THE WELEARN DISTANCE TEACHING FRAMEWORK

Roman Divotkey, Jörg R. Mühlbacher, Susanne Reisinger, Doris Remplbauer
FIM – Institute for Information Processing and Microprocessor Technology
Johannes Kepler University of Linz, Austria, www.fim.uni-linz.ac.at

Introduction

The field of Distance Teaching/Learning (DTL) has attracted considerable attention within the past three or four years and currently it seems that nearly all distinguished educational institutions are active in that field. At the same time there is a trend to move from passive and uninvolved, "stand alone" courses, towards tutored yet collaborative and self-organized approaches. The anticipated advantages that drive this trend include (but are by no means limited to) a more active and participatory learning process, improvement in soft skills while preserving independence in time and place. Hence a quite high level of acceptance of DTL approaches can be observed and this in turn fuels further developments of related tools and technologies.

Unfortunately the positive climate that surrounds the field has also given rise to a tendency to oversee some important aspects of the emerging educational infrastructures. Attention often focuses either solely on learners (pupils, students, etc), or on tutors, or on the quality of the provided learning material that is judged without taking any context into account. In other words aspects such as the acceptance of the learning / teaching environment and appropriate evaluation methods are not always on top of the priority list.

Based on the above observations, we have identified a number of principles to guide the design and development of WeLearn, a new application framework, so that it serves as both a flexible and scalable learning and teaching platform, and as an open and easily extensible base for further development (see: open software).

The WeLearn System

Design Principles

Platform and Tools: Keep them simple

At present, there exist several software platforms for DTL, with wide-ranging differences in the functionalities they support, their pricing, performance, etc. Furthermore, it seems that people are often inclined to deem a rich set of functionalities as a panacea to the challenges encountered by the tutors and the developers of educational content in general. Seldom are the required (human and other) resources, quality factors such as usability, or costs related to training, maintenance, etc., considered. To evaluate, or assess a platform, at least two categories of criteria should be taken into account: *technical requirements* and *objective requirements*.

Technical requirements: There is consensus that DTL platforms have to satisfy a set of minimal requirements, such as sufficient network connectivity, easy installation on the learner's side (ideally requiring only standard, pre-installed software, such as a browser) and, last but not least, support for reusability of the learning material, and adaptation of the learning material to the bandwidth available to the learner.

Objective requirements: The platform should offer learners sufficient support for common learning and communication activities (including, e.g., a personal workspace, discussion forums, etc.) At the same time, the platform should feature an easy to learn and use, uncluttered interface, which is non-intimidating to novice users, and enables more advanced ones to focus on the learning tasks at hand.

The platform must also provide sufficient support for tutors in their role as course administrators. Specifically, it is vital that course setup and management be flexible to accommodate for different course delivery models, but flexibility should not result in excessive complexity on the side of the tutor / administrator.

Race condition: Undoubtedly, fulfilling all of the above requirements is cost intensive. Usually, when migrating from conventional teaching methods towards DTL, the budget is limited. Thus, a gap emerges that needs to be bridged: Should one opt to invest in the acquisition / development of an appropriate platform, or should the development of content be favoured as a cost priority. The usual way out of this dilemma is to arrive at a compromise, somewhere between the two ends of the spectrum. Which brings us to our second principle for WeLearn.

Adopt, Adapt, Improve

Adopt: To start with, the development of a comprehensive DTL solution (including the infrastructure, course delivery models, actual course material, etc.) from scratch, is, in all but the most trivial cases, economically prohibitive, mainly due to (human) resource- and budgetary- limitations. A first step towards a viable solution in this respect would be to "adopt" an existing DTL platform, making sure that it both offers the desired degrees of freedom for both learners and tutors, and satisfies the already identified technical and objective requirements.

Reusability, a concept very well understood (although not always perfectly practiced) in software development, is also essential in the area of education. However, reusability assumes that one has already developed a tool or concept and would like to make further use of it, in identical or modified form. This is the basic premise of "adaptation" in the context of the present discussion, and the second step towards a solution to the problem of economic feasibility of DTL solutions. In principle, one could identify two possibilities of adaptation in this respect: *adaptation of course material to the platform*; and, *adaptation of the platform to the course material*.

Adapting the course material to the platform: Whatever technical facilities for course material adaptation may be provided, a platform that only supports proprietary formats for the representation of content is, essentially, insufficient. The adaptation of existing material typically represents a very significant resource expenditure, which is practically nullified by the use of proprietary formats, as the latter present hurdles to the further evolution of the course material, or even to its reuse in a different context.

Specifically, although tutors may find existing course material attractive, in order to make use of it they will typically need to transform it (by, e.g., removing parts, merging it with other material, and so on) to make it appropriate for different teaching aims, different audiences, etc. Consider, as an example, the case of academic courses: It is good practice to base one's courses / lectures on existing material from several sources (books, scientific publications, etc.), manifest one's own emphasis on the subject matter through the selection process, and complete the material with personal knowledge and experience.

Such forms of adaptation and reuse would be severely compromised if material from different sources followed a proprietary format, specific to that source. It is a logical consequence that tutors (or content authors more generally) will be unwilling to expend the effort required for the adaptation of the material, if the prospects of further adaptation / reuse from there onwards are minimal. Even the (unlikely) decision never again diverge from the use of a particular format would not solve this problem, because it would most likely lead to the formation of "islands" of knowledge, each expressed in its own format, but without the possibility for exchange or cross-fertilisation.

An argument that is often voiced against this line of thinking is that adaptation of this form is not necessary, since, in any case, new material should be developed in the context of DTL. Nonetheless, the migration from conventional course delivery to DTL is, in most cases, a stepwise process, in which most phases involve the adoption of hybrid teaching models (i.e., part of the teaching is done through conventional means and some through DTL methods and technologies). A further fallacy in the aforementioned argument is that existing material is to be entirely discarded, or, in the best case, merely consulted. However, DTL signifies a departure in the way knowledge is delivered and

assimilated, and, therefore, poses no requirement for massively revisiting available material, other than making it appropriate for the novel teaching / learning approach (-es).

Adapting the platform to the course material: From a different point of view, an ideal solution would be to be able to "adapt" the platform to the available course material, because there is only one platform, but there are multiple course materials and many different users. There are two important aspects:

- **Scalability**: A platform used solely in a small electronic classroom and one used in a large company-wide intranet, or at a university campus, are faced with enormously differing requirements with respect to simplicity, supported functionality, acceptable levels of performance, etc. Thus, scalability is a very important factor for any platform that aspires to be used in several different contexts, meeting the requirements of each of them. Additionally, platforms would ideally scale while in use – it is often the case that once a DTL platform has been instated, interest in it rises and the number of users (both tutors and learners) increases substantially over time. To cope with an environment characterised by such dynamically increasing demands, a platform would need to scale "smoothly" and, equally importantly, without requiring major management / upgrading / (re-) configuration tasks that could cause lengthy interruptions in its operation (or, even worse, loss of material, configuration settings, etc.)

- **Adaptability towards scenarios or working environments**: The employment of DTL approaches can take several forms: Courseware may be provided in the context of regular physical meetings of all involved parties; or, physical meetings may be sparse; or, physical meetings may be eliminated altogether and tutoring be done solely via the platform; or, even, there may exist learning arrangements based on self-organisation, where the tutor assumes mainly the role of a coach. A very pragmatic requirement for a platform is, then, that it should be adaptable to the prevalent teaching model.

Many commercial platforms tout for their customisation facilities. But when one takes a closer look, the truth is that most of these platforms are parameterisable, but neither scalable nor adaptable as outlined above. This is naturally a major disadvantage, as the capability of realising radically different configurations of a platform is not a luxury, it is a necessity.

Improve: In addition to supporting course adaptation, a platform should also enable and facilitate improvement and evolution of the courseware on the one hand and the learning environment on the other hand. The experience gained during the learning process influences the proceeding process. Specific demands may arise and the platform must provide the flexibility to deal with those change requests, e.g. creating shared folders 'on the fly'.

Treat the platform as a framework

In today's world of informatics software application frameworks are quite common. These matured and became popular within object-oriented programming and are now an indispensable tool in the hands of software developers. An application framework usually provides direct support for a number of typical software configurations (sometimes specific to a given application domain), while it also allows for its own expansion and extension through well-specified mechanisms.

It is our claim that treating a DTL platform as a framework dedicated to a specific yet broad and diversified application domain, bears several advantages across a number of dimensions. Such a platform can go far beyond simple customisation like changing colours or arranging the entries of a menu bar. With the help of the framework the entire system can be redesigned. Entire modules can be swapped in and out to cater for different requirements of different contexts, while modifications are also easy at a lower level of granularity.

The framework can be used by individual organisations as the basis for their own specialised development needs. Organisations that have adopted the framework can more easily benefit from each other's work on developing/modifying/extending it, through the exchange of technical know-how, specialised modules, targeted configurations, or experiences from its everyday use in real-world settings.

The WeLearn – Distance Learning and Coaching Framework

WeLearn stands for Web Environment for Learning and it is much more than a simple learning platform. WeLearn is a framework that provides the possibility to create a specialized platform, which lives up to the expectations and needs of the course providers and learners.

WeLearn consists of the following three parts: the platform itself, the settings and the course materials.

The platform

WeLearn is a free and open learning environment (GNU-philosophy), which is easily and universally applicable. Because of its implementation as a framework, it provides the possibility for adapting and scaling it. This construction kit philosophy is the reason why WeLearn can offer not only suiting but tailored settings for specific usage sites and can respond to changing learning situations.

The technical design: Within the WeLearn-system everything is treated as an object: persons, folders, documents, forums and so on. All these WeLearn-objects realize the modular conception of the WeLearn-framework. Therefore a WeLearn-system is the arrangement of selected objects within a highly dynamic system structure. This structure is continuously modified through the addition and removal of objects, occurring as the result of activities such as uploading a document, creating a folder, or setting up a user.

It could be useful to understand the concept of WeLearn, if it is not considered as a simple web application, but as a program with HTML-interface. WeLearn was implemented in Java. This design decision makes it independent from platforms and guarantees extensibility. All developed modules respectively WeLearn-objects have to follow the specified interfaces to classes (API). The created components can be added to existing WeLearn-systems at runtime.

Functionality: As each configuration of a WeLearn-system can differ in functionality, this section focuses on the description of such functions that are typically needed for eLearning. Overall each eLearning-scenario will comprise at least the following points, maybe with varying focus: administration, presentation of courseware and support of the learning process.

WeLearn offers the administration of users (learners, instructors, coaches, system administrator,…) and the possibility of forming groups. The administration includes the configuration of the system, the management of the course materials and the administration of the courses themselves. WeLearn also is content independent or in other words courseware in each data format can be used with WeLearn.

On the basis of our experiences in eLearning we have seen that any communication among the learners and collaborative work encourage the learning process and the sustainability of acquired knowledge. WeLearn provides discussion groups and chat as communication tools that can be used in various ways and at any desired place within the system.

As WeLearn offers a virtual filesystem, each user has its own home directory, where any documents or files can be uploaded and shared with other users. Because of the implementation as a web application, the system in general and the personal workspace with the users data can be accessed from allover the world simply by using a web browser. For setting up courses the instrument of shared folders can be utilized to realize collaborative work among the learners.

WeLearn is both user-centered and course-centered. Courses (containing various documents, shared folders, discussion groups, etc.) play a decisive role within the platform. But not less important are the users of the system. WeLearn can be personalized to satisfy the special needs of each user and to show him/her only those parts of the system, which he/she actually needs. This comes along with the design aim: Keep it simple! WeLearn offers a great amount of functionality but only those parts of the system that are really necessary are presented to the user. As an example a student needs not or should not see the functions for course administration. The personalization is also possible for courses and courseware, therefore it is possible to show only attended courses to the student. WeLearn provides a strong right-system, which manages the access to all objects like documents, folders, forums, …

Appearance: The look and feel of WeLearn can be experienced at http://welearn.fim.uni-linz.ac.at.

The Settings

As no eLearning-environment is similar to each other the chance to scale and adapt the platform is a big advantage. In further terms we call the adjustment / customisation of the platform "setting". A setting in our context is specific to the usage site, e.g. a setting for a school differs from a setting for university purpose. In more detail a setting can also be different depending on the target group, the kind of course or even because of different didactical concepts. In addition eLearning is more than the presentation of electronic content with the aid of a platform. A developed setting for a special eLearning-environment must provide different ways for communication and collaborative work.

On the basis of our experiences we developed such settings for selected learning scenarios. These settings are part of WeLearn as ready-made configurations, which can be used as they are or can be adapted at will. In the following example settings, one for a secondary school and one for university use, are described.

School: The administrator of a school network will establish the WeLearn-system. A typical setting for a secondary school includes a library containing content interesting for the whole school. Additionally each pupil has his or her own working space (home directory) for personal use. As courses in school primarily match with classes, the WeLearn-system is divided into sections corresponding to each class. Within such a part of the system, the class teachers have the right to administrate these levels.

A useful structure for each class may be to set up folders for each subject. On this level each teacher has the possibility to form his/her own course using shared documents and folders, discussion groups, chat or whatever he or she wants. A prefabricated setting for a secondary school realizes the described learning environment by implementing typical classes, subjects and courses.

University: A setting for university purpose provides a library containing general accessible content and a section with important web links for students. But the main part of the WeLearn-system for universities consists of courses, which are divided into lectures, practical courses and seminars.

The settings for those different kinds of courses are also different. The main teaching aid holding lectures are courseware and discussion groups. Exercise courses and practical courses demand, by definition, interaction of the students. Mostly the result of an exercise has to be presented to the instructor. For that purpose delivery folders can be established where each student has access only to his or her specific subfolder, for depositing the material to be reviewed.

In addition, seminars have the characteristic that teams of students generate the presentation of a topic. In this context there is a need for team folders to share any documents among the group members. A ready-made setting for university purpose offers templates for typical lectures, exercise courses and seminars.

The course material

As mentioned before WeLearn basically doesn't set restrictions to the course materials. Any data format can be used within the platform. The documents will be embedded in the WeLearn system, if the web browser used by the client supports embedding which is true for most cases. For not being online the whole time while learning, the documents can also be downloaded.

To develop reusable, distributable courseware we decided to support the Content Packaging Specification of the IMS Global Learning Consortium. The hierarchical structure of the course is described in XML and meanwhile this specification is used by various applications. WeLearn offers an export function for courses in CPS-format to produce offline versions of the course.

Case Studies

The WeLearn framework has been and is being used in various pilot studies, which are organized and performed by FIM in cooperation with the Austrian Centre of Distance Learning. These case studies address very different learning and teaching situations that demand a different setting for each individual case. Due to lack of space, we will focus on:

Teaching Operating Systems Principles: The course on Operating Systems (part of the curriculum of CS at J. K. University of Linz) that was held in the past in the traditional way (in a lecture theatre) with 180 students enrolled. This course is now provided as DTL course. The setting and the use of the WeLearn-platform/framework are adopted to its requirements:

The subject is subdivided into a sequence of self contained chapters, each of them is made available in time. Students are supposed to go through the various electronic teaching material (consisting of slides (ppt, html), text (pdf), self-assessment (html) and additional references.

In parallel, the instructor meets the students periodically in the lecture theatre in order to give a preview of the incoming chapter that the students are supposed to study.

In order to master the complexity provoked by the number of participating students, they are subdivided into n virtual learning groups G_1, G_2, … G_n. A discussion forum and up-/download folders associated with each group G_i. Any member of G_i has r/w access to all objects (forums, folders, …) belonging to G_i, but has no access at all to objects belonging to G_j, $j \neq i$. Each group G_i is tutored by a tutor T_i, who has r/w rights to all G_i-objects, but he/she is granted read-right to G_j objects, $j \neq i$. The tutors T_i own up/download folders and a forum, both are dedicated for internal communication between the tutors themselves and the main instructor.

Finally there is a general "news-board" and a global forum for all. The main instructor owns the blackboard and it is up to him/her to whom he/she provides access rights. The forum is available to everybody who either belongs to the group teachers/ instructors or is enrolled officially as student in one of the groups G_i, that we have mentioned already.

It is worth mentioning that a special team from the department of Psychology/ Pedagogic follows the progress of the case study. Members of this team are granted read right to all objects.

Conclusions

One of the specific advantages of WeLearn is that at any time the course instructors and/or the development team are able to adapt the system quickly as soon as specific demands (e.g: proposed by the students or tutors) arise. The set of prefabricated objects is growing each time we are faced with a different teaching/learning environment that demands a different or modified setting and assembly of objects. This precisely is the reason why we regard the WeLearn system rather as a teaching/learning framework that provides flexibility in order to accommodate specific needs. WeLearn is made available to the public following the GNU-philosophy.

References

1. Divotkey R., Remplbauer D. (2002) Design and Implementation of a web-based Learning Environment, FIM
2. IMS Content Packaging Information Model, Final Specification (2000) Version 1.0, IMS Global Learning Consortium, Inc. http://www.imsproject.com
3. The GNU project, http://www.gnu.org
4. Muehlbacher,J.R., Leng,P.H., Shave M.J., Aiken R.M. An Experiment in multinational collaborative learning and group work using the Internet, Education and Information Technologies
5. http:// www.fim.uni-linz.ac.at/, WeLearn-Testaccount: http://welearn.fim.uni-linz.ac.at/welearn
6. Rosenberg M. (2001) eLearning, McGraw Hill
7. Wagner E., Szücs A. ed (2000) Eden, First Research Workshop, Prague
8. Tella S.(1998) The poor Relation of the Education System? Aspects of Distance Education and Open and Distance Learning; Media Education Publ., Vol6, Dep. of Teacher Education, Univ. of Helsinki, pg 1-23
9. Klöckner K. Computer Supported Cooperative Learning based on Shared Workspaces; pg 190ff [7]
10. Stiles M. COSE; The Virtual Learning Environment- for Active3 Collaborative Distributed Learning, Cambridge; http://www.staffs.ac.uk/COSE/