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METHODOLOGICAL FOUNDATIONS OF EDUCATIONAL WEB
PLATFORM DESIGN FOR TEACHING WEB DEVELOPMENT
FUNDAMENTALS AT THE STAGE OF INTER-LEVEL EDUCATIONAL
INTEGRATION

The current stage of global information society development and the rapid digitalization of the socio-cultural space necessitate a radical transformation of the national educational paradigm. These processes acquire particular significance at the stage of inter-level educational integration, which ensures a transitional bridge for learners from specialized secondary school (grades 10–11) to the first year of higher education institutions. This period is critically important for professional self-determination and foundational training of future specialists, particularly undergraduate students majoring in "Software Engineering" and "Secondary Education (Mathematics, Computer Science)." Fundamental knowledge and practical skills in web development constitute a key component of their professional competence, as web technologies currently serve as the basis for building most modern information systems.

The purpose of this study is to provide a theoretical substantiation, development, and experimental verification of a comprehensive software and methodological toolkit for teaching the fundamentals of web development at the stage of inter-level integration between general secondary and higher education.

The methodological framework of the study is constituted by a conceptual synthesis of the systems approach, active learning theory, and the principles of individualization and human-centered digital interface design. The systems approach enables the consideration of a modern educational web platform as an integrated, multi-level socio-technical system where technical parameters, including the technology stack, database architecture, and rendering speed, exist in an inseparable dialectical connection with didactic objectives and the psychophysiological characteristics of the users. Within the domestic scientific discourse, the fundamental tenets of establishing such an information and educational environment are substantiated in the works of V. Yu. Bykov, O. M. Spirin, and O. P. Pinchuk, who define the vectors of educational computerization development. Concurrently, the methodological aspects of the direct application of information and communication technologies within the

instructional process and teacher training have been thoroughly investigated by M. I. Zhaldak.

This necessitates a shift away from reproductive methods of material presentation in favor of active learning theory, according to which knowledge is not transmitted in a ready-made format but is actively constructed by learners themselves while solving real-world practical tasks. Furthermore, during the design of the interface and content components of the platform, R. C. Clark and R. E. Mayer's cognitive load theory in multimedia learning was incorporated, alongside T. Anderson and D. R. Garrison's community of inquiry framework, which defines the importance of the instructor's cognitive, social, and teaching presence in the online environment. The process of designing and practically implementing the educational environment comprised five sequential stages, the first of which was a meticulous analysis of the educational context, encompassing the study of current curricula, existing material and technical infrastructure, and the IT competence level of educators. Subsequent stages involved the description of pedagogical objectives, architectural planning, UX/UI design, and the development of assessment modules. The work is grounded in four foundational principles: systemicity, ensuring all modules operate as a single coherent entity; personalization, whereby the learning pace adapts to the user; interactivity, providing an active dialogue with the interface and peers; and adaptability, representing the system's capacity to transform according to emerging demands of the educational process.

The architecture of the developed web resource is a complex system that integrates several invariant blocks. The information-content block is responsible for structuring lectures and video materials. The interactive-activity block contains practical simulators and test systems. The administrative module regulates access rights based on role models, while the analytical module ensures the tracking of digital learning footprints and the visualization of academic progress. The communication hub integrates tools for synchronous and asynchronous interaction.

The practical implementation of this study is represented by the developed "EduTech" educational and methodological toolkit, which combines three interconnected components. The first component is an author-developed instructional module created based on an analysis of modern specialized computer science textbooks by Bondarenko and Rudenko, encompassing the full cycle of web product development from requirements gathering to publication. The second component is an interactive online course on the Kwiga platform, structured into five modules: ranging from exploring the educational website concept, mastering the technological foundation (HTML, CSS, JavaScript, TailwindCSS, React), and core UX/UI design principles, to the direct development of an interactive React application, its optimization, and deployment. The third component serves as a centralized personal website developed using a modern technology stack (React, TailwindCSS, Firebase),

acting as a unified digital hub that hosts technology roadmaps, didactic materials, and a gallery of final student projects.

The integration of the developed toolkit into the actual instructional process was carried out according to a methodological framework of balanced time distribution in a 70:20:10 ratio. Only ten percent of the instructional time was allocated to the theoretical stage, during which the educator outlined the architecture of the topics and demonstrated short media materials from the platform. Twenty percent of the time was occupied by the demonstration-analytical stage, built upon the "live-coding" method, where the educator analyzed syntactic structures, the operation of React components, or TailwindCSS styling in real time. The primary portion of the lesson, constituting seventy percent of the time, was dedicated to an independent laboratory practicum. During this stage, learners worked within the professional development environment VS Code to create their own projects, concluding the lesson with a brief defense of their completed work, which significantly enhanced their self-reflection and presentation skills.

Experimental verification of the platform's effectiveness and the instructional methodology was conducted under distance education conditions during laboratory classes via Google Meet, involving first-year undergraduate students majoring in "Software Engineering" and "Secondary Education (Mathematics, Computer Science)." To evaluate the outcomes, a pre-test and post-test diagnostic method was applied.

The initial testing indicated that the majority of respondents possessed fragmented or entirely absent knowledge of markup language syntax and stylesheets. However, the summative assessment demonstrated a high qualitative increase in knowledge and the formation of robust practical competencies. Students exhibited the ability to independently design user interfaces in Canva and Figma, create responsive layouts, operate functional React components, and integrate the Firebase cloud database, successfully bringing their own websites to the deployment and hosting stage. An analysis of the study's findings suggests that the successful functioning of modern EdTech products depends not so much on their engineering and technical excellence as on pedagogically appropriate content and alignment with the actual needs of the learners.

Concurrently, the implementation of such systems faces certain limitations. Notable among these are the uneven material and technical infrastructure across different educational institutions, the lack of unified state standards for evaluating complex web projects at the "school-university" transition stage, and the psychological conservatism of some teaching staff, manifested as resistance to shifting from obsolete static technologies to modern reactive frameworks. Prospects for future scientific inquiry in this direction lie in the integration of artificial intelligence elements into the educational environment for automated

peer-review of student software code, as well as the implementation of blockchain technologies to verify the copyright of developed projects.

Based on the conducted research, it can be concluded that well-founded methodological foundations of educational web platform design ensure the continuity, consistency, and seamlessly integrated nature of IT education at the stage of inter-level integration. The developed three-component "EduTech" toolkit has proven its high didactic effectiveness, contributing not only to a significant increase in students' hard skills but also to the creation of their first professional developer portfolio, which establishes a solid foundation for subsequent academic pursuits and future professional activities.