Supporting Open and Distance Learning Tutors in Learning Design: the case of D4P

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Abstract. Systematic investigation of e learning technological tools and resources to support tutors' design of educational content is at the core of the ongoing research in Higher Education. Data mining is one step at the core of the knowledge discovery process, dealing with the extraction of patterns and relationships from large amounts of data. Today, most enterprises are actively collecting and storing large databases. Aim of this paper is to present basic characteristics of *Design for Pedagogy tool (D4P),* as a learning- design- oriented tool developed in Hellenic Open University (HOU) which provides support on HOU tutors for designing learning activities and space for storing educational material and activities' structures. This paper outlines the scope, methodology rationale, background design of D4P, reporting on preliminary user testing. The application presented aims to provide scaffold and support to educators for embedding Learning Technology tools into their Open and Distance Learning courses.

Keywords. Database design, Learning Design, Open and Distance Learning, Higher Education

Introduction

Automatic learning design generation is an important topic in the research area of adaptive learning systems and technology-enhanced learning. Educational resources function as keystones for the design of new learning activities whereas the dynamic combination of these forms a new basis of learning: environments that support different learning activities and personalization seem to be at the scope of educational research.

Educational design cannot occur in isolation from educational execution but the essence of learning stems from the activities of learners solving problems, interacting with real devices, interacting in their social and work situation. Under this scope, it is the learners' activities into the learning environment which are accountable for learning. Working from student data can help educators both track academic progress and understand which instructional practices are effective.

This paper presents the scope, basic features and use of D4P, a software application for supporting Hellenic Open University (HOU) tutors in storing and further design of learning activities. In the first section important issues of educational content reusability and activity's structure are presented under the scope of the Learning Design field. Section 2 critically presents basic features of Open Educational Resources and Learning Object Repositories. Section 3 presents basic steps of

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methodology, features of database design, and preliminary data of D4P user testing as a supportive tool for HOU tutors' learning design activities, developed by HOU.

1. Educational content reusability and Learning Design activity structure

The term *learning design* is often used today to describe the outcomes of the process of designing, planning and orchestrating learning activities. The OECD report "E-learning: The Partnership Challenge" expressed skepticism toward a "technology driven" approach to education and learning: under this scope the challenge is to create learning options that enhance learning by increasing flexibility, by offering tools for collaboration and by creating options for interaction with large -scale multi-media learning resources through a series of learning activities.

Activities are used to express actions that learners or instructors perform during learning and teaching: activity structures combine several activities in order to create a sequence or a selection. The task of the experienced tutor with knowledge of students and curriculum is to set up or outline a frame for learning activities. In order to support the creation of learning activities in relation to large learning resources, teaching experiences from former use of the material could be collected, stored and supplied with relevant pedagogical data in digital databases. Shifting the focus to learning activities reinstalls the tutor as an educator with responsibility for organizing the learning process as a facilitator.

2. Open Educational Resources and Learning Object Repositories

Research on machine learning has yielded techniques for knowledge discovery (see sidebar for a definition) or data mining that discover novel and potentially useful information in large amounts of unstructured data. These techniques find patterns in data and then build *predictive models* that probabilistically predict an outcome. Applications such as LORs accommodate a collection of small units of educational information or activities that can be accessed for retrieval and use: a warehouse for storing digital content for educational purposes. As supportive tools in the Learning Design field, LORs' design depends on the specific characteristics that meet the needs of instructors, designers and learners such as a) easiness of LOs accessibility, b) content compatibility, c) interdisciplinary or not character of the LOR, d) ease of sharing information with others, e) capability for reuse of LOs, g) context sensitivity, coding and retrieval, editing, combining and repurposing. Learning object repositories enable the organization of learning objects, improve efficiencies, enhance learning object reuse and collaboration, and support learning opportunities.

One of the most important types of reusability is the *reuse of design*. Tutors use many different approaches to designing learning experiences for students some of these more supportive to learning than others: sharing examples of good practice and the notion of learning design in the sense of deliberate plans for learning activities and their constituent elements are important dimensions in HE educational content reusability. In contemporary settings, learning designs can involve descriptions of activities, resources and spaces that are different in many ways to traditional sequences and it is the emergence of new and engaging learning opportunities that leads to renewed interest in learning designs, their sharing and reuse .Often learning designs are

held in the minds of tutors: tutors modify and adapt learning designs through their experiences and practices but often have no inclination, nor need to ever formalize the process .There are few collections of learning designs which exist to guide teachers and their practices or from which tutors might choose in response to particular learning needs.

Uptake in the use of LMS technologies within HE has been fragmented and slow. Factors that slow down the uptake is the lack of the coherent framework within which to evaluate both pedagogical benefits and the organizational changes required to effectively implement it. Many practitioners lack the necessary e learning skills to take full advantage of the potential affordances that these technologies offer and training in this area is inadequate. A more theoretically consistent approach to learning design is needed which inter relates theory with the desired features of learning and then maps relevant tools and resources against these.

Current educational practice is more complex than just learners working with a series of Learning Objects. Quite popular tools for supporting practitioners in the process of designing and redesigning activities emphasizing on tutors' support on design and decision making are frameworks, wizards and toolkits. Frameworks, toolkits and wizards lie at different points of educational continuum with open but unsupportive maps at one end and restrictive but easy to use software "black boxes" at the other: each supports users with different needs and expertise .

3. The educational context

Hellenic Open University (HOU) (http://www.eap.gr) is the major Hellenic educational institution in Open and Distance Learning. Educational Content Methodology and Technology Lab (http://www.eeyem.eap.gr) is the supportive organization in providing HOU with educational content methodologies introducing and applying the use of ICT tools such as Learning Management Systems and Teleconferencing tools. The tutor's role in ODL involves facilitation and moderation [12] : the basic pedagogical concerns are the formulation of basic objectives of groups, suggestion of tasks and problems, suggestion of readings and research, questioning students in a creative and stimulating manner, encouraging students to participate, stimulation of reflection and arguing in, as well as discussion moderation.

4. Towards building a pedagogical application D4P

4.1. Description of D4P

The D4P tool initially has been designed as a design template of ODL learning activities' with the aim to provide a description and generic structure of components of learning. The important components of Learning Design are based around the Unit of Learning . These components include learning objectives, roles, activities, activity structures, environment (quiz, chat, tools), resources and method. As a prototype training and support tool is designed to address the need for just in time practical support for academics to provide accessible e learning resources (learning activities, Learning Objects, Learning Outcomes).

Identifying ways that make the learning designs evident and accessible to teachers would appear to play a large part in influencing levels of reuse of learning designs . An important strategy has been to develop a framework that identifies the critical elements underpinning the choice of a learning design for example learning outcomes that have been delivered, depth of learning sought, form of student activity, cohort size, time available for the activity, learning space available . These items used as keywords or descriptors, facilitate the discovery and accessibility of particular learning designs. Figure 2 presents the D4P database with the archived registries of input learning activities:

Figure 1. D4P Database.

The D4P database is used to store information regarding activity structure and educational material, whereas: developing a Web-based toolkit to help practitioners, irrespective of their current degree of expertise, contribute to the evaluation of use and range of learning materials. All toolkits include an expert model of a process derived from recognised theory and best practice. This provides a manageable process, supporting the implementation of performance monitoring systems. Furthermore, by providing a common conceptual framework (particularly one in which multiple interpretations of terms can be negotiated and agreed), it becomes possible to define and establish standards.

4.2. Methodology of D4P

The methodology adopted in developing the learning design toolkit follows the approach described as follows:

- Work closely with practitioners to analyze their methods when creating or repurposing resources and be guided by their requirements
- Explore and enshrine good practice within the application such that it will guide, support teachers as they create, modify, share resources
- Research , understand and apply what is going on in the learning design field, evolving standards in the areas of sharing digital resources, interoperability, repurposing and permissions

- Embrace new technologies such as semantically structured metadata to provide a tailored development environment
- Develop, test and evaluate a prototype toolkit with practitioners and then revise it in the light of feedback

The activities have been based on existing courses whereas discussions with practitioners and detailed analysis informed the initial requirements analysis for the toolkit. The purposes that this toolkit caters for are:

- As step by step guidance to help practitioners make theoretically informed decisions about the development of learning activities and choice of appropriate tools and resources to undertake them
- As a database of existing learning activities and examples of good practice which they can be adapted and reused for different purposes
- As a mechanism for abstracting good practice and metamodels for e learning

The D4P as a paper prototype design tool has been presented to HOU tutors by the instructional designer of E-Co-Me T Lab in the context of Focus Groups sessions so as to collect feedback on its structure and purpose: confirmation of its structure led to the development of first prototype using Object Oriented Methodology . First prototype of D4P has been pilot tested by tutors of (1) TU of Hellenic Open University, and assessed by means of a 21-item 5 Likert point scale questionnaire.

4.3. Preliminary user testing

HOU Tutors have been asked to design a learning activity using the LAMS Learning Management System (http://www.lamsfoundation.org) with specific prerequisites and methodological tools provided by the E-CO-Me-T Lab to support the design. The activities have been tested by HOU students.

The research questions covered issues of D4P's structural efficiency and usability. Tutors seemed to enjoy interacting with the D4P environment and its simple interface did not seem to hinder the process of inserting the activity in the levels of D4P. However, quite a few important issues emerged:

- the sequence/order of inserting educational material in the D4P database
- lack of familiarization with terms of educational methodology such as Learning Objects and Learning Outcomes
- questions regarding the educational material used as well as the criteria for completing the process of inserting data in the D4P database

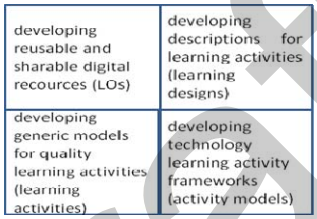
Users' characteristics did have an impact on the feedback collected from the usability test: tutors with thorough and analytical skills provided detailed feedback on the D4P mechanism. During the D4P hands on pilot testing, on qualitative data collected have been verbal indicators referring to doubt, task difficulty, incomprehensibility during the testing process. The types of problems that occurred relate to layout, data entry, feedback problems and comprehensiveness problem. Table 1 presents categories of qualitative data analysis adopted :

Table 1. Emerging categories of qualitative data analysis

Interface Orientation	Process analysis	Synthesis
Navigation	Task material	Task requirements
Layout	Task maps/diagrams	D4P functions
Structure	Information supplied by moderator	Terminology
		Feedback

Data which have also been collected from the research scheme are a) Learning Outcomes and Learning Objects regarding the designed activities as well as content representations regarding the activities' structure. Figure 3 presents the types of representations collected from the preliminary user testing of D4P, though in the preliminary user testing phase these representations have been partially completed:

Figure 3. D4P activity formats and products.



The learning activity designed by HOU tutors and inserted in D4P has been problem centered involving students' activation of prior experience, demonstration and application in real world settings. Learners according to the basic design characteristics of the activity: a) went beyond memorisation, b) brought in their own experience, c) used the ideas and concepts of the material and applied them , d) learned by doing, e) reflected on their own feelings. The activity designed has been of medium difficulty, using a cognitive learning approach, and a productive task type. Assessment has been conducted through submitting a short essay as well as an artifact: the problem solving graph finally designed by students.

4.4. Evaluation

The preliminary assessment phase of the D4P first prototype using an 21-item (5point Likert scale) questionnaire revealed positive feedback on the structure simplicity and usability of the application whereas the tutors who actually tested D4P viewed it as a positive tool in supporting their educational practice. Data collection is still in progress as well as the toolkit's broad assessment phase. A limited number of tutors of (1) Thematic Unit in HOU have interacted with the application, externalizing the experience to E-Co-Me-T Lab instructional designer. However, the data collection, analysis and assessment phase is still in progress.

The basic axes in questionnaire design focused on D4P usability, satisfaction, tutors' attitudes on introducing the application in the HOU educational practice, the UI structure, components, instructions provided as well as the feedback mechanism to the user. Table 2 presents indicative categories of user testing :

Table 2: Indicative categories of user testing

User Case #1
Usability
Activity & D4P integration
Positive attitude on integrating D4P into educational practice
User feedback
Information Retrieval
Content presentation and D4P design levels

Tutors commented positively on the D4P's design rationale, its structuring on Learning Outcomes and Objects, and their correspondence to LMS tools. D4P segmentation to design levels has been intriguing for the tutors. However, the feedback mechanism to users has to be reinforced as tutors stated difficulties in interacting efficiently with the structural parts of D4P while processing the activity design. Currently, changes to D4P prototype are made so as to incorporate the tutors' feedback according to data collection and assessment process: our goal is to enhance structure, architecture and content formation of the application so as to provide a strong learning design tool for tutors supporting them during design of learning activities.

5. Conclusion

The tools and resources that practitioners use to inform their practice can be used as means of sharing good practice and enable reuse of learning activities whereas example of good practice may be communicated to other teachers: thus practitioners make informed decisions between comparable activities and approaches. In this paper basic features of D4P interface have been presented, its scope, steps in methodology applied as well as preliminary results of user testing. The goal is to create a process and means for representing learning designs that facilitate their sharing and reuse, exploring examples of good practices in Thematic Units of HOU, creating representations of effective learning designs across a number of disciplines that are technology facilitated. Our aim is to further plan for accessibility in ODL field, since resources can be replaced by other materials that closely match learners' needs: reusable design rationale units provide focus points for dialectic collaboration and offer generalized solutions for contextualized consideration. Tutors' motivation on implementing alternative teaching strategies is quite important whereas our aim is to explore ways on developing models of best practice that could guide and inform future activities and which could form the basis of a repository of learning designs that tutors might use extensively to improve learning outcomes for students. For that reason we aim at further testing D4P to more Thematic Units and Tutors of HOU.

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