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CHAPTER 4. THEORETICAL BASIS OF THE USE OF DIGITAL TECHNOLOGIES IN TECHNOLOGY LESSONS IN GENERAL SECONDARY EDUCATION INSTITUTIONS

4.1. Possibilities of Using Digital Technologies in the Educational Process of General Secondary Education Institutions

The current stage of education development is characterized by a deep digital transformation, which radically changes the forms, methods and content of education in general secondary education institutions. The development of the information society, the large-scale spread of network technologies, mobile devices, cloud services, interactive multimedia environments and analytical tools lead to the emergence of new educational models focused on individualization, flexibility and openness of the educational process. Digital technologies not only complement the traditional education system, but also form a new paradigm, the center of which is the active activity of the student, high intensity of interaction, the use of various types of visual, text and interactive information, constant feedback and the possibility of self-control and self-assessment. The use of digital technologies in general secondary education institutions (GSEI) has become a necessary condition for the formation of a competent modern student, able to effectively use information resources, work with large volumes of data, analyze information, create their own digital content and function responsibly in a digital society. The integration of digital tools into the educational process contributes to the development of key competencies defined by educational standards: the ability to learn throughout life, information and digital competence, mathematical and natural literacy, social and civic activity, entrepreneurship and innovation.

The digitalization of education is not limited only to technical support. It involves comprehensive changes in the structure of the educational process: new approaches to lesson planning, modernization of methods and forms of work, updating the content of curricula, training teachers to use digital tools, reorientation from reproductive learning to research and project-based learning. Therefore, an analysis of the possibilities of using digital technologies in GSEI is necessary to substantiate the methodology for their application in lessons, in particular in technology lessons, where digital activity has particular importance.

Therefore, the digitalization of the educational space has become an integral part of the modern world, and its development is directly related to increasing the competitiveness of the state. For Ukraine, the digital transformation of education is of strategic importance, as it ensures an increase in the level of accessibility and quality of education, allows the introduction of new approaches to teaching and assessment, and contributes to the formation of skills in students that determine success in professional and personal activities. One of the important reasons for the relevance of digitalization is the active penetration of digital technologies into the daily lives of students. Children of the modern generation from an early age have experience using smartphones, tablets, computers, and Internet resources, which forms a different style of information perception, a different speed of data processing, and new needs in education. In the

GSEI, digital technologies have long ceased to be an additional tool. Against the background of global challenges, such as the COVID-19 pandemic and a full-scale invasion by an aggressor country, digital tools have become the main channel for ensuring the continuity of the educational process. The experience of mass distance learning has made it possible to see the importance of maintaining the digital readiness of the GSEI and teachers. At the same time, digitalization has created new opportunities that should be integrated not only into distance or blended learning, but also into the traditional face-to-face educational process.

Digital technologies allow you to diversify forms of activity, use individual, group and differentiated ways of working, provide instant access to various information resources, organize feedback between the teacher and students. In addition, digitalization opens up new opportunities for pedagogical diagnostics, analytics of educational achievements, and the creation of individual educational trajectories.

Thus, digital technologies in education are usually understood as a set of technical and software tools that ensure the creation, processing, storage, transmission and dissemination of educational information in digital format. Such tools include hardware devices (computers, tablets, interactive whiteboards, mobile phones), software products (educational platforms, virtual environments, electronic journals, digital textbooks), network technologies, means of communication and multimedia tools.

To systematize various digital tools, they are classified by functional purpose:

- information technologies (access to educational resources, electronic textbooks, open databases);
- communication technologies (platforms for video conferences, electronic diaries, chats, forums);
- organizational and management systems (electronic journals, educational data analytics systems);
- interactive technologies (simulators, interactive whiteboards, virtual laboratories);
- modeling and simulation technologies (VR, AR, 3D modeling);
- cloud services (collaboration with documents, information storage);
- adaptive and intelligent technologies (personalization of learning, automatic assessment).

Each of these groups of tools has its own didactic potential, and together they create a comprehensive digital educational environment in which the student has the opportunity not only to consume ready-made information, but also to actively create new content, collaborate with other participants in the educational process, and engage in self-study.

Distance and blended learning platforms are one of the most important digital tools of a modern school. They not only provide the organization of the educational process, but also allow the teacher to create their own courses, systematize educational materials, conduct testing, track progress, and provide individual consultations.

One of the key functions of such platforms is the ability to model a flexible educational environment. The student can learn at his own pace, independently process

materials, return to complex topics, work asynchronously, and complete tasks at a time convenient for him. For the teacher, this creates an opportunity to organize differentiated learning and individual support.

Distance learning platforms also contribute to the integration of formative assessment elements. For example, a teacher can provide quick feedback, apply different types of tasks, use performance analytics to adjust further learning. Thanks to digital tools, the transparency of assessment and individual responsibility of the student are significantly increased.

Interactive online tools are one of the most dynamic areas of digitalization of learning. They make it possible to diversify the learning process, make it more flexible and creative, which is especially important for students in primary and high school.

Unlike traditional methods, interactive digital resources involve two-way interaction between the student and the educational content. The student does not just view information, but interacts with it, modifies it, creates his own options, can test his hypotheses and immediately get the result.

Interactive digital tools include online simulators, simulations, resources for creating interactive tasks, mini-games, test modules, interactive maps, mind maps and visualizations. Due to their interactivity, such tools have significant potential in developing students' cognitive activity, maintaining interest, and forming practical skills.

A significant advantage of interactive tools is the ability to adjust to different levels of student readiness. For example, simulators can automatically adjust the complexity of tasks, answer options, pace of completion, and number of repetitions. This creates conditions for differentiation of learning and allows each student to move at their own pace, which is an important requirement of a modern competency-based approach.

No less important is the motivational aspect of using interactive digital resources. They allow you to include elements of the game, competition, and instant reaction to student actions in learning. Due to this, students' interest in completing educational tasks increases, and they are more willing to engage in activities that require concentration, repetition, or analysis. In developing motivation, the ability to visualize learning results, for example, in the form of points, levels, ratings, or graphic successes, is especially important.

The use of multimedia resources expands the boundaries of the classroom space. The lesson may include video demonstrations, interactive presentations, fragments of experiments, dynamic models of technological processes, animations or recordings of real objects and phenomena. This enhances the clarity of teaching and makes it possible to show processes that are difficult to reproduce in the classroom (for example, complex production operations, the operation of mechanisms, the functioning of technological equipment). A special place is occupied by virtual laboratories - environments in which students can conduct experiments, perform measurements, change model parameters and observe the results. Such laboratories allow you to reproduce experiments that are difficult to implement due to lack of equipment or safety restrictions. In GSEI they are

especially useful in physics, chemistry, technology, computer science and the basics of entrepreneurship.

Modern electronic educational resources significantly go beyond traditional textbooks. They contain interactive elements: videos, animations, tasks with automatic verification, hypertext links, multimedia explanations, interactive cards and self-control modules. Their advantage lies in the combination of theoretical material with practical exercises.

The compactness and mobility of electronic resources allow students and teachers to use them at any time. Students can do homework, review theoretical materials, listen to explanations, take tests, even when outside the school. The teacher gets the opportunity to organize blended learning: part of the material is studied independently, part - in the classroom with the teacher.

Electronic textbooks are convenient in that they can be quickly updated. If traditional printed editions are used for years, then digital versions can be supplemented and updated in accordance with changes in curricula. This makes the educational material relevant and close to the modern development of science and technology.

The use of electronic resources is an effective means of forming information and digital literacy. Students work with different types of information: text, graphic, audio, video. Such experience contributes to the development of the ability to analyze information, draw conclusions, systematize material, and critically evaluate data.

Electronic educational environments (learning portals, learning systems, virtual classrooms) allow for the systematic and structured presentation of material. The teacher has the opportunity to create his own educational modules, combine materials into logical topics, monitor student progress, and use a bank of digital resources. Such environments provide convenient navigation, the ability to quickly search for materials, and individualized access to educational resources.

Cloud services have become one of the key tools of the modern digital school. Their main advantage is that they provide the ability to simultaneously interact with multiple users in real time. Cloud technologies allow students to create projects, prepare joint presentations, and work with texts, tables, and images even while in different places.

Cloud services develop teamwork skills in students, one of the key competencies of the modern world. Shared documents show the contribution of each participant, you can leave comments, edit the text, track the history of changes. This helps to increase student responsibility and develop skills in constructive cooperation.

For teachers, cloud technologies open up the opportunity to organize project activities even in classes with different levels of preparation. Students can carry out joint projects, conduct mini-research, create digital models of objects, prepare descriptions of educational experiments, and maintain electronic portfolios that store the results of their activities.

It is important that cloud services reduce the need for printed materials. The teacher can create a shared document for each class, where educational materials, lesson

plans, instructions, teaching materials, and homework will be placed. Students can supplement the materials, ask questions, and send their own works.

Cloud technologies also open up the possibility of organizing a student's electronic portfolio. Such a portfolio stores his projects, creative works, test results, photos of products made during technology lessons, video reports, that is, all those materials that allow you to track individual progress. This forms responsibility and awareness of your own educational trajectory in the student.

The digitalization of education creates fundamentally new opportunities for individualizing the educational process. One of the key tools in this direction is digital analytics systems that allow you to track student progress, identify their strengths and weaknesses, predict learning outcomes, and adjust their further individual trajectory.

Digital analytics is based on data automatically generated by distance learning platforms, electronic journals, electronic textbooks, and interactive exercises. Such data includes task completion time, number of attempts, typical errors, activity level, speed of transition between modules, and the proportion of correct answers. Thanks to this, the teacher can quickly identify students who need additional assistance and those who can perform tasks of increased complexity.

Adaptive technologies are the next step in the development of individualized learning. They work on the principle of intelligent algorithms that automatically adjust the educational content to the level of preparedness of a particular student. If the student performs the task easily, the system offers more complex options; if difficulties arise, the tasks are simplified or tips are added. Thus, the pace and complexity of learning become individual, and the learning process is more effective.

The use of adaptive technologies in GSEI contributes to the formation of positive learning motivation. The student does not feel overloaded or excessively easy - the tasks correspond exactly to his level. In addition, adaptive systems allow students to independently plan their study time, work at a convenient pace and receive instant feedback.

The digitalization of education is impossible without the formation of a digital culture in students. Digital competence consists not only of technical skills, but also of responsibility, a critical attitude towards information, safe behavior on the Internet, the ability to protect one's personal data, compliance with copyright and rules of communication in the digital environment.

Digital security is one of the key components of the competency approach. Students must understand the risks of the digital environment: malware, phishing, manipulation, false information, dangerous online communities. It is important to teach students to recognize these threats and use protection tools - complex passwords, two-step authentication, responsible privacy settings.

Ethical aspects of digital interaction include respect for others, tolerant communication, the inadmissibility of cyberbullying, and adherence to the norms of academic integrity. The teacher plays an important role in shaping such a culture: he must not only demonstrate examples of responsible behavior, but also systematically

include conversations, exercises and tasks aimed at developing digital ethics in the educational process.

Digital culture also involves the ability to critically evaluate information, which is especially relevant in the era of information wars and the mass distribution of unreliable materials. Students must learn to check sources, analyze the reliability of information, not succumb to manipulation and draw their own conclusions based on facts. This forms information immunity - the ability to resist negative information influence.

In order for digital tools to work effectively, appropriate conditions must be created. Among them are:

- systematic material and technical support of the school - updated devices, high-speed Internet, accessible multimedia tools;
- digital competence of teachers - the ability to plan lessons using digital tools, mastery of modern platforms, the ability to integrate digital tools into the methodological system;
- development of a school digital security policy - clear rules for using technology, responsibility for electronic communication, formation of a culture of safe use;
- didactic expediency of choosing a digital tool - each tool should meet the purpose of the lesson and provide a practical result;
- combination of digital and traditional activities - it is important not to replace traditional methods, but to harmoniously combine them, ensuring a balance between digital and real types of work;
- support for students in independent activity - the teacher should teach students to work with resources, and not just give ready-made links [14].

Pedagogical conditions provide not just the technical implementation of means, but the pedagogically justified, effective use of digital technologies.

Thus, digital technologies open up wide opportunities for the modernization of the educational process in GSEI. They provide interactivity, increase student motivation, allow organizing individualization of learning, support the development of key competencies and form digital literacy.

Digital resources, such as educational platforms, cloud services, electronic textbooks, virtual laboratories and adaptive systems, significantly enhance the didactic capabilities of the teacher. At the same time, the effectiveness of their use depends on the level of training of teachers, the school's readiness for digital transformation, the availability of technical conditions and the formed digital culture.

Therefore, digitalization is an integral part of the modern educational process, and its correct use contributes to the development of students' independence, their critical thinking, creativity and ability to work with information - competencies that are key for life in the modern world.

4.2. Introduction of Elements of Educational Automation and Robotics in Technology Lessons in General Secondary Education Institutions

In the conditions of a modern mechanized and digital economy, the ability to work with automated systems, robotic devices and digital technologies is becoming a necessary competence for a graduate of GSEI. Changes in the field of production, transport, energy and consumer electronics determine the need to form basic technical competencies in students already at the high school level, in particular within the framework of the subject "Technology".

Educational automation and school robotics are areas that not only expand the content of the subject, but also create conditions for the formation of engineering thinking, the development of 21st century competencies, increasing students' motivation for learning and professional self-determination. In technology lessons, students gain practical experience in creating, programming and debugging automated systems, modeling technological processes, working with electronic components and designers.

A modern school has the function not only to transfer knowledge, but also to provide students with a base for further education in the field of engineering, technology, IT and robotics. In this regard, the introduction of elements of automation and robotic systems into the educational process is an important direction of modernization of technological education, as it allows students to gain competence experience that meets the requirements of the modern economy and technical development.

The use of educational automation and robotics in high school is based on several key conceptual approaches that determine the structure, content and methodology of training. Let's consider each of them:

1. Competency approach – involves the formation of students not only knowledge about technical systems, but also the skills to apply them in practical activities. Robotics allows you to implement this approach as effectively as possible, since students work with real devices, perform specific tasks, create projects and models, and analyze the results obtained.

The competency approach in robotics forms: technical literacy, engineering thinking, the ability to analyze and synthesize, the ability to work in a team, and skills in using digital tools for design and programming.

2. Project-oriented approach – here robotics is organically combined with project activities, which are a mandatory component of the educational subject "Technology". Students work on the creation of automated systems or robotic mechanisms, perform the role of engineers, programmers, designers, researchers. Each project has a specific goal, stages of development, success criteria and the ability to demonstrate the result.

The project approach gives students the opportunity to: independently plan work, choose materials and technologies, program the behavior of the device, experiment and correct errors, present the finished product.

3. STEM/STEAM approach – the integration of natural sciences, technology, engineering, art and mathematics ensures the comprehensive development of students.

In robotics lessons, students simultaneously apply knowledge of physics (electricity, mechanics, sensors), mathematics (algorithms, proportions, measurements), computer science (programming, logic), technologies (design, materials science).

The STEAM approach promotes the formation of creative vision and the ability to think systematically, since students do not simply follow instructions, but create functional models that have an aesthetic and practical aspect.

4. Practical-oriented approach – a feature of studying automation and robotics is the need for constant practical application of knowledge. Students work with components, create circuits, connect sensors, conduct testing, program microcontrollers. This forms sustainable technical skills and develops labor competence.

Technology lessons have a unique potential for introducing automation and robotics. Unlike computer science, which focuses on programming, and physics, which considers the laws of mechanics, technology lessons combine different fields in one practical environment: engineering, electronics, modeling, materials, design, safety and work organization.

It is technology classes that allow:

- conduct practical work on assembling electronic circuits;
- create robotic systems;
- program control algorithms;
- test designs in real conditions;
- modify and improve models;
- carry out project activities in teams.

Such classes are the first step towards introducing students to engineering specialties: automation, mechatronics, electronics, robotics, industrial design. The formation of engineering skills at school contributes to professional self-determination and increases the competitiveness of future graduates.

The peculiarities of high school determine the importance of developing students' independence, critical thinking, the ability to work in a team and make decisions. Robotics meets these requirements, as it contributes to the development of higher cognitive processes: analysis, synthesis, design, modeling, evaluation.

From a psychological and pedagogical point of view, robotics provides:

- high motivation – students see the result of their work immediately;
- increased level of involvement – project tasks arouse interest and reduce passivity in the lesson;
- development of perseverance – the need to find errors, improve the design, and test repeatedly;
- formation of responsibility – students themselves manage the process of creating a device;
- development of communication skills – teamwork, distribution of roles, discussion of solutions;
- ability to be creative – creation of unique models and non-standard solutions;
- increased self-esteem – achieving a successful result after a series of experiments.

Robotics meets the natural curiosity of high school students, opens up opportunities for the practical implementation of their interests, forms a positive learning experience and gives a sense of success.

For the effective implementation of educational automation and robotics in the educational process, it is necessary to form an optimal material and technical base that will provide the opportunity to conduct practical classes, carry out projects and master the basics of programming and design. Depending on the level of school provision, you can use both simple entry-level designers and complex educational sets with microcontrollers:

1. Educational robotic designers – the most common in the educational space are modular robotic sets that allow students to create basic designs and program their behavior. Such sets include designers based on plastic elements that can be combined with each other in various configurations, as well as equipped with sensors and motors. The advantages of such kits are: ease of use, the ability to quickly construct models, visual programming, accessibility for students who have not previously worked with robotics, modularity and the ability to expand functions.

Such kits allow students to familiarize themselves with the basics of mechanics, the structure of robotic systems, the basic principles of operation of electric motors, sensors and microprocessor controllers.

2. Microcontrollers and automation boards – for high school, the use of microcontroller platforms is especially relevant, which allow you to perform more complex projects that are close to real technical tasks. Microcontrollers are the basis of automated systems and allow students to program the operation of various devices, create control systems and analyze signals from sensors. Typical elements of such kits: microcontroller board, sensor modules (light, distance, temperature, motion, humidity), servo motors, stepper and collector motors, relays and load control modules, power supplies, wire connections, breadboards.

By working with microcontrollers, students gain insight into real-world automated systems: sensors in household appliances, production line controls, intelligent monitoring systems, etc.

3. Software for robotics and automation – educational platforms used in schools provide for both block programming (visual) and text programming (based on the syntax of programming languages). It is advisable for students to gradually move to text programming, as it is the basis of the professional skills of a process engineer, programmer, and automation specialist. The software allows you to: create and edit algorithms; configure sensor parameters; test the program in simulation mode; upload code to the microcontroller; visually monitor the system status; analyze the device operation in real time.

The combination of software and real technical devices provides duality of learning: students see the result of their actions immediately after making changes to the code.

In order for robotics to become not just an interesting addition, but a full-fledged component of the educational process, it is necessary to adhere to certain methodological principles. They ensure systematicity, logic and efficiency of learning.

1. The principle of sequence and gradual complication – the educational material should be structured in such a way that students: first get acquainted with the basic concepts (electrical circuits, sensors, servo motors); then master the basics of programming; perform simple practical work; gradually move on to complex projects.

Such a consistent increase in complexity provides a deep understanding of the technical system, rather than superficial execution of instructions.

2. The principle of integration with other subjects – robotics should not exist separately from other educational lessons. It naturally integrates with physics, mathematics, computer science and labor training, which creates conditions for interdisciplinary interaction. A technology teacher can involve students' knowledge from other subjects to reveal the practical significance of the educational material.

3. The principle of problem-solving – students should work not only according to ready-made instructions, but also solve real technical problems. This may be a problem of imperfect design, incorrect operation of a sensor, inaccurate algorithm or unstable power supply. Finding a solution creates conditions for the development of critical thinking and engineering ingenuity.

4. The principle of activity – the main type of students' work should be practical activity. Robotics is not a theoretical subject: up to 70% of the time should be devoted to designing, connecting, programming, testing and modifying models. Theory is provided in the amount necessary to perform practical tasks.

5. The principle of the research approach – students should conduct mini-research: analyze the operation of mechanisms, compare results, change system parameters, make adjustments. The research approach contributes to the development of engineering thinking and understanding of patterns.

Robotics lessons have a specific structure that combines theoretical information, demonstrations and practical activity. A typical lesson may consist of the following stages:

1. Updating knowledge – students repeat basic concepts (electrical circuits, algorithms, sensor functions).

2. Explanation of new material – a brief theoretical explanation is given; a demonstration of the operation of the device or algorithm is given.

3. Modeling and design planning – students develop a model, discuss solution options, choose a connection diagram.

4. Design and assembly of the device – students perform the main technical work.

5. Programming – creating or modifying a program to control the device.

6. Testing and debugging – finding errors, optimizing the algorithm, improving the design.

7. Analysis of results – students present the results obtained, compare the operation of different models.

8. Reflection and discussion of difficulties – students determine what was successful and what needs improvement.

This structure corresponds to the logic of engineering design and ensures the integration of theory and practice.

Project activity is a key tool for introducing robotics in high school. It allows students to apply the knowledge they have gained, develop technical thinking and teamwork skills. The project organization methodology involves several main stages:

1. Formulation of the project task – the teacher together with the class determines the problem that needs to be solved using an automated system or robot. This can be, for example, the creation of an automatic irrigation system, an object sorting robot, a simple transport robot.

2. Project planning and distribution of roles – students develop stages of implementation, select materials, determine work algorithms and distribute responsibilities in the team (designer, programmer, tester, analyst).

3. Manufacturing and assembly of the structure – practical work includes designing the mechanical part, connecting electronic components and installing sensors.

4. Programming and configuration – students create a program that controls the robot, conduct testing and debugging of the system.

5. Testing and improvement – the project goes through several testing cycles, in which students analyze errors, optimize algorithms and improve the design.

6. Presentation of results and reflection – each group demonstrates the operation of its device, discusses difficulties and achievements, compares the results with the initial task. Students receive feedback from the teacher and classmates.

Project activities form a complex of competencies in students: technical, social, managerial and creative.

For the successful use of robotics in the educational process, it is necessary to create certain pedagogical conditions:

1. Systematic learning – robotics is integrated into the curriculum gradually, starting with simple tasks and moving on to complex projects.

2. Availability of material and technical resources – students must have access to construction kits, microcontrollers, sensors and software.

3. Teacher training – the teacher must have knowledge of the basics of automation, electronics, programming and methods of working with robotic kits.

4. Organization of group work – students work in teams, which contributes to the development of communication skills, cooperation skills and responsibility.

5. Support for creative activity – it is important to stimulate the search for non-standard solutions, encourage experimentation and independent search for optimal options.

6. Use of the principle of scientific research – students analyze the results obtained, compare them with the expected ones, draw conclusions and suggest improvements.

The introduction of robotics in high school increases students' motivation to learn. Practical activity, visible results of work, the opportunity to implement their own ideas contribute to the formation of a positive attitude towards the educational process.

Robotic projects satisfy students' natural curiosity, form an interest in exact sciences and technologies, and develop independent work skills.

In addition, working in teams helps to form social competencies: communication, cooperation, mutual support, the ability to listen and take into account the opinions of others.

Thus, the introduction of elements of educational automation and robotics allows: to increase students' motivation to learn; to develop engineering thinking and technical competencies; to form practical skills in designing, programming, and debugging robotic systems; to promote the development of teamwork, communication, and responsibility; to integrate knowledge of physics, computer science, mathematics, and technology into practical projects.

Robotics in technology lessons not only increases the effectiveness of learning, but also forms key competencies in high school students necessary for life and professional activity in the modern world.

So, in this section of the collective monograph, we analyzed the possibilities of using digital technologies in the educational process of GSEI and introducing elements of educational automation and robotics in technology lessons.

The introduction of digital technologies into educational lessons allows for interactivity, individualization and differentiation of learning. The use of multimedia materials, interactive platforms, electronic textbooks and software contributes to the formation of key competencies of the 21st century in students: information literacy, critical thinking, independent learning skills.

The use of robotic kits, microcontrollers and programmable devices in technology lessons creates conditions for the development of technical thinking, engineering skills and practical competence of students. Working with real objects and systems allows students to see the result of their activities, experiment and analyze the data obtained.

Practical activities in robotics and automated systems significantly increase students' interest. The motivational effect is achieved through the opportunity to create their own projects, solve real problems and demonstrate results. This contributes to the formation of a positive attitude towards the educational process and the development of independence.

Effective implementation of digital technologies in lessons is ensured by adhering to the principles of consistency and gradual complication of educational material, integration of knowledge from other subjects, problem-based, activity-based and research-based approaches. The use of project activities allows students to put knowledge into practice and develop a set of competencies.

For the successful use of digital technologies and robotics, a systematic organization of the educational process, the availability of a material and technical base, teacher training, support for students' creative activity, organization of group work and creation of conditions for research activities are necessary.

The integration of digital technologies and robotics into the educational process contributes to improving the quality of education, the formation of technical, engineering and information competencies, the development of creative and critical

thinking, as well as the preparation of high school students for professional self-determination and further education in technical, information and engineering fields. Thus, the analysis of the possibilities of using digital technologies and the implementation of elements of educational automation and robotics confirmed their important role in the modernization of the educational process of GSEI s and the formation of competencies necessary for successful functioning in the modern information and technological society.

Reference

1. Барна О.В., Балик Н.Р. Впровадження STEM-освіти у навчальних закладах: етапи та моделі. *STEM-освіта та шляхи її впровадження в навчально-виховний процес: збірник матеріалів I регіональної науково-практичної веб-конференції, Тернопіль, 24 травня 2017 р.* Тернопіль : ТОКІППО, 2017. С. 3–8.
2. Бойчук В.М. Інформаційно-комунікаційні технології у професійно-технічній освіті: [монографія] / А.М. Гуржій, Р.С. Гуревич, М.Ю. Кадемія та ін.; за ред. академіка НАПН України Гуржія А.М. у 2 частинах. Ч.2. Вінниця : Нілан-ЛТД, 2016. С. 329–357.
3. Босова Л.Л. Інформатика : підручник. Чернігів : БІНОМ, 2007. 208 с. : іл.
4. Вольянська С.Є. STEM-освіта. *Довідник сучасного педагога.* Харків : Вид. група «Освіта», 2016. С. 124–125.
5. Воронін Ю.А. Комп'ютеризовані технології у процесі підготовки вчителя. *Педагогіка в освіті.* 2003. № 8. С. 53–59.
6. Гребенюк О.С., Гребенюк Т.Б. Теорія навчання : навч. для студ. вищ. навчань, закладів. Херсон : ВЛАДОС-ПРЕС, 2003. 384 с.
7. Жалдак М.І. Педагогічний потенціал інформатизації навчального процесу. *Розвиток педагогічної і психологічної наук в Україні 1992 – 2003 : зб. наук. пр. до 10-річчя АПН України.* Харків : Академія педагогічних наук України. Ч. 1. 2002. С. 371–383.
8. Іващук К.О. Інформаційно-комунікаційні технології – як сучасний засіб в освіті [Електронний ресурс]. Юіасна оцінка : освітній портал. URL : <http://klasnaocinka.com.ua/ru/article/informatsiinokomunikatsiini-teklmologiyi-yak-suc.html> (дата звернення: 14.11.2025).
9. Коберник О.М. Креативні технології навчання : навчальний посібник. Умань : ВПЦ «Візаві», 2016. 272 с.
10. Коберник О.М. Проектна діяльність – основа розвитку творчої активності учнів на уроках трудового навчання. *Молодь і ринок.* 2004. № 2. С. 36–41.
11. Коберник О.М. Теорія і методика профільного технологічного навчання учнів в старшій школі: навчальний посібник. Умань : ФОП Жовтий, 2013. 365 с.
12. Кузьменко С.В. Робототехніка в школі. *Зб. матер. V Всеукр. наук.-пр. конф. «Наукова молодь – 2017».* Київ : ІТЗН НАПН України, 2017. С. 287–290.
13. Матвієнко О.В. «Електронний підручник» у системі дидактичного забезпечення комп'ютерних технологій навчання. *Нові технології навчання.* 2014. Вип. 29. С. 132–135.
14. Онищенко С.В. Візуалізація дидактичних елементів як сучасна стратегія навчання. *Теоретико-методичні аспекти технологічної освіти учнівської та*

студентської молоді засобами естетичної культури та дизайну : збірник матеріалів Всеукраїнської науково-практичної конференції кафедри теорії і методики технологічної освіти Полтавського національного педагогічного університету імені В.Г. Короленка (24-25 вересня 2020 року) / За заг. ред. проф. В.П. Титаренко, А.Ю. Цини; Полтав. нац. пед. ун-т імені В.Г. Короленка, каф. теорії і методики технологічної освіти. Полтава : ПНПУ імені В.Г. Короленка, 2020. С. 117–120. Режим доступу : <http://dspace.pnpu.edu.ua/handle/123456789/17182>

15. Онищенко С.В. Використання ІКТ в педагогічній діяльності вчителя-предметника. *Неперервна освіта нового сторіччя : досягнення та перспективи : збірник наукових праць ЗОІППО за матеріалами II Міжнародної науково-практичної конференції (18-25 квітня 2016 р.)*. 2016. № 2 (24). С. 74–78.

16. Онищенко С.В. До проблеми викладання технічних дисциплін при підготовці спеціалістів за напрямом «Професійна освіта. Енергетика». *Наукові записки Бердянського державного педагогічного університету. Серія: Педагогічні науки : зб. наук. пр.* Випуск 2. Бердянськ : БДПУ, 2022. С. 304–310. URL : <https://dspace.bdpu.org.ua/handle/123456789/855> (дата звернення: 14.09.2025)

17. Онищенко С.В. Застосування ІКТ в викладанні дисциплін циклу машинознавства під час підготовки майбутніх учителів технології. *Збірник наукових праць Уманського державного педагогічного університету імені Павла Тичини [гол. ред.: М.Т. Мартинюк]*. В 1. Умань : ФОРМ Жовтий О.О., 2015. С. 252–257.

18. Онищенко С.В. Місце дисциплін енергетичного циклу у формуванні професійної компетентності студентів енергетичних спеціальностей. *Development strategiest for modern education and science : Materials of the III International research and practical internet conference (February, 28, 2022) : collection of abstracts. Zdar nad Sazavou : «DEL a.s.»*, 2022. Р. 27–30. URL : <https://dspace.bdpu.org.ua/items/c05fdf35-ebc5-4808-870f-ddbf52eefcad> (дата звернення: 15.09.2025)

19. Онищенко С.В. Психолого-педагогічні особливості впровадження засобів мультимедіа в освітній процес підготовки фахівців енергетичної та технологічної галузей. *Науково-методичні засади підвищення якості підготовки фахівців-педагогів системи професійної та технологічної освіти в умовах сучасності : колективна монографія [за заг. ред. С.В. Онищенка]*. Одеса : Олді+, 2024. Розд. 7. С. 124–139. URL : <https://dspace.bdpu.org.ua/handle/123456789/3378> (дата звернення: 14.09.2025)

20. Онищенко С.В. Технологія формування професійної компетентності майбутніх учителів технології. *Науково-дослідні публікації. Серія «Інформатика і техніка»*. 2014. № 7 (11). С. 44–52.

21. Онищенко С. В. Формування професійної компетентності майбутнього вчителя технології засобами інформаційно-комунікативних технологій. *Науковий часопис Національного педагогічного університету імені М.П. Драгоманова. Серія №5. Педагогічні науки: реалії та перспективи*. Випуск 31. Київ : Вид-во НПУ імені М.П. Драгоманова, 2012. С. 154–159.

22. Пуха Г.П. Сучасні технології в освітньому процесі. *Вісник сучасної освіти*. 2021. № 2(29). С. 59–62.

23. Савічева Т.В. Змішане навчання у сучасному освітньому процесі : необхідність та можливості. *Вісник сучасної освіти*. 2021. №3 (30). С. 92–96.
24. Струтинська О.В., Василюк А.Д. Навчання освітньої робототехніки в українських школах : напрями впровадження. *Інженерні та освітні технології*. 2019. Т. 7. № 3. С. 122–138.
25. Терещук А.І. Методика організації проектної діяльності старшокласників з технологій : метод. посіб. для вчителів, навч. прогр., варіат. Модулі. Київ : Літера ЛТД, 2010. 128 с.
26. Федоров А.І. Підхід до вдосконалення рівня підготовки майбутніх фахівців у сфері інформаційних технологій. *Сучасні технології у науці та освіті. СТНО-2017 : зб. тр. міжнар. наук.-техн. та наук.-метод. конф.* 2017. С. 101–103.
27. Fletcher J.D. Education and Training Technology in the Military. *Science*. 2009. №2. P. 72–75.
28. Onyshchenko S. Formation of ICT-Competence of the Future Specialist in the Energy Industry in the Conditions of Informatization of Education (Distance Education). *The latest foundations for the development of production, science and education – 2023 : collective monograph*. Nová Dubnica : NES Nová Dubnica s.r.o., 2023. P. 37–55. URL : <https://dspace.bdpu.org.ua/handle/123456789/118> (дата звернення: 16.09.2025)
29. Onyshchenko S. New Information Technologies in the Conditions of Distance Education. *Наукові записки Бердянського державного педагогічного університету. Серія: Педагогічні науки : зб. наук. пр.* Випуск 3. Бердянськ : БДПУ, 2022. С. 172–178. URL : <https://dspace.bdpu.org.ua/handle/123456789/378> (дата звернення: 16.09.2025)
30. Onyshchenko S. Psychological and Pedagogical Foundations of the Application of Modern Information Technologies in the Educational Process of Future Specialists in the Energy Industry. *European vector of modern education, science and production – 2023 : collective monograph*. Nová Dubnica : NES Nová Dubnica s.r.o., 2023. P. 57–73. URL : <https://dspace.bdpu.org.ua/handle/123456789/117> (дата звернення: 16.09.2025)
31. Onyshchenko S. Theoretical Foundations of the Formation of Graphic and Graphical and Informational Competences of Students of Energy Specialties on the Basis of Training at a Pedagogical University. *European vector of modern education, science and production – 2024 : collective monograph*. (Series of monographs Slovak Publishing House NES Nová Dubnica s.r.o. Monograph 2). Nová Dubnica : NES Nová Dubnica s.r.o., 2024. P. 162–175. URL : <https://dspace.bdpu.org.ua/handle/123456789/3507> (дата звернення: 14.09.2025)
32. Onyshchenko S. Visual Means in the Educational Activity of Professional Teachers of the Professional Education System. *Scientific and research work in the system of teacher training in natural, technological and computer spheres : materials of VIII international scientific conference (with the international participation), Berdyansk, September 16-17, 2021*. Berdyansk : BSPU, 2021. P. 213–215.

ANNOTATION

CHAPTER 1. MODERN BASICS OF ECONOMICS, MANAGEMENT AND TOURISM

1.1. Ulyana Balyk INFLUENCE MARKETING IN THE CONFECTIONERY MARKET

Increasing competition in the global confectionery market and rapid changes in consumer preferences are creating a need for new approaches to brand promotion. The increasing demand for products with natural ingredients, a decrease in the share of sugar and the active development of digital sales channels are driving the transition from traditional advertising to personalized communications, where influencer marketing plays a key role.

Keywords: digitalization, marketing, confectionery industry, digital technologies, consumer analytics.

1.2. Nadiia Vasylytsiv FEATURES OF LOGISTICS SERVICE FOR CLIENTS FROM OTHER COUNTRIES THROUGH THE INTEGRATION OF NEW DIGITAL TECHNOLOGIES IN THE SERVICE MARKETING SYSTEM

The work examines the peculiarities of logistics service for clients from other countries through integration of new digital technologies in the service marketing system. The purpose of the research is to determine the place of marketing in the management of logistics processes, as well as to identify the parameters that shape the quality of service at the international level. The paper emphasizes that modern service marketing should integrate the logistics function not as an auxiliary, but as a central component of the service offer.

Keywords: logistics, logistics service, customer orientation, marketing, marketing services, digital technologies, digitalization.

1.3. Andrii Kalynovskyi ORGANIZATIONAL AND ACCOUNTING ASPECTS OF TOLLING OPERATIONS IN MODERN ENTERPRISES

This work examines the organizational, regulatory, and accounting aspects of operations involving tolling raw materials, which have become widely used in both international and domestic economic practice. The study highlights the advantages such operations provide to processing companies, customers, and the state, while emphasizing the necessity of legislative oversight to prevent economic risks and undue dependence on external contractors. Special attention is given to the influence of contract terms on the accounting system of processing enterprises.

Keywords: tolling operations, tolling raw materials, processing enterprises, accounting system, resource control.

1.4. Oksana Kobylukh MANAGEMENT OF CUSTOMER DATA IN THE DIGITAL ECONOMY: MODERN APPROACHES AND THE CAPABILITIES OF CRM TECHNOLOGIES

The study highlights key shifts in marketing shaped by strengthened data-privacy requirements and the global move away from third-party cookies. It analyses the transformation of customer-interaction models and the growing importance of first-party data in the digital economy. The work outlines the role of CRM systems in improving analytical accuracy, optimising business processes, and enabling

3.3. Olena Nikitina STEM TECHNOLOGIES AS A STRATEGY FOR FORMING MATHEMATICAL COMPETENCE OF YOUNG SCHOOL STUDENTS

The article is devoted to the theoretical substantiation and methodological aspects of the implementation of STEM technologies in primary school in order to form the mathematical competence of younger schoolchildren. Based on the analysis of domestic and foreign research, the content of the STEM approach in the context of the New Ukrainian School is revealed, the psychological and pedagogical features of teaching younger schoolchildren as a basis for organizing research and project activities are outlined. The structural components of the mathematical competence of younger schoolchildren are identified and the possibilities of their development using STEM technology are shown. The pedagogical conditions for the effectiveness of STEM education in primary school are substantiated.

Keywords: STEM education, primary school, young learners, mathematical competence, integrated learning, inquiry-based projects.

CHAPTER 4. Serhii Onyshchenko THEORETICAL BASIS OF THE USE OF DIGITAL TECHNOLOGIES IN TECHNOLOGY LESSONS IN GENERAL SECONDARY EDUCATION INSTITUTIONS

This section of the collective monograph examines the theoretical foundations of the use of digital technologies in technology lessons in secondary education institutions. Modern approaches to the digitalization of the educational process are analyzed, the possibilities of using multimedia tools, cloud services, virtual laboratories and modeling tools when studying technological disciplines are characterized. The pedagogical conditions for the effective integration of digital technologies into the educational environment and their impact on the formation of technological competence of students are determined. The importance of digital tools for increasing student motivation, individualizing learning and developing practical skills is substantiated. The conclusion is made about the need for systematic training of teachers and the creation of a digital educational space to ensure the quality of technological education.

Keywords: digital technologies, technology lessons, general secondary education institutions, technological education, digitalization, digital competence, multimedia tools, cloud services, virtual laboratories, modeling.

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