

Document Models for User-Oriented Diffusion of eLearning Technologies

Helge Høivik

Center for Staff and Learning Development
Oslo University College

With reference to a general understanding of digitalization as remediation of circles of discourse, this paper poses one problem: If unchecked the remediation process in higher education will be dominated by administrative concerns as they develop in response to increased competition in the educational marketplace. To counteract this, teachers and others with direct exposure to educational practices must strengthen their digital competencies. Attention should simultaneously be directed at wide dissemination of end user competencies and at in-depth training for end user development. The paper presents a few document and training models that were developed and implemented as one effort to answer these two challenges.

DIGITALIZATION AS REMEDIATION

Although ICT has been progressively deployed in educational institutions for decades, there are indications that the academic community conceive this as a typewriting technology [Ramboll 2004]. First demonstrated in 1714, the typewriter is an *..instrument for producing by manual operation characters similar to those of printing. Corresponding to each key on the instrument's keyboard is a steel type. Activated through a series of levers or an electronic impulse when its key is pressed, the type strikes the paper in the machine through an inked ribbon; the carriage holding the paper then automatically moves, providing space for the next character* [Columbia Electronic Encyclopedia]. The *computer-as-typewriter* concept thus represents an industrial mode of understanding. A set of alphanumeric signs are statically inscribed and bound in time and space to the physical copy creating and impacting a well-known and paper-based writing space [Bolter 1991]. But the binary notational systems have introduced several changes like new modes of collation, conversion and integration of different expressive regimes [Bush 1945, Engelbart 1962, Berners-Lee 1990, Finnemann 1994], high textual density, both dynamic and static texts, new logistics resulting in qualitatively new writing spaces. One important consequence has been the reach and richness of on-line information retrieval and the corresponding interest in classification and semantic description. But the crucial characteristic of digitalization is not found along such lines, but in the prescriptive (or “active definitional”) function. Supported by physical infrastructures and terminals, the execution of written programs restructure how people and institutions interact. How does this impact institutions of higher learning?

On a general level we consider institutional learning as the interplay of manifold discourses where written and otherwise mediated expression circulate between social agents [Blackmore 1999]. We refer to this as engagements within *mediated circles of discourse*. Each circle has one expressive and one impressive (or adaptive) side. Participants take turns in appropriating symbolic content produced by others, but do also provide their own input. The latter may consist of mere reproductions or imitations. The reproduced texts may also be rephrased, augmented and extended leading to either *simple* or *extended* textual reproduction. In this view, digitalization can be described as a remediation of circles of discourse where content and behaviours related to an established set of media conventions are reworked and reinvented [Bolter and Grusin, 2000]. This process is supported or hampered through social organization and reorganization.

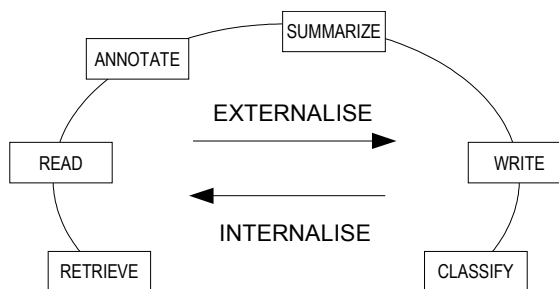


Illustration 1: Circle of textual reproduction. The terms write/read may equally be exchanged with talk/read, display/watch etc.

One much-debated shift in higher education is linked to the influx of commercial logic. But the early conjuncture of marketplace dominance through the production and procurement of commercial learning objects

has failed to materialize. In their overall conclusion to the EU Directorate-General for Education and Culture, the Danish Technology Institute expresses for instance the belief that *e-learning is here to stay and will be increasingly adopted in education, training and workplace development. However, the picture emerging for e-learning is not one where high volume commodity trading will generally occur. Rather, traded services in technologies, e-learning content and services in education, training and workplace learning will be built around customer relationships and higher end/high value products and knowledge services.* [Danish Technology Institute 2005]. The reason for this, in our view, is that the main point of value creation is found in an emerging dialectic between texts and their specific contexts. This effect is produced by live teachers and live students in interaction between themselves and with fields of practice. Singular texts, demonstrations etc. are valuable but mostly as raw materials. As such they are already widely available and have been so since the dawn of print without removing the need for teachers. Education bears therefore little resemblance to industrial articles. The field is more akin to the vacation market: Holiday resorts and entire countries compete to attract customers. Institutions vie for good students, good academics and external R&D funding. As a consequence, market logic does not impact higher education by the development of discrete “packages” of learning, but through the internal organizational changes that are deemed necessary to survive in an increasingly cohesive and increasingly competitive educational environment. We emphasize two trends.

One trend is linked to the growing self-service sector of the economy [Gershuny 1978]. Citizens are now enticed and expected to perform computer-mediated transactions and productive work that previously implied direct involvement with other human producers or intermediaries. It has for instance become commonplace to use computers to report on the electricity meter, consult highly specific medical expertise, produce the seasonal Christmas cards, organize holidays and have bathroom sinks delivered to the front door. Paid work itself is not restricted to the workplace but extends into the fabric of our private lives. We act simultaneously as consumers and producers; we are digital *prosumers* to use Alvin Toffler's collation of the two terms [Toffler 1980].

The other trend is linked to strengthened bureaucracy in the Weberian - not the derogatory - sense. The logic of presumption currently enters academia through the institutional uptake of Learning Management Systems (LMS) and other Virtual Learning Environments (VLS). These systems evolve to provide better overview and administrative support for educational logistics and management. To a growing degree they also provide one-stop shopping for learners. As 24/7 services become more prevalent in public and private life, the student body expects the same at school. Students register for exams, apply for loans, join courses, check their marks and do assignments on-line – equally at home, on campus or in a student watering-hole that may be down the street, across town or in another country. The learning management systems may well have pedagogical dimensions to them. But emphasis should rather be put on the *management* section of the phrase. One might also add a connotation of *self-management* [Cornford and Pollock 2003].

The more important shift, in our view, therefore occurs as the digitally supported redefinition of the relationship between the rationalities of research and teaching on the one hand and the needs for effective and efficient administration on the other. An essential entry point to analyse this relationship is to grasp how prescriptive technologies are diffused and controlled within the academic institution.

As a brief illustration we look at the management group responsible for a new Learning Management System at Oslo University College. Survey data was collected from participants in a training program for employees in the spring of 2004. They were selected and expected to become department heads and core users (*superusers*) for local implementation, configuration and support of the system at the department level. As the diagram indicates, 3 out of 5 participants were academics giving the impression that teachers were at the helm of the process. But correcting for age, a somewhat different picture emerges. Every 4 out of 5 of all participants were in the age group 35-55, but the distribution was skewed between job types. Only a few administrators were 45 years or more, while the opposite was true for teachers and researchers. 4 out of 10 faculty members took the course as standard *users* while 1 out of 10 administrators described themselves in this way. A similar difference was evident on gender. 4 out of 10 women labelled themselves as *users* but only 1 out of 10 men. As is often the case, this university college is largely oriented towards teacher and health care training. As a consequence of this, there were equal numbers of men and women

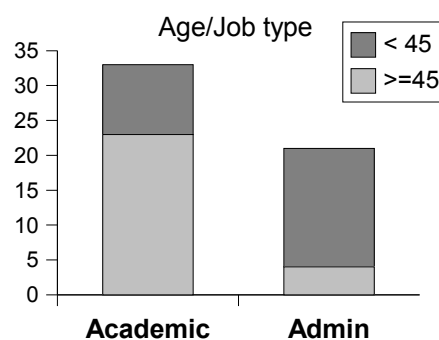


Illustration 2: Age versus Job Type

in administrative positions, while women outnumbered men 2:1 among teachers. In short: At this particular school the LMS administrator group is composed of older female academics (the majority) as well as somewhat younger people from the administrative branch. Female academics tended to describe themselves as system *users*, while the younger administrators - both male and female - as well as male participants in general labelled themselves *coordinators*, *superusers* etc. As more and more elderly academics retire one may expect that the logic of administrative concerns will play an increasing role in how Virtual Learning Environment are run, applied and developed. That this is not an isolated fact is indicated by The Joint Information System Committee which is a public body composed of senior managers, academics and technology experts working in the United Kingdom further and higher education. The September 10th 2004 update to their paper *Designing for eLearning* states that *there has been widespread implementation and increasing use of Virtual Learning Environments in UK .. but the evidence suggests that 'pedagogical issues... have been of secondary concern' in this process . There is a need for practitioner guidance on effective use of these new tools that focuses on learning activities, rather than content delivery or general learner management* [JISC 2004]. On the one hand the academic institution moves firmly down the path of prescriptive digitalization where computational logic is married to consumerist and administrative concerns. If unchecked, this will lead to a strategic redistribution of power.

It seems that educational and didactical perspectives are in need of stronger solicitors. To support knowledge transfer and knowledge creation, academics themselves need better theoretical and (not the least) practical grasp of remediation.

A TWO-THRONGED APPROACH

The Ramboll report mentioned earlier describes several challenges to the dispersion of digital technology in higher education. It points to an absence of coherent and comprehensive management, the scarcity of ICT knowledge and competence, a lack of high-quality ICT-based teaching materials and compelling examples as well as the resistance to change in the university culture and the perceived threat to traditional values of academic freedom. These problems have an inner cohesion which may explain their durability. Of particular importance, in our view, is the need for compelling examples that a majority of academic opinion leaders perceive as relevant to their work. Whereas research may formally indicate usefulness, this does not equate with persuasive power. Research projects are seldom prototypes that fulfil the double requirement to demonstrate socio-technical possibility as well as social feasibility across institutional landscapes. Without persuasive prototypes, and the faculty members and their students to tell enthusiastic stories about them, there is little input to the planning and other administrative processes. The deadlock occurs since the production of sound examples are dependent on sound qualifications. In our view the solution to this dilemma is found in the firm, step-wise and long term development of end user qualifications.

We approach this challenge in relationship to five types of work. The first is performed by system programmers who develop artefacts that programmers use to create applications, e.g. operating systems, compilers, database managers etc. In the second group we find these programmers themselves. They use the outcomes from system programming to create end user applications, e.g. spreadsheets, word processors and other editors, accounting packages, Virtual Learning Environments etc. The third group, by far the most numerous, consists of end users which in our case are academics, academic administrators and students. The fourth group are composed of system facilitators. They perform user and production support. At the low end they populate the help desks and are often recruited among students. At the high end we find well qualified instructional designers that work intimately with end users to build digital learning resources.

But it is also common to refer to a fifth group which spans all the latter three. The members here belong to the end user category in the sense that their primary activity is teaching, learning, research and educational administration. But they also act as a kind of programmer in that they configure and tweak their software applications to better suit their practical needs. Thirdly, they play an important role as local or *peer user and production support*. These *super users* are particularly important since they bridge the gap between technical ability on the one hand and domain knowledge on the other.

Attention should be directed at both groups of end users while striking a balance between them. Broad training initiatives should reach a larger group of academic teachers, while special provisions should be given to the select few that shows potential to spearhead local developments. Training should also reflect the deeper level of change which we take to be a long-winded remediation of the educational circles of discourse.

In the following we describe a small number of document models that was developed to support such an approach. They were developed and implemented as resources for a complex of training programs at a North European University College over the years 1998-2004. We will then give a short summary of the program itself.

DOCUMENT MODELS

Generally speaking a *model* presents some aspects or elements of phenomena to the detriment of others. Digitalization provides a plethora of formats and expressive modes, tools and theories. Most of them change rapidly. As a consequence training must be limited to a few generic traits. In this environment trainees may approach the practice of remediation when they have support in simple models that answer to particular requirements, the most important being the long-term impact (or longevity), simplicity and practicality. The latter generally imply that low-threshold production tools are readily at hand.

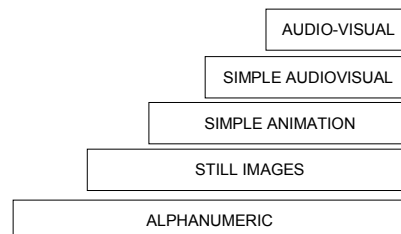


Illustration 3: "Stair" of digital formats

To illustrate this idea we may use the huge number of formats that are available to authors of educational texts. Illustration 3 provides a metaphorical "staircase" or "ladder" of digital formats leading from the most immediate and widespread, namely alphanumeric texts in HTML format and onwards. The second step is represented by the two most common still image formats GIF and JPEG. The next three steps cover simple animations (roll over using Dynamic HTML), simple audio-visuals (commented pages, commented slide shows) followed by more complex audio-visual formats like full-blown animations (i.e. Animated GIFS, FLASH etc.) and videos (AVI, MPEG, RM, etc.). This model indicates *zones of proximal development* (Vygotsky 1978) that trainees may traverse. The higher levels comprise the lower ones, and all components and formats are eventually considered as so many aspects of a common prototype text that is orchestrated by one or more a container languages. In this case it might be Synchronous Multimedia Integration Language (SMIL), but other global container formats are also available. To exemplify exclusion, we mention MathML and ChemML that are relevant languages for learning purposes, but in need of more time until editors and rendition engines have sufficiently matured. To traverse such formats, the trainee is in need of document structure. We present one lecture-oriented ("static") and one interactive ("dynamic") model.

The model in Illustration 4 exemplifies a presentation-format structure that facilitates training in content remediation. An essential requirement is that the model supports a writing space for both author and lecturer, - these two roles being performed by single teachers -, and as a reading space for students using displays of varying form factors. In order to facilitate navigability, reusability and screen renditions for writing and writing, material should minimally be addressable at two levels of graininess. Individual HTML files that cover 100-150% of one screen (useful for lecturing) were used as the atomic unit. These were collated into a binder with material for one teaching unit, - commonly 2x45 minutes of lectures. Each binder consists of 7 HTML-files for subject content, introduction and assignments. This was technically organized as a HTML frame set with a local menu and thus became directly addressable. As default, 7 such sets were collated into one thematic unit, and there were 7 such units, giving a total of 7x7x5 or approximately 350 individual pages. All content was accessible from entries in a folded global menu. This structure maintains strict correspondence between renditions (reading) and the underlying file structure (writing), thus facilitating navigation and editorial work. But it is possible to construe perpendicular pathways like overviews (introductory or assignment pages only), temporal sequences or present topical pages in variant orders. A Quick Menu is also available. For training and dissemination purposes the file set and a separate batch file was stored together as a compressed file archive. By creating a directory, extracting content there and activating the batch job, a complete but empty web site for an entire course could be set up in seconds rather than minutes.

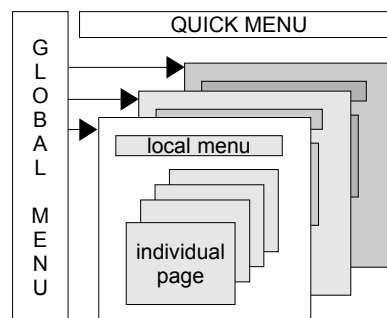


Illustration 4: Static website structure

Both the commercial marketplace and the Open-Source movement provides a number of interactive (dynamic) document models. They are useful for short-term and broad-scale training. But as stated earlier, these Learning

Management Systems are not sufficiently context-specific. In practice they tend to support administrative logic rather than didactical concerns. In order to train educational front-runners in how to configure, criticise and transcend such systems, they need to understand document models on a higher level of abstraction. In the following example we look at one such document modelling *kit* that enables end users to define and build their own interactive systems.

TERM	id	parent	seq	
SENTENCE				
DESTINATION				
PARAGRAPH	IMAGE			
	AV			

Illustration 5: Basic tuple of lexicals.

The document model kit uses a basic textual unit implemented as a database tuple as its basic building block. This record type contains structures that support most basic expressive needs. It contains fields for a single term, a set of words, whole texts, external pointers (URLs), images/ audiovisuals etc. as well as internal administrative information (unique identifier, network and sequence pointers etc.) From a discursive point of view, it may be conceived as a *textual fragment* consisting of lexicals like term, sentence and paragraph with additional room for Binary Large Objects (BLOBs). To lower the learning curve for participants, the document model is strictly based on this simple and repeatable record type. Higher level structures like discussions forums

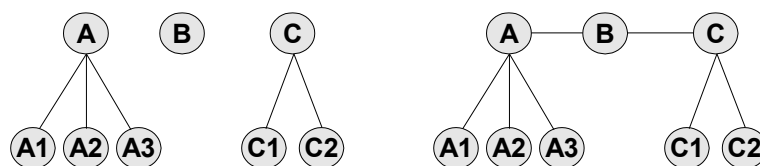


Illustration 6: Graph structures interpreted as discussion forum (left) and collective document (right)

and chats, project planning, collaborative term papers, image collections, personal portfolios and other individual or collaborative documents may then be erected as aggregates of these basic units. It is a user responsibility to define and implement these such structures. In this way the end users may implement a variety of e-learning solutions dependent on topic, organization, pedagogical approach etc. We illustrate this approach with a few examples.

Each nodes in the graphs above represents the basic document record type,- a database *fragment*. The nodes are interpreted as a discussion forum (left) with textual fragments A,B and C acting as top level entries and fragments A1-A3 and C1-C2 as comments. By introducing linked lists (right) the parent nodes may alternatively be taken to represent a sequence of paragraphs in a collective document or an image collection with children nodes acting as suggestions, criticisms, annotation etc. When participants master such elementary structures, more complexity may be added as shown in Illustration 7 to the right. A screen capture from a corresponding factual application is shown below. The graph is here interpreted as a classification scheme where top nodes represent basic weaving patterns (A, B, ..) with variants (A1, A3, B1, B2) and variants on variants (A32, B11, B12, B13). Nodes that are connected with dotted lines represent factual tapestry examples (A1, B2, A11, A31, etc..).

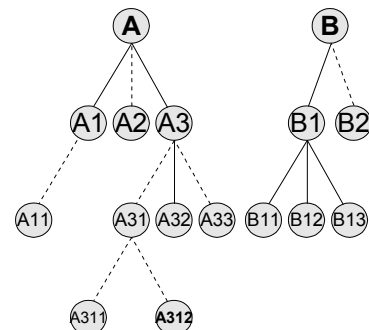


Illustration 7: Extended diagram

In the screen shot in Illustration 8 one single weaving diagram is rendered in the upper pane - corresponding to node A in the diagram in Illustration 7. The immediate children in this diagram may represent photographs of factual fabrics (as shown in the lower pane) or be interpreted as sub-types of the basic pattern (not shown in the screen shot).



Illustration 8: Weaving pattern database for collaborative textile studies in the Nordic countries by Eva Strøm and Helge Høivik

Quite different applications may represent variations on similar graph structures. In one

such case the software was developed to support collaborative work between primary level school children in Oslo, Norway and Rome, Italy. The top level nodes are here interpreted as activity types, while children nodes represent student contributions in each area of activity (or visa versa). Activities might for instance be “to get to know each other”, “collect and discuss examples” and “provide your own solution”. This taxonomy was used to teach students about architecture.

The socialization part was organized as an exchange of commented collective and individual photographs of the participants. Exposure to the topic was organized as excursions where the students took photographs or made drawings of typical Norwegian and Italian architecture. This material was subsequently registered and commented upon in the database. Finally, the students made their own blueprint for international youth centres at predefined (and photographed) locations in Oslo and Rome.



Illustration 9: BEST/Roma. Collaborative work for Norwegian and Italian students. By Jorun Retvik and Helge Høivik, Oslo University College

The software was built so that each working group was composed of both Italian and Norwegian youths that had to work together in order to deliver on their assignments.

In the general model, such basic document structure are supplemented with a simple interaction model. This is developed and presented as a (very simple) finite state machine.

Illustration 10 shows the core of this interaction model as a singular and script-generated HTML page. The page contains a search panel (upper left) and a list of the identifiers for (retrieved) top level nodes of a given document structure (lower left). In the weaving example this corresponds to the set of top level weaving pattern. In the architecture example is may correspond to all groups or all activity types.

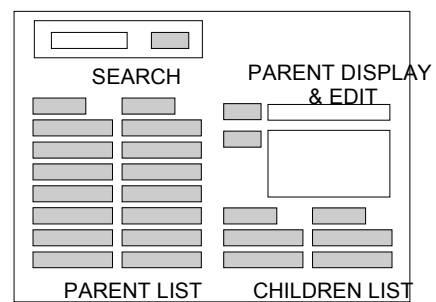


Illustration 10: Base page with a search filed, parent identifiers, selected record and children identifier.

When the user selects one entry in the list of parent entries, the relevant parts of the corresponding record is put on display together with child identifiers.

Dependent on user rights, the record is made available as read-only or read-write. This base page is linked to one other where users may add top level entries and still another to display parent nodes together with their children and add or edit children nodes. In this way, the default mode is that each and every top node, be it a short message, a document part, an image etc., is *debatable* or *commentable*. But if the developer feel that this is required, it is easy to modify such links or access rights.

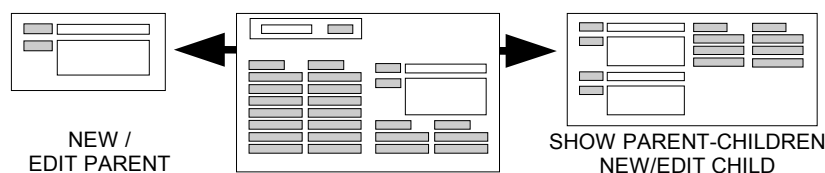


Illustration 11: Interaction structure: Base (default) page with additional edit/insert pages

One entry point to the organizational issues in such e-learning applications are found in the administrative routines to make sure that the current user has a legitimate role within the system. Access rights must then be aligned with these roles. The dual process of authentication and authorization defines what may be undertaken at the individual or group level in relationship to particular tasks in particular contexts, e.g. generating the

provenance and action spaces for the e-learning solution. The third aspect of the training model was therefore a simple approach to user handling and user rights. The third aspect of the training model was therefore a simple approach to user handling and user rights.

In this model the actions and identities are relate to the primitives of the document model, e.g. Read or Write access on the parent or child level of the fragment hierarchies. As an example, one may construe applications where only aggregates (social groups) may act as legitimate authors of a collective document or an image collection, and only members of this group may individually comment on or suggest new content. This was done in the architectural solutions where individual students from Norway and Italy were grouped together and had to present their work as a singular unit. This was done to enhance the cross-national collaborative aspect. But other individuals (or collectives) may be given the right to offer public comment on the document or collection as a whole. To support this a simple organizational model was added. The components here were *institutions* (university, school), *units* (schools, departments within a college or university), *groups* (student groups, class or other aggregates of people that work together) and *users* (students, teachers and other individuals). These elements refer to each other so that groups consist of one or more users, users may participate in several groups and groups are associated with one or more institutional units drawn from one or more institutions.

The document models presented above have been used and developed as part of several institutional training programs at Oslo University College, a mid-size North-European academic institution of about 10.000 students and 1.000 employees.

IMPLEMENTATION

When the Internet took hold around 1995 and onwards, the front-runners at this college counted a handful out of a teacher staff of 600. This small group was referred to as *the enthusiasts* and common wisdom had it that one might leave elearning developments to them. But spurred by both external and internal pressures, the college initiated an aggressive program with the aim to expand their number and competency levels. The main elements of the program was designed in 1998 and effectuated from 1999 and onwards. It enlisted a total of 325 participants with about 200 drawn from the teacher group. In the autumn 2004 we asked these participants about their acquired digital competence profiles and experiences and obtained an 80% response rate. All respondents reported that they use computers with Internet connection on a daily basis at work while 7 out of 10 do so out of their homes. 90% of them said that they know how to use Learning Management Systems, 70% can produce their own HTML pages and 4 out of 10 responded that they know how to build entire web sites. Finally: Around 20 users or 1 out of every 30 faculty member (3% of all), reported that they can build their own interactive e-learning solutions using databases and programming/application builders.

The training program had an two main goals. The first one concerned the overall – or *broad* – diffusion of digital competencies. Respondents were selected for this survey precisely because they had participated in one or several training programs towards this end. According to the data, this group has generally acquired basic experience in how to use networked computers and Virtual Learning Environments. The second goal was to strengthen a core of semi-professionals. This group should have sufficient digital competency to negotiate didactical requirements with policy makers and professional programmers and be able to provide varied peer support. In order to de-emphasize the instructionist connotation of the American title *paraprofessional instructional designer*, they were referred to as *learning architects*. The survey indicates that such a group had also come into existence. According to the data, 4 out of 10 academic respondents (13% of all teachers) reported that they were able to build their own static web-sites. A smaller group of 20 *learning architects* (3% of all teachers) said that they could build interactive web sites for learning purposes.

Even if it seems commonplace, it is worth to state that such training for digital competency is a practical endeavour. This is also the unanimous conclusion in a recent study by Norway Opening Universities covering the entire country [Arneberg et al 2005]. All respondents in this particular investigation felt that courses for academic teachers are virtually worthless if they are not intimately linked to running practices. Trainees need time and a clear expectation, if not outright control, that lessons taught should be lessons implemented. Another common experience is the strong learning effect of doing training oneself.

Combining these two requirements, the training program at Oslo University College was organized with enough time for each participant to develop individual projects towards their own students. During the first rounds participants were each allowed to spend 25% of their time for a full year to participate in training and

implementation work organized as individual development projects. They were also invited, and in some cases required to, take on the role as trainers for other colleagues.

The initial plan for the first course was to receive 12 participants. When close to three times this number volunteered, arrangements were made to cater for all. The following year, a group of particularly interested participants from the first cohort were given time and resources to act as trainers for the next one. With some additions, this group also went on to qualify for a practical doctorate with an orientation towards end-user development of elearning solutions. This equated to a total of about 2000 hours of training time.

In the third and fourth rounds, the initial on-line course material was divided between a number of one-to-three day courses, equally with practice requirements for participants. A network organization was established to run this as a campus-wide initiative with the previous course participants as teachers and teacher assistants.

The entire program comprised 50.000+ training hours. 15-20 academics participated in in-depth training with long term project development where each of them disposed between one and two thousand hours. The remaining 30.000 hours were used by more than 300 participants with an average of 100 hours each.

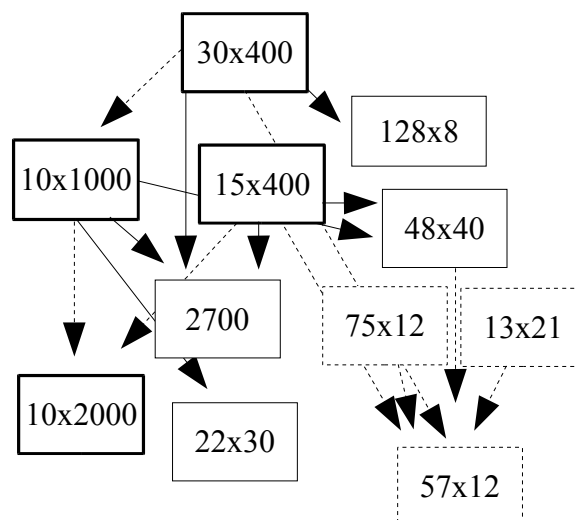


Illustration 12: Course events 1999-2004. Each box represents one event or course type with number of participants times course hours for each event in $[n \times m]$ format. In-depth courses have thicker frames. Dotted lines represent LMS training. One initiative (in italics) consisted of several short courses for a total of 2700 training hours. Arrows indicate transfers, i.e. how trainers continued their training (dotted) or became trainers themselves (whole line).

CONCLUSION

The impact of interventions as those describe above reveal themselves after decades rather than years. There is furthermore a danger that leadership at the institutional and national levels will identify new challenges that require most of a limited collective attention. In the Norwegian setting, it appears for instance that formal academic research now takes centre stage. The mainly developmental character of elearning diffusion and implementation runs the risk of faltering. Potential long-term effects of initiatives in the late 1990ies will not materialize. It may seem as if the challenges of remediation is catered for by the mere introduction of Learning Management Systems. If this is true, we run the risk of building educational institutions on the administrative rather than the educational logic. This will possibly make higher education cheaper. If it gets any better or more relevant for highly developed knowledge economies is another question. There is reason for some caution towards the industrial mode of thinking where we try to handle learning through prescriptive systems that are administered by non-teaching bureaucrats, and where teachers and students are reduced to content “shufflers”

On the other hand, it may well happen that experiences gained will be put to good use. Teachers and students are the core agents of learning and must take centre stage. If so, we suggest that more work should be done on document modelling of their learning process. To this end we have described elearning today as a remediation of circles of discourse. With this as a theoretical sketch, we have presented and described the implementation of a few practical models. One illustrates how one may scaffold the approach the variety of media formats that continues to evolve. Others describes possible building blocks for static and interactive (or collaborative) documents.

We propose that future Virtual Learning Environments be built with such kinds of models and the corresponding operational toolboxes in mind. They should play a dual role as explicit environments for training and competence building *and* as vehicles for the daily work of teachers, students and everyone else involved.

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