

A set of software tools to build an author assessment package on Moodle

Implementing the AEEA Proposal

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Abstract. A set of new types of assessment is required for learning management systems (LMSs), and there is a need for a way to assess lifelong adaptive competencies. Proposed solutions to these problems need to preserve the interoperability, reusability, efficiency and abstract modeling already present in LMSs. This paper introduces a set of software tools for an author assessment package on the LMS Moodle being developed as part of adaptive e-learning engine architecture (AEEA). The principal features of this set are: 1) The set avoid editing items for a 360-degree feedback evaluation, 2) Whole items and tests are linked to levels of competencies acquisition, 3) The competency-based e-assessment data model are based on e-learning specification and complemented with XML data on the appraised competencies, 4) Items and tests are storage in repositories, and 5) The tools are integrated within Moodle to facilitate the design of an assessment plan.

Keywords- *Competency Assessment Process; New Assessment Types; Virtual Learning Environment, Learning Management System, Moodle; Adaptive Learning Design.*

I. INTRODUCTION

Nowadays, in the context of a virtual learning environment, some of the problems and disadvantages of e-assessment come from the different weaknesses that have the learning management systems (LMSs).

Competency acquisition is the process through which people engage in activities or solve everyday problems in a professional or work context, through the joint exercise of three types of knowledge: know-how, knowing how to learn and knowing how to be, accompanied by critical awareness and the taking of responsibility for actions undertaken [1].

Competencies acquisition based on a virtual learning process join theory and practice, contextualize training, guide the organization of content and activities, promote comprehensive education (the three types of knowledge) and establish mechanisms for rigorous ongoing assessment based on performance in problematic situations in the relevant context (discipline, social, scientific, etc.). To address a competency acquisition process, LMSs need to transform their learning design and assessment methods.

To carry out a competency acquisition process the traditional summative assessment provided by an LMS must be complemented with other types of assessment. Formative

assessment, self assessment, peer assessment and 360-degree feedback might all be considered. During a course each type of assessment produces at least one outcome variable linked with some assessed competence. This information is stored within a portfolio assessment to obtain an all-round measurement of the level of competency acquisition.

- *Summative Assessment* is when after a period of work, the learner takes a test and then the teacher marks the test and assigns a score. The test aims to summarize learning up to that point.
- Assessment can be considered *formative* when the feedback from learning activities is used to adapt the teaching to meet the learner's needs or to encourage students to take control of their own learning.
- *Self assessment* is where students make judgments about their own work. Students critique their work and form judgments about its strengths and weaknesses.
- *Peer assessment* is student assessment of other students' work, both formative and summative.
- In e-learning *360-degree feedback* refers to feedback that comes from all the different actors around the student. The name refers to the 360 degrees in a circle, with the student at the center of the circle. Feedback is provided by subordinates (e.g., where the student is leader of a team), peers, and teachers. It also includes self assessment and, in some cases, feedback from external sources.
- *Portfolio assessment* provides evidence of the learning process as an active demonstration of knowledge. It is used to evaluate learning processes and learning outcomes, as well as to encourage student involvement in their assessment, their interaction with other students, teachers, parents and the larger community.

Currently, in LMSs teachers only can grade their evaluations in a numerical way or simple scales at the most; for self-assessment there are no free-answers activities to be taken in account on evaluation and the assessment can't be done filling scales or/and rubrics; about peer and collaborative assessment most LMSs won't handle it [2]. The other aspect that lacks most LMSs is feedback, even they usually have some way of doing it, and it's not the best feedback, especially in quantity, timing and quality [2].

In order to support new types of assessment in LMSs while preserving interoperability, reusability, efficiency and abstract modeling, new models to extend the current e-assessment specifications are required. In [3] and [4] a UML model is proposed to extend and combine IMS-QTI [5] and IMS-LD [6] specifications. [7] - [10] show how an outcome variable of a QTI test can be coupled to an IMS-LD property, and how assessment application tools can be integrated with IMS-LD as services. [11] and [12] propose the creation of a new layer over IMS-QTI and IMS-LD data, thereby establishing a new specification by building a high-level assessment process modeling meta-language. The LAMS project [13] is another kind of proposal based on IMS-LD and IMS-QTI specifications, but a totally new specification is being built to support a whole range of possibilities in e-assessment.

These ideas were taken into account in [14] when adaptive e-learning engine architecture (AEEA) was proposed. AEEA is a competency-based adaptive process for to judge the competencies of learners in a virtual learning environment. The process is supported by educational specifications and new proposed XML schemas [19], besides for an integral user modeling and a suite of software tools. In order to implement AEEA, the suite of software tools must be developed. The final implementation of these software tools, which includes the entire new e-assessment software scenarios proposed in AEEA (formative peer assessment, formative teacher assessment and self assessment), is presented in this paper.

The paper is structured as follows: in Section 2 an AEEA overview is presented. In Section 3 software tools for author assessment package on Moodle are explained. In Section 4 conclusions and proposals for future work are laid out.

II. THE AEEA PROPOSAL OVERVIEW

The main aims of AEEA [14] are: 1) to create an adaptive structure in the learning design based on a definition of the competence element; 2) to build repositories of assessment items and tests with additional meta-information about the competencies assessed; 3) to build different, new, assessment engine software tools integrated within an LMS; and 4) to define a set of rules to drive learning design adaptations aimed at producing an adaptive competency e-learning process.

AEEA is composed of two packages: an *Author Assessment Package* to support design time process steps and a *Monitoring Assessment Package* to support the run time process steps.

The first package proposed in AEEA, the *Author Assessment Package* (Fig. 1), covers the first three steps of an e-assessment process at the design stage:

- *Competency Assessment Plan Design*: to select the sequence of appropriate assessment types to demonstrate students' competencies; to construct and define decision rules and assessment policies for adaptation.
- *Items Construction*: to prepare items of evaluation in different assessment authoring software tools.

- *Tests Construction*: to build units of assessment for each type of assessment proposed in the assessment plan. The unit must assure the type and value of the expected response in the plan.

Four data models are required for the implementation of the *Author Assessment Package*:

- *Competency data model*: this is a data model to describe the hierarchy of competencies, their characteristics and relations. Its basic specification is IMS-RDCEO [15].
- *User model*: this is a data model to describe a system user's relevant data, such as demographic information, learning style, background, etc. The basic specifications are IMS-LIP [16], IMS-AccLIP [17], and ISO-PNP [18].
- *Competency assessment learning design model*: this is a data model to describe the assessment plan and adaptive rules. The basic specification is IMS-LD [6].
- *Competency assessment data model* [19]: this is a data model to describe e-assessment scenarios (formative peer assessment, formative teacher assessment, self assessment and summative assessment.) and students' results.

Three kinds of software tools are required for the Author Assessment Package:

- An *LD editor software tool* is used to configure the LD assessment plan where outcome variables of QTI can be coupled to LD properties.
- *External test/item repositories* are used to store assessment items and tests.
- *Assessment editor software tools* are used to design assessment items and tests.

In the *competency assessment plan design* step, an *LD editor software tool* is used to configure the *competency assessment learning design*. The *competency data model* and the *user model* are also set up inside this step.

In the *item construction* and *test construction* steps *assessment editor software tools* are used to define and to recover assessment item and test metadata from the *Competency assessment data model* data model stored in the *external test/item repositories*.

III. ASSESSMENT EDITOR SOFTWARE TOOLS

This set of software tools are implemented over Moodle to provide items and tests editors for *Formative teacher assessment*, *Formative peer assessment* and *Self assessment*. Items metadata and tests metadata are defined by *Competency assessment data model* [19].

A. Formative teacher assessment tool

Teachers can assess student products indicating strengths and suggestions. Students have an opportunity to improve their products. The data model relates each product with the competencies assessed on it and its context. A weighted rubric score is given by the teacher at the end of attempts possible for each product.

B. Formative peer assessment tool

Formative peer assessment can be developed in three modalities: *individual*, when students complete their assignments alone and other students on the course peer review their work; *intra-group*, when the students work on a collaborative task in groups and each member is judged by the others; and *inter-group*, when the students on a course are divided into subgroups to carry out a task and the peer review of one group is performed by another. This tool allows rating data and comments about strengths and weaknesses to be saved. Rating data are defined using a rubric to score the quality characteristics of the evaluation items.

C. Self assessment tool

Students take a short test to assess their interests, skills, abilities and competencies in every task. Assessment items are linked with competencies and qualified with a general rubric score.

IV. CONCLUSIONS AND FUTURE WORK

Assessments play a significant role in the competence acquisition process and there is a clear need to run interoperable and competence assessment tests in LMSs. The traditional summative assessment of LMSs must be accompanied by other types of assessment. Metadata about assessed competencies must be defined and monitored throughout the e-learning process, and therefore the competency data model, learning design and assessment must work together.

The need to raise new assessment systems for students is just prior to any educational innovation. To accommodate the way the teacher teaches and the way in which the student learns must be developed assessment systems that meet the new methodologies.

In this paper a set of software tools to build an author assessment package for Moodle is proposed as part of AEEA implementation. Three new types of assessment editor software tools are proposed (formative peer assessment tool, formative teacher assessment tool and self assessment tool). Competency data are introduced in assessment items and test metadata. Other research is integrated to implement the data models of the author assessment package of AEEA.

For the future, our work is now focused on preparing assessment items in different repositories in order to test the author assessment package within real courses. Also, we plan to implement data models and assessment software tools as Moodle services and provide proof of the design-time architecture.

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