highlight that teachers aren't optional in these AI-rich classrooms. I see this as more than just a safety net: educators bring that vital human empathy and ethical judgment.

Infrastructure also matters. Not every nation has stable, high-speed internet coverage, and not every school can purchase cutting-edge devices. Japan's generative AI experiments might feel worlds apart from the logistical hurdles of Ukraine's post-conflict regions, yet both aim to ensure that technology fosters, rather than fragments, learning opportunities.

From my vantage point, AI feels like a thrilling spark in educational reform, but it's also a fragile one. If local governments, private companies, and educators fail to collaborate on ethical standards and robust teacher training, we risk perpetuating inequities. On the other hand, if AI is shaped with empathy and inclusivity in mind, the potential is enormous. Public-private partnerships could fund widespread digital upgrades. Teacher workshops might deepen understanding of AI's intricacies, so nobody treats it as a black box. Above all, we need a commitment to «student-centered» design. To me, that means making sure technology bends toward the diverse realities of learners, not the other way around.

References

1. Bhutoria A. Personalized education and Artificial Intelligence in the United States, China, and India: A systematic review using a Human-In-The-Loop model. *Computers and Education Artificial Intelligence*. 2022. Vol. 3.

2. Use of AI in Schools (25 case studies). DigitalDefynd, 2024. URL: https://digitaldefynd.com/IQ/ai-in-schools-case-studies/ (available at: 01.04.2025).

3. Eronen J., Lee S. Improving English Education in Japan: Leveraging Large Language Models for Personalized and Skill-Diverse Learning, 2024.

4. Johnston H. Moving towards dynamic multiculturalism in Canada through the use of AI and personalized education, 2023.

5. Nikitina I., Ishchenko T. New Ukrainian school : AI implementation in education. *Academia Polonica*, 2025. Vol. 67, № 6. P. 101–108.

EDUCATIONAL STRATEGIES FOR TRAINING IT SPECIALISTS IN THE CONTEXT OF THE STEAM APPROACH

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The information technology sector is one of the fastest-growing and most dynamic fields in the modern world. However, the rapid evolution of digital tools, programming paradigms, and user expectations creates significant challenges for higher education. Traditional educational models often fall short in preparing students for this ever-changing landscape. In this context, the STEAM (Science, Technology, Engineering, Arts, Mathematics) approach emerges as an effective strategy to equip IT

students with the necessary skills to innovate, collaborate, and solve real-world problems.

The key problem lies in aligning IT education with contemporary labor market demands. Employers are increasingly looking for candidates who not only have strong technical skills but also demonstrate creativity, critical thinking, adaptability, and the ability to work in interdisciplinary teams. The STEAM approach addresses these needs by fostering holistic development and promoting applied learning through project-based and problem-oriented instruction.

The STEAM approach promotes a synergistic combination of technical and creative disciplines, enabling students to acquire a wide range of competencies essential for success in the IT industry.

Key Competencies Developed Through STEAM:

Critical Thinking and Problem Solving: Students learn to analyze complex systems, identify patterns, and generate effective solutions.

Creativity and Innovation: The integration of arts encourages outside-the-box thinking, which is crucial in software design, UI/UX, and product development.

Teamwork and Communication: Project-based learning strengthens collaboration and communication – skills essential for multidisciplinary teams.

Digital and Technological Literacy: Exposure to cutting-edge technologies ensures students are prepared for real-world tasks.

Entrepreneurial Thinking: Many STEAM-based projects mimic startup environments, fostering initiative and business acumen.

Application in IT Education:

Interdisciplinary Project-Based Learning

Mobile App Development: From ideation and needs analysis to interface design, coding, and testing.

Web Development: Combining front-end and back-end programming with UX/UI design and content creation.

Game Development: A comprehensive task involving programming, visual design, storytelling, and mathematics.

Machine Learning Tasks: Implementing algorithms using Python, R, and other tools to solve classification or prediction problems.

Design Thinking and Prototyping

3D Modeling and Printing: Designing objects using tools like Tinkercad or Blender and fabricating them with 3D printers.

Wireframing and Mockups: Creating visual prototypes of applications to test usability and design logic.

Rapid Prototyping Techniques: Quickly building working versions of digital or physical products for iterative testing.

Data Science and Analytics

Big Data: Analyzing large datasets to extract insights using statistical tools and programming languages such as Python or SQL.

Data Visualization: Employing libraries like Matplotlib or Tableau to communicate findings effectively.

Predictive Modeling: Using historical data and algorithms to forecast future trends or behaviors.

Internet of Things (IoT).

Smart Environments: Designing automated systems for home, health, or industry applications using microcontrollers (Arduino, Raspberry Pi).

Wearable Technologies: Developing fitness or health-monitoring devices and their corresponding software interfaces.

Industrial IoT: Monitoring and optimizing production lines through sensor networks and cloud integration.

Artificial Intelligence and Smart Systems.

Chatbots: Building AI-powered virtual assistants using NLP libraries.

Computer Vision: Applying OpenCV or TensorFlow for facial recognition, object detection, or autonomous navigation.

Recommendation Engines: Developing personalized content delivery systems for e-commerce or education platforms.

Educational Benefits of STEAM in IT.

Enhanced Student Motivation: The practical orientation and creative freedom of STEAM projects result in higher student engagement.

Increased Relevance: Students see clear connections between academic content and industry needs.

Holistic Learning Experience: Students learn to connect disparate domains, which promotes deeper understanding and interdisciplinary thinking.

Startup and Innovation Ecosystems: Students acquire tools and mindsets suitable for entrepreneurship, including prototyping, pitching, and iterative design.

Case Examples.

In our institution, STEAM elements have been successfully implemented in course modules such as «IT Project Design», «Digital Prototyping», and «AI in Practice». For example, student teams developed smart traffic monitoring systems using IoT sensors and real-time data analysis, which won recognition in local tech competitions. Another group built a multilingual chatbot designed to support international student integration.

The STEAM approach serves as a transformative strategy in IT education. It enables students not only to master technical disciplines but also to think creatively, work collaboratively, and respond flexibly to new challenges. While implementing STEAM can present difficulties – such as curriculum revision, lack of resources, or limited staff training – the long-term benefits justify the effort.

To fully realize the potential of STEAM, educational institutions must invest in interdisciplinary programs, teacher development, and modern infrastructure. The ultimate goal is to produce well-rounded IT professionals capable of contributing meaningfully to technological innovation and societal progress.

References

1. Asrizal A., Dhanil M., Usmeldi U. The Effect of STEAM on Science Learning on Student Learning Achievement: A Meta-Analysis. Jurnal Penelitian Pendidikan IPA, 2023, № 9(4). P. 1650–1657.

2. Asti P. N. W., Andriyani A. Improving Critical Thinking Ability and Active Learning of Statistics Materials Through Problem Based Learning Model with STEAM Approach. Formosa Journal of Sustainable Research (FJSR), 2022. № 1(2). P. 133–152

3. Chistyakov A. A., Kunitsyna M. L., Yagudina R. IExploring The Characteristics and Effectiveness of Project-Based Learning for Science and STEAM Education. Eurasia Journal of Mathematics, Science and Technology Education, 2023. № 19(5).

ОСОБЛИВОСТІ ВИКОРИСТАННЯ ТЕХНОЛОГІЙ АДАПТИВНОЇ ВЕРСТКИ САЙТІВ

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У сучасному цифровому світі вебсайти відіграють ключову роль у взаємодії користувачів з інформацією, сервісами та бізнесом. З розвитком мобільних пристроїв адаптивна верстка стала необхідністю для забезпечення зручного перегляду сайтів на різних екранах. Вона дозволяє створювати вебресурси, що відображаються та функціонують на будь-яких пристроях від смартфонів до широкоформатних моніторів.

Збільшення частки мобільного трафіку та різноманіття пристроїв змушує розробників використовувати адаптивні технології, щоб забезпечити якісний користувацький досвід. Відсутність адаптивної верстки може призвести до втрати потенційних клієнтів, погіршення оптимізації та зниження ефективності веб-ресурсу. Саме тому вивчення адаптивної верстки та сучасних фреймворків, які її спрощують, є надзвичайно важливим.

Адаптивна верстка це метод створення вебсторінок, при якому дизайн та елементи інтерфейсу динамічно змінюються відповідно до параметрів пристрою: розміру екрану, роздільної здатності, орієнтації та інших характеристик [1]. Головна мета такого підходу зробити сайт максимально зручним для всіх користувачів, незалежно від того, чи переглядають вони його з мобільного телефону, планшета чи комп'ютера. Принцип роботи адаптивної верстки базується на використанні спеціальних технологій, таких як CSS Media Queries, гнучкі сітки (flexible grids) та адаптивні зображення (responsive images). Завдяки цим методам сайт здатний змінювати своє відображення, зберігаючи при цьому логіку розміщення контенту та зручність навігації [2].

У вебдизайні існує кілька підходів до створення інтерфейсу, кожен із яких має свої особливості та сфери застосування. До основних альтернатив адаптивної верстки належать гумова (гнучка) верстка та мобільна версія сайту. Кожен із цих