ORGANIZING INDEPENDENT LEARNING ON A DIGITAL PLATFORM BASED ON LABOR FUNCTIONS

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Abstract. Independent study assignments in vocational education institutions are often reproductive in nature and unrelated to the labor functions specified in occupational standards. This study aimed to develop and test an approach to organizing independent study via a digital platform in alignment with labor functions. Based on an analysis of ICT occupational standards and functional decomposition, an algorithm for converting labor functions into three-level assignments, a "labor function – assignment – digital evidence" alignment matrix, and a four-block model were developed. In a one-semester quasi-experiment with second-year ICT students at a technical college (EG n = 54, CG n = 52), the experimental group showed a statistically significant advantage in a professional case assignment (d = 1.00) and in self-regulation (d = 0.91). It is argued that designing assignments around work actions rather than curriculum topics is a transferable way of linking vocational education with the labor market.

Keywords: vocational education, independent study, occupational standard, labor function, digital platform, ICT, e-portfolio, self-regulation.

In the digital economy, a qualification is increasingly defined not by the amount of knowledge acquired but by the work a specialist is able to perform. UNESCO's strategy for 2022–2029 identifies the transformation of technical and vocational education and training in line with the digital transition and labor market requirements

as a priority (UNESCO, 2022). In the ICT sector, where technologies are rapidly updated, the ability to learn independently has itself become a professional requirement. In Uzbekistan, occupational standards describe generalized labor functions in terms of work actions and the required skills and knowledge, and are linked to the levels of the National Qualifications Framework. The Law "On Education" (2020) and Presidential Decree No. PF-5812 (2019), which introduced a three-level vocational education system, set the task of aligning vocational education with the labor market.

In practice, however, independent study assignments (essays, lecture notes, presentations), which are allocated a substantial number of hours in curricula, are not linked to labor functions; their assessment has become a formality, and digital platforms are used mainly for file sharing. The study seeks to answer the following research questions: *(1)* How can the labor functions in an occupational standard be systematically converted into independent study assignments? *(2)* What model and platform functions are required for this? *(3)* Does the proposed approach improve students' professional practical skills and self-regulation compared with conventional independent study?

In international literature, independent study is examined within the theories of self-directed learning (Knowles, 1975) and self-regulated learning (Zimmerman, 2002). In their systematic review, Broadbent and Poon (2015) showed that time management, metacognition, and effort regulation in online environments are positively associated with academic achievement; hence, a platform should not be limited to content delivery but should also support self-regulation. Zawacki-Richter et al. (2019) noted the potential of adaptive systems alongside their weak pedagogical grounding. Research on competence-based vocational education substantiates the need to express learning outcomes in terms of activity (Mulder, 2017) and to integrate theoretical, practical, and self-regulative knowledge in authentic work tasks (Tynjälä, 2008). In

Uzbekistan, N. A. Muslimov (2007) studied the professional formation of vocational education teachers, and U. Sh. Begimqulov (2007) investigated the informatization of educational processes. According to Biggs's (1996) concept of constructive alignment, intended learning outcomes, learning activities, and assessment should be mutually aligned. However, the labor function of an occupational standard has not been sufficiently studied as a system-forming element of independent study content on a digital platform.

The study comprised a development phase (research questions 1 and 2) and a quasi-experiment with a control group (research question 3). In the development phase, ICT occupational standards (software development, network administration, database management, and computer hardware maintenance), curricula, and course syllabi were analyzed; the results were evaluated by an expert panel of teachers (n = 7) and employer representatives (n = 5). The experiment was conducted over one semester of the 2025–2026 academic year with second-year ICT students at Technical College No. 2 of Vobkent District, Bukhara Region: the experimental group (EG, n = 54) worked according to the proposed methodology on the platform, and the control group (CG, n = 52) followed the conventional procedure. The instruments were a professional case assignment scored with a 100-point rubric (two raters, $\kappa = 0.68$), a 5-point self-regulation questionnaire (Cronbach's $\alpha = 0.86$), and platform analytics. Pearson's χ^2 test, Student's t-test, Cohen's d (Cohen, 1988), and Hake's normalized gain (Hake, 1998) were used in the analysis. Participation was voluntary, informed consent was obtained, and the data were anonymized.

Algorithm for converting labor functions into assignments.

The key idea is that the unit of design for an independent study assignment is not a curriculum topic but a *work action*. The algorithm consists of six steps: (1) identifying the occupational standard, labor function, and qualification level relevant to the course; (2) decomposing the labor function into work actions and the required

skills and knowledge; (3) mapping work actions to course topics; (4) designing reproductive, productive, and professional-creative assignments for each work action; (5) specifying the form of digital evidence and the assessment rubric; and (6) posting the assignment on the platform with a labor function code and collecting the outcome in an e-portfolio. Coding generates a "labor function map" for each student (Table 1).

Table 1. Sample of the alignment matrix

Vocational course	Labor function / work action	Independent study assignment	Digital evidence and criterion
Fundamentals of Web Programming	Developing a web application interface / creating a layout from a technical specification	Creating a responsive web page in HTML/CSS based on a client brief	Git repository; compliance with web standards
Computer Networks	Configuring a local area network / drawing up an IP addressing plan	Designing a small office network in Cisco Packet Tracer and verifying connectivity	Project file and report; connectivity tests
Database Management Systems	Designing a database / data model and queries	Building an ER model for sales records, normalizing it, and writing 10 SQL queries	ER diagram, SQL script; correctness of query results
Software for Mobile Devices	Developing mobile application software / implementing app functions from a technical specification	Building a simple Android app from a client brief and testing it on an emulator	APK file, Git repository; functional test results

The algorithm was incorporated into a four-block model (Figure 1). The model was implemented on mobilit.uz, a WordPress-based platform developed by the author. The platform includes the following components: an assignment manager with labor function tags, an adaptive assignment bank, camera-proctored online testing via a third-party service (Quilgo), an e-portfolio, analytics, an employer-mentor module, and digital badges for work actions.

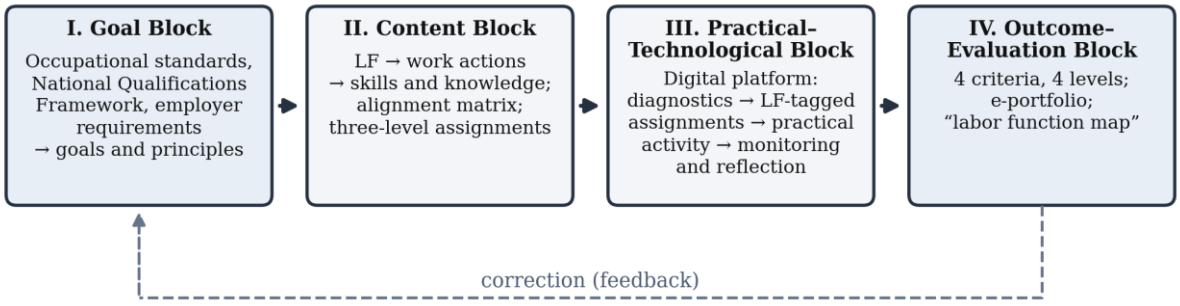


Figure 1. Model for organizing independent study in alignment with labor functions (LF – labor function)

Table 2. Results of the experiment

Indicator	EG pre	CG pre	EG post	CG post	Post-test difference
Share of sufficient and high levels, %	27.8	28.8	68.5	36.5	$\chi^2 = 12.30$; $p = 0.006$
Case assignment (0–100), M ± SD	52.4 ± 11.8	51.9 ± 12.1	71.6 ± 10.9	60.3 ± 11.6	$t = 5.17$; $p < 0.001$; $d = 1.00$
Self-regulation (1–5), M ± SD	3.02 ± 0.61	2.98 ± 0.64	3.84 ± 0.55	3.31 ± 0.62	$t = 4.66$; $p < 0.001$; $d = 0.91$

Before the experiment, there was no significant difference between the groups (level distribution: $\chi^2 = 0.02$; $p = 0.999$). After the experiment, the share of students at sufficient and high levels increased from 27.8% to 68.5% in the EG, whereas in the

CG it reached 36.5%. On the case assignment, the EG outperformed the CG by 11.3 points; the normalized gain was g = 0.40 in the EG and g = 0.17 in the CG.

The results confirm previous findings on the importance of self-regulation strategies in online environments (Broadbent & Poon, 2015): the individual plan, deadline monitoring, analytics, and reflective portfolio included in the model support precisely these strategies. When the learning outcome (labor function), the activity (an assignment based on a work situation), and the assessment (digital evidence) are aligned, independent study becomes purposeful rather than a formality (Biggs, 1996). In countries whose occupational standards have a similar structure, the algorithm can be transferred to other vocational fields. The study has several limitations: the experiment was conducted in a single institution over one semester with non-randomized groups, and self-regulation was measured by self-report. Future research should employ multi-institutional, longitudinal designs and explore artificial intelligence-based recommendation mechanisms.

The study developed an algorithm for converting labor functions into three-level independent study assignments, an alignment matrix for ICT courses, a four-block model, and the functional architecture of the platform. The experiment demonstrated the effectiveness of the approach in improving professional practical skills and self-regulation. It is recommended that the independent study components of vocational course syllabi be aligned with occupational standards, that platforms with labor function tagging be introduced in technical colleges, and that employers be involved in assessment.

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