EXPLORING THE DIGITAL LANDSCAPE:

INTERDISCIPLINARY PERSPECTIVES

EXPLORING THE DIGITAL LANDSCAPE: INTERDISCIPLINARY PERSPECTIVES

Monograph

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and Iryna Ostopolets

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5.4. Peculiarities of using artificial intelligence in the processes of training and evaluation of web programmers in it companies

The current stage of digital society development is characterized by the intensive penetration of artificial intelligence technologies into all spheres of human activity, particularly in the education and professional training of IT specialists. In the context of continuous knowledge and skill updating, an important task becomes enhancing the efficiency of educational processes. Artificial intelligence (AI) opens new perspectives for accomplishing this task by offering tools for adapting the educational process to the individual needs of each web programmer, optimizing teaching methodologies, and evaluating knowledge and skills.

The use of artificial intelligence in the training and evaluation processes of web programmers in IT companies has several advantages. Specifically, the application of machine learning algorithms and data processing can contribute to creating more flexible and effective training systems capable of adapting to changes in technological trends and labor market needs. This, in turn, can enhance the quality of IT specialists' training, ensure their competitiveness, and facilitate a quicker adaptation to the demands of the modern IT sector.

Despite the obvious advantages, the integration of artificial intelligence into the educational process presents several challenges for scientists and practitioners, related to the ethical aspects of AI use, data security, and privacy, as well as the development of appropriate teaching methodologies and technologies. Addressing these challenges requires a comprehensive approach that combines technological innovations with the fundamental principles of pedagogy and learning psychology.

Considering the potential of artificial intelligence in improving educational processes, the scientific community is faced with the task of researching and developing effective methods and technologies that will maximize the capabilities of AI to enhance the quality of education for web programmers in IT companies.

For any IT company, it is crucial to establish a regulation for the functioning of the information system – from identifying information needs to utilizing

information. This involves the typification of tasks solved within the IT company, establishing the periodicity of information receipt, processing, and use, standardization of input and output documents, and information processing procedures.

Every IT company or its division can be viewed as a system that aims to achieve a set goal in its operation. The following are the main characteristics of a system: complexity, divisibility, integrity, diversity of elements, distinction in their nature, and structuredness.

The methodology for creating an intelligent information system (IIS) has certain fundamental principles of construction. The main one is a systematic approach, which involves decomposing the system into parts (subsystems) according to the goals of its operation.

The specific objectives of an IIS at the current stage of its development include ensuring the integration of tasks solved by the IIS, data interpretation, diagnostics, monitoring, designing, forecasting, planning, learning, management, and decision support with the aim of widespread use of the IIS or its components in educational and scientific institutions, in production, and in everyday life.

The rapid development of information technologies in the digital society necessitates the preparation of creative IT specialists, particularly programmers. Therefore, the development of modern methodological approaches to the use of the latest information technologies in the training of programmers and the creation of new technologies and methods for solving both educational and practical tasks becomes relevant.

According to the portal roadmap.sh, the specificity of a web programmer’s work is directly related to the global Internet network (RoadmapSH, 2024). Therefore, a web programmer needs to have a command of Internet-specific markup languages HTML and CSS, and modern approaches to layout as well as be proficient in modern frameworks like Bootstrap, and Wingtail; programming languages PHP, JavaScript, and Python; modern databases MySQL, MariaDB, MongoDB; know and be skilled in main frameworks: Drupal, WordPress, Laravel, Django, Flask, FastAPI; know and

understand the main data transfer protocols: HTTP, HTTPs, FTP, SSH, UDP; know and understand the principles of secure data transfer over SSL/TLS protocols.

According to research (CTOClub, 2024), the most popular tools for web development are modern Integrated Development Environments (IDEs), which play an important role in the web development process as they provide developers with a comprehensive set of tools for writing, debugging, testing, and deploying code. For programming languages such as JavaScript (JS), PHP, and Python, there is a wide selection of IDEs, each offering various functions to meet the specific needs of web developers.

It is worth noting that to be successful in the IT industry, a web programmer does not always have to have a university education in computer science or related disciplines. Modern technological and educational resources provide potential web programmers with a wide range of opportunities for self-education and professional development, both with and without a university degree.

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According to research (CTOClub, 2024), the most popular tools for web development are modern Integrated Development Environments (IDEs), which play a crucial role in the web development process since they provide developers with a comprehensive set of tools for coding, debugging, testing, and deployment. For programming languages such as JavaScript (JS), PHP, and Python, there is a wide choice of IDEs, each offering various features to meet the specific needs of web developers.

It’s worth noting that to succeed in the IT field, a web programmer does not always need to have a university degree in computer science or related disciplines. Modern technological and educational resources provide potential web programmers with a wide range of opportunities for self-education and professional development, both with and without a university degree.

University education in information technology or computer science provides students with a theoretical foundation, including the study of algorithms, programming, databases, and other fundamental aspects of computer science (Yuskovych-Zhukovska & Bogut, 2023).

An important aspect is also the fact that many employers in the field of web development are increasingly focusing on the practical skills and experience of candidates, rather than solely on the presence of a higher education diploma. This emphasizes the possibility of success in this field for individuals with different educational and professional backgrounds.

Thus, the opportunity to become a web programmer exists both for individuals with a university education and for those who have chosen the path of self-education. The main factors of success in this field are continuous learning, adapting to the latest technologies, developing practical skills, and active participation in the professional community.

Let's identify three separate problems regarding the effective functioning of the knowledge acquisition system for the web programmer profession.

The first approach is to obtain higher education in IT with an in-depth study of the web development direction. As a result, the graduate will have a bachelor’s (or master’s) degree and a lot of theoretical knowledge, but at the same time, they will lack sufficient practical skills and abilities.

The second approach is to acquire knowledge in the field of web development independently, using various available open Internet resources. The disadvantage of this approach is the absence of a higher education diploma, which is an obstacle to career advancement in the IT field.

The third approach is to undergo training at specialized educational IT centers, and IT academies through online/offline training formats. The advantage of such training is the acquisition of practical skills and receiving job offers from IT companies to fill open positions.

The labor market in the field of information technology has several features that distinguish it from other labor markets:

- High dynamism: Technologies change rapidly, and the requirements for IT specialists are also constantly adapting, which may require professionals to engage in continual learning and self-improvement;

- Shortage of skilled personnel: The high demand for IT professionals in many countries leads to a shortage of highly qualified programmers, which can increase salaries in this field;

- Wide range of specializations: From programming to cybersecurity, from data analysis to design – the IT field offers a vast range of specializations;

- Importance of soft skills: Despite the technical nature of the profession, soft skills such as communicability, critical thinking, and the ability to work in a team are becoming increasingly important;

- Continuous development and education: As technologies evolve continuously, IT professionals must be prepared for ongoing learning and adaptation to new tools and approaches.

Thus, compared to other labor markets, the IT sector requires a higher level of specialization, adaptability to rapidly changing conditions, and flexibility in choosing the place and format of work.

To ensure the maximum level of efficiency in the operation of IT companies, it is necessary to consider the current requirements for skills that a modern web developer must meet.

A modern web developer must possess a broad range of technical and soft skills to effectively handle the challenges of developing and supporting web applications in a rapidly changing technological environment.

The implementation of an intelligent information system in the field of training and selection of web programmers in IT companies will change the technologies of learning and selection, anticipating the use of a complex of applied software tools in the educational process designed to intensify the independent educational activities of future web programmers and their evaluation, to fill the existing need of IT companies.

One of the most important tasks is the organization of professional training for web programmers and their evaluation.

Let’s highlight the main sub-tasks that arise in the process of professional training of web programmers and require automation through artificial intelligence tools:

- Analysis of modern approaches to personnel management: Study the specifics of personnel management in IT companies, particularly for web programmers, existing problems, and possible solutions using intelligent information technologies.

- Development of decision-making automation methods: Develop methods and algorithms that use data from information systems, analytical tools, and intelligent technologies to automate decision-making processes in personnel management.

- Adaptation of developed methods to the needs of specific IT companies: Adapt the developed methods to the work specifics of specific IT companies, taking into account their sizes, organizational structures, tasks, projects undertaken, culture, strategic goals, and other factors.

- Testing and evaluating effectiveness: Test the developed methods on real data, analyze the results, and evaluate their effectiveness in terms of improving the quality of decision-making in personnel management processes.

- Developing and implementing intelligent information systems for automating decision-making processes in personnel management can be an important step towards improving the efficiency of IT companies. This will help optimize work processes, increase employee satisfaction, and ensure a more stable and competitive functioning of enterprises in the dynamic and competitive IT sector.

At the International University of Economics and Humanities named after Academician S. Demyanchuk, according to the educational program «Software Engineering of the Internet of Things», a model curriculum for the training of first level (bachelor's degree) higher education applicants in specialty 121 Software Engineering has been developed. The Department of Information Systems and Computational Methods has processed distance courses in the disciplines «Web Programming», «Web Design», «Web Technologies», «Web Development», and «IT Project Management».

Effective web development requires a deep understanding of both frontend and backend technologies, as well as the ability to integrate them to create secure, fast, and responsive web applications.

Currently, there are no single theoretical foundations and universally accepted industry regulations and standards that would unambiguously regulate the evaluation of professional skills and abilities of IT specialists in the field of web development on a global level.

Instead, there are international standards, certification systems, and commonly accepted but not strictly regulated approaches that cover part of the competencies and allow for the classification and assessment of the knowledge, skills, and abilities of a web developer. The methodological basis for web development is the scientific method of researching various programming languages, frameworks, libraries, component sets, and platforms.

The gradation of professional levels of web programmers in IT companies creates a structure for evaluating and developing technical skills, professional experience, and the ability to collaborate in a team. Professional levels include Trainee, Junior, Middle, and Senior, each with its own characteristics and requirements.

Career growth in the IT industry requires continuous education, development of technical skills, communication skills, project management, the ability to work in a team, and adapt to changes in technologies and methodologies.

The main methodological premise for designing and implementing an intelligent information system to intensify the training and selection of web programmers is the concept of training and selection as a process of solving a learning management problem in a human-machine system, consisting of the management subsystems «teacher (tutor) – automated training course» and the management object – students of specialty 121 «Software Engineering», or other users who wish to undergo selection for the position of web programmer in an IT company.

The methodology for constructing and operating an intelligent information system for intensifying the training and selection of web programmers has a hierarchical structure, where the main element is the automated training course «Web Programming», developed by the author. The course has five levels of training and selection for web programmers. By downloading this course, the user enters a special environment of the chosen level of preparation. The intelligent information system unveils an educational environment with a list of topics, and questions that the user, the candidate for the corresponding level position, needs to master. The educational environment provides the user with a whole group of automated services:

- information and reference services;
- solving course-related tasks;
- knowledge assessment of the user by the system.

An extension of the automated training course is a decision-making system based on the use of artificial intelligence technologies, which controls and manages the process of learning and knowledge assessment at all levels when working with the intelligent information system (Fig. 1).

The main methodological premise for designing and implementing an intelligent information system for recruitment and personnel management in IT companies is the concept of staffing as a process of solving a personnel management problem in an automated decision-making system with artificial intelligence technologies.

The methodology for building and operating an intelligent information system for the selection of web programmers has a multilevel hierarchical structure, where

the main element of the first level is the automated training course «Web Programming». The main element of the second level is an automated testing environment. The main element of the third level is an automated decision support system (ADSS) for forming project teams.

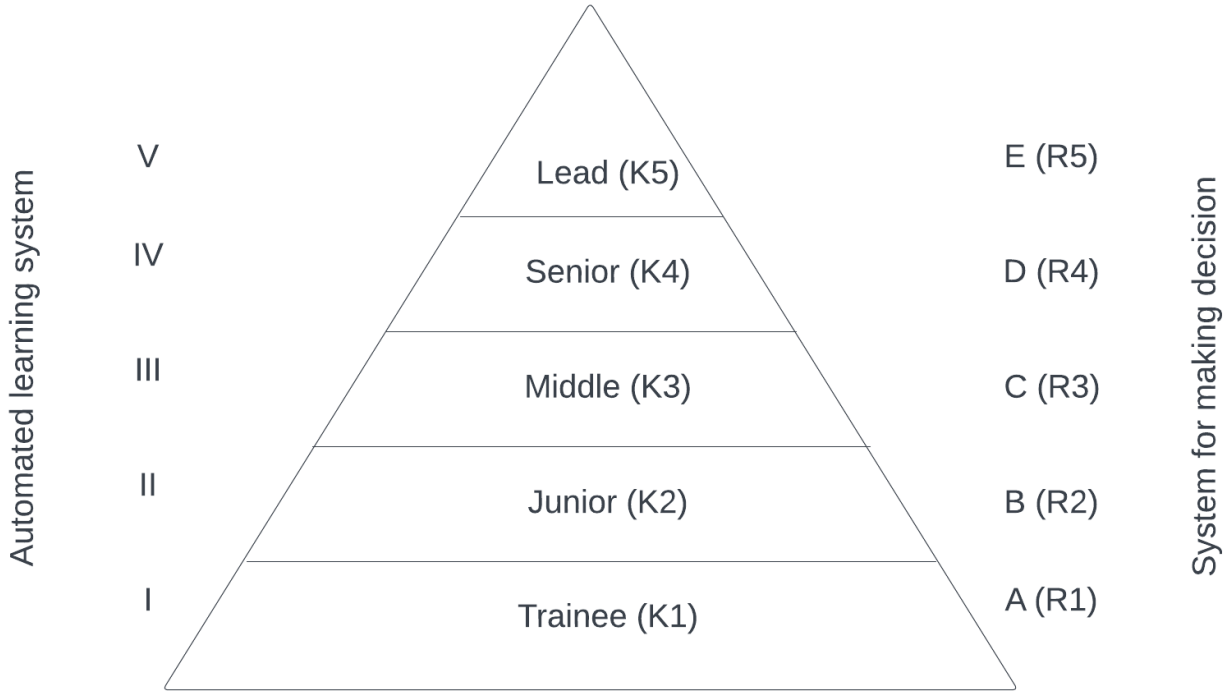

Fig. 1. Multilevel model of the intelligent information system

For the construction of an intelligent information system for the training and selection of web programmers in an IT company, which includes subsystems for managing recruitment, staff training, testing, and project team management, a project approach was used that encompasses both the latest IT technologies and modern personnel management methodologies.

Let’s highlight the main technologies that can be used for the development of an intelligent information system for the recruitment of personnel in IT companies, specifically web programmers.

As a result of the conducted systemic analysis of the existing personnel management processes in IT companies, key requirements were identified, and the boundaries of the automated system were defined, with a formalization

of business processes. As a result of the study, a high-level structure (Fig. 2) was proposed and developed following the C4 notation (Brown, 2024).

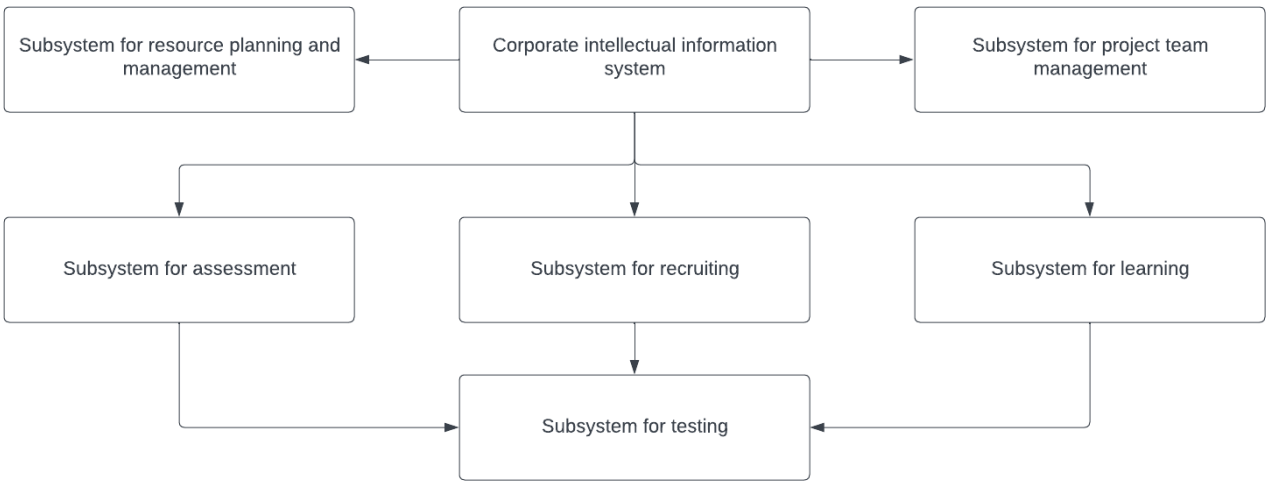

Fig. 2. Structure of the IIS and personnel management in an IT company

The application of machine learning algorithms and artificial intelligence to automate and optimize the processes of personnel selection, and analysis of employee performance efficiency, as well as for predicting training and staff development needs has allowed the integration of artificial intelligence technologies into the information system. The integration was carried out using AutoGPT technology, which allows the use of OpenAI GPT – 4 (Mett, 2024) as the technological basis for implementing applied data analysis processes and decision support.

The technologies used for the web programming training course block and the knowledge testing subsystem block for hierarchical levels of web programming can be presented in Table 1.

The intelligent information system facilitates the automation of training and evaluation processes for web programmers within the concept of continuous learning. The operation scheme of the intelligent information system can be represented in the form of a business process (Fig. 3).

In the development and implementation of the intelligent information system for training and evaluating web programmers, we encountered a complex set

of challenges that required an innovative approach and a deep understanding of the specifics of the learning process in the modern IT sector. The results of our work demonstrate significant potential for using artificial intelligence and machine learning to optimize and personalize learning processes, opening new perspectives in the training of highly qualified web development specialists.

Table 1. Technologies for Building an Intelligent Information System

Technology	Solution	Purpose
Databases	SQL	Storing, selection, and starting data processing
WEB	HTTPS, Nginx, PHP	Collaboration with users, data transferring, practical implementation of business processes
Authentication	OAuth	Safe access to data
AI	OpenAI GTP-4, AutoGPT	Automatical intellectual data processing

The system we created integrates advanced data analysis algorithms and natural language processing, providing adaptive learning based on the individual needs and progress of each student.

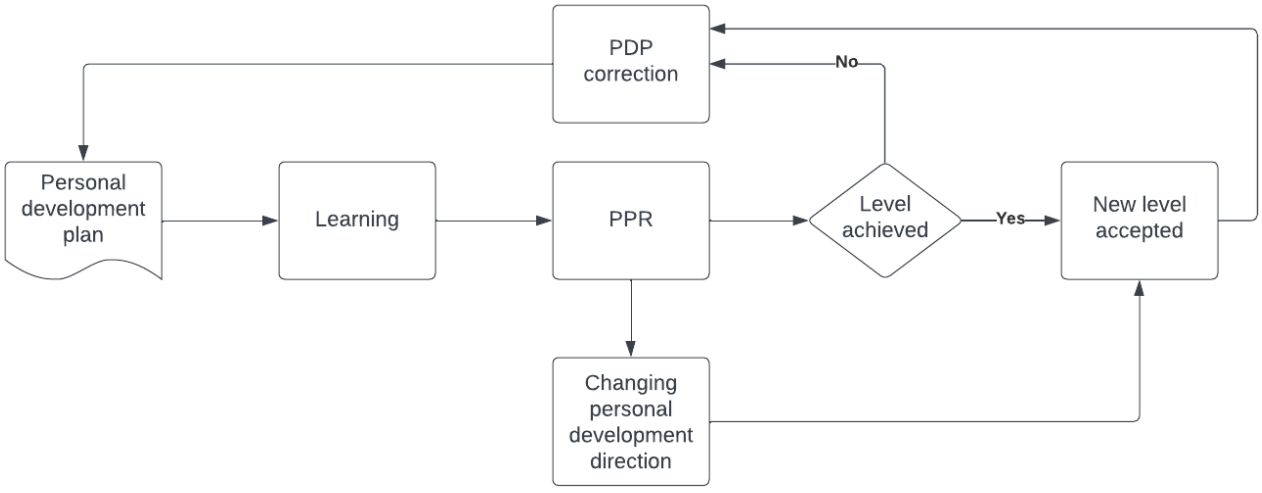

Fig. 3. Business Process of Web Programmer Professional Development

5.3. ***Olena Titova, Petro Luzan, Iryna Mosia.*** **The concept of college teacher's professional competence development.** The research dealt with the process of professional competence development for the teachers at a college. The understanding of the fact that the teacher's professional competence is essential in the process of vocational education development under the current global and local challenges requires the college teacher to be involved in the continuing improvement of their professional knowledge and skills. The conceptual idea of the research was based on the assumption that for the purposeful development of the teacher's professional competence, it was necessary to develop a system that covers all the elements of the educational process. The conceptual model was built to illustrate the process of a college teacher's purposeful professional development.

5.4. ***Oleg Bogut, Valentyna Yuskovych-Zhukovska.*** **Peculiarities of using artificial intelligence in the processes of training and evaluation of web programmers in it companies.** This article explores the innovative application of artificial intelligence in IT companies with respect to the processes of training and evaluating web programmers. It examines the current state and potential of artificial intelligence technologies and the possibilities of their application to enhance the efficiency and productivity of web programmer development and evaluation programs. Key advantages and challenges associated with the use of artificial intelligence are discussed.

5.5. ***Tetiana Karpenko, Olena Lakomova, Daria Shiyan.*** **The significance of school geographic education in Ukraine for the «green» transition.** The article is devoted to the analysis of the possibilities of geography training programs of basic general secondary education in Ukraine for the formation of an ecological style of thinking and ecological behavior among students in accordance with the «Concept of the New Ukrainian School». The greatest attention is paid to the curriculum of the 9th grade «Ukraine and the world economy», which consists of five sections. Each section opens various opportunities for the formation of knowledge about the features of the «green economy» and the policy of sustainable development, and as a result of the formation of an environmentally conscious personality.

5.6. ***Oleksandr Kondratenko, Olha Lytvynenko.*** **Ecological safety of transport as a component of national security of Ukraine during armed aggression and as a prerequisite for a «green» transition during post-war reconstruction.** Present paper describes the results of analysis of modern and relevant issues of technogenic and ecological safety of urban systems as the component of national security of Eastern-European countries on example of Ukraine in the time of armed aggression and as a prerequisite for a «green» transition during post-war reconstruction. The purpose of the study is determining the aspects of assessment and provision of the necessary level of ecological safety of exploitation of transport, in particular units of fire and emergency rescue vehicles, as a component of Ukraine's national security in times of armed aggression as a prerequisite for a «green» transition in times of post-war reconstruction. The object of the study is ecological safety of the exploitation of transport, in particular units of fire and emergency rescue vehicles, as a component of the national security of Ukraine. The subject of the study is the aspects of assessment and providing the necessary level of indicators of the object of the study in times of armed aggression and as a prerequisite for a «green» transition in times of post-war reconstruction.