Analysis and Synthesis of Educational Content of Courses in Moodle LMS Based on the Competence Approach of FSES

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Abstract
The article outlines the principles of analysis and synthesis of the educational content of courses in the Moodle Learning Management System, taking into account the competence approach, approved in the Federal State Higher Education Standards. A methodological approach is proposed based on the systematization of the content of the lecture and practical course material by indicators of achieving universal and generic professional competencies, as well as, for professional competencies, following professional standards and generalized labor functions, which the educational program is focused on. Under the methodological approach, an algorithm for using the tool for forming user competencies in LMS Moodle, a competency framework, is proposed.

Keywords 1
LMS Moodle, competencies, competency framework, competency indicator, professional standard, labor function, quality, content, learning plan.

1. Introduction

In the context of the COVID-19 pandemic and the quarantine measures caused by it and during 2020-2021 periodically forcing universities in the Russian Federation to switch to distant education. It is especially important to improve the quality of the content of distance courses. At the same time, the support of the compatibility standard for the development of electronic courses SCORM and the ideology of hypertext makes learning management systems like Moodle are a convenient tool for implementing the competence-based approach based on the federal state educational standards of higher education.

The goal of the article is to determine the principles of analysis and synthesis of the educational content of courses in the Moodle learning management system, taking into account the competence-based approach based on the federal state educational standards of higher education, and to develop an algorithm for using the competency framework to implement these principles.

2. Main Part

To implement the competence-based approach, all developers of courses included in the basic professional educational program must match the content of the lecture and practical material created for the formation of the competencies listed in the work programs of the disciplines [1, 4, 15, 16, 17].

To determine the correspondence of discipline's materials content to a specific competence, each course developer must systematize the content of the lecture and practical course material by the indicators of achieving universal and general professional competencies, following professional standards and generalized labor functions that the educational program is focused on. It is necessary to study the detailed content of the competence. If the competence belongs to the category of universal or general professional competencies, it is necessary to study what knowledge, skills, and possession of it are recommended in the federal state educational standards of higher education.

Test assignments should be compared with the indicators of achievement of competence developed in the federal state educational standards of higher education. The implementation of the competency-based approach in comparing the content of the lecture materials, practical, laboratory competencies (for example, the course "Technologies of Business Analysis") is shown in Table 1, 2.

The quality of assessment materials for checking the formation of competence is assessed, firstly, by their compliance with the declared competencies or elements of competencies; secondly, variety (tests, assignments for practical work, assignments for laboratory work, the presence of individual assignments, etc., the presence of an indication of which element of competence checks each assignment); thirdly, the availability of assessment material for each competence or element of competence in the discipline [2, 3, 8, 9, 10, 18, 19].

Table 1

Indicators and formation assessment of the universal competence № 1

Universal competence № 1. Able to search, critical analysis, and synthesis of information, apply a systematic approach to solving the assigned tasks. (The category of universal competencies "System and Critical Thinking").	
Competency indicators:	• To know the principles of collection, selection, and generalization of information, methods of a systematic approach to solving professional problems. • To know how to analyze and systematize heterogeneous data, evaluate the effectiveness of procedures for analyzing problems and making decisions in professional activities. • To possess the skills of scientific research and practical work with information sources; decision-making methods.
Topics of lectures, practical, laboratory courses:	• Lectures: topic 1 "Business analytics - basic concepts", topic 2 "Big data and its processing in memory", topic 9 "Introduction to Data Mining". • Lab 1 "Data visualization on the Qlik Sense cloud platform", lab 2 "Building applications on the Qlik Sense cloud platform: KPI dashboards, history snapshots". • Practical 7 "Deductor Academic analytical package - analysis of data features and assessment of their informativeness", practical 11 "Data analysis and visualization on the IBM Cognitive Analytic cloud platform", practical 12 "Business game: consider the typical structure of the organization's data: university, determine which points data can be the target of data mining and business analysis ".
Conclusion on achievement of competence /element of competence:	• Course elements implement a systematic approach to data management, to systematize data based on the methodology of a systematic approach, to use the advantages provided by systematization and data management in the professional activity of applied informatics as an IS developer and as a systems analyst. • Course elements form the ability to analyze and systematize heterogeneous data, evaluate the effectiveness of procedures for analyzing problems, and make decisions in professional activities. • Course elements allow mastering the skills of scientific research and practical work with information sources; decision-making methods.

Under the methodological approach to the analysis and synthesis of the content of the courses, having completed it according to the matrix and indicators of the federal state educational standards competencies approved in the basic professional educational program, after filling the course in LMS

Moodle with theoretical, practical and evaluative material, it is necessary to use the tool for forming user competencies - the framework of competencies.

Table 2

Indicators and formation assessment of the professional competence № 7.

Professional competence № 7.	
Ability to determine the initial requirements of the customer for IS (Informational system) and the possibility of their implementation in IS at the stage of pre-contract work. (Category of professional competencies "Project type of activity").	
Competency indicators:	• To know the subject area of automation, methods for identifying requirements, architecture, design, and operation of computer systems, communication equipment, network protocols, the device and operation of modern ISs, modern approaches and standards of organizational automation (for example, CRM, MRP, ERP, ITIL, ITSM), the basics customer and customer relationship management (CRM), modern tools and methods of organization management. • To be able to analyze the source documentation, inform the customer about the capabilities of a typical IS and options for its modification, and simulate business processes in the IS. • Can identify the initial requirements of the customer for IS, determine the possibilities of achieving compliance with the IP with the initial requirements of the customer, the ability to collect initial data from the customer.
Topics of lectures, practical, laboratory courses:	• Lectures: Topic 3 "ETL process in Qlik Sense: extracting, transforming and loading data. BI - Business Data Analysis ", Topic 6" SAP HANA - Real-Time Business Platform ". • Lab 5 "Building applications on the Qlik Sense cloud platform: KPI dashboards, history snapshots". • Practical 7 "Deductor Academic - analysis of data features and assessment of their informativeness", practical 12 "Business game: consider the typical data structure of an organization: university, determine which data points can be the purpose of data mining and business analysis."
Conclusion on achievement of competence/element of competence:	• Course elements form knowledge about the capabilities of a typical IS of the modern level of systems development, including data management; knowledge about the subject area of automation and its impact on the choice of IS with the appropriate functionality; knowledge of methods for identifying requirements for enterprise IP in the context of the subject area of automation and taking into account the current level of development of systems. • Course elements form the ability to analyze the source documentation, inform the customer about the capabilities of a typical IS and options for its modification. • Course elements allow mastering the skills of identifying the initial requirements of the customer for IP, determining the possibility of achieving compliance with the IP with the initial requirements of the customer, the ability to collect initial data from the customer.

The framework of competencies implements the ideology of hypertext and can "connect" the components of the educational program: disciplines, courses, modules, just as it is laid down in the federal state educational standard of higher education [12]. A framework is a hierarchical set of competencies and their components. 4-level hierarchy is allowed. Within the framework of one educational program, it is necessary to form a competency framework for the program as a whole: for

example, include a list of competencies, naming them the same as they are named in the educational standard [5, 6, 7, 11].

LMS Moodle offers the following algorithm for creating a competency framework:

- create a framework, define the levels of hierarchy (taxonomy); the system offers various options, the top level is the parent of the previous level (Fig. 1);

- fill in the framework (Fig. 2);

- link the necessary competencies (or their levels) to various courses of the educational program (Fig. 3);

- link the necessary competencies (or their levels) to various elements of the training course (Fig. 4) [12, 13, 14].

A student's competency assessment can be obtained automatically upon completion of the assignment (with a default scale), or the instructor can manually assess competencies using a customizable Experienced scale. The instructor selects a student and clicks on a specific competency that has not yet been graded, then clicks the Grade button and selects the desired rating from the available options. After saving, mastering will change if the match is met (Fig. 5).

To form the structure of the basic professional educational program and link it to created frameworks of competencies for all courses, it is necessary to create a template for a learning plan. It defines a set of competencies that can be assigned to a group of learners in LMS.

In Site Administration> Competencies> Learning plan templates, all existing learning plans are displayed and a new learning plan template can be added. To add competencies to the template, you need to go to the appropriate page in the new learning plan, where you can add, edit, and delete competencies [12, 20].
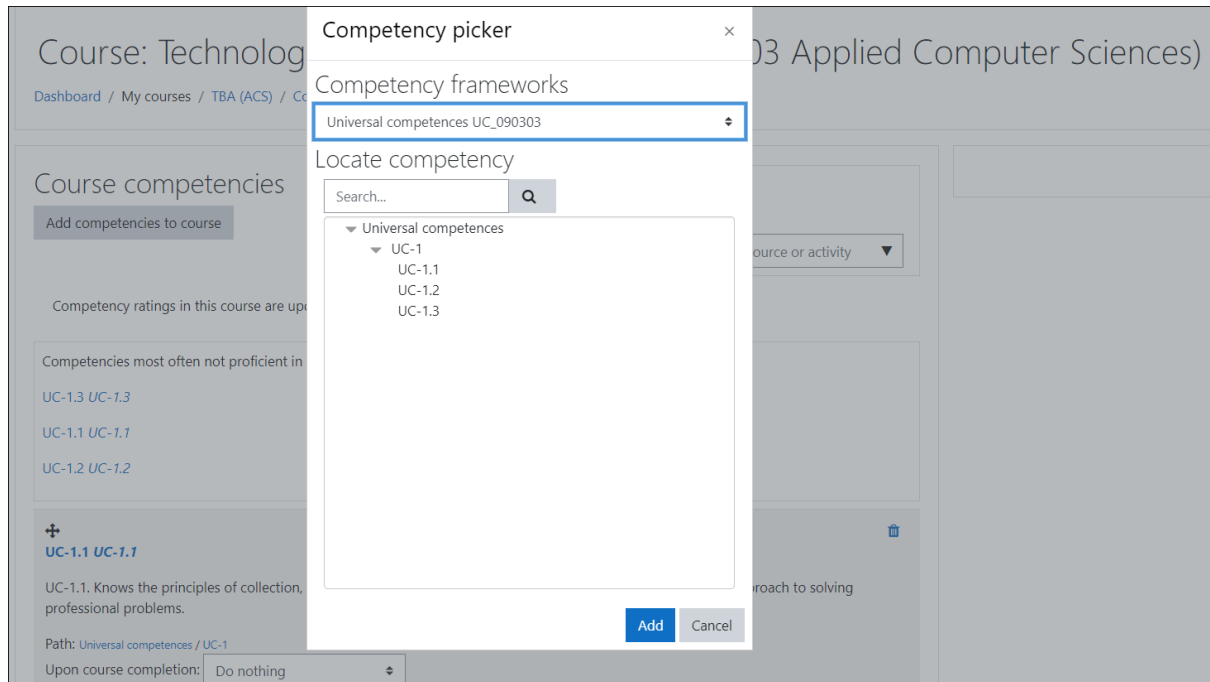

Figure 1: Creating a framework for universal competencies

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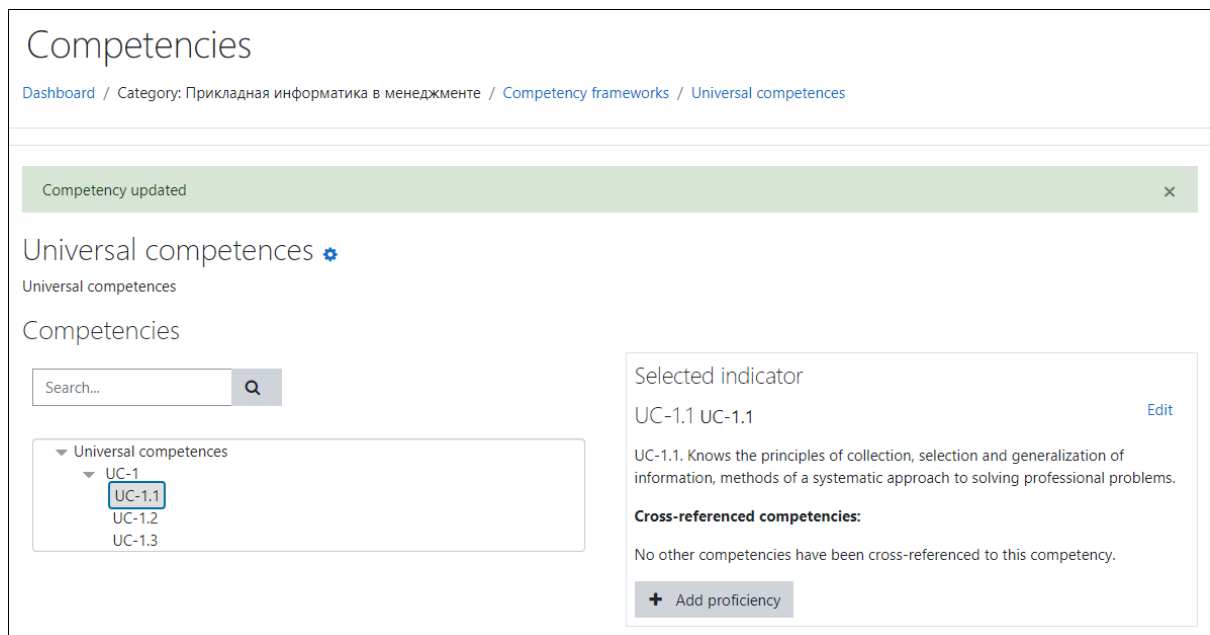
Figure 2: Filling the framework with universal competencies and indicators

If the creator of the course cannot see the Learning Plans block, then the administrator has not set this value for the block of rights (capabilities) of teachers. However, administrators additionally need to set other capabilities in the context of the system related to viewing the learning plan for the block to display all the useful information. It may be necessary and useful to create a dedicated role, such as "Supervisor", with the capabilities that need to be allowed for teachers in a systemic context so that they understand the integrity of the learning and competency development program.

Figure 3: Linking the necessary competencies (or their indicators) to various courses of the educational program (for example, "Technologies of Business Analysis")

Figure 4: Linking the required competencies (or their indicators) to various elements of the training course (for example, "Technologies of Business Analysis")

Figure 5: Manual assessment by the teacher of the competency mastery rating

3. Conclusions

Based on the analysis of the principles of basic professional educational program implementation in LMS Moodle using the competency-based approach, it was proposed to compare course elements with competency indicators, and to implement this policy in the system using competency frameworks and learning plans as connecting links between courses and competencies.

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