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ВЕБ-ТЕХНОЛОГИИ В ПЕДАГОГИКЕ: ТЕОРЕТИЧЕСКИЕ ОСНОВЫ, ИНСТРУМЕНТЫ И МЕТОДИЧЕСКИЕ МОДЕЛИ

Аннотация. *В статье с теоретической и методической точек зрения рассматривается применение веб-технологий в педагогическом процессе. Исследование основано на анализе научно-педагогической литературы и нормативных документов, сравнительном анализе, классификации и синтезе. Рассмотрено влияние этапов Web 1.0–5.0 на образование и психолого-педагогические основы цифрового обучения (конструктивизм, коннективизм, TPACK), а веб-инструменты классифицированы по их дидактическим функциям. Предложен поэтапный подход к внедрению, опирающийся на модели перевёрнутого класса, смешанного обучения, геймификации и проектного обучения. Обозначены основные риски и меры по их снижению.*

Ключевые слова: *веб-технологии, цифровая педагогика, смешанное обучение, перевёрнутый класс, геймификация, цифровая компетентность.*

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WEB TECHNOLOGIES IN PEDAGOGY: THEORETICAL FOUNDATIONS, TOOLS, AND METHODOLOGICAL MODELS

Abstract. *The article examines the use of web technologies in pedagogy from theoretical and methodological perspectives. The study is based on the analysis of scientific and pedagogical literature and regulatory documents, comparative analysis, classification and synthesis. It reviews the impact of Web 1.0–5.0 on education and the psychological and pedagogical foundations of digital learning (constructivism, connectivism, TPACK), and classifies educational web tools by their didactic functions. A staged implementation approach based on flipped classroom, blended learning, gamification and project-based learning is proposed. The main risks and mitigation measures are outlined.*

Keywords: *web technologies, digital pedagogy, blended learning, flipped classroom, gamification, digital competence.*

Introduction

In the modern educational system, web-based platforms, cloud services, and interactive resources are breaking the boundaries of time and space in teacher-student interactions, making education open, flexible, and learner-centered. Digitizing education in Uzbekistan is one of the priority areas of state policy, reinforced by the Law “On Education” [1] and the “Digital Uzbekistan – 2030” Strategy [2].

Recent systematic reviews demonstrate that pedagogical innovation and the digital environment are inseparable, emphasizing that technologies enhance student engagement, collaboration, and meaningful learning only when combined with active methodologies; at the same time, there is a recognized need to “humanize” digital pedagogy by maintaining cognitive, social, and teaching presence [3, 4]. Thus, the fundamental question is not whether to use technology, but rather through what pedagogical objectives and methodology it should be applied.

The objective of this study is to theoretically substantiate the pedagogical capabilities of web technologies and to propose a methodological approach for integrating them into the educational process. To achieve this goal, the following tasks were defined: to analyze the evolution of web technologies from the perspective of their impact on education; to identify the psychological and pedagogical foundations of digital education; to classify web tools based on their didactic functions; and to develop implementation stages along with risk-mitigation measures.

Literature Review and Theoretical Foundations

Evolution of Web Technologies

Tekdal and co-authors conducted a comparative analysis of technologies from Web 1.0 to Web 5.0 using document analysis methods, showing that Web 2.0 and Web 3.0 are currently the primary technologies in use, while Web 4.0 and Web 5.0 are expected to become widespread in the future; they noted that educational materials have evolved alongside the development of web technologies [5]. A pedagogical generalization of these stages is presented in Table 1.

Table 1. Stages of Web Technologies and Their Pedagogical Potential

Stage	Core Feature	Educational Manifestation
Web 1.0	Static pages; user is a passive consumer	Electronic textbooks, information portals, library resources
Web 2.0	Interactivity, user-generated content, collaboration	Blogs, wikis, social networks, shared documents, video platforms, online tests
Web 3.0	Semantic web, data analytics, personalization	Adaptive learning platforms, educational analytics, recommendation systems
Web 4.0	Intelligent, predictive systems	AI-based virtual assistants
Web 5.0	Emotional and socio-emotional interaction (future direction)	Emotion-aware systems, immersive (VR/AR) environments

Psychological and Pedagogical Foundations

The application of web technologies in education relies on several theoretical approaches. According to social constructivism, knowledge is constructed collaboratively by learners within the “Zone of Proximal Development” [6]; this concept is realized through wikis, shared documents, and forums. Connectivism emphasizes that knowledge in the digital age is formed through networks, and learning is the ability to connect to sources and people within the network [7]. The Community of Inquiry model links the effectiveness of online learning to the harmonious integration of cognitive, social, and teaching presences [8]. Meanwhile, the TPACK model demonstrates that effective digital teaching relies on the intersection of technological, pedagogical, and content knowledge [9].

Research Methods

This study is theoretical and methodological in nature, employing the following methods: analysis of scientific and pedagogical literature alongside regulatory documents, comparative analysis, classification, and synthesis. Web tools were grouped based on didactic functions, ease of use, collaborative and assessment capabilities, and safety criteria. The effectiveness of the proposed implementation approach is planned to be verified in a subsequent stage through a pedagogical experiment (experimental and control groups, pre- and post-tests, surveys, and statistical testing using Student's t-test); empirical results are not included in this paper.

Results and Discussion

Didactic Classification of Web Tools

As a result of the analysis, web tools used in education were categorized based on the pedagogical functions they fulfill (the main tools are listed in Table 2). This classification enables educators to select tools based on learning objectives rather than current trends.

Methodological Models

Web tools do not produce results on their own; they become effective only within clear pedagogical models. Table 2 outlines the primary models relying on web technologies. In the flipped classroom, theoretical content is studied at home via videos and digital resources, freeing up classroom time for practical exercises and discussions [10]; gamification refers to applying game elements in non-game contexts [11].

Table 2. Pedagogical Models Supported by Web Technologies

Model	Core Essence	Applicable Tools
Flipped Classroom	Theory studied at home; classroom time dedicated to practice and discussion	YouTube, Edpuzzle, Google Classroom
Blended Learning	Combination of face-to-face instruction and online activities	Moodle, Zoom, Google Workspace
Gamification	Boosting motivation through points, leaderboards, and badges	Kahoot!, Quizizz, Wordwall
Project-Based Learning	Collaborating on real-world problem-solving projects	Google Docs, Padlet, Canva, Miro
Micro-learning	Learning through concise modules (3–7 minutes)	H5P, short videos, Telegram channels

Conclusion

The analysis indicates that web technologies offer extensive opportunities in modern pedagogy to improve instructional quality and foster student engagement and autonomy. While Web 2.0 and Web 3.0 tools ensure collaboration, interactivity, and personalization, future Web 4.0 and Web 5.0 iterations are expected to shape intelligent and immersive learning environments. However, technology itself does not guarantee success: overall effectiveness depends on selecting a pedagogically aligned model, the teacher's digital competence, and maintaining social and cognitive connection.

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