Chapter 2.
DIGITAL AND COMPUTER SCIENCE EDUCATION: EXPERIENCE AND PROSPECTS FOR IMPLEMENTATION

2.1. METHODOLOGICAL ASPECTS OF INTRODUCING THE SUBJECT "COMPUTER SCIENCE" INTO SPECIALIZED SECONDARY EDUCATION IN UKRAINE AMID DIGITAL TRANSFORMATION

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Education plays a key role in today's information society. It is the foundation for personal and professional development, a force for information and technological progress, and one of the main means of ensuring success in a globalized world. Transformational processes in the educational systems of countries around the world are determined by the constant active development of information technologies, technological progress, globalization, and other political or economic factors. On the one hand, "...education is changing toward actively using information technology in the educational process, and on the other side, it's the main driver of the development of information technology and information society in general" (Leshchuk S., 2025).

Svitlana Trubacheva, together with her colleagues (Trubacheva S., 2024), are analyzing the directions of development of digital technologies and trends in the organization of the educational process in general secondary education institutions during martial law, and are identifying priority areas of transformation in education that will influence the development of the education system in Ukraine in the near future. These include: distance and blended learning; informal education; cloud technologies; gamification; virtual and augmented reality; mobile technologies in education; STEM education; educational robotics; 3D technologies; programming or coding.

Artificial intelligence systems are considered one of the engines of digital transformation in education and global change in general. The use of AI is transforming all areas of human activity (industry, technology, engineering, education, media, marketing, advertising, trade, financial sector, gaming industry) and causing changes in the labor market. Given that AI will be a big deal for economic, industrial, and technological development in the near future, we need to rethink how countries around the world set up their education systems.

The key tasks of the digital transformation of education and science in Ukraine include: developing an accessible and modern digital educational environment, forming digital competencies among education and science professionals, regularly updating the content of ICT education in step with the development of information technologies (Concept, 2021).

Thus, the success of the digital transformation of education and science is directly proportional to the level of information culture, digital competencies of graduates

of general secondary education institutions, and the provision of educational and scientific institutions with appropriate hardware and software.

The definition of the purpose of specialized secondary education indicates the need to develop pupils' personalities by establishing their Ukrainian national and civic identity and forming the competencies necessary for their resilience, independence, responsibility, communication, and interpersonal interaction, teaching pupils to use information technology in everyday life and learning, developing a responsible attitude toward the environment based on a scientific worldview and the principles of sustainable development.

The main task of developing pupils' information and communication competence lies with the field of computer science education. In grades 5–9, the study of computer science involved teaching pupils the basics of information culture and key competences (State Standard, 2020). Studying computer science in a specialized school involves summarizing and deepening the key competencies and skills that pupils have developed in using digital tools and resources in their chosen subject area, educational activities, everyday life and digital communication. At the same time, it is important to develop students' information and communication competence, which involves the confident, critical, and responsible use of digital technologies for their own development and communication; the ability to safely apply information and communication tools in learning, personal, and social life, adhering to the principles of academic integrity.

The State Standard for Specialized Secondary Education (State Standard, 2024) provides for the study of the subject «Computer Science» at the basic level only in the 10th grade. According to the Typical Educational Program (Typical Program, 2025), the 10th grade is a specialized adaptation cycle of specialized secondary education. In this cycle, the subject "Computer Science" is studied equally for all educational profiles. The content of computer science education during this period should include practice-oriented tasks from other disciplines. This will increase the applied focus of computer science education and familiarize pupils more deeply with various fields of human activity, creating better conditions for their future choice of profile.

The number of hours for compulsory educational components in the first semester of grade 10 is the same for all clusters. This creates conditions for compensating possible educational losses and also gives pupils the opportunity to familiarise themselves with the specifics of their chosen field of study and make an informed decision about their future educational path in the profiled adaptation cycle (Typical

Programme, 2025, p. 4). Directly specialized education is planned for grades 11-12 (cycle of specialized education in specialized secondary education).

Thus, the subject "Computer Science" in a specialized school can be studied at the basic level as a compulsory educational component for most study profiles for 1 hour per week only in the 10th grade. Advanced study of computer science is provided only as part of a profile with advanced study of mathematics, computer science, and technology. Figure 1 shows possible options for implementing the computer science educational component in the content of specialized secondary education.

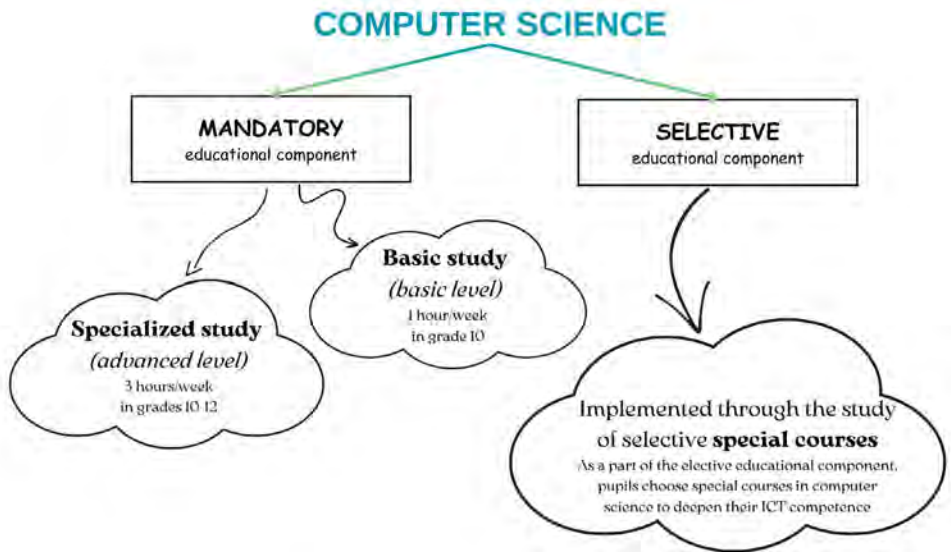

Рис. 1. Options for implementing the computer science educational component in the content of specialized secondary education

In our opinion, it is necessary to intensify teaching of computer science in all study profiles, since the subjects of the computer science educational field (directly the subject "Computer Science" or elective subjects of a computer science orientation) play a decisive role in the formation of the information and communication competence of graduates.

Basic level of computer science education

The purpose of studying the subject "Computer Science" in a specialized school at the basic level is to develop the personality of the pupil, enabling them to effectively use digital tools and technologies to solve problems, personal and professional development, creative self-expression, ensuring their own and social well-being, thinking critically and creatively, and acting safely and responsibly in the information society.

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The goal of studying the subject is achieved by solving tasks aimed at implementing the mandatory learning outcomes of the computer science educational field (State Standard, 2024), which provide that the pupil:

- finds, analyzes, transforms, generalizes, systematizes, and presents data; critically evaluates information to solve real-life problems;
- creates information products and programs for effective problem solving and creative self-expression, individually and in collaboration with others, with or without digital devices;
- organizes and consciously uses digital environments to access information, communicate, and collaborate as a creator and/or consumer;
- is aware of the results of using information technologies for themselves, society, the environment, and sustainable development of society, adheres to ethical and legal norms of information interaction.

During the research, we highlighted particular tasks for studying the subject:

- forming a modern informational worldview in pupils and understanding the paths of its further development;
- forming digital competence and skills for the safe use of information technologies in pupils;
- developing pupils' readiness to apply information and communication technologies in their chosen field in the information society;
- developing thinking, learning and lifelong development skills.

The priority goals of computer science education at the basic level were defined as follows:

- stimulate children's interest in learning;
- create opportunities for the creative development and self-realization of pupils, in particular through the use of digital tools;
- teach pupils to critically evaluate information disseminated by media resources and on the Internet;
- develop the ability to configure a personal information environment and organize its information protection;
- teach how to set learning goals and select digital tools to achieve them;
- use technologies for creating information products in educational and daily activities;
- develop the ability to use information modeling capabilities to solve applied problems;

- develop an understanding of the world of professions in the chosen field and the IT industry;
- develop logical, systematic, structural, and algorithmic thinking in pupils;
- ensure the comprehensive development of the child.

According to the distribution of the general workload of specialized secondary education pupils by class and educational field, computer science is taught at the basic level in the 10th grade for all educational profiles. At the same time, the subject "Computer Science" should be taught according to the model curriculum "Computer Science. 10th grade. Basic level."

The list of topics covered in the basic knowledge section of the State Standard for Specialized Secondary Education defines the content of computer science education at the basic, sufficient, and advanced levels. Based on the list of basic knowledge and corresponding groups of learning outcomes provided in the standard, we have identified four main topics that fully cover the list of issues in the field of computer science education and roughly correspond to the four groups of learning outcomes listed in the State Standard for Specialized Secondary Education.

Table 1.

Proposed distribution of topics for the subject "Computer Science" in 10th grade (basic level)

Semester	Topic
1	**Modern information systems. Personal information environment** The information picture of the world. The place of humans in today's information society. Information technologies in the digital society and promising areas for their development. Field-specific information systems. Their structure and functional features. Information processes in field-specific information systems. Use of information systems based on artificial intelligence. Internet of Things. Smart technologies. Personal information environment and its technical support. Hardware and software for digital communication. Their main characteristics. Selection criteria. Configuration of hardware and software for digital communication. Software and/or hardware failures, their possible causes and ways to eliminate them.
1	**Digital communication. Information security** The global information space as an environment for communication and cooperation. Digital communication and its characteristics in the chosen field. Social networks and professional digital communities. Messengers and chatbots. The digital divide and ways to overcome it.

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1	Cybersecurity in the information environment. Types of cyber threats. Ways to avoid them. International standards of information security. Critical thinking methods for verifying the accuracy of information and the reliability of information sources, counteracting/protecting against manipulation. Information wars. Health-saving approaches in organizing a personal information environment. Digital hygiene, digital addiction. Legal relations and ethical norms in the field of intellectual property and the use of information technologies. Subjects of information relations, their interests and security, prevention of harm to them. The definition of plagiarism. Licensing of intellectual property. Rules for citing and referencing such objects. Digital citizenship. E-government systems. Digital reputation, digital footprint, digital competence of a specialist in a chosen field.
2	**Information product development technologies** Software and digital devices used to solve problems in the selected field. Analysis of requirements for information systems in the subject area and their configuration. Technologies for creating information products. The concept of the life cycle of an information product. Stages of creating an information product. Criteria for evaluating the quality of information products in a selected field. The concept of testing information products. Design of information products, its principles and development tools. Organization of teamwork for the creation of information products. Principles of team interaction. Rules of teamwork Effective interaction and communication, technologies and tools for their implementation during project development. The concept of project management.
	I**nformation modeling as a means of solving applied problems** Modeling in the selected subject area. Stages of building an information model. Types of computer modeling. Data, its types, features of processing and presentation in the selected field. Coding and visualization of digital data in the selected field and features of its use. Infographics. Principles of synthesis and decomposition in solving problems in a selected field. Algorithms for solving problems in a selected field: selection, development, evaluation of effectiveness. Structured data and algorithms for processing it. Software tools for performing calculations and data analysis. Processing sets of similar data.

In the first semester of 10th grade, we propose studying the topics “Modern Information Systems. Personal Information Environment” and “Digital Communication. Information Security” (Table 1). The aim of studying these topics is to review the

computer science material covered in gymnasium and to develop pupils' ability to consciously and effectively use information technologies to organize their own digital educational environment, as well as to deepen their digital communication and information security skills in the information society. One of the main tasks of studying the first topic is to complete the formation of pupils' information worldview. This involves familiarizing pupils with promising areas of digital technology development (such as artificial intelligence, smart systems, Internet of Things) and an overview of industry-specific information technologies. Based on this picture, a pupil can build a personal information environment for solving professional and life tasks using information technologies. The second topic is devoted to the study of information and cybersecurity issues in the information environment, teaching critical thinking methods and their application, particularly in the field of digital communication.

Since the study time for the compulsory educational component common to all profiles is allocated for the entire year of study, we propose to continue the study of computer science in the 2nd semester of grade 10 with the topics " Information Product Development Technologies" and "Information Modeling as a Means of Solving Applied Problems". In the topic " Information Product Development Technologies", students learn more about specialized information technologies. In the course of studying the topic "Information Modeling as a Means of Solving Applied Problems", pupils consider ways to use them to solve applied problems in the chosen subject area.

Compliance with the State Standard and assessment methodology

The structure of the subject " Computer Science" in grade 10 (basic level) is developed in accordance with the structure of the description of the computer science educational field in the State Standard. The four topics proposed by the authors for the 10th grade computer science course at an academic lyceum roughly correspond to the four groups of learning outcomes in the State Standard of specialized secondary education. These groups of outcomes correspond to such key aspects as theoretical knowledge, practical skills, technical skills, and ethical attitudes. The assessment of pupils' learning achievements in a specialized school will be carried out according to the groups of results, that is, each current and semester assessment will correspond to one of the four groups. Both grades by outcome groups and a generalized grade will be given for the year.

- Search, presentation, transformation, analysis, generalization and systematization of data, critical evaluation of information to solve life problems (theoretical knowledge). Assessment of the first group of learning outcomes is aimed at

checking pupils' understanding of the impact of information technology on their own lives, society and the world around them; the ability to work effectively with information; assess the reliability of information from various sources; build information models of real objects, events and processes for better understanding. Tests, surveys, discussions, and informational mini-compositions on the use of digital technologies to solve life situations can be used to test understanding and evaluation of information.

• Creating information products and programs for effective problem solving and creative expression, individually and in collaboration with others, with or without digital devices (practical skills). When assessing the second group of learning outcomes, the teacher checks pupils' ability to develop and implement algorithms, create and debug software projects; develop modular projects; create and process information products using different types of data, as well as skills in teamwork to create an information product. To do this, the pupil can use a variety of exercises, tests, practical work, group and individual projects, and competency tasks. To evaluate various aspects of pupils' group and individual activities in creating information products, it is advisable to use mutual and self-assessment. This promotes reflection, critical thinking, and the ability to self-analyze.

• Organization and conscious use of digital environments to access information, communicate and collaborate as a creator and/or consumer (technical skills). The third group of learning outcomes assesses the teacher's conscious use of information and communication technologies and digital devices to access information, communicate and collaborate as a creator and/or consumer. It assesses how pupils use a wide range of digital devices, organize their own information environment, use communication technologies and networks for their own development, communication and collaboration. That is, when assessing pupils' performance, not only the content of the tasks performed, but also the process of performing them should be taken into account. To assess these skills, the teacher can use rubric-based assessments with appropriate criteria, analyze pupils' actions in the digital environment (whether they choose appropriate tools, how they work in a team online), questionnaires and reflective questionnaires, projects and competency tasks that involve online collaboration, online discussions, debates, etc.

• Understanding the results of using information technologies for oneself, society, the environment and sustainable development of society, compliance with ethical and legal norms of information interaction (ethical attitude). Assessment of

the fourth group of learning outcomes is aimed at checking the formed attitudes of pupils towards ethical and safe interaction in the digital space, compliance with the rules of digital ethics and legal norms when using digital technologies and resources, understanding the positive and negative consequences of the spread of digital technologies and their impact on the environment, society and the individual. To check the formation of relevant attitudes, the teacher can use surveys, discussions, mini-studies, creative essays, reflections, individual and group projects on relevant topics, reflective questionnaires and case studies, etc.

Table 2 shows how many outcomes from each group are achieved in each topic. This information can be used for thematic and semester assessments by learning outcome groups.

Table 2.

Formation of learning outcome groups by topics of the 10th grade computer science course

	I group	II group	III group	IV group
Modern information systems. Personal information environment	✶✶✶ ✶✶		✶✶✶	
Digital communication. Information security	✶✶		✶	✶✶✶ ✶✶
Information product development technologies		✶✶✶ ✶✶✶ ✶✶✶		✶
Information modeling as a means of solving applied problems	✶✶✶ ✶✶	✶✶✶	✶	

Advanced level of study of computer science

The goal of studying computer science at the advanced level of education is to provide pupils with fundamental knowledge in this field, to develop and deepen practical skills in using information technology tools in everyday life and educational activities, to prepare pupils for participation in competitions, research, and to form a strong interest in computer science and related future professional activities or for successful study in higher education.

Pupils who have chosen advanced study of computer science within the profiles with in-depth study of mathematics, computer science and technology of the STEM cluster will study computer science at an advanced level starting from the 2nd se-

mester of the 10th grade. This will be ensured by expanding the content of the basic course, strengthening its applied focus, solving problems of increased complexity and performing creative tasks, educational projects, writing research works, and actively creating new information products in computer science classes.

Thus, the study of computer science at the advanced level is ensured by deepening and expanding the content of computer science education at the basic level in accordance with the State Standard of specialized secondary education and should be carried out according to the model curriculum "Computer Science. Grades 10 - 12. Advanced level". The weekly load is increased to 3 hours per week and can be supplemented by compulsory educational components in the chosen profile of study and elective educational components.

Table 3 shows the special courses for the computer science education field, which will help to expand pupils' knowledge and deepen their skills in modern areas of information technology.

Table 3.

List of special courses for advanced study of computer science

Title of the special course	**Purpose of study**	**Methodological support**
Theoretical foundations of computer science	forming pupils' knowledge of the mathematical foundations of the functioning of digital devices and information technologies, which is the basis for further mastering knowledge in this area	Curriculum, study book, digital application
Databases	developing pupils' knowledge of the theoretical foundations of database design and functioning, skills in creating and managing databases, and the ability to organize data integrity and protection.	Curriculum, study book, digital application
Web Technologies	formation pupils' skills in creating and developing websites, knowledge of basic web development technologies (HTML, CSS, JavaScript), development of the ability to work with tools for creating interactive and functional web resources, development of critical thinking and creative abilities through the creation of their own web projects	Curriculum, study book, digital application
3D modeling / 3D graphics and animation	learning by pupils the basics of creating three-dimensional models with the help of specialized programs, development of spatial thinking, creativity and visualization skills	Curriculum, study book, digital application

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Cybersecurity and information protection	pupils learn the basics of protecting data and information systems from threats in cyberspace	Curriculum, study book, digital application
Robotics	learning by pupils the basics of designing, assembling and programming robots	Curriculum, study book, digital application
Basics of drones control	learning by pupils the basics of control and programming of drones, training flights on drones in a computer simulator	Curriculum, study book, digital application
Artificial intelligence technologies	familiarizing pupils with the basics of artificial intelligence, its application in various spheres of life and the principles of operation of major technologies such as machine learning, neural networks, natural language processing and computer vision	Curriculum, study book, digital application

The special courses proposed in Table 3 would also be appropriate to study as interdisciplinary integrated courses in the structure of other STEM cluster profiles and profiles of other clusters. Their study will help pupils develop skills in using modern information technologies in educational activities and everyday life.

Advanced study of computer science is closely related to mathematics, as it provides the necessary tools for solving problems, understanding complex theoretical concepts, and building effective solutions in various fields of computer science. In this context, learning mathematics not only complements but also actively contributes to a deeper understanding of key concepts and technologies in computer science. On the other hand, the use of information technologies to master mathematical concepts allows us to visualize them and realize their practical value. Thus, combining the study of these two subjects at a deeper level makes both computer science and mathematics education thorough and comprehensive.

According to the typical educational program the profiles with in-depth study of mathematics, computer science and technology of the STEM cluster should also study mathematics and technology at a deeper level. This implies an increase in the number of hours of mathematics study at the expense of hours of choosing a profile of the compulsory educational component. The content of mathematics education within this profile should be expanded and deepened.

For profiles with in-depth study of mathematics, computer science and technology of the STEM cluster, we recommend studying Algebra and Beginning Analysis

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and Geometry separately in grades 10-12. To deepen the mathematical training of pupils studying in profiles with in-depth study of mathematics, computer science and technology of the STEM cluster, depending on educational needs, you can study the following special courses:

- Mathematical logic
- Discrete mathematics
- Theory of probability
- Mathematical modeling
- Data analysis
- Cryptography
- Theory of games
- Mathematics in programming

In-depth study of computer science at school involves its integration with other disciplines, among which a foreign language plays an important role. Knowledge of a foreign language (primarily English) provides access to the best international learning resources, allows you to actively participate in the global exchange of knowledge and experience, and is essential for professional development in the modern technological environment. There are numerous examples of areas where foreign language skills are required: working with English-language software interfaces, working with online resources, programming, reading programming documentation, communicating during team projects, participating in international research and publications, etc.

Pupils' English language skills (speaking, reading reference books, and writing code) are essential for in-depth study of computer science. Therefore, we propose to strengthen this direction by studying separate special courses in English focused on working with information technology. We offer such special courses that can be implemented in specialized secondary education through an elective educational component:

- English in IT
- English for STEM
- English Conversation Club

Besides, pupils have the opportunity to take other courses that are not related to the profile, but are quite important in terms of future professional activity (subjects and special courses of the language and literature cluster and the social and humanitarian cluster). These courses are selected from the list of special courses

(modules) that are mandatory for the formation of certain profiles or elective for other profiles (listed in the typical educational program). Pupils can attend project classes, circles, and clubs that meet the educational needs of learners.

Studying computer science as a part of the elective educational component

A modern person is a member of the information society who probably spends most of his or her life actively using information technology. Therefore, a modern graduate of both a school and a higher education institution should have information and communication competence at the same level as professional (subject) competence.

Studying computer science at the basic level only in the 10th grade of an academic lyceum, on the one hand, and the increased requirements for graduates of general secondary education in terms of their digital competence, on the other hand, necessitate strengthening the study of computer science in all study profiles. This is possible through the study of individual course topics as elective educational components.

The set of elective educational components depends on the study profile chosen by the pupil. For example, in profiles with in-depth study of mathematics, computer science and technology of the STEM cluster, elective educational components are formed to strengthen pupils' mathematical, computer science and technological training by deepening and expanding the content of study. These profiles are focused, in particular, on the pre-professional preparation of pupils for studying in higher education institutions in the specialties of the field of knowledge "Information Technology". In the modern information society, specialists of such profiles are in great demand, especially in the era of digital transformation and the development of artificial intelligence technologies. Computer science and mathematics are a basic component of education for all professions that require an understanding of algorithms, data structures, process modeling, and data analytics. Examples of such professionals include specialists in software development, artificial intelligence and machine learning, cybersecurity, data analysis, financial technologies, robotics, computer graphics, computer systems engineering, control systems, business process optimization, game development, algorithm development for autonomous systems, and optimization of data flows between devices.

The proposed number of hours for basic learning of computer science in the State Standard of specialized secondary education is not enough, even though pupils have been studying this subject since elementary school. Therefore, we propose to integrate into the educational process of any profile of study subjects whose content covers promising modern areas of information technology development. Studying them will allow pupils to become more familiar with the possibilities of

using IT in the subject area corresponding to the chosen study profile. Such subjects (special courses) include:

- Information Security and Media Literacy
- Fundamentals of Media Literacy
- Fundamentals of Artificial Intelligence
- Information Technology in a selected field
- Computer Modeling in a selected field
- Web Technologies and Web Design

The study of these subjects will allow pupils to become more familiar with the possibilities of using information technology in the subject area that will correspond to their chosen study profile.

Another methodological approach to realizing the unique integration potential of the subject "Computer Science", which overcomes the contradiction between the universal nature of information technology and the predominantly isolated teaching of computer science in general secondary education, is the introduction of interdisciplinary integrated courses.

Teaching at a specialized school should be based on problem-based, project-based learning, research methods for applying theoretical knowledge in real-life situations, and be close to real professional activities in accordance with the profile (Conceptual Framework, 2024). The introduction of interdisciplinary integrated courses with a practical focus can provide a synergistic effect of combining computer science and other subjects, and help pupils form a holistic picture of the world. Such courses can complement and expand the content of subjects at the basic level, and be part of a variable educational component both within and outside the profile. Interdisciplinary integrated courses for non-informatics profiles of the STEM cluster can be:

- Digital Technologies in Natural Sciences
- Modeling of Natural Processes with IT
- Digital Cartography
- Geographic Information Systems and Environmental Monitoring
- Fundamentals of Bioinformatics: Genome and Protein Analysis
- Programming for Ecologists and Natural Scientists

General secondary education institutions already have experience in introducing interdisciplinary integrated courses in basic education, including STEM (integration of natural, mathematical, technological, informatics, social and health education) and Robotics (integration of natural, mathematical, technological and informatics education).

The above topics of the subject " Computer Science" in grade 10 (basic level): "Information product development technologies" and "Information modeling as a means of solving applied problems" become an integrative basis for selecting content and building course programs.

The implementation of this methodological approach consists of three consecutive stages:

- Conceptualization and goal setting. At this stage, the curricula of selected basic-level subjects are analyzed to identify "intersection points" - topics where subjects complement each other to solve real professional problems, and knowledge and skills can be combined. The integrative goal of the course is defined not as the sum of two subject goals, but as a new, synergistic goal aimed at forming specific competencies and creating an educational product.
- Choosing a didactic model and integrating content. Interdisciplinary integrated courses should be focused on solving real-world problems, and pupils' learning activities should be built around the implementation of complex projects. Teaching of courses can be implemented as joint teaching by several subject teachers (co-teaching or team teaching) or by one teacher with the relevant competencies.
- Development of educational and methodological support and assessment tools in the course. This stage involves creating a course curriculum, guidelines for project implementation, practical work, etc., selecting digital tools, and developing assessment criteria. The evaluation system should be comprehensive, taking into account both the quality of the final product and the process of working on it, the level of subject knowledge and digital skills.

Examples of such courses include:

- Digital Philology (Ukrainian Language and Literature and Computer Science);
- Digital Design (Arts, Technology and Computer Science);
- Analysis of Historical and Sociological Data (History, Civic Education and Computer Science)

In such courses, computer science turns into a universal tool for cognition, creativity, and problem solving, and integration through project activities ensures the comprehensive achievement of all groups of results in the computer science education field, increases pupils' motivation, and forms holistic, interdisciplinary thinking, which is critical for successful self-realization in the modern world. This makes it possible to effectively implement the requirements of the new State Standard of Specialized Education.

Continuous informatization and digitalization of educational, scientific and other spheres of human life form a number of requirements for the training of graduates of higher and general secondary education. In particular, the requirements for the formation of digital (information and communication) competence of a school graduate are growing. To achieve these requirements, it is necessary to rationally approach the formation of an educational program of a certain profile of study at an academic lyceum, while enhancing the training of pupils in computer science. The study of computer science should not be limited to the 10th grade at the basic level. It is necessary to expand the study of information technology tools for pupils in certain fields (in accordance with the chosen profile of study) through elective educational components, in particular, interdisciplinary integrated courses.

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