

Determination of the psychological and pedagogical substantiation of the cognitive functions influence on the development of higher education students' universal competencies

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Abstract—the article analyzes the role of the competency-based approach in higher education, with a particular focus on universal competencies and their significance in shaping a well-rounded student personality. It provides a terminological clarification and examines the impact of cognitive ability development on the formation of students' universal competencies.

Keywords—competencies, higher education, neuroscience, cognitive abilities

I. INTRODUCTION

Higher education is currently undergoing significant transformations driven by rapid technological development, socio-economic changes, and new labor market demands. In recent decades, traditional educational systems designed for mass education have faced challenges related to the need for adaptation to individual student needs and the rapid evolution of knowledge and skills that are becoming relevant in the 21st century [1].

One of the key problems of modern education is its insufficient flexibility and adaptability. This leads to a decrease in motivation and academic performance, as well as the inability to fully unlock the potential of each student. Consequently, increasing attention is being paid to the personalization of education, which involves adapting the educational process to the needs and abilities of each student.

However, within higher education, a personalized approach alone proves insufficient; professional qualities necessary for the development of future specialists capable of performing their anticipated professional activities also play an important role.

In this context, the concept of customization emerges as a relevant aspect of individualization. While personalization emphasizes the interests and inclinations of the student, customization facilitates the organization of the educational process according to the requirements set by educational institutions and potential employers [2]. Additionally, customization is defined as a process in which the compilation of mass assignment types, individually selected for each

student, ensures the achievement of unique individual learning outcomes [3].

The Federal State Educational Standards for Higher Education (3++) have been developed, in part, due to the necessity for greater professional integration within the educational process, the consideration of existing professional standards in educational practice, and a focus on developing specific professional skills and qualities. However, such an approach may lead to unintended outcomes, such as "deepened professionalization"—a process in which potential employers, engaged in contractual relationships with students, exert excessive influence on their educational activities, focusing only on the development of professional competencies. This, in turn, entails problems in the formation of universal competencies [4]. Furthermore, students, in their pursuit of enhancing professional skills, may neglect the development of universal competencies important for the active life of a person as a member of society and a specialist.

Universal competencies are aimed at the formation of general skills and qualities necessary for successful professional and social activities.

An important feature of modern higher education is the creation of such educational conditions that would allow the formation of a well-rounded personality, motivated and capable of further self-development. The process of developing universal competencies is also dependent on the level of cognitive development of the student. As we mentioned in our previous work [5], the study of the educational process features is currently being considered not only from a psychological and pedagogical perspective but also through neuroscientific and interdisciplinary research [6, 7]. Neuroscience provides a deeper understanding of the biological aspects of cognitive activity, including its role in the process of professional activity. Previously, we defined the importance of extracurricular activities influence on the development of certain schoolchildren's cognitive abilities [5]. This article extends that discussion by identifying how these cognitive abilities influence the development of universal competencies in higher education students.

II. RESEARCH PAPERS REVIEW

In the process of analyzing research literature, theoretical issues requiring clarification were identified:

- The importance of the role of the competency-based approach in higher education, as well as the terminological clarification of the concept of "universal competence";
- The characteristics of the influence of the level of cognitive ability development on the formation of universal competencies.

A. Universal Competence

The competence-based approach in higher education is becoming increasingly important in modern conditions—for example, I. D. Rudinsky identifies 5 subsets of prerequisites for the formation of this approach:

1) *Social*. There is a significant societal demand for a revision of the higher education organization system, particularly among the participants in the "employer-employee" relationship.

2) *Technological*. The digitization of education [8], along with continuous scientific and technological progress, influence professional activities throughout a person's life. Employees need to continuously enhance their competencies and learn to interact with evolving technologies.

3) *Economic*. Without the constant updating of knowledge and skills initially acquired in educational institutions, the received education becomes outdated. This, in turn, emphasizes the need for well-formed personal, communicative, and motivational components, which enable an individual to timely identify the obsolescence of educational components and try to fix it.

4) *Pedagogical*. This subset is conventionally divided into cognitive and qualimetric prerequisites. The cognitive group is related to shifting the primary role from the possession of knowledge as such to the ability to effectively search for and analyze information. Qualimetric prerequisites consider the insufficient predictive reliability of traditional methods for assessing student knowledge, as high results in individual academic disciplines do not always allow for an objective assessment of professional competitiveness.

5) *Motivational*. This subset includes unlimited career growth opportunities and the increasing mobility of specialists, which also requires them to quickly master new knowledge and skills [9].

Such an approach meets the requirements for constructing continuous education. It allows students to develop not only professional skills but also universal competencies, such as the ability to learn, critical thinking, and communication skills, which remain relevant throughout life and allow them to adapt to changes in the professional sphere [10].

As a result, the competency-based approach serves as a tool for improving the quality and efficiency of the educational process, facilitating the preparation of specialists capable of successfully addressing professional tasks in modern conditions.

Despite the proven importance and relevance of this approach, there remains a problem of specifying the definition

of the concept of "competence" in education. In the domestic literature, educational competence is considered as:

1) A requirement for educational preparation, expressed as a set of meaningful orientations, knowledge, skills, abilities, and experiences in relation to specific objects of reality, necessary for productive activity [11].

2) From a pedagogical perspective—a set of content that the student must master, an objective given, pre-selected, structured, and didactically organized; from a psychological-practical perspective—"the intellectual and psychophysiological qualities of the subject as conditions for the successful mastery of the specified content" [12].

3) A "specific property of an individual, consisting of a set of qualification characteristics and determining their ability and readiness to perform a specific type of activity in a particular field" [9].

In the Federal State Educational Standards for Higher Education (3++), competencies are divided into universal, general professional, and professional [13]. The list of universal competencies is determined by the federal standard.

Universal competencies occupy a special place in this list—they include: 1) the formation of personal qualities that enable individuals to effectively operate within extensive and diverse professional settings; 2) the acquisition of "general" knowledge and skills that are necessary in any professional activity [14], and must be mastered by every graduate of a higher education institution, regardless of their specialty.

There is no unified approach to defining the concept of "universal competence." There are different definitions:

1) General cultural, communicative, intercultural, and socio-personal competencies of the graduate, characterizing their general cultural level of preparation and socio-personal qualities that contribute to their social mobility and stability in the labor market [15].

2) The ability to establish connections between knowledge and problem situations, choose the correct educational direction, and develop an action plan for its implementation, which in turn serves as a basis for more specific and subject-oriented components [16].

Universal competencies most fully reflect the essence of the competency-based approach, combining the prerequisites for its emergence and the demands arising in society. It can be said that universal competencies represent the formation of general cultural, communicative, socio-personal characteristics of the student, as well as their ability to master and apply a set of skills embedded in the educational process, necessary for solving social and professional tasks.

B. Mechanisms of the influence of cognitive abilities on the universal competencies development

To establish a theoretical foundation, it is necessary to conduct an analysis of the scientific literature. However, it should be noted that the term "universal competence" is not commonly used in international practice; its approximate equivalents include key qualifications, basic skills, core skills, and so on [17, 18].

The theoretical paradigm previously used in studies of school-aged children is applied in this research [19]. The studied cognitive abilities include: visual search, working

memory, mathematical skills, the ability to integrate these abilities, as well as attention.

For the analysis, the following scientific publication databases were used: international databases (Science Direct, PubMed, Google Scholar), as well as the national database RSCI (in Russian).

As a result of the preliminary selection process based on article headings, about 100 publications relevant to the research topic were identified. After additional screening, which included a full-text review, 14 relevant scientific studies were selected.

According to Hofer S. and Clouston S., the development of cognitive abilities from an early age is associated with better educational, emotional, and career outcomes throughout life [20].

Critical thinking is defined as the ability to apply cognitive skills that enhance the likelihood of obtaining a desired outcome [21]. Unlike intelligence (despite some common traits), tests for critical thinking are more accurate in predicting various life outcomes (in addition to academic and professional success) [22].

Empathy is an essential component of teamwork, effective communication, and interpersonal interactions. The development of high-level cognitive abilities, such as executive abilities, language, and the ability to mentalize (i.e., understanding the behavior of others as psychologically motivated), significantly enhances the capacity for empathy [23].

Another key aspect of communication is emotional regulation. Cognitive processes play a crucial role in the emergence and regulation of emotional states. They affect various components of emotions—physiological arousal, subjective experience, emotional expression, and behavioral responses. The development of cognitive abilities allows for more effective emotion regulation through reappraisal of situations and shifting the focus of attention [24].

Research indicates that a high level of numeracy skills is associated with better health outcomes and more favorable medical decisions by both patients and physicians. Individuals with advanced mathematical abilities have a better understanding of health risk information, more accurately assess the likelihood of developing diseases, and evaluate the effectiveness of proposed treatments. Furthermore, those with strong numeracy skills are more likely to adhere to dietary and medication guidelines [25, 26].

In the study conducted by Benjamin D. J., Brown S. A., and Shapiro J. M., a correlation was found between cognitive abilities and financial behavior. Participants with higher cognitive abilities demonstrated more rational behavior in risk-related and delayed gratification scenarios. Specifically, individuals with higher scores exhibited greater patience regarding short-term financial decisions (favoring increased delayed rewards over immediate gains) and were more inclined toward rational risk-taking. This causal relationship persisted even after accounting for socio-economic factors and family background [27].

The research by Estrada-Mejia C., Vriesa M., and Zeelenberg M. [28] revealed a consistent and statistically significant connection between the level of numeracy skills and financial accumulation. On average, individuals with

higher numeracy skills accumulated more wealth. Moreover, numeracy skills influenced the trajectory of accumulation—over a five-year period, those with lower numeracy skills tended to see a decline in savings, while those with higher skills maintained a stable positive level of financial well-being.

Christelis D., Jappelli T., and Padula M. found a statistically significant relationship between cognitive abilities (specifically testing numeracy, verbal fluency, and memory) and tendencies to invest in stocks, even when controlling for education, health, and socio-economic status [29].

Banks J. and Oldfield Z. in their work identified a significant correlation between financial well-being and numeracy skills—the higher the numeracy skills, the greater the savings, investment portfolios, and sense of financial security [30].

In an article by Skagerlund K. et al., it was found that numeracy was the strongest predictor of financial literacy, even after accounting for demographic factors such as age, gender, education, and income [31].

Researchers conclude that individuals with higher cognitive abilities exhibit greater patience in decision-making [32]. In addition, well-developed cognitive abilities positively impact abilities related to teamwork, collaboration, and planning [33].

III. CONCLUSION

Thus, cognitive processes play a crucial role at all stages of the emergence, experience, and regulation of emotions, shaping their content, intensity, and influence on human behavior [34]. The level of numeracy skills affects a patient's understanding of health-related information and the process of making informed medical decisions. Additionally, cognitive abilities, particularly numeracy skills, significantly influence the development of financial literacy and the making of rational financial decisions. These skills are key factors in determining an individual's ability to effectively accumulate and preserve financial resources.

As a result of the analysis, the formation of a theoretical foundation on the influence of cognitive ability development on the formation of universal competencies has begun. This will enhance the understanding of cognitive development characteristics in higher education students and may serve as a basis for further research aimed at the objective assessment of students' personal and cognitive characteristics.

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