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A WWW-environment for project-based collaborative learning

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ABSTRACT

Increasing demands for remote on-line education are changing the way teaching and learning is performed. New behavior in using pedagogy and supporting technology is needed to drive the learning process. To facilitate the use of services for selected activities to participants in on-line education, a web site named UniFlex (University Flexible learning) has been developed and brought into use. The site is a comprehensive set of bookmarks including course taking, upload/download, and - of special significance - collaborative on-line project work. UniFlex has been developed to meet the requirement for a simple and cheap personalized interactive site, supporting problem oriented and project organized study form, which has characterized Aalborg University for more than 25 years. UniFlex supports a virtual group room for collaborative work as a key facility. UniFlex has downloadable templates, which includes newly, developed pedagogical methods supporting teachers producing course materials. UniFlex is used as the selected site to prevent inconsistency and loss of information. The site is based on the most commonly used Internet architecture and tools and is structured relatively simple to ease technical maintenance. Web interfaces for all type of users are developed to ease information and document upload, user administration and more. The product is used at Aalborg University open distance education for "Master of Industrial Information technology" (MII) and "Master in Mobile Information Communication" (MMIC), and other collaborative applications. The majority of the users are very satisfied with the product since it is simple, inexpensive, has a reasonable speed and easy to use and maintain.

Keywords—UniFlex, teaching tool, online services, collaborative work, remote education, online supported learning.

1. INTRODUCTION

Development of course materials for e-learning require advanced pedagogical methods and technology supported by an appropriate digital platform. A flow of actions is shown in Figure 1

Raw materials are typically stored in private structured files such as text, images and video clips, slides etc., and the challenge for the teacher is to find out how to present materials to optimize motivation, learning and his or hers reputation. Research has been made resulting in new pedagogical principals which is incorporated in templates to guide and facilitate the course production. The structured material is verified by the producer and validated by persons in a consumer before the release on the digital platform. Digital platforms are very different in complexity, quality of services, infrastructural requirements, operating system and costs.
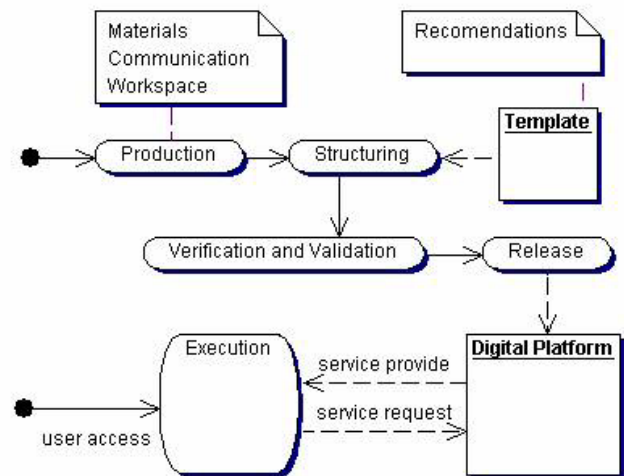

Figure 1 Flow diagram for production, structuring and delivery of persistent on-line materials by using recommended templates.[4]

CD based materials and flat web-based documents are the simplest way to organize e-learning materials. Advanced and commercialized platforms are often expensive and general in the sense of servicing a large range of user profiles. The platform to be chosen depends on the educational provider and the user group profile. Technical oriented students are satisfied with simple platforms, since they are used to navigate in an on-line environment, where others wants a platform offering all services needed in one site, not disturbing the primary goal for the study.
For more than 25 years Aalborg University (AAU) has used the group oriented project work as the major way to learn and adapt theory and methods however, the market for satisfactory on-line project work is limited and expensive. Initial to the start of the MII program in 1999,

some digital platforms were evaluated and one selected, but the experiences was so bad in terms of speed, bugs, support and handling collaborative project work, which caused UniFlex to be developed, implemented and brought into use.

In a modern distance education environment, it is less accepted to allow teachers autonomy in the use of pedagogy and technology. The teacher driven classroom teaching is based on this autonomy and the variations in quality are accepted and not a major disturbing factor when it comes to the learning progress. Often it is a pleasant variation. On the other hand - when participants are not located in the well-known social classroom and are alone 'out there and on-line' - they need more guidance to navigate and trying to manoeuvre through the learning process.

A new pedagogy and the supporting technology when being an on-line student are required. The environment for this support is an organization and a web site clearly supporting and stressing those requirements.

A digital platform is needed to provide services to the remote users and should be the one selected communication site for an education. If there are parallel communication canals, information can be lost. The platform is also a site where resources can be uploaded and stored and thus defining the release. Support for backup, user access measurement etc. are supported services too.

The UniFlex digital platform is service provider for communication, courses, project work, administration, news and information. The site is personalized and is supporting different profiles – (sometimes called roles) - of actors: student, teacher, super user and visitor. When logged in, the profile can be changed at any time and the default profile can be set. The list of available roles for an actor is determined by the super user.
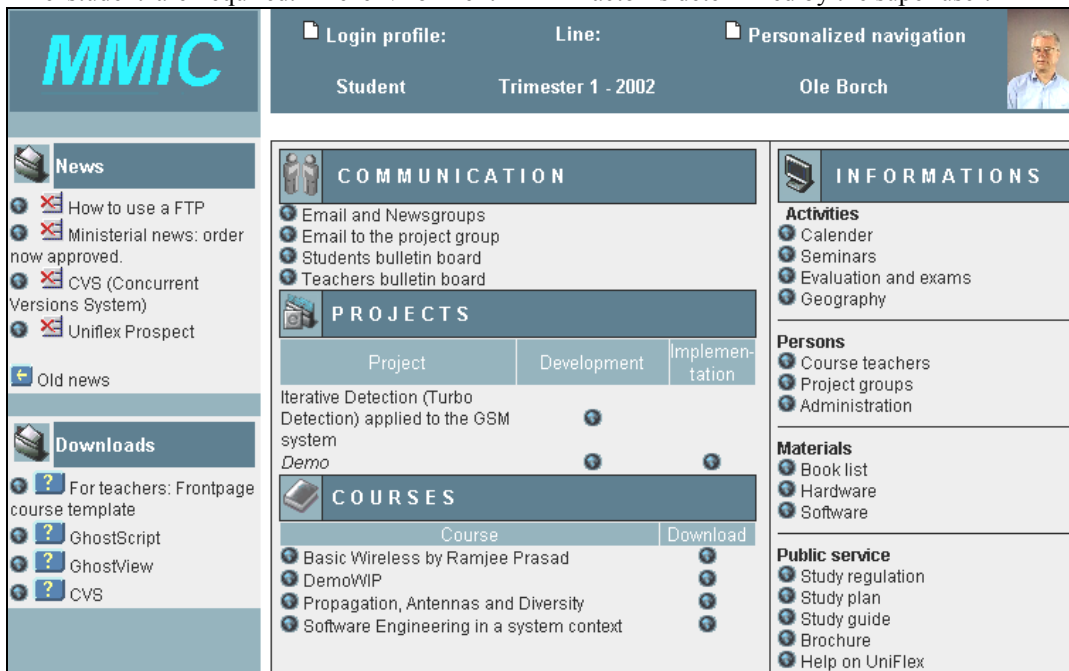

Figure 2 UniFlex personalized user interface for remote education, MMIC and logged in the student profile. A detailed prospect is shown in [1].

Every activity is a UniFlex instantiation like the MMIC activity shown in Figure 2. After sending an URL from the browser and a login, a personalized interface is returned from the server. In the top bar personal settings and user profile can be changed. Selecting another profile will result in other services available in seven major groups on the interface:

- Communication: Access to facilities such as email, discussion groups, bulletin boards and multimedia applications.
- Projects: Development of collaborative project work with tree structured document view, work distribution and deadlines.
- Courses: Upload, download and taking courses.

- Information and news: Common information, requirements, laws and regulations. Flow of study news.
- Downloads: Products such as viewers and templates.
- Administration: Register projects and courses and assigning users to projects and courses.

2. ARCHITECTURE AND TECHNOLOGY

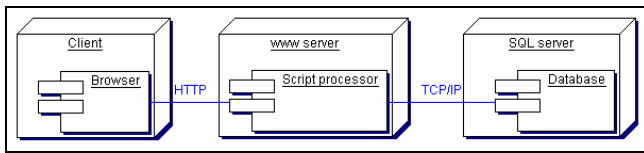UniFlex is a distributed system with a physical architecture based on a middle tier arrangement as shown in Figure 3.

Figure 3 Client node and www server node contains the three components in a middle tier arrangement: browser, script processor and database

The user site is a thin client node using a simple browser and communicating with the www-server accessing different pages of scripts written as ASP (Active Server Pages). The server site is accessing the backbone SQL (Structured Query Language) database server. When a client is accessing an ASP script in the www-server a HTML (HyperText Markup Language) page is returned. The contents is extracted from the database and structured by the ASP script. ASP is able to extract from the database and auto generate an XML (Extensible Markup Language) file, which again is used to produce the returned HTML stream by using a XSL (Extensible Style Language) definition file.

Every UniFlex instance has its own database and login. All instances are using the same server scripts. A configuration file is used to differentiate between instances. The implementation of UniFlex is made on a MS-IIS V5 (Microsoft Internet Information Server/Services Version 5) server using a database in a MS-SQL server 2000.

3. SERVICES

3.1 On-line Courses

Figure 4 shows a learning sequence state diagram for a single learning object, and the recommended learning path for all objects (block) is shown in the block sequence in Figure 5. [5]
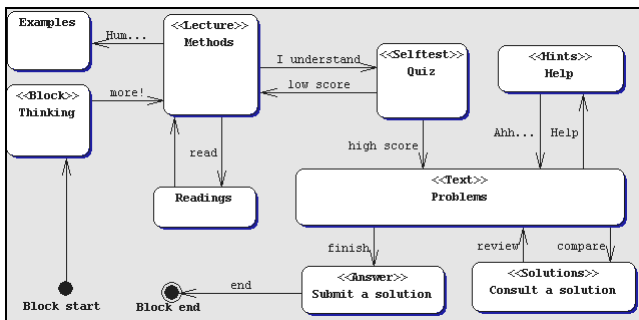

Figure 4: Learning state diagram for a single learning block. After the motivation state (Thinking) the lecture document is studied supported by examples and a selftest. When the user is satisfied with the score, the problem solving activity is entered supported by hints and eventually a comparison with the teacher solutions. The solution state may be omitted and instead the user may submit his or hers solution to the teacher.
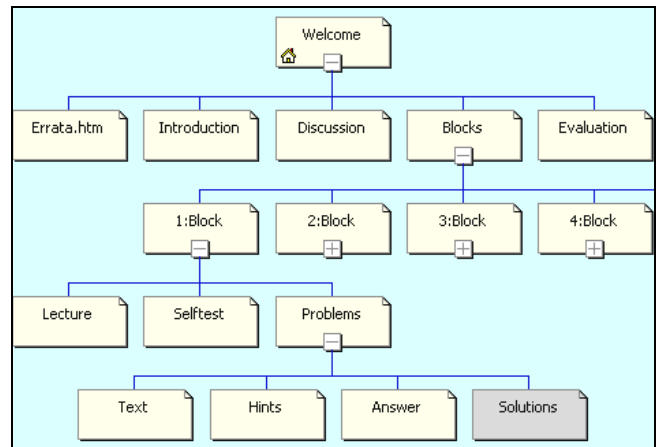

Figure 5 Elements in the course structure showing one expanded learning object ('1: Block') supporting the learning sequence shown in Figure 4 State stereotypes (<<xx>>) in Figure 4 are shown as element names. Here the 'Solution' element is removed from the navigation and thus invisible for the user.

The *first* layer in Figure 5 is the course welcome presentation document.
The *second* layer contains 5 elements:
- 'Errata' informs about changes since last course upload.
- 'Introduction' contains a collection of goals, contents, load, literature, references etc. for the course.
- 'Blocks' contains a short description of all learning objects and motivate the learning path.
- 'Evaluation' contains an electronic evaluation of the course and eventually an on-line examine guide.

The *third* layer presents the individual object including literature, goal, notes, slides, motivation, load etc.
The *fourth* and *fifth* layer contains elements supporting states in Figure 4 .
The empty structure of the course is stored as a zip-file template offered as a download service from UniFlex. The course template is a technological offer for on-line course production, where a set of recommended pedagogical methods are incorporated.
When the course developer has filled in the materials into the template, a zip-file is made and uploaded to UniFlex by using a web based interface. This upload ensures a well-defined course release, login protection and regularly backup. At the server site, the file is stored and unpacked and registered in the database. The references for the files are hyperlink services in the UniFlex user interface. The zip-file is downloadable to let the user unpack and take the course off-line minimizing network costs, but then it is not possible to monitor the individual student activities for support and control purposes. The copying process is justifying the existence of the 'Errata' element.
Self test for every learning object is produced when logged in as teacher by typing in questions and answers to the commercial quiz component. When created, an URL

is returned and inserted in the course material self test element.

Problem solutions from the students may be submitted 'passed by reference' (URL) or 'passed by value' (attachment) to the teacher. Corrections are made as reviews or annotations and returned to the submitter. In some cases self correction may be selected and supported by opening the link to the teacher solution for comparison.

3.2 On-line Project work

The virtual group room is never as intense and social as the physical one. When the AAU PBL (Problem Based Learning) model is going to work in the remote learning environment, all activities must be identified and supported by the virtual environment to some extend. UniFlex provide a variety of services under the column 'Development' in the project activity as seen in Figure 2.

- Project is created by the educational coordinator and associated with a group of persons including the project supervisor.
- Chapters and sub-chapters are created by group members and responsible person and deadlines are attributes.
- Documents are uploaded from time to time by group members to selected chapters. Versioning, person identification and time stamp is made automatically.
- Review of a downloaded document is stored on the reviewer's local disk and uploaded with automatic registration of person, version and time.
- Management
  - Invisibility of a document in the project tree can be selected.
  - Moving and deleting documents, chapters and group of chapters can be made as well as blocking for further upload of reviews.

All manipulations in the project tree are registered in the database and documents are stored in open files with reference stored in the database. When the project work has an implementation an URL is inserted in the column 'Implementation' of the project activity as seen in Figure 2. An example of a project tree is shown in Figure 6.
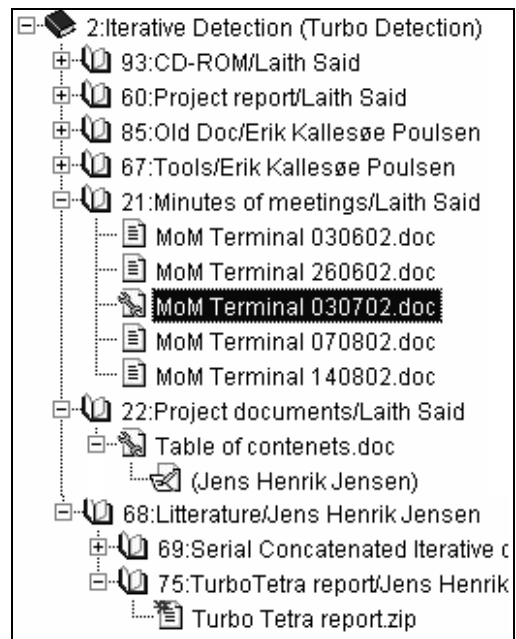

Figure 6 Item 2 at the top is the project number and title. Sub-chapter 75 has one uploaded document not yet seen by any members of the group (star icon).Chapter 22 has a locked document (tool icon) with one review assigned not accepting further upload of reviews. A click on a document will open a frame showing a list of group members who had touched it, document deadline, download facility and document delete among others.

CVS (Concurrent Versions System) are available, but the UniFlex system is much simpler, easy to adapt and appropriate to support the AAU PBL model.

3.2.1 Teacher considerations

The project tree signals information about progress in the project work, individual activity, work distribution and timing giving fine possibilities for the supervisor to advice students individually. It is however important for the supervisor not to play a too active and dominant role in the project work without specifically having been asked.

3.2.2 Student considerations

When a document has been developed by a group member, it is uploaded to UniFlex into a specified chapter, and group members are invited – possibly automatically - to a review. The reviewer downloads the document to the local disk, reviews it and uploads the result. This default parallel review process is going on until deadline for the document is met, then the responsible group member is locking the document, processing all reviews, releasing a new version and invite to another review session. The version sequence is repeated until the chapter deadline is met. When all chapters are ready, all highest versions are collected into a report-chapter and a new review process is performed until the project report is ready. All documents uploaded are backed up even in case of upload overwrite and all

documents are protected for access by others except group members and other associated persons.

3.2.3 Other services

Apart from being a personalized web based digital platform, the user may change profile and thereby change service access possibilities on the UniFlex interface. For instance is a user - in the teacher profile - able to upload a course whereas a user in the student profile is able to download a course

News is produced by using a template too (Figure 2), and uploaded to a stack in UniFlex, from where the user may read and pop it into a embedded recycle bin.

Downloads contains all sorts of facilitating services such as course template, viewers and other software packages.

Communication used in UniFlex is component based like email and news used as API (Application programmers Interface) to the UniFlex server site. An email address in the University is mandatory to obtain a campus software site license access. Recently, chat and audio chat component has been added as new external components. Bulletin boards are used to broadcast persistent information such as notes, slides and interesting links. The quiz generator component is accessible in the teacher profile only.

Information about required hardware, software and study plans etc. is useful services as well as person data and group associations. A very important service is the activity calendar reflecting the overall principals for progress in the learning process. The ratio between project activity and course activity load is scheduled in terms of time and milestone signaling clear goals. The calendar is used to guide the participants in professional competence development by first taking courses followed by project work. This strategy has been chosen due to the fact, that students are very much attracted by the project work and thus giving the courses too little attention. [[3] Another advantage in the calendar is to synchronize the competence development among project members, which is the basis for a useful project development. This parallel competence development in the group is fundamental for the possibility to communicate scientifically on an equal base.

Administration is an educational coordinator service offering web interfaces to create courses and projects and establish users as well as assigning users to projects and courses.

4. Experiences

UniFlex is used for many collaborative remote educational purposes as the default digital platform, such as "Master in Mobile Internet Communication" (MMIC) and "Master in Industrial Information Technology" (MII), but collaborative article writing and software coding is also a use case. The MMIC master program is given to engineers mainly employed in the mobile industry and the educational provider is two universities in Denmark. The

MII master program is offered as a supplementary education too for people in general who would like to get a formal competence in information technology. The two programs mentioned are based on 50% project work and the rest on courses.

4.1 Courses

Experiences by UniFlex course structuring are that not all teachers have used the recommended pedagogical model and the offered template. Some claimed to have pedagogical and technological freedom and some just uploaded one page containing links to public sites elsewhere. This on-campus attitude did certainly not support the service level expected from participants. Teachers using the templates together with FrontPage expressed satisfaction with the simple structure and guidance to fill in course materials.

4.2 Projects

Many project groups have used the collaborative facility and gave a lot of useful inputs in the development of UniFlex version 2. Fast re-design implementation and test was only possible because users and developers were close related. Other versioning systems are available on the commercial market, but UniFlex is found to be simple, useful and cheap.

4.3 Communication

Communication by using News groups has been very limited compared to email. The teacher's release of results and general information's on News did increase the interest for News groups, but the immediate collaborative discussions in project work and courses were rare. Carefully planned written chat sessions have been used for project work meetings and most groups also used audio chat. However, the most important communication (project work planning and decisions) was performed every one and a half month when participants physically attended seminars.

4.4 Maintenance

Student help has been used extensively to debug the system in collaboration with staff persons to ensure documentation and continuity in the organization. UniFlex is a generic class from where activities (such as MMIC) are instantiated by using a configuration script.

5. CONCLUSION

UniFlex is a simple, cheap and 'easy to use' unified digital platform supporting all necessary requirements for remote education based on the AAU PBL model. UniFlex has a personalized login preventing public access like search engines. The server is open source, platform dependant and located in the educational environment to secure dynamic, cheap and fast product maintenance. Runtime access is relatively fast and performed from a normal standard browser. Study period login is sold

cheaply to the users. The server is planned to be commercialized when converted into JSP (Java Server Page) and thus turning UniFlex into a less platform dependent product. Selection of the SQL database relies on driver support inside JSP. Another improvement for the next version is to incorporate a shared whiteboard associated with the audio chat. MS Netmeeting has been used by few persons, but firewalls are a problem.

"UniFlex is a cheap medium range digital platform used in distance learning and collaborative project work where group members are informed about work distribution, e.g. who has read a document, and showing a clear work progress."

6. ACKNOWLEDGEMENT

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