Work processes for the development of integrated e-learning courses

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INTRODUCTION

A large number of institutes of higher education have decided on introducing eLearning by using a so-called 'learning management system'. Lecturers use this system to provide course information and to upload their PowerPoint presentations and additional reading texts on the Web. They use e-mail and newsgroup facilities in addition to their lectures and seminars. However, in most cases the learning management system and the digital materials are used in addition to the regular teaching activities and the basic paradigm of teaching and learning has not changed at all.
By way of contrast, the introduction of integrated eLearning can radically change the entire outlook of education. It can offer flexibility of time, place and pace and can enable students to follow their own personalized learning paths. Moreover, it offers great opportunities for self-directed learning and independent study. A radical change, however, entails more than using e-mail and PowerPoint presentations on the Web. It requires a complete rethinking of the educational system and, when it comes to quality, integrated eLearning courses which meet these challenges and live up to very high standards.
Developing these kinds of courses requires a great deal from the developers. They need a thorough knowledge of the subject matter, competency in instructional design and in Web design, technical skills, writing skills for the web and competency in graphic design and the use of multimedia. It is very rare to find one person who is an expert in all these fields. Developing integrated eLearning courses is not a job for one individual. It is an industrial process, which requires teamwork, co-operation between different specialists and a systematic workflow.
In this chapter we first describe the workflow in the development process of integrated eLearning courses, which are suitable for the new paradigms of learning. We then go on to outline the different fields of expertise, which are involved in the development process. Finally, we give some examples of the course development process and report on our experience.

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THE DEVELOPMENT OF INTEGRATED ELEARNING COURSES: AN INDUSTRIAL PROCESS

Traditionally educational courses have been developed by the so-called 'artisan approach'. A lecturer is responsible for the entire development and delivery process. He or she is responsible for one or more groups of students, decides what to teach, designs the course, puts it on the Web or in print, and changes it whenever necessary. In addition, the lecturer tutors the students, answers their questions and corrects their assignments. There is a lot to be said for this approach. Courses can easily be adapted to the needs of the students, the time between design and actual realisation is small, and the development costs are limited.

For developing high quality, re-usable multimedia courses for large heterogeneous groups of students studying at different times and places, however, the artisan approach is not satisfactory. It does not produce the high quality required, the process is not efficient, the course components are not re-usable and, moreover, the fields of expertise needed for developing these courses are seldom to be found in one person.

Institutes for distance education such as the British Open University and the Open University of The Netherlands (OUNL) adopted a new systematic approach for designing and developing courses as early as the 1970s and 80s (Kaye and Rumble, 1981; Van den Boom and Schlusmans, 1995). This so-called 'industrial approach' allowed these institutes to develop written materials and audio-visual and computer programs on a large scale. First of all, this approach advocates working in course teams with a strong division of labour. In the traditional institutes for distance education course teams consisted of subject matter specialists, educational technologists, lay out specialists, producers of video materials, publishers, computer experts and so on. Secondly, there is also a clear distinction between the development process in which the courses are designed and developed and the delivery process in which students study, interact with tutors and write exams. A third difference between the two approaches is the cost. In the industrial approach a great deal of time, effort and money is invested in the development phase, while the delivery is relatively inexpensive. In the case of the artisan approach, development and delivery merge with each other and more emphasis (time, effort and money) is often placed on delivery than on development. As the industrial approach is fairly expensive in the development phase, it is particularly suitable for courses with large groups of students and with re-usable components (Koper, 2003).

With the introduction of the Internet in the mid-90s, there was a tendency at the Open University of The Netherlands (OUNL) to move away from the industrial approach to course development. Individual tutors and lecturers started to experiment with the Web and as it was comparatively easy to produce and change materials many of the quality checks and the whole systematic workflow were abolished. It was felt that the quality of these eLearning courses did not live up to our traditional standards and the new way of developing courses led to a large increase in exploitation costs. This is the reason why we reintroduced the industrial approach to course development at the OUNL and adapted it to the new challenges of eLearning courses.

REQUIREMENTS OF INTEGRATED ELEARNING COURSES

Students and staff alike have high expectations of integrated eLearning courses. The courses have to be attractive, effective and efficient. Students want user-friendly multimedia courses, which allow them to interact with the materials, with each other, and with the teachers. They want a fair measure of flexibility to organize their studies and they want courses, which can be adapted to their own learning needs. The teaching staff expects the courses to be user-friendly and decrease their teaching load. They should also be easy to adapt and update. Teachers and institutes want learning objects to be re-usable and shareable. Moreover, educational institutes tend to use different Learning Management Systems (LMS) and the staff expects the courses to be compatible with their own LMS and to allow interaction with their own administrative systems.
To meet all these expectations, integrated eLearning courses have not only to meet high educational standards but also several technical requirements. The most important ones concern the manner in which the courses are described and the way in which they are stored. When it comes to learning content, not only are technical standards such as graphics interchange formats required. So are formats for the way in which the packaging, sequencing, and other management of the software is handled in order for it to be transferred between platforms and environments. To make integrated eLearning courses re-usable and compatible with different systems, it is necessary to use a formal language that describes the course exhaustively. This includes the learning design, the learning objects and the services needed (Koper, 2001a/b). Such a language is called an 'educational modelling language' (EML) (see also chapter 7). The work on EML at the Open University of The Netherlands has led to the work on the IMS Learning Design Specification that is now available as an independent open standard (IMSLD, 2003). Both EML and IMS Learning Design use XML to create highly structured course materials. A course described in EML might offer features such as re-usable course material, personalised interaction for individual students and media independence. It allows the developers to model the pedagogical scenario (the learning design) of eLearning courses in such a way that students can interact with the educational environment. It also enables the course materials to be adapted to the individual needs of the students.

THE COURSE TEAM

Developing integrated eLearning courses using EML requires specific skills and knowledge in several fields of expertise (see Table 10.1). There is not a one-to-one relationship between people and fields of expertise. Although some people combine several fields of expertise, it is unlikely that any one person will combine them all. These fields of expertise should all therefore be represented in a course development team (Duffy, 2002).

Table 9.1 Areas of expertise and examples of competencies

Areas of Expertise	*Examples of Competencies*
Project management	Managing multidisciplinary teams Planning a project Reporting on the project's progress Managing time and finances
Instructional design	Developing a didactic scenario Developing learning activities advising on using media Designing interactions Advising on writing instructional texts and assessments
Subject matter expertise	A good knowledge of educational modelling languages Translating the didactic scenario into an EML design
Content management	A good knowledge of content management learning systems Advising on the best data storage Developing a database of different educational materials
Editing	Editing educational materials
Developmental testing	Developing questionnaires for developmental testing Carrying out a user test
Publishing	Preparing materials for publication on the Web
Data entry	Using XML or EML authoring tools 'Translating' educational materials into EML formats
Graphic design	Designing a user interface Preparing pictures and illustrations for Web publication
Media technology	Developing streaming audio and video

THE INSTRUCTIONAL PROCESS: SEPARATION OF DEVELOPMENT AND DELIVERY

To guarantee high quality materials of a consistent standard, development and delivery are strictly separated. This is one of the main characteristics of the industrial approach. The whole instructional process can be divided into five phases (see Figure 10.1). These phases are the course definition (the task); course development; implementation; delivery; and evaluation.

In the course definition phase, the curriculum committee or the planning advisory board decides that a particular course should be developed in a particular subject area for a specific target group. A course team is selected and the course is developed. There is an implementation phase between development and delivery. Here the tutors are trained, the authorisation issues are resolved, and the course is incorporated into the curriculum. During the delivery phase, students study the course and write assignments and exams. The tutors give feedback and assess the students' progress. In the evaluation phase the quality of the whole course, including tutoring and support, is assessed.

THE COURSE DEVELOPMENT PROCESS

The development process can in its turn also be divided into four phases, namely analysis, design, construction and developmental testing (see Figure 10.1).

Analysis

First of all, the course definition or task is analysed and the different course requirements are established. These requirements concern the following issues:

- course objectives;
- target groups;
- connection with other courses and programmes;
- study load;
- instructional model;
- financial and time constraints.

At the end of this phase the course requirements are clear and the development team can be established.

Development

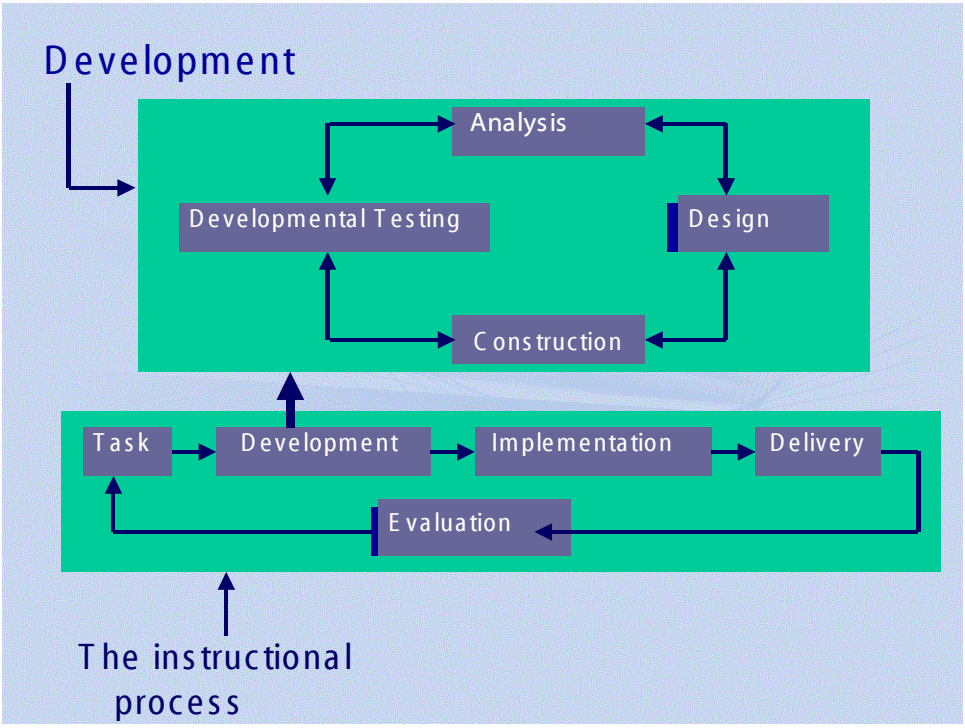

Figure 9.1 Development and the instructional process

Design

The design phases consist of three parts which are closely linked together, namely instructional design, technical design and test design, along with a fourth part, which deals with the planning and the budget.

The instructional design is based on the requirements from the analysis phase. In the instructional design the following issues are addressed:

- refinement of the course objectives;
- establishing the detailed entry level requirements and the consequences of not meeting these requirements;
- the assessment criteria for the course;
- the way in which students will be assessed during and at the end of the course;
- the way in which the course will be adaptable to different students' needs;
- the different roles of staff and students;
- the different learning activities students should undertake to meet the course objective;
- the order in which the learning activities will be presented;
- the materials the students will need to perform the activities;
- the way in which student progress will be monitored;
- the way in which tutors will give feedback;
- the interaction patterns between tutors and students;
- the media which will be used, that is to say what will be printed and what will be Web-based.

Part of the instructional design is a description of the didactic scenario (see Table 10.2) and a description of the separate learning activities (see Table 10.3).

Table 9.2 Example of part the didactic scenario of a course in Public Administration

	Learning-activities	**By whom**	**When completed**	**What is registered in portfolio**	**Support activities**	**By whom**	**What is registered in portfolio**
1	Registration	student	When form is filled in	All data	-		
2					Welcome	Tutor	-
3	Reading Study Guide	student	unrestricted	-			
4	Practice assignment 1	student	When feedback is positive	Result of Assignment 1			
5					Feedback	Tutor	Feedback

Designing a course is a creative, non-linear process in which subject matter specialists and instructional designers work closely together. It is important to refine the instructional design and to agree on every issue before even beginning to construct the course. The instructional design is the most important aspect of the whole development process. In our experience it is worth spending about a quarter of the development time on this phase.
Only when the instructional design of the course is completed, the technical design can start. At the Open University of The Netherlands we use EML for the technical design of courses. The instructional design is translated into a so-called 'course skeleton'. All activities and interactions are modelled in EML but without actual content. This course skeleton allows us to test the run of the course, the interactions and so on. After a technical test, the course skeleton can be adapted. Expertise in the field of EML is required for the technical design.

Table 9.3 Example of the design of a learning activity

Number	1
Titel	Practice Assignment 1
Description	Student writes a policy statement based on the case 'pollution in Heerlen'
By whom	Student
Indivudual/group	Individual
Entry requirements	None
Completed	When feedback is positive
Registration	Assignment + feedback in portfolio
Resources in Learning environment	Case materials Textbook Reference manual

The requirements for the course are set in the analysis phase. The test phase is to establish if the requirements have been met. The test design phase includes information on:

- the objective of the test;
- the stakeholders;
- the object which is tested;
- the manner in which data are gathered;
- the planning.

In the test design phase the subject matter specialist, the team manager, the instructional designer and the evaluation expert work closely together.

Table 9.4 Example of test design

Objective	**Stakeholders**	**Object**	**Method**	**Planning**
Developmental testing	Students	Use Appreciation	Observation Logging Questionnaire	Week 12 : students a, b,c Week 13: students x,y,z
	Tutors	Use Appreciation	Questionnaire Interviews	Week 14: tutor x Week 15: tutor y

Finally, when the different parts of the design are ready, the course manager draws up the budget, which is necessary to construct the course including the developmental testing phase and which estimates what the exploitation costs of the course will be. The course manager also describes the activities planned, projects them on a time scale, and selects the course team which will be involved in the construction phase. In this phase editors, graphic designers and media specialists are frequently asked to join the team.

Construction

It might sound disrespectful, but if the instructional design phase were really successful, the construction phase would merely involve filling in the course skeleton. In this phase, the different tasks are divided according to the design of the course. Subject matter specialists write the learning activities, assessments and learning texts. They select case materials and interesting hyperlinks. They work with media specialists to

develop streaming audio and video materials. Data entry experts and content management experts ensure that all the materials are stored in the right formats for publication while EML experts integrate all the different aspects in the course skeleton. No matter how well the design has been thought out, minor changes might be required in the basic design in this phase.

Developmental testing

The developmental testing is mainly carried out by evaluation experts. The course is presented to a selected sample of students. Both the students and the tutors tackle the course as if it were real but they are asked to fill out questionnaires, keep a time log, and report back on any problems they encounter. The test results are reported to the whole course team and then it is decided how the course needs to be adapted with reference to the test findings.

Cooperation between experts

We described a method for developing Web-based courses in which experts from different fields have to work closely together to achieve an optimal result. All these experts depend on each other's work as far as timing and quality is concerned. In Figure 10.2 we show how different experts have to work together in the analysis phase. In our systematic development method, all the different phases have been designed in this way.

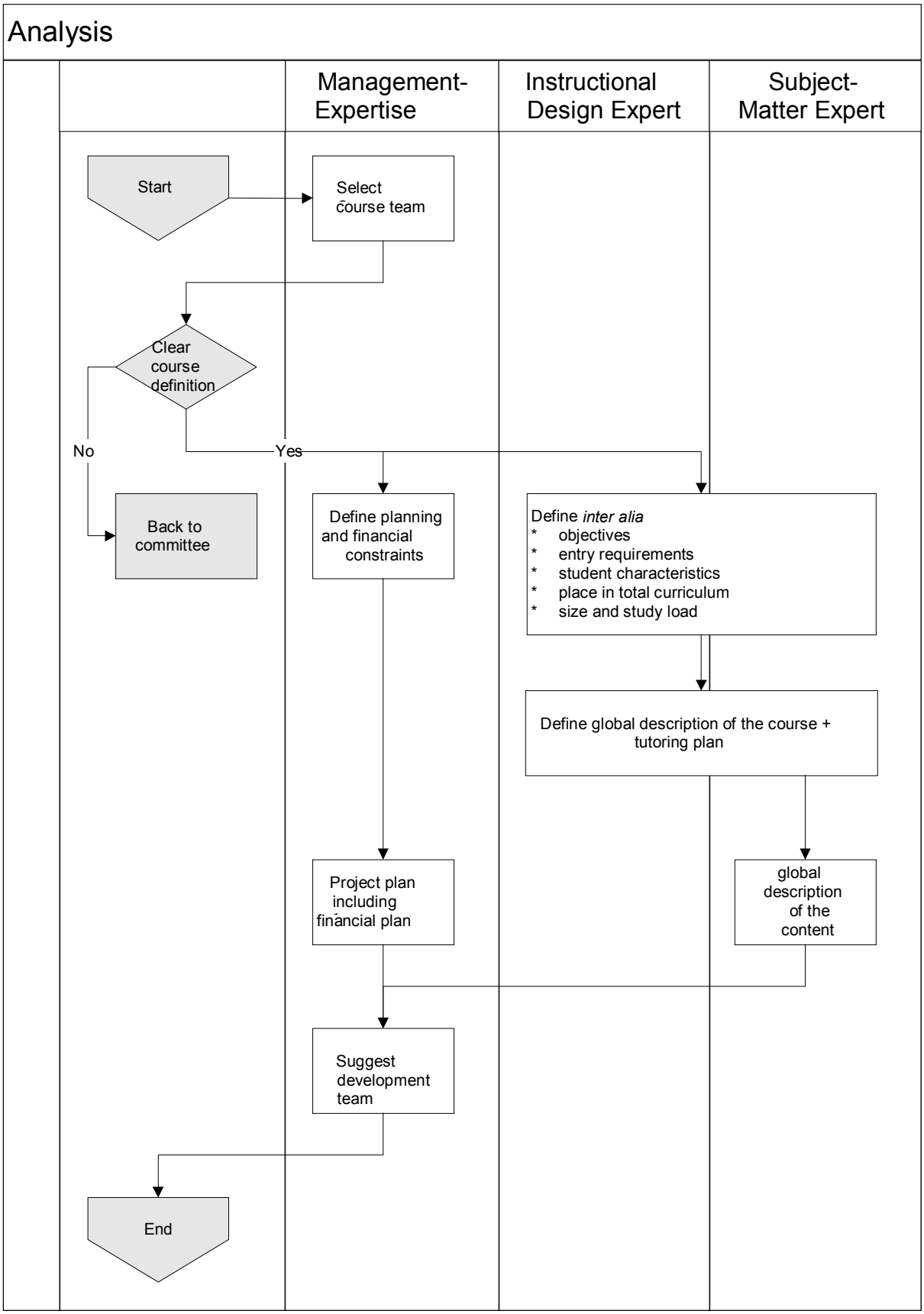

Figure 9.2 A sequence diagram of the analysis phase

OUR EXPERIENCE

The Open University of The Netherlands has had considerable experience of working with course teams on the development and production of printed courses. We have developed over 300 courses in this manner. Since 1997, we have also been using course teams to produce integrated eLearning courses. In the past we used HTML for course description but in 1998 we started developing and using EML.
Our first experiments with Web-based courses in EML were not at the Open University of The Netherlands itself but at the School of Higher Hotel Management in Maastricht. A form of dual education was introduced at this institute so that, students could combine study and work at the same time. All first year courses had to be redesigned from face-to-face courses to distance, Web-based courses. It was decided to use EML for this purpose. The development approach we described above was not used in the first instance. The lecturers in Maastricht developed course materials using a word processing programme and then handed the course over to the educational technologists at the Open University. The courses were 'translated' into EML at the OUNL. However, this way of working proved to be rather problematical. The instructional design of the courses was implicit in the materials and had to be deduced from the course in order to make an EML design. This quite often resulted in having to redesign the course, which required a great deal of communication. In the end it was concluded that a joint design phase and a more systematic development approach could have solved many problems (Janssen and van der Klink, 1999).
When we introduced working with EML at the OUNL, we also introduced the development approach described above. This approach was adopted in six course projects and an extensive evaluation of the whole process of course development was carried out (Verreck *et al*, 2001). Most course teams were perfectly satisfied with the systematic approach for developing materials. It is useful to have a description of the whole process and it seems to work in practice. Most course teams work according to the phases and task divisions explained in the approach. However, they observed that the description of the different phases is not as linear as is described in the approach. The development teams frequently wanted to perform a test after developing the first part of the material to ascertain the look and feel of the course at an early stage. There also seem to be several ways of applying the systematic approach. For instance, one course team decided to design the whole course without taking technological constraints into account and only afterwards did they adapt their initial design to the scope of the technology. Another team considered technological considerations to be an integral part of the instructional design and started with an extended discussion of the technological constraints. At the moment it is difficult to decide which of the two approaches is the more effective.
Another point which emerged from the evaluation is the high degree of satisfaction as far as working together in teams is concerned. Each team member appreciated both the expertise of the others and the added value of a range of points of view and of different fields of expertise. The co-operation between instructional designers, subject matter specialists, course managers and technological specialists was rated particularly highly. The position of editors, graphic designers and data entry experts still requires extra attention and has not been thoroughly enough thought out yet.
One problem, which was frequently reported, was the feeling of the subject matter specialists that they had lost their freedom to change and adapt courses as they went along. Although theoretically they could appreciate the value of good design, they felt the need for more freedom and more adaptability. It was felt that the Web offers the opportunity to change materials quickly and that by using an industrial development process, this opportunity seemed to get lost.

Finally, it was established that, although EML offers a high degree of flexibility in terms of course design and pedagogy, authoring tools for creating EML based courses still require further refinement.

CONCLUSION

In this chapter we have described the industrial approach for developing integrated eLearning courses using EML, that is IMS learning design. We have tried to show that the whole development process of integrated eLearning courses is rather complex and requires many fields of expertise. It is too much to leave the whole process to one teacher. Developing integrated eLearning courses requires teamwork, in which the experts each bring their own field of expertise. Moreover, we argued the case that designing the eLearning course is one of the most important phases in the development process. One of the issues, which remain unresolved, is that integrated eLearning courses should be easy to update and adapt. The tools and instruments we use at the moment do not permit this. A great deal of effort will have to be devoted to the development of tools and authoring systems in the near future.

REFERENCES

Boom, G and Schlusmans, K (1995) *Didactics and Course Development at the Open University of The Netherlands*, Open University of the Netherlands – Centre for Educational Technology, Heerlen

Duffy, TM and Kirkley, JR (2002) Learning theory and pedagogy. Applied in distance learning: The case of Cardean Uuniversity, in *Learner Centered Theory and Practice in Distance Education: Cases from Higher Education*, Duffy, TM and Kirkley, J (in press), Lawrence Erlbaum & Associates, Mahwah, NJ

Giesberts, W., Schlusmans, K., Koper, R. & Schuncken, R. (2001). *Systematiek voor het organiseren van werkprocessen bij het ontwikkelen van onderwijs in EML*. Heerlen: Open Universiteit Nederland – OTEC

IMSLD (2003) IMS Learning Design. Information Model, Best Practice and Implementation Guide, Binding document, Schemas, *imsglobal.org*

Janssen, JPW, and van der Klink, MR, (1999) *In de Praktijk Beproefd: Rapportage van een Pilot met een Prototype van de Elektronische Leeromgeving (ELO)*, Open Universiteit Nederland, Onderwijstechnologisch Expertisecentrum, Heerlen, Nederland

Kaye, A and Rumble, G (1981) *Distance Teaching for Higher and Adult Education*, Croom Helm – Open University Press, London

Koper, EJR (2001a) Van verandering naar vernieuwing, in *Handboek Effectief Opleiden*, **26**, ed P Schramade, pp 45-86, *eml.ou.nl*, Elsevier, Den Haag

Koper, EJR (2001b) *Modelling Units of Study from a Pedagogical Perspective: The Pedagogical Metamodel behind EML*, eml.ou.nl/introduction/docs/ped-metamodel.pdf, Open Universiteit Nederland, Heerlen

Koper, EJR (2003) Combining re-usable learning resources and services to pedagogical purposeful units of learning, in *Re-using Online Resources: A Sustainable Approach to eLearning*, ed A Littlejohn, pp xx-xx, Kogan Page, London

Schlusmans, K (2001) *Het Inhoudelijk-Didactisch Ontwerp*, OTEC Open Universiteit, Heerlen

Verreck, W *et al* (2001) *Rapport Evaluatie Startprojecten. Project Evaluatie Digitale Open Universiteit*, Onderwijstechnologisch expertisecentrum – Open Universiteit Nederland, Heerlen