模块化技术和数字化是开发适应性教育过程的最现代、最有效的方式

# MODULAR TECHNOLOGIES AND DIGITALISATION ARE THE MOST MODERN AND EFFECTIVE WAY TO DEVELOP ADAPTIVE EDUCATIONAL PROCESS

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注解。本文介绍了基于信息和通信技术、数字化和人工智能的使用的模块化方法在职业培训组织中的优势的研究结果。这项研究的相关性取决于有必要培训所有专业的专家，这些专家是动态和灵活的劳动力市场所需要的，如果不广泛应用适应性培训，这是不可能的。关键词：信息通信技术、适应性教育技术、模块化技术、专业领域模型、培训个
性化、教育体系、"劳动能力模块"概念、活动方法。

***Annotation.*** *The paper presents the results of research on the advantages of the modular approach in the organisation of vocational training, based on the use of information and communication technologies, digitalisation and the use of artificial intelligence. The relevance of the research is conditioned by the necessity to train specialists of all specialties, who are in demand in the dynamic and flexible labour market, which is impossible without a wide application of adaptive training.*

***Keywords:*** *infocommunication technologies, adaptive educational technologies, modular technologies, model of professional field, individualisation of training, education system, concept "Modules of labour competences", activity approach.*

One of the most important trends in the development of education in the modern world [1] is the orientation on the learner's personality in order to fully develop his/her abilities and meet his/her educational needs. The opportunity to implement this trend is provided only by the organisation and use of adaptive educational process.

Historical studies indicate that the first attempts to adapt the process of knowledge accumulation, or the process of learning, both to the capabilities of those who were learning and to the needs for this knowledge, were made already in the first century BC [2], as evidenced by the ancient Greek, Jewish

and Chinese treatises of that era. The pedagogical foundation of adaptive learning was laid by Jan Amos Comenius [3], in the Middle Ages AD. The great pedagogue of the Middle Ages brilliantly formulated the pedagogical principles of the classroom-lesson system of learning, which are, in fact, the basis of adaptive learning systems [4].

The relevance of the tasks solved in the process of adaptive learning is continuously increasing nowadays. This is due to the fact that informatisation, digitalisation and application of artificial intelligence, actively penetrating into all spheres of human activity, significantly facilitate the implementation of adaptive educational process at all levels of its implementation, namely:

- pre-school education,
- general secondary education,
- vocational education,
- specialised secondary education, - as well as higher education.

The creation of a modern system of adaptive learning, at any of these levels, implies the solution of a priority task:

- determine **what is what, and how to adapt.**

In order to successfully resolve the above, inherently multi-stage task, it is necessary to develop:

- a model of the system,
- and, on its basis, an algorithm that allows implementing adaptive learning [4].

It should be taken into account that the essence of any professional training, traditional or adaptive, is ultimately reduced to:

- to the formation of the necessary amount of educational material - i.e., the creation of the content of vocational training;
- the learner's assimilation of this material, consolidation of the acquired knowledge, and formation of competences necessary for future professional activity.

Speaking in modern info-communicative language, **the task of the created adaptive learning system**, or, more precisely, the system model and the algorithm implementing this model, is reduced to: **the use and optimal interaction of two data sources**:

- training content (**occupational domain model**);
- data on the capabilities and needs of the learner (learner model). The needs of the learner, in turn, depend on the specialities demanded by a dynamic and flexible labour market

Based on the above, we can draw an unambiguous conclusion:

- Quality professional learning is **IMPOSSIBLE** without the necessary completeness and quality of learning content, for modern adaptive learning this sounds like - **without a highly effective model of the professional field.**

In order to create a model of a professional field, i.e. to form the content of professional training, it is possible to use two alternative ways: *traditional and activity-based* [4].

In the first case, the formation of learning content is based on the subject-lesson (lecture-seminar) approach. The obtained learning material is a set of subjects or disciplines. However, even a deep and complete assimilation and knowledge of the material of academic disciplines does not always lead the learner to the effective use of this knowledge in practice.

More effective is the activity-based approach based on the modular technology developed by ILO experts in the crisis years of the 1980s and widely known in the world as the concept of "Modules of Labour Competencies" (ILO MLC-concept). The main principles underlying the creation of modern educational systems and the formation of vocational training content under the activity-based approach are the following principles [4]:

- responsiveness and flexibility;
- continuity and openness;
- democratisation;
- accessibility;
- modularity;
- efficiency and quality;
- standardisation;
- individualisation of the learning process;
- result-orientation;- activation;
- pluralisation, etc.

This approach, also called functional approach, is based on the predictive analysis of the future specialist's activity. The analysis is carried out by a group of experts in order to identify all labour functions within this activity; identification of objects and means of labour. According to the results of the analysis, an exhaustive description of the specialist's activity is drawn up, with a list of all tasks to be solved by the future specialist. Based on the consideration of these tasks, the content, structure and sequence of material study are determined.

The use of educational and methodical materials developed in this way allows for individualisation of training, implementation of flexible training programmes or educational standards. All this contributes to increasing the

motivation of the learning and cognitive process of students. As a consequence, the quality and cost of education is increased.

Implementation of individualisation of training is possible in two variants:

- by regulating the rate of learning of educational material for individual students, with the same amount of material for all;

- by choosing the amount of learning material by the students themselves, in accordance with their wishes and capabilities, to study in a given period of time.

All the above mentioned here promotes self-learning and thus increases the responsibility of the learner for the results of his/her work. The role of the teacher changes significantly - the main functions of the teacher become management and control of the cognitive activity of students. The teacher does not become the only source of learning information, but rather a counsellor; and his/her qualifications have less influence on the results of learning. As a result, learning time can be significantly reduced without affecting the completeness and depth of learning.

In the educational system implemented in this way, the learner can use the capabilities of modern information and communication technologies (ICT) independently (or under the guidance of a teacher) to work with an individual package of educational and methodological support, which should contain [4]:

- target programme of actions;

- a bank of educational information;

- methodological guidance for achieving the set learning objectives;- means of control or self-control over the quality of training; - ways to adjust the level of training.

Let us consider in detail the main provisions of the ILO MLC-concept [5]. As already mentioned, the basis for the development of the programme and the formation of the content of professional training is the description and analysis of the specialist's activity. Such description is obtained on the basis of using:

-professional standards (existing);

- qualification characteristics;

- employers' production tasks;

- job descriptions for professions;

- as well as taking into account the professional knowledge and experience of the developers of these materials themselves.

The description of a specialist's activity obtained in this way is divided into separate logically completed parts - the so-called modular blocks (MB) [5].

*MB - is a logically completed and acceptable part of work within a work assignment, profession or field of activity with a clearly defined beginning and end, which is usually not further subdivided into smaller parts.*

IBs grouped for a specific type of work form the so-called module of labour competences (MLC).

*The MLC represents a job description expressed in the form of MBs (the MLC describes in the form of MBs the work performed within a specific production task).*

The work within each IB must be broken down into smaller, clearly defined steps (*operations*) that must be performed in a certain logical sequence. In order for a learner to be able to perform these operations, he/she needs to acquire certain knowledge, skills, abilities and competences (psychomotor, intellectual and emotional).

Analysing the steps of work in each MB, as well as the skills and competences required to perform them, allows determining the necessary and sufficient amount and content of learning material to prepare the learner to perform step-by-step work within the entire MLC.

The training material is subdivided and structured in the form of individual training elements (TE). Each of the TE is dedicated to the formation of a specific type of knowledge, skills or competencies in the learner.

*TE is an independent learning booklet (learning element in electronic format) designed for learning, oriented to both independent work of the learner and work under the guidance of a teacher. Each TE is designed for certain practical competences or theoretical knowledge, i.e. it contains the whole volume of learning material necessary for the learner to form these competences or acquire these theoretical knowledge.*

The logical interrelation of MLC, MB and TE within the framework of MLC programmes is shown in Figure 1.

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┌─────────────────────────────────────────────────┐
│                  MLC program                    │
│   ┌───────────────────────────────────────┐     │
│   │          MODULE OF LABOUR             │──┐   │
│   │  ┌─────┐  ┌─────┐  ┌─────┐            │  │   │
│   │  │  M  │  │     │  │  M  │            │  │   │
│   │  │  B  │  │ MB  │  │  B  │            │  │   │
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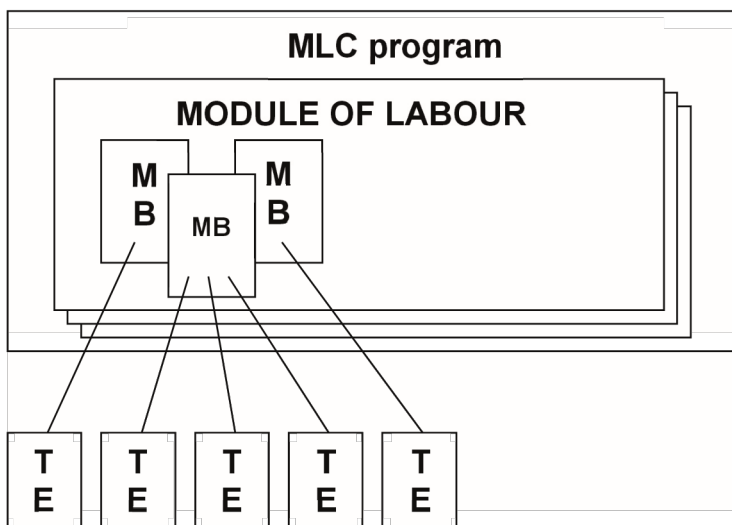
*Figure 1. Schematic structure of MLC programmes*

The prepared TE bases are the content of vocational training and are the main source of learning information for students. Such databases can be created both for a particular profession and for an entire professional area. The accessibility of the professional learning content *(model of the professional field*) formed in this way is ensured thanks to the possibilities of ICT and, especially, the use of cloud technologies.

The above review of the main provisions of the ILO's MLC concept, the results of the pilot implementation of MLC programmes created within the framework of the ILO project "Development of the modular system of education in the Republic of Belarus" [5], as well as long-term experience accumulated by Belarusian, Russian and Ukrainian colleagues, convincingly confirm the possibilities of achieving higher efficiency of the adaptive educational process on the basis of using the model of professional field, formed with the use of the modular activity approach, as compared to the traditional approach.

Modern highly effective adaptive learning systems can be created only on the basis of the modular approach and the wide application of information and communication technologies, digitalisation and artificial intelligence. Therefore, adaptive learning is very labour-intensive and expensive, but it pays off in terms of high efficiency and shorter learning times.

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