

A Generic Framework for Describing Study Plans for Networked Universities using Meta-Data

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Abstract

This paper presents a generic framework that can be used to describe study plans using meta-data. The context of this research and associated technologies and standards is presented. The approach adopted here has been developed within the mENU project that aims to provide a model for a European Networked University. The methodology for the design of the generic Framework is discussed and the main design requirements are presented. The approach adopted was based on a set of templates containing meta-data required for the description of programs of study and consisting of generic building elements annotated appropriately. The process followed to develop the templates is presented together with a set of evaluation criteria to test the suitability of the approach. The templates structure is presented and example templates are shown. A first evaluation of the approach has shown that the proposed framework can provide a flexible and competent means for the generic description of study plans for the purposes of a networked university.

Keywords: Networked Learning, Generic study plans, European Credit Transfer System

Introduction

An overriding theme of much of today's discussions on issues regarding Distance Learning in the European Union is that of forming alliances among Institutions for the development of joint programs that are delivered through Information and Communication Technologies (ICTs). During the past 10 years consortia of academic institutions, under the umbrella of European Union funded projects, have started testing new models for the provision of Networked Open and Distance Learning (ODL). Such a type of ODL model has been studied extensively in the context of MECPOL project (Goodyear, 1997; MECPOL, 1998; Haugen, 1998), where Networked Universities are defined as "Virtual Learning Institutes" that are created through collaboration between two or more universities with the aim of providing networked open learning opportunities to students". This idea of the Virtual Learning Institute or Networked University

has been tested under a number of projects (such as DoODL, 1997; SHARP, 1999 and EuroCompetence, 2000), where short-term collaborations have been established, for the development and provision of Networked Open Learning courses. A more systematic approach towards a European Networked University (ENU) is that of the mENU project (mENU, 2003; Haugen et al., 2002; Ask, 2004) in the context of which models for collaboration (formal partnership agreements), for joint study plans organization and economic strategies, were defined, were tested and evaluated through user trials regarding the provision of a variety of e-learning opportunities.

One of the most crucial issues identified within the mENU project was the need to define study plans in a generic and flexible way in order to provide a useful tool to all stakeholders of an ENU, such as developers, contributors, professional bodies, delivery teams and students (both current and potential). There are two main issues that differentiate such study plans from those already developed in the context of “typical” curricula for in campus studies:

- The curricular to be described is a joint program where two or more institutions, probably from different countries collaborate
- The courses offered are strongly based on e-learning technologies

Part of the problem relates to the existence of great differences in quality assurance processes and requirements between the various higher education systems in European countries. Even if these systems were harmonized they fall short of being able to deal with the networked learning nature of the studies in the context of a ENU.

In order for collaboration between institutions to take place, it was necessary to develop a joint approach to the description of programs and course modules in order to create a common working language. In this respect the generic framework presented in this paper is based on:

- A careful study of quality assurance systems of the European Union
- The European Credit Transfer System – ECTS (ECTS User’s Guide; 1998) and
- The necessary adaptations they above need for Networked Learning

As a practical aim for the support of the generic framework was that of developing a set of templates that are able to encapsulate all the information required. These templates contain XML based meta-data needed for the description of joint programs by different institutions. Based on subsets of information encapsulated in these templates one can produce different formats of the study programs, in an automatic or semiautomatic way. These different formats may include, for example, an on-line student handbook or a printed document needed for the accreditation procedure of the study program.

The suggested methodology for the design of the generic framework is given in the next section. The process of the templates development is given in section 3. As a case study the templates for describing a Master Program together with its ECTS-NL description (which an extension of the ECTS standard developed for the needs of the networked learning) is presented. Conclusions are given in the last paragraph

The design of the generic Framework

The main objective of this research was to provide a framework that will facilitate the production and use of study plans in the context of a joined study program to be offered through a European Networked University (ENU). In designing such a framework a number of critical issues have to be considered. These issues play the role of design requirements for the framework and can be categorised in three levels as follows:

a. Program Design – Course Design, Delivery and Assessment

These issues affect the required structure of a study plan. Questions that should be answered include the following:

- Is the program designed according to some commonly accepted criteria?
- Is there a consultation of professional bodies that affect the decisions made for the curriculum?
- Is there a commonly accepted policy on the method of NL course modules design?
- Which institution is responsible for the design of each course modules?
- Is there a commonly accepted credit system?
- Is there a commonly accepted policy on the methods of NL course modules delivery?
- Is there a commonly accepted policy on the methods of NL course modules assessment?
- Are there clear examination procedures?
- What is the appropriate granularity of course modules? It is generally accepted that programs of study are subdivided into course modules. However, the flexibility of further subdivision into Sub-module units and learning components may be necessary, especially when distance-learning modes are adopted.

b. Quality Assurance Processes

These issues affect the Quality Assurance processes involved in the production and maintenance of a study plan.

- *Level of course module information required:* Depending on the QA processes adopted by various academic institutions in different countries, the required detail in module specifications varies considerably. A core of essential information can be identified, but extra information that provides valuable insight and the context of course modules cannot be discarded.
- *Varying QA requirements for the description of programs of study:* This issue is similar to the previous point. However different QA processes followed, especially in terms of the validation and subsequent reviews of programs of study mean that the description of such programs is contingent on the stakeholders who take part in these processes (Academic, state bodies, professional bodies, student bodies etc) and on the views that each stakeholder needs to have access to.

c. Lifecycle and use of Study Plans

These issues affect the possible uses and stakeholders/beneficiaries of a study plan.

- *Maintenance of study plans:* Study plans need the flexibility to change and evolve with time. However, they need to do so within a framework that provides an audit trail of changes and references to QA processes that were used in these transformations. There is also a need for temporal transparency of the study plans, both in terms of the structure, but also in terms of regulations and rules that may change at various points. Study plans may need to have the ability to “roll back” to a particular point of time in the past, so that information on the structure or regulations from that time can be ascertained.
- *Capturing curriculum development knowledge:* Even before study plans become operational, they need to provide a generic framework that will allow the collaboration of various developers/contributors, such as course module developers, program leaders and external bodies. Information concerning important design and operational decisions and intentions may need to be captured into the study plan, so that it provides an audit trail. This is particularly relevant where there is a separation between the development and delivery team(s). Temporal maintenance issues are particularly relevant here as some of the development knowledge is related to changes in specifications and the rationale behind such changes. This kind of knowledge can be encapsulated in terms of time intervals related to data (Knight & Petridis, 1995).
- *The use of study plan:* The study plan needs to contain the necessary information to enable various stakeholders to be provided with different views of the information in the study plan. This should vary according to the particular use that each stakeholder needs to put the study plan to and the security clearance that is needed. It is important to be able to display information to users of the study plan in a way that they would naturally need and perceive their view of it. For example, it will be unnecessary to provide prospective students with lots of information about operational matters. Also, it may not be appropriate to reveal critical evaluations of previous programs of study to prospective students and external bodies. Possible uses of study plans may include:
 - Publication material / brochures
 - Information for sponsors or prospective employers
 - Validation / review documents
 - Operational manuals
 - Student handbooks
 - Submissions for accreditation by external bodies
 - ECTS credit accumulation documents

It is obvious that in a ENU which is a consortium of institutions functioning in different countries of the EU, all the above issues are answered in different ways. It is also more than obvious that the most important final user, the student, should not have any involvement with all these questions. On the contrary he/she needs a very clear view of the Program structure and on the relevant courses. The same applies to all other stakeholders of the ENU such as teachers involved in the development and delivery of the courses, administrators, etc.

A number of initiatives and standards were investigated and used for the specification of the generic framework. In particular, the European Credit Transfer System (ECTS) standard was found to address issues of matching components within a networked university, but needed adaptation in order to accommodate procedures related to the net based learning (NL) nature of study programs. ECTS-NL, which an extension of the standard ECTS, was developed for this reason (Kargidis et al., 2003). Quality assurance systems and standards regarding educational systems of the European Union were also investigated. A number of adaptations regarding also networked learning needs were also made in order to accommodate all the necessary information to the generic study framework (Kefalas et al., 2003).

Using the underlying philosophy of the ECTS-NL system helps a lot in the process of simplifying the development of courses and studies. This underlying philosophy is mainly based on the Top-Down approach to the allocation of credits to courses. The starting point should be the full program structure and the normal pattern of courses a student would have to take in an academic year or in an academic semester to complete the qualification in the official length of study. Allocating credits to individual course units on a “bottom-up” basis is very complicated and may result in a total of more than 60 credits for a year or 30 credits for a semester, thus making credit transfer very difficult.

To have an effective and flexible collaboration scheme in designing a joined degree program it has been decided to apply this top down approach at least in two levels:

- Level 1: Each semester is allocated with 30 ECTS credits
- Level 2: Each semester has a fixed number (N) of course-module units with the same number of credits (30/N) allocated to them

As an example one might consider each semester having 5 course modules of 6 ECTS credits each, or 3 course-modules of 10 ECTS credits etc.

Each course-module in turn could be consisted of a number of learning units (learning objects). A Learning Object is considered as a self-standing unit of instructional content that meets a learning objective. In such a way one can have clear decisions on which partner institution(s) of the ENU could take over the responsibility of designing and/or delivering each course-module. Those responsible for the course-module, in most of the occasions have the freedom of specifying the number of learning units, the content, method of delivering/teaching etc.

It has to be noted with emphasis that the notion of semester in the context of a Networked Learning study program could be considered “virtual”. This is due to the fact that the program should be flexible enough, since different institutions with different time schedules might offer course modules. Also students following the courses might need to work on their own time pace as long as the prerequisites and post requisites of the course modules are preserved. In this respect, when we talk about a semester this could be interpreted as a chunk of course modules of 30 ECTS credits in total. The same applies for a year: It is a chunk of course modules of 60 ECTS credits in total.

Among the advantages of such a modular approach in designing a joined program are the following:

- *Standardisation*: Those designing a course-module know in advance the exact amount of workload the module should have and are guided in implementing it with specific learning units.
- *Flexibility*: It is very easy to Develop interchangeable course-modules that can be assembled, disassembled and re-used “quickly”.
- *Distributed* development of course-modules: More than one institution can collaborate for the design, development and delivery of a course-module.
- *Adaptability*: a course-module can be localised to diverse student populations or special target groups

Implementation of the generic framework by the use of templates

In order to support the generic framework that allows a flexible description of study plans and addresses the issues identified in the previous section a set of templates that are able to encapsulate all the information required, was developed. These templates provide a complete set of fields that would be needed to describe any program of study. The approach adopted was the use of tagging information with XML based metadata to provide the required flexibility. The methodology for templates development was based on the analysis of master’s program study plans provided by the mENU pilot programs of study and their comparison with an MSc program that was provided by University of Greenwich. To evaluate the methodology the following set of criteria have been devised:

1. *Ease of use*: It should be easy to extract, merge and combine information from home institutions' study plan into the generic framework
2. *Flexibility*: The approach should allow a flexible use of the study plan information for its various intended uses and stakeholders. This includes all the required views and security levels.
3. *Auditable trail*: Important changes need to be tracked flexibly throughout the life of the study plan. This should cover the development, operational and maintenance/change stages of its life.
4. *Extendibility*: The approach should allow further extensions that may become necessary in the structure of the study plan, especially those forced by the inclusion of contributions from academic institutions with substantially different/incompatible QA processes and practices

The results of this analysis are provided in the tables 1 and 2 given below. Table 1 presents a template for describing a complete study program and Table 2 a template for describing a course module. Some examples of certain fields have been provided to clarify the meaning where appropriate.

Each field is tagged with C, CE or O indicating whether it is core (C) i.e. a required field that must be filled in core if the data exists (CE), or O for optional field. Indentations show sub-headings.

Table 1. Template for describing a Study Program

Field	Core / Option	Security (excluded)	Views
Title of award e.g. Info. & Com. Technology	C		all
Type of award e.g. MSc	C		all
Awarding body e.g. University of Greenwich, European Networked University	C		all
Fee Structure	C		PS
History	O		
Critical appraisal of previous programs	O	CS, PS, PUB	
Overview of the program i.e. what	C		all
Rationale i.e. why	C		AD, AO, RB, PS
Aims of the program	C		all
Learning outcomes for the program *	C		AD, AO, ES, PS
Intermediate awards e.g. Postgraduate certificate, certificate in.... *	CE		PS, ES
Program structure	C		
Core Modules and associated credit points (link to module description) * X→	C		AD, AO, ES, RB, PS
Optional modules and associated credit points (link to module description) * X→	O		AD, AO, ES, RB, PS
Program constraints e.g. you can't take more than X credits a level Y *	O		ES
Length of program	C		all
ECTS credits	C		AD, AO, RB, PS
Local credits	CE		AD, AO, RB, PS
Entry requirements *	C		PS, RB
Delivery modes e.g. part-time, full-time, distance on- line, etc. (at program level, not module) *	C		AD, AO, RB, PS
Other program information e.g. induction attendance requirement. *	CE		PS, AD
Approach to teaching and learning	C		PS, AD
Regulations	C		
Program specific regulations	CE		AD
Links to appropriate institutional regulations *X->	C		AD
Awards and progression	CE		AD
Assessment e.g. across more than one module *	CE		AD, AO, ES, PS
Market	O		
Analysis	O		
Marketing strategy	O	CS, PS, PUB	
Sales pitch	O		PS
Program Contacts (details and role) *	C		all
Program Management Structure	O		AD, AO, RB
Student Experience i.e. student support statement	C		PS
Accreditation Information	CE		PS, RB
Quality Assurance	C		RB
Resources e.g. machine specs, local library access	CE		PS
Review Information e.g. how program is updated	C		
Program status e.g. draft, approved, withdrawn	C		all

Having elicited the core fields, we had to consider how the information would be stored and reported to users. Within this context, there are several issues that need to be resolved. Some are still outstanding and for others we have made assumptions.

First assumption we have made is that there will be a variety of users and that information about a program will be entered onto the system as it is developed. This requires that each field is tagged with a “draft” or “approved” status and also that the status of the entire program is logged with e.g. “Draft”, “approved/validated” and “available” or “withdrawn” (as we may wish to store historical information on the system).

Security issues – we might wish to record sensitive information about a program that we would not wish to release to the public, regulatory bodies etc. Examples of this might be a critical appraisal of the program prior to updating it, or our marketing strategy for the program, pass rates.

Views – as already outlined, there will be a variety of people involved in writing, documenting, accessing the information and they will not all want to see all of the information as a norm. In the views column, we have defined the default view for each group of people, however, if the user asks for further information then the system could display all fields that they have a right to view.

Key words are recorded to enable efficient searches. As details of the program and modules are entered, developers will have the facility to tag key words in any section to enter into the search facility in addition to adding their own as they see fit. The system will have a mechanism for managing version control and recording details of changes / updates to programs and modules. All updates will be tagged with author, date, nature of change etc. in order to provide a full audit trail of changes. Where appropriate, certain fields will be enabled with a comment tag for notes that cannot be recorded elsewhere in the system.

The templates that we have developed could be used in several ways (see fig. 1). At its simplest they could just provide section headings for a standard document format for describing any programs and modules developed and offered within the ENU framework. More usefully they could be used as the basis for storing data in a more structured way (e.g. as a database or using XML based meta-data). This approach has the advantage that subsets of the information could then be presented in a variety of formats e.g. printed documents or an online searchable catalogue. Table 3 presents a specific interpretation of the template regarding a course-module, which is the description of a course-module using the ECTS-NL standard. The fields of the ECTS – NL description are considered specific views of the fields of the generic template.

Table 2. Template for describing a Course-Module

Field	Core/ Option	Security (excluded)	Views
Course Module Title	C		All
Course Module Code	C		All
Language	C		All
Fee	C		PS
Overview	C		All
Aims	C		All
Learning Outcomes *	O		All
Content	C		All
Delivery Mode(s) e.g. distance learning	C		PS
Delivery Structure i.e. proportion of time spent on activities	C		CS, PS, AD
Assessment Strategy	O		AD
Assessment Components *	C		ES, PS, AD
Name	O		ES, PS, AD
Weighting	C		ES, PS, AD
Type	C		ES, PS, AD
X*→ LO	C		ES, PS, AD
Pre-requisite Knowledge/Skills	O		PS
Pre-requisite modules *	O		PS
Programs X→*	O		
ECTS credits	C		PS
Local credits	CE		PS
Learning Resources *	C		ES
Software *	O		
Computing requirements	O		PS
Responsible module leader contact details *	C		All
Developed by (Names of institutions) *	C		
Offered by (Names of institutions) *	C		

Table 2: Template for describing a Course-Module

Explanation of the codes used in the tables is given below:

Core / Option

C = core field, must contain data

CE = core if the data exists then it must be included in the program

O = optional field, need not be filled in

Views:

AD – Academics from developing institution(s)

AO – Academics from other institution(s) (collaborating institutions)

ES – existing student

PS – prospective student

RB – regulatory bodies e.g. QAA, ADM – administrators from developing institution(s)

PUB – public - a summary view.

Security: IS - Internal staff, ES - External Staff, CS - Current students, PUB - Public

* means repeating

X→ means hyperlink pointer

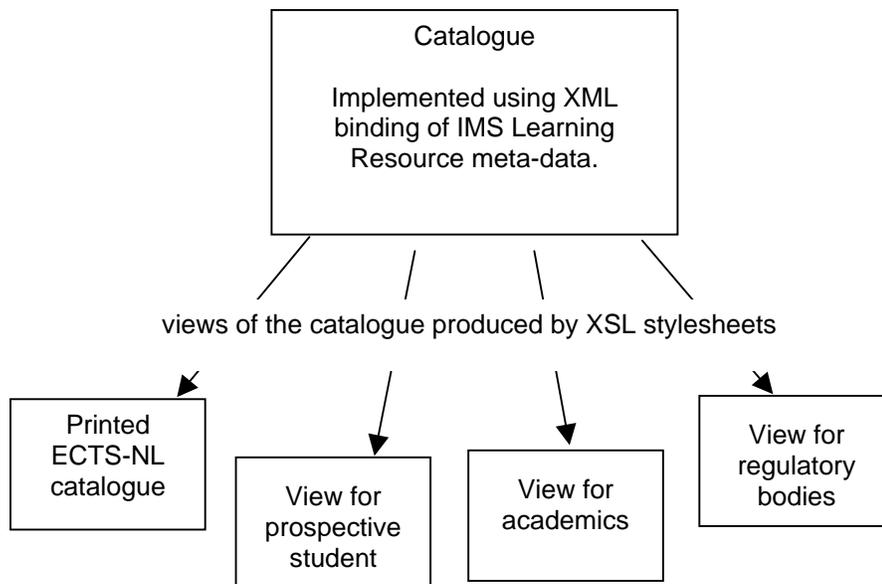


Figure 1. Views that may be required to provide for different stakeholders.

Conclusions

A first attempt towards an evaluation of this framework was done through the exercise of applying this to the study plans for two masters programs that were offered at a pilot phase in order to test the *mENU* approach. A first step towards an evaluation of the framework was done by examining its application to the produced study plans in terms of the criteria identified in the previous section.

1. *Ease of use:* It was found that the flexible structure of the templates allowed easy extraction and merging of the relevant information contained in the submitted study plans. It was felt that this process that was conducted manually at this stage could be helped by the provision of a software tool that could provide some degree of automation.
2. *Flexibility:* It is easy to see how the use of meta-data tags provides a layer of flexibility and it can provide different views and presentation layouts to the various stakeholders. This was tested further during the pilot phase of the *mENU* project.

Table 3. Describing Course-Modules using ECTS-NL

No	Field Name	Field Description
1	Course-Module Name	It is the name of the Course-Module. By course-module we mean either a single course or a number of courses (most probably 2), which form the module. The Course-Module Name should be accepted at the ENU level to avoid duplicates (courses with same name offered by different institutions with same or even different content)
2	Course-Module Code	A code given by ENU. We consider that ENU has agreed on a standard way of assigning codes.
3	ECTS credits	The number of ECTS credits agreed and assigned to the Course-Module by ENU.
4	Duration	If there are time restrictions for delivering the Course-Module, give dates or any other description (e.g. number of weeks) to specify the time needed for students to complete it. Could be "Any Time" if there are no restrictions.
5	Term(s)	If the Course-Module is part of a Complete Study Program give the term/semester or terms/semesters the Course-Module is offered. Could be "Any Time" if there are no restrictions.
6	Type	Could be: Theory, Tutorial, e-Lab, etc.
7	Language(s)	Language or languages to which course material is given.
8	Prerequisites	Course-Module Code(s) of course(s), which are prerequisites of the Course-Module under description. (See field No 2 above)
9	Post requisites	Course-Module Code(s) of course(s) to which the Course-Module under description is a prerequisite. (See field No 2 above)
10	Developing Institution(s)	The name(s) of the institution(s) that developed the Course-Module.
11	Offering Institution(s)	Name(s) of Institution(s) offering the course-module.
12	Course module leader	Name of person responsible for the Course-Module
13	Teaching Group	Name(s) of person(s) responsible for teaching – tutoring
14	Fees	Cost of Course-Module in Euros if applicable
15	Aims and Objectives	Brief Course-Module description, given aims and objectives/ learning outcomes
16	Content Description (Learning Units)	List of topics covered by the Course-Module with brief description for each one. (If Course-Module is divided into a number of Learning Units brief description of each one)
17	Mode of delivery (V-classroom activities)	Brief description of mode (or modes) of Course-Module material delivery as well as ways of communication between tutors and students (synchronous and/or asynchronous)
18	Infrastructure needed	Hardware, Software and any other infrastructure needed by the students in order to successfully participate and complete the Course-Module
19	Teaching Methods	Approach to teaching and learning followed by teachers/tutors of the Course-Module
20	Assessment	Ways students are assessed for successfully completing the Course-Module (Assignments, Exams, etc)
21	Other Remarks	Any other information that does not fit in the other fields
22	Learning Resources	Text book(s), URL address(es) for the Course-Module material needed for the students.

3. *Auditable trail*: The templates provide a mechanism to store contextual knowledge and to provide facilities for change management.
4. *Extendibility*: The methodology and the templates were tested against a study plan for an MSc program provided by the University of Greenwich, UK. There were considerable differences both in the structure, but also in the depth and nature of QA processes. These are typical of the differences in QA processes between EU academic institutions. However, the templates and methodology proved extendible. When extra meta-data tags were added, the underlying structure of the templates needed no changes, proving that the approach adopted can be extended to encapsulate information from a variety of heterogeneous sources.

The generic framework for study plans as conceived in this paper is a superset of the European Credit Transfer System for Networked Learning (ECTS-NL). This has shown that it can be used to express and extend existing frameworks such as the initial ECTS standard (ECTS User's Guide, 1998).

Furthermore, the implementation of the ECTS-NL in the demonstration phase of the mENU project has shown that functional study plans can be created in a flexible way using derived forms of the generic framework. The study plans created can be operated successfully on real programs of study and can provide a flexible infrastructure for developing effective web portals for programs of study enabling both study program developers and tutors as well as students.

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