Traditional and digital technologies in professional education: integration opportunities

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Abstract. The article considers the traditional and digital technologies taking into account vocational education modern directions of development and modernization. It has been substantiated that the integration of such technologies is an important factor in improving the quality of vocational education. The authors’ approach to such integration is proposed on the basis of complementarity or mutual reinforcement of the capabilities of traditional and digital technologies. The types of integration of such technologies are described from the standpoint of increasing their didactic productivity: addition, replacement, development, transformation. Algorithms for the integration of traditional and digital technologies in teaching a particular discipline and in the implementation of an educational program are presented. These algorithms can be used by college teachers and heads of educational programs of secondary vocational education.

1. Introduction
Vocational education plays a key role in ensuring the global competitiveness of Russia in the world, meeting the current and forecast needs of the labor market. In the last decade, professional education in Russia has been developing and modernizing in the following directions: Strengthening practical training:
- the introduction of a competence-based approach;
- distributed practice;
- dual learning (the theoretical part of the program is mastered in a professional educational organization; the practical part is mastered at a partner enterprise [1]);
- practice-oriented forms of monitoring training results (demo exam, professional testing, independent assessment competencies);
- modernization of educational standards taking into account the requirements of professional standards and World Skills International standards;
- the creation of structural divisions of educational organizations at enterprises, the expansion of targeted training.

2. The main directions of development and modernization of vocational education in Russia
Strengthening the variability of educational programs stated by The Federal Law of the Russian Federation “On Education in the Russian Federation” provides students with academic rights to
participate in the formation of the content of their professional education, subject to compliance with educational standards; to choose optional academic subjects, courses, disciplines (modules) from the list offered by the educational organization; to master, along with academic subjects, courses, disciplines (modules) according to the educational program being mastered, any other academic subjects, courses, disciplines (modules) taught in an organization carrying out educational activities; for training according to an individual curriculum, including accelerated learning. The educational standards provide for a variable part (at least 30% of the study time for each study cycle), which makes it possible to expand and (or) deepen training to obtain additional competencies necessary to ensure the competitiveness of a graduate in the regional labor market.

Development of networked forms of education, allowing to use and concentrate the resources of not only the education system, but also the real sector of the economy A promising form of network education is the creation of high-tech scientific and educational clusters.

Adaptation of the training system to the requirements of a modern high-tech economy. Computer and digital technologies are widely introduced into the training process. The material and technical base of professional educational organizations is being modernized. A requirement has been established for the annual updating of educational programs of open source software, taking into account the latest achievements of production, science and technology.

3. Traditional and digital technologies of vocational education

The key factor in ensuring the quality of vocational education includes pedagogical technologies used in vocational training. A significant part of them is fulfilled by traditional technologies based on traditional (physical) educational resources (teacher's word, textbook).

Traditional technologies are developing in line with the priority areas of vocational education development:

- Strengthening practical training is achieved with the help of traditional technologies that involve students in quasi-professional and educational-professional activities and develop their professional competencies: technologies of dual, contextual learning, design, game technologies, workshop technologies.
- The enhancement of the variability of educational programs is facilitated by traditional technologies aimed at personal orientation of the educational process: differentiated (multilevel), vitagenic learning, portfolio, etc.
- The development of networked forms of learning is served by modular technologies.
- The adaptation of the training system to the requirements of a modern high-tech economy is provided with the help of traditional technologies aimed at developing intelligence, creativity, critical thinking, universal competencies: technology of problematic, developmental, programmed learning, learning in cooperation, solving research and creative problems.

The global trend in the last decade is digitalization - the introduction of digital technologies into various sectors of the economy and the daily life of people. Digital technologies are widely used in vocational education, ensuring its continuity throughout life (life-long learning), individualization based on advanced-learning-technologies, the formation of 21st century competencies in students [2].

In education, both digital technologies themselves are used (general purpose - wireless communication technologies, cloud technologies, technologies of large databases, artificial intelligence), and specialized - digital educational technologies.

Digital technologies in vocational education are also developing in line with the priority areas of its development.

Gamification technologies [3], “packing” traditional content into educational projects, digital measuring instruments, virtual laboratories, computer simulators and simulators, and computer modeling technologies contribute to strengthening the practical orientation.
Strengthening the variability of educational programs can be achieved using technologies of personalized organization of the educational process, adaptive online learning, custom educational materials, consulting systems, technologies of virtual, augmented and mixed reality, authentic assessment, assistive technologies.

The development of network forms is provided by distance educational technologies, e-learning technologies, digital educational and methodological complexes; technologies for organizing educational communications (chat bots, instant messengers, e-mail, corporate universal communication systems, learning management systems (LMS), massive open online courses, electronic document management technologies.

The adaptation of training to the requirements of a modern high-tech economy is achieved through the use of intelligent teaching systems, technological design, robotics; group creation and use of MR applications, group computer business games, web quests, etc.

However, the introduction of digital technologies in the implementation of professional educational programs is a necessary but insufficient condition for improving the quality of vocational education. By itself, the use of such technologies does not lead to an increase in educational results. To increase the effectiveness of the use of digital technologies, it is necessary to create certain pedagogical conditions. One of such conditions, in our opinion, is the integration of traditional and digital technologies.

4. Essence, models and algorithms for the integration of traditional and digital technologies in vocational education
Integration (from the Latin integratio - restoration, replenishment) in a broad sense is understood as the unification into a whole of previously disparate parts in the process of moving towards a more integral state [4]. Integration is characterized not only by a greater degree of interconnectedness of elements, but above all by a change in their properties, which brings it closer to the concept of a system [5]. The researchers emphasize that pedagogical integration does not imply the dissolution of one element in another; it is impossible for fundamentally different objects [6].

Integration processes are a distinctive feature of modern society: European integration, Asia-Pacific economic cooperation, globalization, solving global world problems, international traditions, etc.

The following integration processes take place in educational practice: integration of education and society (culture, production, science); integration of educational systems of different states (Bologna process); integration of educational institutions (network forms of education, educational consortia); integration of teachers (lecture for two, training by a team of teachers); integration of learners (inclusive education); integration of goals (the formation of interdisciplinary (metasubject) and supradisciplinary knowledge among students), content (interdisciplinary connections, integrated courses, cross-cutting topics), forms (lesson-game), methods (method of problem-developing learning) and technologies (problem-modular technology [7]) training.

At present, in pedagogical science and practice, there are preconditions for the development of theoretical foundations for the integration of traditional and digital technologies in vocational education: the idea of synthesis and mutual enrichment of existing didactic concepts has been put forward [8]; substantiated the possibility and efficiency of integration of teaching methods and technologies [9]; forms of training organization [10]; integrated learning technologies have been developed and successfully applied (technologies of sign-contextual [11], problem-modular learning, modular-rating technology, case technology that combines role-playing games, educational design and situational analysis, etc.), blended learning technology [12], based on a combination of distance and traditional learning (for example, Carnegie Learning Inc. has developed a set of training programs focused on the use of blended learning “Cognitive Tutor”).

In our opinion, the main mechanisms for integrating traditional and digital technologies should be complementarity or mutual reinforcement of their capabilities, i.e. it is necessary to integrate technologies that have the same capabilities, which can be enhanced through integration, or have complementary, mutually compensating capabilities. An example of mutually reinforcing integration
of traditional and digital technologies can be the integration of developmental learning technology and intelligent learning systems. Intelligent learning systems and providing students with a large amount of factual information can facilitate the solution of problems aimed at developing the skills of theoretical generalization, the formation of the ability to transfer and expand the scope of application of the concepts being mastered. An example of complementary integration can be a personalized organization of the educational process that integrates traditional technology of differentiated learning and adaptive training programs. At the same time, it is important that the digitalized traditional technology itself be effective, give didactic effects, because “the automation of ineffective processes only multiplies their inefficiency” [13].

A team of scientists from the Higher School of Economics has identified four levels of change in pedagogical practice as a result of the introduction of digital technologies:

- levels of routine use of digital technologies:
  (1) substitution - traditional technology is replaced by digital technology without affecting its functionality (transition from reading text in a printed textbook to reading it on a computer screen);
  (2) improvement - the traditional technology is replaced by a new one, improving its functionality (transition from demonstrating material on paper posters to demonstrating it using a multimedia projector, which significantly expands the possibilities of its visual presentation);
- levels of innovative use of digital technologies:
  (3) change - the traditional technology is replaced by digital, expanding its functionality (students create cartoons and "digital storytelling", prepare presentations not only for reporting on the work done, but also for teaching classmates, demonstrating to parents, for posting on the network, etc.);
  (4) transformation - the traditional technology is replaced by a new one, transforming its functionality (transition to a personalized organization of educational work, within which digital tools allow organizing work without lagging behind) [13].

A similar logic underlies the classification of methods for integrating traditional and digital technologies proposed by N.P. Goncharuk and E.I. Chromova:

- inclusion of individual digital tools into educational technologies;
- interaction and combination of individual elements of pedagogical and digital technologies;
- transformation of interacting elements of different technologies;
- enrichment of pedagogical technology with elements of digital technology;
- modernization of educational technologies based on the use of modern digital tools that make it possible to effectively use massive open online courses and open educational resources [14].

Based on the approaches presented, we have identified four models of integration of traditional and digital technologies from the standpoint of increasing their didactic productivity:

- addition - conceptual ideas of traditional technology are realized by digital means;
- substitution - digital technology develops ideas of already known traditional technology;
- development - traditional technology is used in combination with digital, but at the same time its functionality is significantly expanded, which allows to significantly improve teaching practice;
- transformation - the integration of digital and traditional technologies creates a synergistic effect and contributes to the formation of new pedagogical practice.
The presented models can be used both in teaching a separate academic discipline and in the implementation of an educational program. In the first case, the algorithm of the teacher's actions on integration will be as follows: determine the general cultural (universal) and professional competencies, the formation of which the discipline is aimed at → compile a list of traditional and digital technologies that are adequate to these competencies → determine by what type (mutual reinforcement or complementarity) the traditional and digital technologies for each of the competencies → create a matrix of integrated technologies → think over educational tasks for students based on the integration of technologies and organize their implementation → diagnose an intermediate result, assess its impact on the formation of competencies →, if necessary, adjust the integrated technologies or the practice of their implementation.

To integrate traditional and digital technologies in the implementation of the educational program, we recommend the following algorithm: the program manager makes a list of general cultural (universal) and professional competencies (passport of competencies) formed at the graduate digital technologies → end-to-end technology integration lines are determined (i.e., a combination of technologies used in teaching several disciplines) → teachers of one end-to-end line jointly think over study assignments for students, implement them in teaching disciplines, track the impact of integration on the quality of the formation of competencies, if necessary adjust the integrated technologies or the practice of their implementation → the program manager coordinates the interaction of teachers of different end-to-end lines in the integration of technologies, systematically monitors the impact of integration on the results of midterm certification, makes adjustments if necessary.

In the future, we plan to refine and experimentally test the above algorithms.

5. Conclusion
Integrating traditional and digital educational technologies, it is important to understand that digital technologies have not only pedagogical potential, but also the risks of an undesirable impact on learning outcomes [15]. Among the positive effects are: enhancing educational activities, developing students' independence, individualizing learning, increasing visibility, the possibility of organizing quick and systematic feedback, increasing the objectivity of assessing educational achievements, optimizing the teacher's work. The following are indicated as risks of undesirable influence: a decrease in the creative component (this risk can be reduced by attracting students to the creation of digital educational content); mental activity (risk prevention - a combination of digital technologies with developmental and problem-based learning technologies); the emergence of problems of socialization of students (prevention is a combination of digital technologies and live communication, the implementation of not only didactic, but also educational tasks with the help of digital technologies); the occurrence of violations of physical development (prevention - observance of the rules of hygiene and rational organization of educational activities); total control (prevention - reliance on the principles of the humanitarian pedagogical paradigm).

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