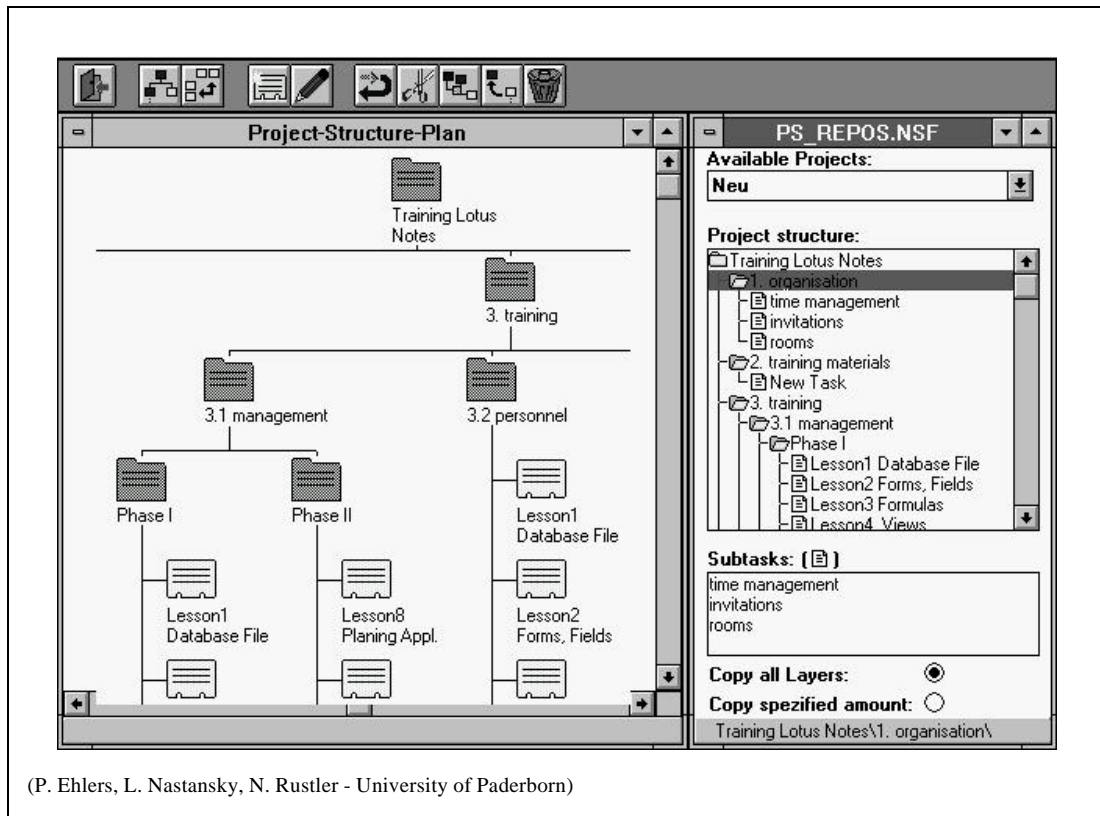
(P. Ehlers, L. Nastansky, N. Rustler - University of Paderborn)

Fig. 2*:   Teaching Process Enacting Environments*

Knowledge content and subjects being repeatedly taught all over again are the main candidates to be delivered by teachware and CBT. With respect to teachware *UniTeach 2000* maintains a unifying infrastructure where use of teachware is just one natural and seamless integrated option. *Fig. 2* depicts a user interface of the current prototype state of the support environment in the *UniTeach 2000* framework. The underlying software objects of this tool are supposed to perform teaching process enacting for the virtual classes which are in operation.

To what degree teachware is going to be used seems to become a question of optimal resource allocation. The basic allocation evaluation is along the lines of comparing the repeating variable cost of teacher-centric delivery against the fixed cost of producing computerized teachware with an appropriate quality level being guaranteed. The best chances to considerably reduce the currently high cost of delivering excellent teachware on a per campus basis will be sharing and reusing teachware in an international context. This is already happening in the global village around worldwide active user group environments, like *Hypercard* user groups. In employing teachware the professor is freeing valuable and expensive resources, which in turn can be transferred into moderator and counseling functions. In addition, in producing teachware or moderating teachware-based education processes professors have much better multipliers for their competence.

Teachware guarantees a certain stability in content focus and quality during delivery in a complex networked knowledge creation environment. This can not be automatically assumed by delivery through human teaching agents, inclined to individual, random performance or accentuation states.

(5)   *Unfortunately, culture is a different matter, even around high-tech*

The cultural aspects of widespread use of computer based information and communication technologies on and off campus are manifold and contradictory.

There is the tendency in society to contrast traditional value sets against new technologies. An often found pattern is, to associate traditional concepts and values with warm sentimental feelings, and new technologies with cold and inhumane perceptions. University libraries are examples of campus related entities likely to trigger sentimental feelings. And, without question, some university libraries are beautiful in architecture and precious in their interior design. Librarians carrying books, sorting them into shelves, students and teachers reading, radiate campus cultural tradition worth being maintained. If it were not for the cost. The demand for information services once more or less completely delivered by campus libraries is growing dramatically. This increase is caused by phenomena like decreasing halftimes of knowledge, proliferating science areas, or student masses to be serviced. Not only cynics are pondering questions of the kind that the average content equivalent of ten books is being distributed every second via just one TV cable into our homes. This is, wait, some 864,000 books a day. Taking everything together it is inevitable to complement classical library services by new information technology options on a large scale. Thereby, it has to be considered whether outsourcing of vital information management processes from the core of the various (virtual) classroom environments to an outside service organization, as libraries are, is still the approach which provides an optimal cost-benefit ratio on campus. Whatever the solution is, campus culture has to be transferred into a new state of harmony as well.

Given this type of discomfort, and uncountable more, the *UniTeach 2000* framework takes a neutral stance. It definitely supports new computer based information or communication technologies including new media. In terms of its radiance on the very essence of subtle academic cultural assets it takes the position that there is none. We do not imply that there is no culture on campus but we suppose that technology and media have always been part of culture. There seems to be the archetypal and ever repeating notion that evolving new technologies and media are being perceived as anticultural. This is understandable during deployment and experience phases of new technologies or media. Nonsense uses

will be tried out and soon be turned into trash, hopefully, continuing valuable uses will evolve, some important usage areas might as well been identified only late in the introduction cycles. And again, after some time these new technologies and media are being transformed to accepted cultural mainstream.

Another cultural issue perhaps best can be pinpointed around a 'chalk and blackboard' metaphor. Within the *UniTeach 2000* framework the blackboard information rendering technology is not implemented yet, because of high cost for appropriate interface driver software and hardware devices. The fans in the author's mobile workstation supporting the normal video projection during class hours have the tendency to suck in chalk dust, yielding undesirable results on ASICS [*application specific integrated circuits*], diskette and hard disk functions, or other electronics. Thus, we have tried to minimize the use of chalk in this specific classroom. After three years of battling, the author remorsefully admits: There is a century long tradition and cultural value in itself related to information generation and rendering using chalk as character or graphical input device, and the blackboard as output device, featuring a large 105" reverse-video mode adjusted monitor. Taking this type of conflict potential into account, *UniTeach 2000* is designed to peacefully coexist with the various other ways of teaching and learning process design typical for a multicultural environment, like universities (should) represent.

Some last remarks around the *academic culture vs. high-tech* issue. *UniTeach 2000* is enabled by using groupware. The very core of the groupware approach is that it provides a tool environment and communication oriented infrastructure focused on information management in groups. The data types being handled and processing concepts being used are not the ones we know from legacy DP-systems. Groupware focuses on 'natural' data types and, in our context, it aims at knowledge processing. Especially, the notion of 'automatic' processing is reversed. The drivers who create information management and communication processes in a groupware based environment and keep it alive are people, not the computers. Thus, groupware is to be regarded only as tool, yet a powerful one, worthwhile to learn about for campus use.

There is another area of recent scientific focus in the utilization of computers for knowledge processing which is likely to provoke misconceptions. This is the area of *artificial intelligence*, being used for example in *expert systems*. Groupware may be able to form 'underware' for artificial intelligence supported knowledge processing endeavors, maybe even on campus. But, that definitely would be the next step, and another project, well after the time *UniTeach 2000* finally will have

succeeded. This is to be interpreted the other way around as well: It is still ridiculous to suppose that artificial intelligence tools are of practical use for operative environments if there is not a mundane underlying knowledge processing infrastructure.

Groupware is aiming at this mundane knowledge management infrastructure. The core benefits of Groupware utilization on campus are not about team centered computer automated reasoning. Rather, they are about empowering people to make quantum steps in their ability to communicate in ever varying groups around ever changing communication processes involving myriad of knowledge facets. And this is why design questions of these processes seem to be intellectually much more challenging than automated reasoning.

3.   *UniTeach 2000* is on its way: groupware, strategies, tactics, experiences

In the previous chapter we have outlined some ideas about our strategies to recreate teaching processes for disciplines being much more influenced by the dynamics of worldwide marketplaces than by the thoroughness of academic research. We are aware of the danger, that many of the arguments may sound strange to those who support incremental change out of a model of a principally firm and sound system kernel in university education. Instead, we have taken the radical stance in supposing that hasty change is the only stable component for knowledge content in some disciplines. Hence, the point is how to best cope with this change, which is taking place anyway.

In trying to mold a comprehensive approach around a change anticipating as well as supporting networked education model we have defined the *UniTeach 2000* framework as placeholder. *UniTeach 2000* is not real, of course. Critically speaking, *UniTeach 2000* does not even contain 'visions'. *All* the pieces of information and communication technology referred to above and weird in their appearance to many of us are already happening somewhere. Consequently, they can not be labeled to be 'visions'. Given this context, our principal innovative attempt during the last three years has been to recreate new structures in known territories, allowing naive mistrust of widespread preoccupation to be the motor. Therefore, many of the groupware-enabled building blocks of the *UniTeach 2000* framework are already in obvious operation. Many more are to be deployed in the near future.

(1)   *The groupware phenomenon, CSCW and other platforms*

In addition to the principal attitude to positively embrace change we have learnt a great deal about the deployment side of new technologies together with partners outside of the university. These mutual learning experiences had *groupware* as common denominator and catalyst. We have been the first outside the USA to implement and try to gain understanding about costs and benefits of this new kind of application software technology. A problem is that for 'groupware' being used here as a generic term throughout we are currently aware only of one technology platform delivering sufficiently comprehensive concepts. With this we mean the synergetic approach of filling out the very nature of the underlying information management model and holistic views of group-centered communication processes, together with delivery of apt technology modules for the operational side in current and future cross-platform client server environments. For the time being, only *Lotus Notes* [DeJean 1991; Lotus 1993] can be considered as fulfilling and delivering this groupware concept due to the expectations on the various operational sides. Other platforms will come, hopefully, to extend the number of application options or deliver a broader variety in modeling the details. *Notes* groupware has its very origin in visions of its creator *Ozzie* stemming out of the academic world [Ozzie 1991]. The marketing departments of quite a few companies worldwide have jumped on the groupware bandwagon initiated by *Notes*. But their products define a different variety, in basic comprehension of the application scenario as well as technology approach.

The application modules defining the *UniTeach 2000* framework are developed on top of the *Notes* platform. They represent perhaps some ten person years of application development resources. Hence, another aspect in gaining clarity about a precise 'groupware' definition is to consider this group communication enabling application layer as the 'real' groupware. Whatever the outcome of this term clarification process will be, the problem is along the same lines as everywhere in the layered computer world. We are dealing with entities like operating systems, network platforms, higher level data link libraries, graphical user shells, templates, or, finally, the user working in his or her 'application' (in writing this, the author is not aware of dealing with C-code his word processor is being programmed in - he is creating text finally).

We consider the *CSCW* discipline (computer supported cooperative work [Greif 1988]) as the scientific and academic area complementing groupware. Groupware could be regarded as the delivery platform for CSCW concepts. Since 1991, *Notes* groupware has been an important element of increasing momentum around long established CSCW research having been buried in scientific circles for a while. In terms of the basic subject of this paper we are definitely *not* dealing with the

question how *CSCW* results could be applied to redesigning academic education. This is a research exercise which has been undertaken for some ten years and will continue contributing valuable results. Instead, our argument is that groupware like in its *Notes* embodiment defines a pragmatic platform for efficiently supporting mundane teaching and learning tasks on basis of a group communication centered paradigm. Groupware is not about ivory tower issues, part of CSCW research has developed a reputation to be.

There are quite a few computer based communication platforms delivering group oriented information services to campus infrastructures worldwide. They support approaches known as *electronic conferencing*, *bulletin boards*, *forums*, and more concepts. Leading are value added network services like the *internet* or *CompuServe*. In their very core these systems deal with character based data types, though opening up more and more to supporting arbitrary file types to be carried along with ASCII messages. These systems define the generation before groupware [an example: Nastansky 1988]. They are not apt being candidates for learning process support along the lines of *UniTeach 2000*. It would be like restricting a marketing department to use *TELEX* as the only communication channel as well as information rendering medium. *Notes* groupware, on the other hand, employs a semi-structured document approach, with direct support of rich-text as well as table formatting and allowing embedding as well as direct manipulation of arbitrary media objects. Especially, *Notes* groupware extensively supports context manipulation using *view* mechanisms. These mechanisms, together with a *replication* driven information gathering and information sharing approach are the key to flexibility and efficiency for communication in group centric distributed information management environments. In addition, as outlined above, sophisticated security and privacy demands are supported for these group communication and information sharing processes, to a degree, which is not possible in communication worlds like they are defined by the *internet*.

(2)   The UniTeach 2000 *framework: notes about experiences, tactics, next steps*

Many parts of the *UniTeach 2000* concepts are in operation. At the end, we will summarize some factual aspects which are aimed to support some of the basic ideas outlined above. But, this paper is not intended to include the description of the various tasks being actually performed in the *UniTeach 2000* university office. These aspects are part of other reports on *UniTeach 2000*.

Some aspects of the current *UniTeach 2000* deployment state are pictured in **Fig. 3**.
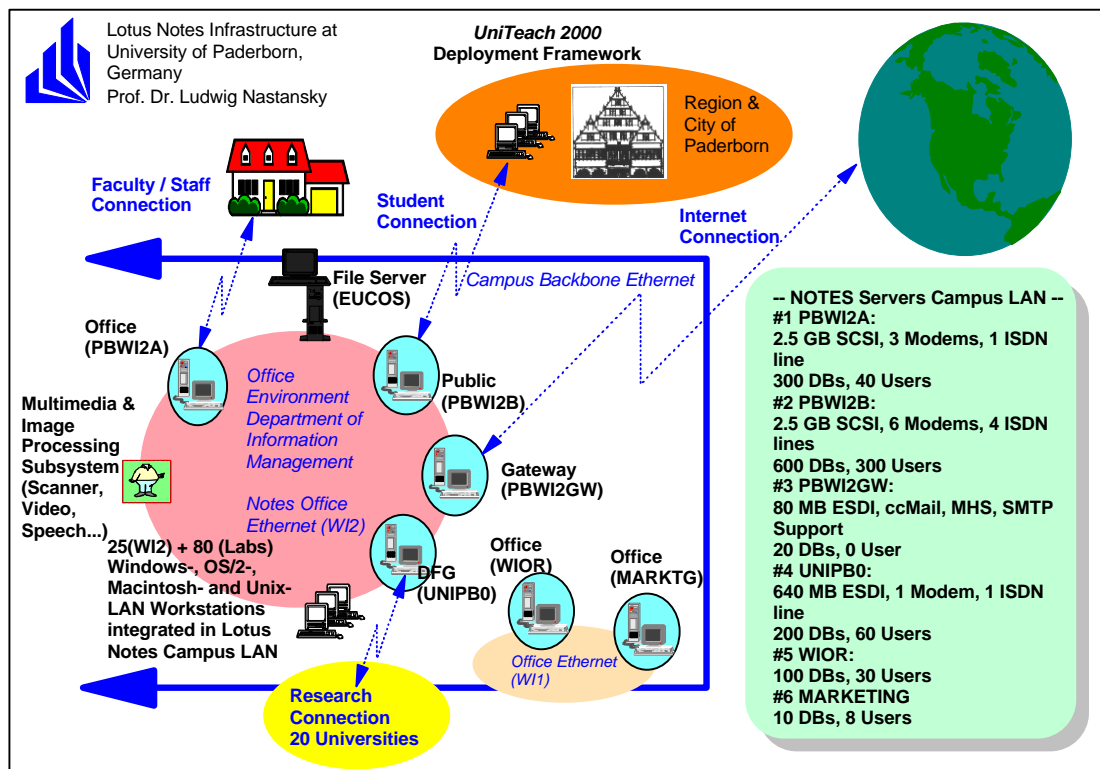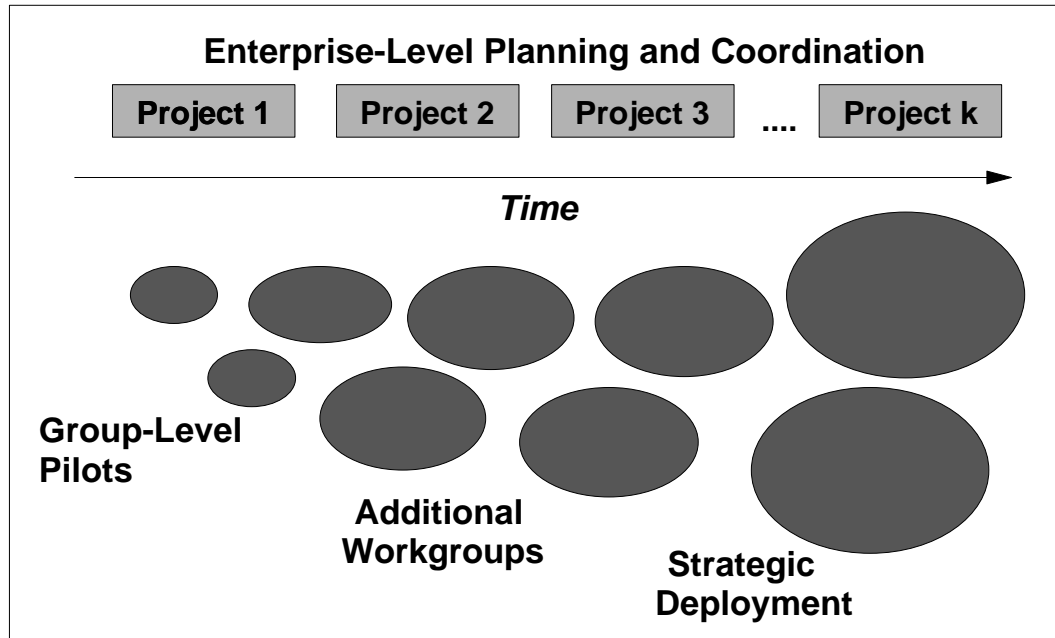
Fig. 3:   *Current UniTeach 2000 deployment status*

The basic deployment approach to bring the many modules and procedures forming *UniTeach 2000* into *operation* is taken by working *bottom up* and *inside out* (all the discussions above were about aspects of the underlying *top down* strategy). We do not follow the '*big bang*' way. This is an important experience for efficient deployment of groupware cells in organizations all over the world. *Fig. 4* denotes this model. The student groups are envisioned to be the most active cells, and, given their sheer number form the best multipliers. This is about groupware finally. We try to create student incentives using a market model rather than a dictating approach. Part of this course is to offer appealing services and attractive clusters of information in the electronic virtual classroom environment. Another part is help in the setup of critical masses necessary to foster ongoing communication. Hence, to give an example, we have sponsored the installation of ISDN phone lines in some students' private homes.

The incremental approach to growth is definitely not around playing with cancerous cells. Rather, the growth path is a precisely controllable procedure interleaving more and more areas, step by step. All steps so far have been productive steps. The rapid prototyping supporting development environment of *Notes* groupware and the user process centric interaction model allow to control the critical success factors of an application in an early stage.

Pilot Systems at the Group Level

Enterprise-Level Planning and Coordination

| Project 1 | Project 2 | Project 3 | .... | Project k |

Time

**Group-Level
Pilots**

**Additional
Workgroups**

**Strategic
Deployment**

(c) Lotus CSG

***Fig. 4**:   Groupware deployment: think big, start small*

The starting kernel for *UniTeach 2000* has been the office infrastructure of the author's team. Some twenty people maintain this infrastructure which is completely founded on workflow enabled electronic document processing based on groupware. Paper is practically not used inside this office. Paper is only utilized to handle external communication if not avoidable. All incoming paper information not being transferred to the wastepaper-basket is being scanned. We employ three scanning approaches: image scan (including automatic inbound-fax capturing), 'quick-and-dirty' OCR scan, and high quality OCR scan with careful reediting of scanned documents. OCR scanning has the advantages of opening the content to being accessible to the embedded full-text retrieval engine and needing less storage space. It has the disadvantage of needing more time to feed-in paper originated documents. Many gateways are supported, such as ingoing and outgoing fax, or all of the typical academic national and international messaging environments. Voice messaging gateways are in a prototype state. They will include functions like delivery of mail by speech synthesizing using any phone to dial-in and choose delivery options (like: read sender name, subject line, text body; repeat; goto next message; etc.), or, sending mail to international pager services.

All content for teaching, research and administration is managed completely electronically: Lecture related information, seminar 'papers', lab reports, master theses, dissertations, the bulk of administrative information. A typical seminar 'paper' in the school of *Business Computing* might include: textual information with embedded tables and graphics, presentation material as slide show or multimedia presentation, data sets or templates for a given tool environment, and prototype software. All these data are submitted completely electronically in a well defined content-structured context. The best of last years seminar works or theses are a substantial part of next years standard lecture materials, at no additional cost. Except, of course, the teachers time for lecture preparation, information integration, context update and modification, or knowledge moderation. But, all these activities have to be performed anyway. An example for the workflow underlying this knowledge management approach is shown in *Fig. 5*.

An important experience of value added working in this document centric environment is that many communication processes just consist of sharing or sending hypertext-links to already exiting knowledge nodes (= documents). The number of documents stored in our distributed databases approaches perhaps 120,000 for the time being (one 'document' in this sense might well be a 40 pp. report having been scanned in). Perhaps every second document created carries one or more hypertext links (this is more or less the electronic equivalent of producing a paper copy). In our experience, linking documents this way has become one of the most valuable information retrieval, context generation and communication tools within *UniTeach 2000*.

We are building up and trying to more professionalize the processes of systematic information collection being available on value added network services, public networks, or company owned information dissemination departments. Part of the training material in use on campus in Paderborn has been provided via these channels. An example is the *LEC* infrastructure (*Lotus Education Consortium*). This is an international network of higher education institutions exchanging information about various aspects of using groupware on campus.
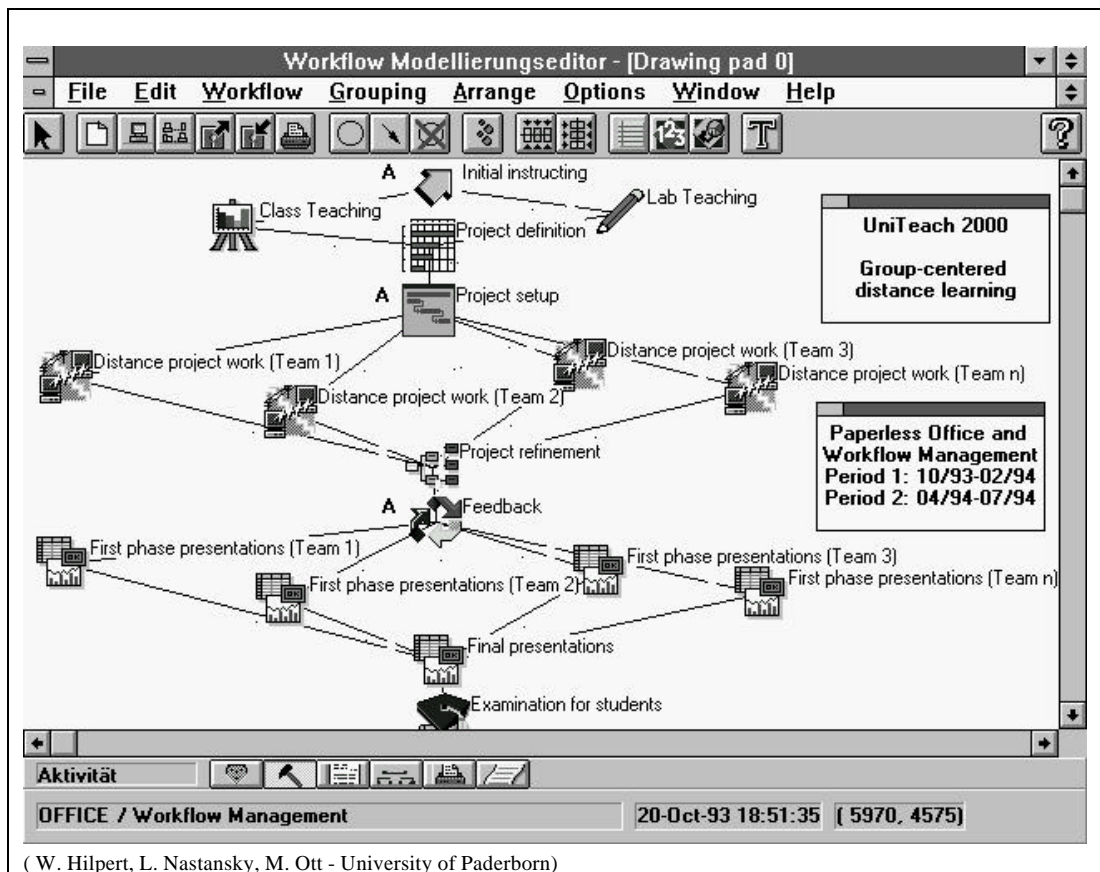
(W. Hilpert, L. Nastansky, M. Ott - University of Paderborn)

Fig. 5:   *Teaching project 'Office Systems': Planning the workflow in the virtual classroom*

Administrative data processing tasks have become more or less a byproduct of the various content management oriented procedures within the *UniTeach 2000* framework. To give one example: The critical issues around the various daily or term oriented time management tasks are rather being resolved by better communication, including group oriented transparent documentation, than by improved scheduling algorithms.

One of our next steps is to displace workstations with touch-sensitive screens in some hallways to replace the bulletin boards on the walls by interactive computer devices. Thus, a student may want to identify a current lecture information on campus, transfer it to his or her mailbox, and pick it up at home after replicating mail and other information to the personal workplace at home using modem or ISDN connection. The underlying architecture for this module is strictly client-server oriented: The frontend (being appropriate for a touch sensitive screen) is a hypermedia tool, on the backend side distributed groupware databases are used as communication engines and repositories for the presented data (including multimedia rendered information content).

Another step will be to install transceivers connected to the campus LAN at selected seats in a lecture hall. Thus, students have the option to link with their notebook computers into the very same lecture material the lecturer is presenting via video screen. The approach is to personalize the documents (including text, graphics, application objects) and annotate them during lecture. This is finally the same procedure like using printed lecture notes and annotating them with a text marker during class.

The *UniTeach 2000* infrastructure is being supported by the complementary *CSDS technology framework* (*CSDS: client server distributed systems*). *CSDS* is a research and project infrastructure within the author's team focusing on the development and evaluation of applications and tool environments for groupware systems.

(3)   Groupware on campus and the UniTeach 2000 *framework: notes about objectives and benefits*

We intend to more formalize the objective system underlying the use of groupware on campus after having succeeded in setting up the starting kernel of our *UniTeach 2000* vision. Above all, this objective system must be complemented by measurements evaluating the benefits (and costs) for students, professors, and the whole university. This cost - benefit analysis is very difficult because its focus must be on team-based knowledge creation productivity [Henry 1992]. But it is nevertheless necessary to empower the transformation from an innovative vision into the maturing phases of an obvious infrastructure concept on campus. Some positions about benefits are exemplified below.

Advantages for students:

1   Encouragement through team-driven learning environment supporting smaller groups.

2   Quality incentives through seamless reuse of building blocks of electronic information in own work; support of personal information management in lecture material handling and studies.

3   Higher motivation by integration in knowledge creation during teaching processes as well as related research and project processes.

4   Continuous feedback cycles for lectures, lab-works, or thesis communication by peers and lecturers.

5   The multi-channel relationships with external organizations being an integrative part of *UniTeach 2000* allows to create prospective job contacts and enables easier transitions into future employment.

6   Learning by doing: as a byproduct of electronic content management in the virtual classroom students learn basics of information technology, system architecture, and up-to-date communication concepts.

Advantages for professors:

1   Ability to include students in the teaching and knowledge gathering processes, including the collection, production, or refinement of information.

2   Support in the preparation, continuation, or refinement of course curricula with no structure breaking presentation concepts for archiving, dissemination, or use in class.

3   Sharing of information pertinent to education processes in an integrated environment, open to the areas of research or projects.

4   Sharing of up-to-date information content with external organizations.

5   Ability to operate in a mobile context.

6   Support for dialogue with colleagues and students without being in the 'same-place-same-time' context.

7   Support of administrative procedures, timetables, etc.

8   Overall productivity gains.

Additional advantages for the university as an organization:

1   The virtual classroom environment is open by principle for external relations and flexible for establishing and maintaining many layers of operational cooperation with external organizations.

2   The productivity for administrative procedures can be improved by offloading many centralized procedures to decentralized student-teacher groups.

3   Competitive edge in the use of information and communication technologies to become mainstream in the near future.

4   Additional infrastructure options for dealing with the quality decrease in library services resulting out of budget squeezes and knowledge presentation changes.

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