FACTORS AND STAGES INFLUENCING THE READINESS OF FUTURE ENGINEERS TO USE INFORMATION LEARNING ENVIRONMENTS IN THEIR PROFESSIONAL ACTIVITIES

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Abstract: This study explores the key factors and developmental stages that influence the readiness of future engineers to effectively use information learning environments in their professional activities. It examines both personal and educational aspects that contribute to their preparedness and highlights strategies to enhance their competence in integrating digital tools and resources into engineering practice.

Introduction. In the conditions of modern economy and technology, the engineering profession is undergoing fundamental changes, in particular, the rapid development of information and communication technologies makes it possible to improve the quality and efficiency of the educational process, making it an urgent task to prepare future specialists for the effective use of the information educational environment. Therefore, the process of forming readiness to use the information educational environment in engineering education requires a multifaceted and systematic approach.

The factors determining the readiness of future engineers to use the information educational environment consist of such multidimensional system elements as personal psychological characteristics, pedagogical and psychological conditions, organizational and technological infrastructure, and methodological support. These factors interact in a complex way, determining the level of training and the quality of the formation of professional competencies. Therefore, the systematic analysis and integration of each of them is one of the urgent issues of engineering education.

In order to determine the factors and stages that affect the professional development of future engineers in an information-based educational environment, it is necessary to analyze the factors and stages presented in the works of a number of famous scientists who have conducted research in this area, study their pedagogical essence, functional tasks and impact on the effective use of information and communication tools in the professional activities of future engineers. This, in turn, will serve to create a theoretical and practical basis for improving the professional qualifications of future engineers in the educational process, as well as to ensure scientifically based pedagogical effectiveness by systematically covering the factors and stages of professional development of future engineers.

Analysis of literature. In the research work of Professor NA Muslimov, the scientific and methodological foundations of the formation of professional pedagogical qualities in future teachers of technological education were studied, and special attention was paid to the issues of forming a new generation of specialists, raising a well-rounded person who is spiritually and morally mature, has an independent worldview, thinks creatively, and is committed to universal and national values [1].

J.A. Khamidov conducted scientific research on the technology of creating and using modern didactic means of teaching in the training of future vocational teachers, and revealed a conceptual approach to teaching general vocational subjects based on modern didactic means, the scientific and pedagogical foundations of creating modern didactic means of teaching and using them [2].

O.X. Torakulov also conducted a systematic research in this area. In his research, the scientist analyzed and studied “the organizational and structural form and model of the informational educational environment, text materials, digital educational programs, mathematical models, multimedia teaching materials for the studied educational direction, a package of applied programs, educational and methodological materials of the studied subject, the option of choosing the most convenient teaching option, innovative components, software platforms for teaching practical and laboratory exercises” [3].

Khatoraqulov , “Information technology is a set of regulated and organized systems and applications that use computers and telecommunications to collect, process, store, represent, systematize, transmit, and make information user-friendly in order to find solutions to specific system problems” [4].

IXNasriddinov and ARKhodjaboyev emphasize that the concept of information technology includes not only computer technologies, but also technical innovations and artificial intelligence, which are currently developing [5].

According to NA Muslimov, competence is expressed in the student's acquisition of the knowledge, skills, and abilities necessary for the implementation of personal and socially significant professional activities and the ability to apply them in professional activities.

As noted by the well-known pedagogical scientist AR Khodjabayev, “The machines, aggregates, equipment, machines and mechanisms used in the educational process of higher educational institutions, schools and vocational schools are not only means of production, but, first of all, educational tools, with the help of which students have the opportunity to develop and strengthen their professional skills and qualifications”[6].

Terry Anderson Student Motivation in Academic Work and pedagogical support in the learning process are crucial factors for the effective use of information learning environments. Terry Anderson's work shows the need to prioritize factors such as: strengthening social interaction, increasing pedagogical management and motivation, and developing online collaboration in the process of training future engineers in information learning environments. These approaches serve to form not only technical knowledge, but also communicative and collaborative skills in modern engineering education.

Based on the analysis of scientific and methodological literature and our own pedagogical practice, we can highlight the following typical difficulties faced by the teaching and student community in the professional development of future engineers in an information-based educational environment .

A generalized analysis of the opinions expressed by the above scientists and taking into account the problems and difficulties faced by teachers and students allows us to divide the factors affecting the professional development of future engineers in an information-based educational environment into the following 3 groups: personal factors, pedagogical factors, and organizational-technological factors (Figure 1).

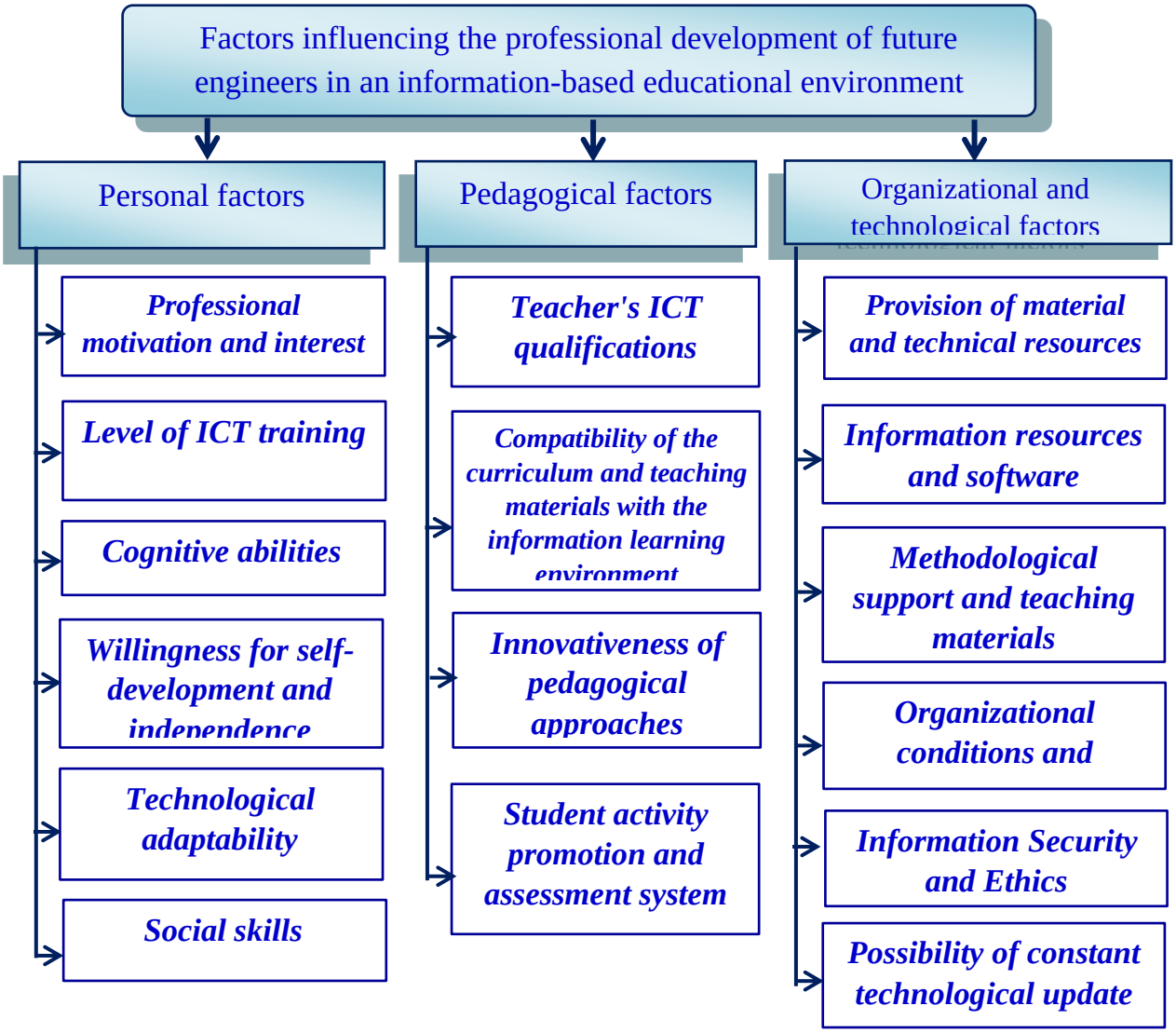

Figure . Factors influencing the professional development of future engineers in an information-based educational environment

1. Personal (individual) factors- these consist of the student's internal characteristics, abilities, psychological state, and motivations, which directly affect their effective use of the information learning environment.

In the professional development of future engineers in an information-based educational environment, factors related to the student's personality are explained by the student's professional motivation, level of preparation in information and communication technologies (ICT), cognitive abilities, readiness for self-development, social skills, and ability to adapt to technology:

Professional motivation and interest - A future engineer's interest in and commitment to his or her professional field plays a major role in his or her readiness to use an information learning environment. When motivation is high,

the student is more likely to learn new technologies, apply them in practice, and continuously develop himself or herself.

Level of preparation in information and communication technologies - Skills such as computer literacy, the ability to use software, and the ability to work with Internet resources are necessary as initial preparation for successful work in an information education environment.

Cognitive skills (thinking, analysis, problem solving) - The ability to quickly and accurately perceive, analyze, and select the necessary information is necessary for solving engineering problems, managing technological processes, and implementing projects. Critical thinking and a creative approach help to quickly master new technologies.

Willingness to develop oneself and independence - in an information learning environment, independent learning is often required, in which the student's self-management, self-motivation, and willingness to independently seek new knowledge are important. This is especially reflected in online learning platforms and distance learning.

Social skills - patience, teamwork, communication, and collaboration skills - are also essential for successful functioning in the information environment.

Technological adaptability - the ability to adopt and actively use new information technologies. This ability helps the future engineer to quickly adapt to technological innovations.

High level of personal preparation for effective search, selection, processing and use of information resources in professional activities At the same time, motivation and cognitive abilities help overcome the difficulties that arise when using the information learning environment.

Conversely, if personal factors are low, the student will have difficulty using technology, which will limit professional growth and success.

In the professional development of future engineers in an information-based educational environment, it is necessary to develop personal factors related to students: - increase **motivation** through professionally oriented trainings, seminars, practical projects ; - strengthen ICT skills through special courses, laboratory work, interactive classes; - develop cognitive and creative thinking through problem situations and case-study methods.

2. Pedagogical factors : - these factors determine the quality of the educational process, the student's interest and readiness to master technologies. The qualifications and readiness of the teacher and educational institution in this

area directly ensure the professional success of future engineers, this class of factors includes the following:

Teacher's competence in information and communication technologies (ICT) - the teacher is required to study modern information technologies and effectively implement them in the teaching process, a qualified teacher teaches students technologies in an understandable and interesting way, increasing their motivation. The teacher must constantly update his knowledge and integrate innovations into the educational process.

The suitability of the curriculum and teaching materials for the information learning environment - the curriculum should include the use of information resources and ICT tools, it is important that the teaching materials are interactive, include multimedia elements and are focused on practical exercises. Virtual laboratories, simulations and online platforms should be included in the curriculum.

Innovative pedagogical approaches - innovative methods encourage students to use the information learning environment independently and effectively. At the same time, interactive communication between teachers and students is enhanced. These approaches, unlike traditional lessons, encourage students to learn independently, think creatively, and provide for the wide use of interactive learning opportunities and the effective use of the information learning environment.

Student activity motivation and assessment system - To increase activity in the learning process, tools such as motivational assessment, certificates, ratings are used. The assessment process should objectively assess the student's skills in using the information learning environment. Also, mechanisms for continuous reflection and self-assessment are effective.

Continuous professional development courses and seminars for teachers to develop pedagogical factors It is necessary to organize, update curricula by integrating them with modern information technologies, increase team project work, interactive classes, and improve the assessment system in an information learning environment.

3. Organizational and technological factors are the material and technical base, information infrastructure, methodological and educational manuals and organizational conditions of an educational institution, which affect the effective functioning of the information educational environment. The main organizational and technological factors are:

Material and technical base - the educational process is provided with modern computer classes, high-speed Internet connection, multimedia equipment (projectors, interactive whiteboards, tablets, etc.), production and laboratory equipment, the possibility of their integration with information technologies.

Information resources and software - the provision of the educational process with electronic libraries, online scientific databases, virtual laboratories, special programs for the professional field, simulators, CAD/CAM systems, design and modeling tools.

Methodological support and teaching materials - make the learning process systematic, effective and interesting, help students actively use the information learning environment, and assist teachers in organizing lessons in a high-quality manner, and consist of the following:

Interactive lesson developments - students' activity to increase focused , with multimedia elements (video, animation , tests) enriched materials .

Video lessons and online resources - independent to study supporting and subject further understandable doer demonstrative tools .

Tests and assignments system - knowledge control to make and strengthen for customized questions , evaluation criteria .

Methodical manuals - teachers for working published , information education in the environment effective lesson transition methodology and recommendations own inside takes .

Electronic educational-methodical sets - textbooks , abstracts , laboratory of work electronic form , interactive projects .

Organizational conditions and management - the necessary discipline, time management and monitoring systems must be in place to organize the educational process in an information environment. Regulatory documents that encourage the use of ICT, as well as a financing and support system, are also required.

Information security and ethics - it is necessary to protect data, ensure the confidentiality of personal information, and teach the rules of information ethics among students and teachers.

The possibility of constant technological innovation - the ability of an educational institution to update, modernize and apply technologies, and the availability of personnel training and a material base for the rapid introduction of modern technologies.

Conclusion. The readiness of future engineers to effectively utilize information learning environments in their professional activities is shaped by multiple interconnected factors and developmental stages. Personal motivation, technical skills, prior exposure to digital tools, and educational support play critical roles in this readiness. Additionally, progressive stages of learning—from initial awareness to confident application—are essential to fully integrate these environments into engineering practice. To better prepare future engineers, educational institutions must focus on tailored training programs that emphasize both theoretical knowledge and practical digital competencies. By fostering these elements, future engineers will be better equipped to adapt to the rapidly evolving technological landscape of the engineering profession.

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