

Learning paths in open source e-learning environments

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Different approaches to the structuring of learning materials and/or learning activities exist in the area of e-learning. The trends in the development of e-learning environments are directed to the using of different structures of learning units and the providing of a route for going through the learning material using relevant learning activities. The learning unit is an abstract presentation of a course, lesson, workshop and/or any event in formal or informal learning and teaching.[2] The learning path defines the sequence of learning activities, realized by the learner within the framework of the learning unit.

In the paper we consider the basic concepts relevant to the learning path in the e-learning environment: learning object, learning service, learning resource, learning activity, learning unit and assessment unit. We propose a classification of the learning paths and analyze the possibilities for defining and using learning paths in some popular open source e-learning environments such as Moodle, Ilias, Claroline, aTutor, LAMS etc.

Keywords e-learning; open source e-learning environments; learning path

1. Basic concepts

Learning path in e-learning course is based on the following key concepts: learning object, service, learning resource, learning activity and learning unit.

Learning object – we accept IEEE LTSC definition – “any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning” [1]. Learning object could be text file, audio or video file, computer graphic file, multimedia presentation or simulation, test or test item packed according to IMS Content Packaging specification [1].

Service is provided by e-learning information system (LMS or LCMS) and could be discussion forum, e-mail, chat room, audio or video conference, wiki, collaborative work etc.

Learning resource can be any learning object or service. There are two general properties for both kind of learning resources:

- Learning objectives, that can be achieved or tested using resource;
- Learning styles of learners for which resource is suitable.

Educational activity is fundamental characteristic of the didactical method. Educational activity is an activity carried out by the learner or the teacher with using of learning resources. The learning activity ensures achievement of learning objectives. Each learning activity is characterised by:

- Purpose:
 - for learning;
 - for assessment of knowledge, skills and abilities;
 - for evaluation of knowledge, skills and abilities;
- Learning objectives that are achieved or assessed by the activity. The learning objective is defined by 2 domains- knowledge domain and cognitive domain.
- Learning style for which the activity is suitable;
- Included resources.

Activities of the learners:

- Learning activities:

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- Self-paced work with the learning materials- reading, working with simulations, using of multimedia materials, tutorials;
- Listening/watching of audio/video lecture;
- Notes collection with special digital tools- note, journal;
- Participation in on- line discussions;
- Problem solving through simulation or application software;
- Problem solving outside the e-learning environment, but with requirements to input decisions in the e- learning system;
- Working on the individual assignment;
- Working on the collaborative assignment.
- Assessment and evaluation activities:
 - Passing of the test;
 - Problem solving;
 - Assignment;
 - Participation in discussion.

Teacher's (tutor's) activities:

- Evaluate in digital and verbal form of student achievements during activities for assessment and evaluation of knowledge and skills;
- Moderate discussions and evaluate in digital or verbal form the communicative abilities of the learners during the discussions or working on the assignment;
- Consult activities related to the assignment and problem solving.

Learning unit - an abstract representation of a course, a lesson, a workshop, or any other formal or informal learning or teaching event [2]. In this way learning unit can be module, chapter, theme etc according to accepted hierarchy of learning methodology. We extend this definition with three new properties of learning unit:

- Cluster of learning objectives that can be achieved or tested using the unit.
- Prerequisites to enter in the unit.
- Learning path for moving through learning unit.

Learning unit can be aggregated from other learning units or learning activities and related learning resources.

Learning path defines sequence of learning activity (linear or non-linear) that is carried out by learner going through the learning unit.

Learning path can be defined as:

- Generic path with free sequencing through all learning activities in the learning unit;
- Generic path with defined by the teacher/author/ static sequence of activities and fixed place of the assessment and evaluation activities, presented in linear sequence.
- Path with required/core/ and optional learning activities and obligatory assessment and evaluation activities;
- Adaptive learning path according the learning styles, entrance level and achievements of the learners in process of learning.

In e-learning the participators in the educational process are not only the students and teachers. The authors of learning objects, designers of the course or the learning unit, administrators also have specific activities that depend from the functional characteristics of the development tools.

2. Models of learning units and learning paths in open source e-learning environments

In our study we consider possible models of learning units and learning path in some popular open source e-learning environments. The presented environments are arranged in alphabetical order. It should be taken into account that these environments are in continued development and evolution.

2.1 aTutor

The system aTutor [6] supports creation and import of SCORM compatible learning objects.

Delivered services are chat, discussion forums. Also there existing possibilities to enlarge the services with different modules such as collaborative Web conferencing environments, audio and/or video conferencing, blog, wiki, course administrative tools- time tables, bulletin boards, course handouts, grades, class lists, surveys and evaluations, events calendar.

Learning activities implemented by the system are: self- directed work with learning materials such as reading of learning material, working with simulations, using of multimedia presentations, tutorials, listening of audio or watching of video lecture, participation in discussions.

Assessment activities are limited to tests and assignments.

Learning unit is course with separated services and activities.

Basically the learning path is generic. The learner can go free through course resources proposed by designer of the course. There exists a possibility to implement a concept map module, which proposes to the student learning materials relevant to used concept. In module reading lists could be defined reading materials for obligatory or optional reading. Fig.1 shows the services, activities and learning unit- course in aTutor v. 1.5.3.

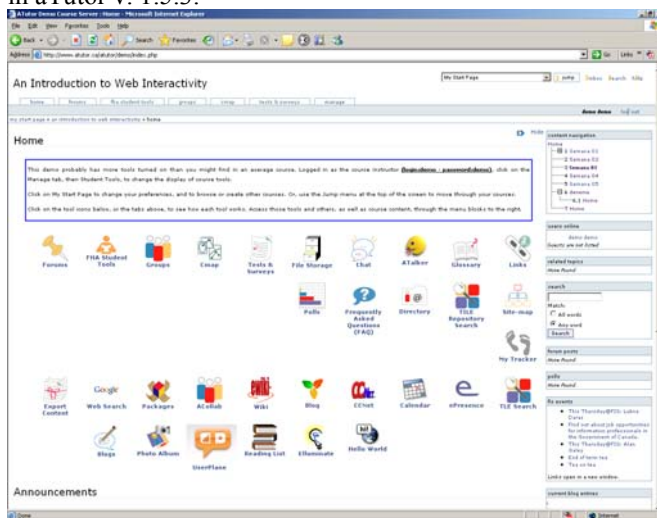


Fig. 1 Services and activities in aTutor v. 1.5.3

2.1 Claroline

The system Claroline [7] not supports creation of SQORM compatible learning objects, but could import LO, developed by another tools. The learning materials could be presented in variety of formats- .pdf, .txt, .doc, graphical formats, .html, flash movies, presentations, interactive simulations.

The delivered services are chat, discussion forum, wiki, collaborative or individual assignments tools, events calendar and notice board.

Learning activities cover all activities mentioned in Chapter 1. Assessment activities are at level self-assessment. There are not tools for assessment student participation in discussions. The learning unit could be course, module, or several learning or assessment activities. Part of the services could be used only in learning unit at level course- chat, discussion, assignment. Description of the learning objectives is passive and could be explored in description of the course.

Two basic possibilities exist in Claroline for using of learning path- generic learning path and learning path with obligatory learning and assessment activities. In one learning path could be implement several modules that also could be learning paths. The learning path could be blocked. That means the learner should go successful through the learning path and after that could continue to the next module. The

adaptivity is minimal at level achieved results. The learner repeats the learning material until he finish successful the blocked modules. Fig.2 shows the services and activities in Claroline 1.8.1



Fig. 2 Services and activities in Claroline v. 1.8.1

2.3. Ilias

The system Ilias[8] supports, creates, imports and exports SQORM/AICC/IMS QTI compatible learning objects.

Basic delivered services are e-mail, chat, discussion forum.

The all learning activities mentioned in chapter 1 are possible. Discussions and assignment could not to be evaluated.

The learning unit could be course, module etc. It is possible to be stacked one module in another module.

The learning activities could be grouped in modules. The learning unit could include all accessible in the system resources- reading files, audio or vide files, presentations, discussion forums, assignments etc.

The learning objectives could be carried out actively. The designer could define the learning objectives for the whole course. The learning objectives are defined free and are not related with some of known taxonomies for learning objectives. After definition of learning objectives they could be associated with assessment item or with learning material that are included in the course. In fact in this system are implemented relations among the learning objectives if the course and assessment test that measures achievements of the learning objectives. Learning content could be also associated with the test items. The learner and the instructor obtain information about achievement of learning objectives.

The learning path is generic with free access to the learning resources. After finishing of the test the learner has a possibility to see learning material associated to the test item.

2.3. Moodle

The system Moodle[5] supports learning objects test and test item according to IMS QTI 2.2. The system do not support creation of SCORM compatible learning objects, but they could be imported in the learning material. The learning content could be presented in different formats- .pdf, .txt, .html., .doc, graphical files, flash movie, presentations, interactive simulations etc.

Delivered services are: chat, discussion forums- text, audio or video (in case of using of additional modules), wiki, workshop for collaborative work, assignment, notice board, events calendar etc.

All learning activities mentioned in Chapter 1 could be carried out with delivered system services. Unfortunately the learning objectives could not be associated with the learning unit, learning activity or learning resource. The learning objectives carried out passively only for information of learners. It is

possible manually to be classified test items in categories and subcategories according to learning objectives, relevant to the knowledge and cognitive domains.

The teachers activities mentioned in Chapter 1 are implemented. Only evaluations of communicative abilities of the students during the discussions or chat are not realized.

Learning units could be structured according the following hierarchy: course, module (theme), learning activities and resources. Fig.3 shows the services, activities and learning units in Moodle v. 1.6

The learning path is generic with free access to the learning activities and resources. There exists a possibility for implementation of lesson. Lesson is activity based on the sequencing of learning content and test item. According to the answer the learner follows the learning path through lesson.

Learning path could be defined according to the LAMS[9] rules after integration of LAMS in Moodle.

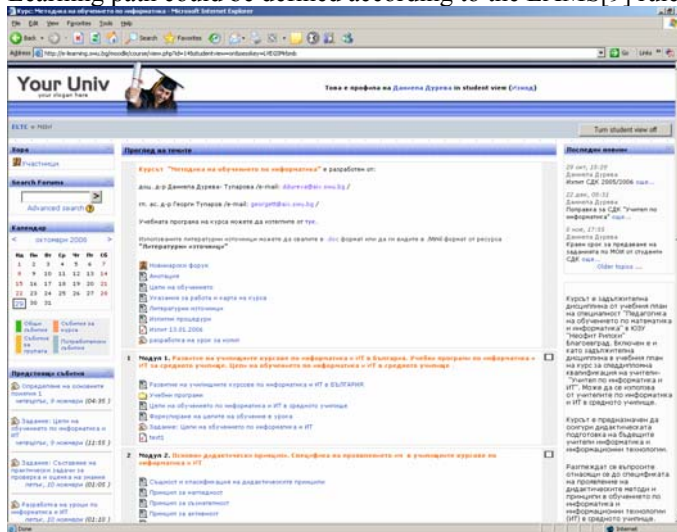


Fig.3 Services and activities in Moodle v. 1.6

4. Conclusions

The proposed analysis of models of learning path in open source e-learning environments signs that adaptivity according students achievements and profiles is at low level. They needs from enlargement of the features. Our study is extended toward modelling of object oriented approach of learning path, driven by learning objectives and learning style of the learners. The results of this study are presented in [3, 4]

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