USEFUL E-LEARNING PROCESS DESCRIPTIONS

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Abstract: E-learning is nowadays one of the most interesting of the "e-"domains available through the Internet. Defining e-learning as a single process, just with content development and content delivery/maintenance, only depicts a limited view to its complex nature. Many more detailed processes exist and can be described, analysed and optimised.

This paper addresses this aspect. It is intended to provide background information about e-learning processes and their possible descriptions. They are used to start a discussion about useful and applicable e-learning process descriptions.

1 INTRODUCTION

E-learning is nowadays one of the most interesting of the "e-"domains available through the Internet. In general it refers to a wide range of applications and processes designed to deliver instruction through computational means (Juneidi and Vouros, 2005).

A process is formally defined as a set of activities associated with a set of events, where an event is an internal or external signal, message, variable, scheduling, conditional change, or timing that is specified in association with specific activities in a process (Wang and King, 2000).

An e-learning process thereby is a special process, whose domain is e-learning and the process transitions involve e-learning-related activities to change certain states within this domain.

A reasonable discussion must base on a solid fundament of knowledge about the targeted problem. After this introduction section 2 provides those needed information about e-learning processes and possible process descriptions. Section 3 discusses the applicability of process descriptions for certain identified e-learning processes. In section 4 we finish with a conclusion and some remarks about future work.

2 E-LEARNING DESCRIPTIONS

2.1 E-learning Process Dimensions

E-learning itself is a process containing two major phases: content development (additionally including planning, design and evaluation) and content delivery (additionally including maintenance). Its nature is iterative (cp. figure 1). Evaluation is recommended for continuous improvement (Giotopoulos et al., 2005).
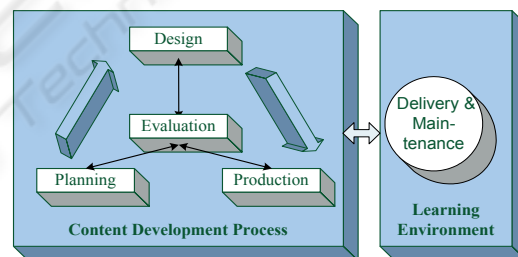

Figure 1: Iterative process of E-learning (cp. (Giotopoulos et al., 2005)).

The stages of a **general e-learning process** are planning, design, production, evaluation, delivery and maintenance, instruction stage and marketing (Khan, 2004).

There exist more specialised e-learning processes being categorised in the following according to their domain of application. The proposed dimensions and some exemplified e-learning processes are:

- Technological dimension
  - E-learning platform operation
  - Technical-enhanced dissemination process
- Organisational dimension
  - E-learning establishment and process
  - Course and organisation administration

– Evaluation through the entire lifecycle
– Coordination process
– E-learning innovation process
○ Authoring dimension (refers to the classic content creation stage)
– Learning object and course design
– Didactical design
○ Learning and teaching dimension (refers to the classic content delivery stage)
– Presentation process
– Learning process

2.2 Process Descriptions

Processes in general can be described using various approaches. The identified classes of process descriptions reveal an increasing degree of formalisation – informal process descriptions, graphical process descriptions and formal process descriptions.

Some process description approaches were already used in the previous subsection about e-learning processes, like e.g. textual descriptions. Other resources refer to activity lists, hierarchies (Pentland et al., 1999) or tables as informal approaches to depict processes with their states and activities.

More graphical approaches to model stepwise processes are diagrams and graphs as for example the one in figure 1 about the general e-learning process.

A last class of approaches categorises formal descriptions like algebraic possiblities, languages or rules. Other examples base on petri nets, like the event-driven process chain (Müller et al., 2005) or ontologies, e.g. describing the structure of didactical ontologies which can be used to model didactical process expertise (Mencke and Dumke, 2007).

3 PROCESS DESCRIPTIONS FOR E-LEARNING PROCESSES

As already introduced processes are determined by sequence of states. This sequence can be influenced on certain levels and depicts the nature of a process' activities - in other words it reveals a system behaviour. The states of the process base on certain domain objects. Within e-learning that can be a learning object, a course, an e-learning system, etc.

These dimensions - the nature of state domain objects and the activities nature - are used to categorize already identified e-learning process classes.

According to the classification in table 1 the rigid nature of activities as well as of state domain objects are used in closed processes. The activities and do-

Table 1: Classification of e-learning processes according to the processes' nature.

ACTIVITIES' NATURE	STATE DOMAIN OBJECT'S NATURE	
	rigid	*flexible*
rigid	technological, organisational	
probabilistic		authoring, learning
situative		learning

main objects rarely change. Technological and organisational processes are categorised here. More open processes deal with flexible objects and flexible activities. Within e-learning open processes are authoring and learning processes. Depending on the type of learning, learning processes can be completely open and therefore guided, but not specifically bounded to any predefined learning path space.

3.1 Closed e-Learning Processes

Main evaluation criteria for closed e-learning processes are stability, safety, being optimised and that they meet time constraints. Routine must be achieved. This process type is already well known and researched. There exist multiple proven approaches to meet the several levels of routine in different domains. Roadmaps defined based on maturity models fit the requirements of process management, following existing standards, measuring and measurement-based adaptation to understandand, model and improve closed processes. An existing maturity model for e-learning is eMM (Marshall, 2007). Its levels are:

5. Optimising: continual improvement
4. Managed: ensuring the quality of e-learning resources and student outcomes
3. Defined: defined process for development
2. Planned: clear objectives for e-learning
1. Initial: ad-hoc processes

Roadmaps of maturity models use the informal textual approach to define rules to help an institution to further develop their closed e-learning processes. Graphical approaches are only used for the human reader for a better understanding. Executable formal approaches are not useful because closed e-learning processes are too complex and rarely can be automated evaluated due to the subjective nature of their analysis.

3.2 Semi-Open e-Learning Processes

Semi-open processes cannot be evaluated simply by the routine of its execution. Authoring and learning based on strict course structures reveal a rigid or maximal probabilistic activity nature. There are predefined degrees of freedom to choose different activities and to change the objects the states are based on. These objects, e.g. learning objects or learning steps, are flexible in the manner that they can and must be adapted to reflect the changes within the environment: new knowledge needs to be integrated and new teaching/learning approaches to be applied. Factors to be taken into consideration are e.g.:

○ Relative completeness, e.g. in terms of extension, issue representation, maintenance conformity, avoidance of semantical thinning and individualisation (concept overvaluation)
○ Didactical preparation, e.g. in terms of comprehensibility, goal conformity, logical consistency

For semi-open e-learning processes also exist applicable process descriptions. That refers e.g. to the PELO model for authoring (Müller et al., 2005). The main steps are process modeling, process execution and process measurement. For the first step, the authors use a formal visualisation technique, the Event-driven Process Chain that is based on Petri-net theory.

For the learning process guidance certain models exist (e.g. SCORM (Advanced Distributed Learning (ADL), 2006)). They are not completely sufficient due to several reason. So they still lack from an appropriate definition of difficulty and a sufficient definition of usage rights and educational activities (because of the often used IEEE LOM (IEEE LTSC, 2003)). Furthermore there is a subjective selection of educational material types or missing detailed specifications for some types of media (Simon, 2002).

3.3 Open e-Learning Processes

Open e-learning processes are the most complex ones. There are high degrees of freedom for activities as well as for the state's objects. The nature of the objects as well as their types can extremely vary. For a learning process there are for example different culture-related, individual disposition-related, intrinsic and extrinsic motivation or timely emotional influences. Other variables are the learning situation, the individual learning type and the learning content.

The main goals for open e-learning processes specifically directed to learning next to individual knowledge increase are not to classify but to individu-

ally treat learners, to keep the learning motivation and to provide learning possibilities that can adapt to individuals and their specific situation. The learner is a partner within the process, not a target.

Some criteria for evaluation of process outcomes are:

○ Content quality according to the learning goal:
   – Degree of the content's abstraction
   – Difficulty level of content
○ Flexibility of the learning system according to individual learning and life situations
   – Method conformity
○ Individual learning goal adaptations by the learner
   – Individual knowledge gain
   – Degree of content understanding, repitition and applicability
   – Achieving the didactical goal

Again routine criteria and related process descriptions are not sufficient. So far no single system provides sufficient process support that comprises all dimensions. Ontologies can be an approach to take into account occuring diversity (Simon, 2002), (Mencke and Dumke, 2007).

3.4 Ontology-based e-Learning Process Description

As argued above, most process descriptions are not sufficient to model the complex influences that may occur within open e-learning processes. A flexible and semantically defined approach is needed to guarantee applicability, reusability and extensibility.

Therefore the authors propose an extension of the ontology for e-learning processes described in (Mencke and Dumke, 2007). Other basic characteristics are described in (Lin and Strasunskas, 2005). This ontology's tasks are twofold: providing a general scheme for process description as well as serving as a starting point for process optimisation.

In the proposed ontology a process is modelled as a graph of *LearningActivities*, each finalised with a *LearningState*. *Conditions* are used to define transitions between *LearningStates* and *LearningActivities*.

Each *LearningState* can be further semantically described by the definition of *Dimensions*. This feature is supposed to be further adapted and extended to depict suitable descriptions for each possible implementation. A *LearningState* is the set of *LearningStates* of each *sub-LearningActivity* of the *LearningStateï£¡s LearningActivity*. Here appropriate mechanisms still need to be developed to (a) interpret subset of *LearningStates* to identify the next ap-

propriate *LearningActivity* and (b) to analyse the user to identify suitable dimension concepts for interpretation. But this is not the focus of this paper.

These feature are the base of the ontology's capability for storing complex e-learning processes. Figure 2 shows the developed ontology.
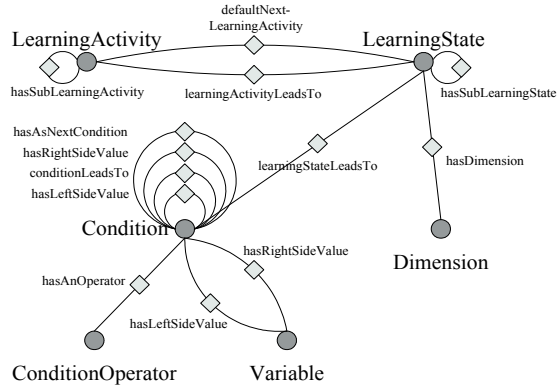

Figure 2: Ontology for e-learning process description.

4 CONCLUSIONS AND FUTURE WORK

In this paper the authors analysed different e-learning process descriptions and possible process descriptions. Their classification is used to start a discussion about the applicability of process descriptions for certain e-learning processes. Three main classes of them are identified and appropriate description approaches are suggested.

Futhermore, for open e-learning processes as the most complex class, an ontology-based description is proposed by the authors.

In the future existing user models need to be analysed for their capability to work with the flexibility of the proposed ontology. Another aspect is the description of the interpretation mechanism that uses the existing ontologies and user models to ensure the flexibility of the learning process support.

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