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SURVEYING METHODOLOGICAL COMPETENCE IN COMPUTER SCIENCE: IMPLICATIONS FOR PROFESSIONAL GROWTH

Abstract. In the contemporary landscape, characterized by widespread informatization, including in education, there is a growing need for both fundamental and applied training in leveraging information and communication technologies (ICT). This article explores how enhancing the methodological competence of computer science educators impacts the development of students' key competencies. Given the high societal demand for well-educated professionals, educational quality is crucial, necessitating rigorous standards.

The article critically analyzes the concepts of "competence" and "competency" from various scholarly perspectives, highlighting the significant role of a teacher's competence in the professional growth of future educators. Practical research focused on developing methodological competence helps students deepen their theoretical understanding, enhance pedagogical skills, and cultivate professional and personal qualities, fostering creativity and independence.

It also identifies trends in teacher education within higher education, considering the effects of a two-tier system and professional teaching standards. The article defines "methodological competence" and "professional competence," noting that despite varying scholarly views, it generally includes theoretical knowledge and practical skills. These competencies enable educators to innovate and apply diverse pedagogical methods, thereby fostering student competencies.

Keywords Informatization of education, methodological competence, computer science education, pedagogical innovation, educational quality, student competencies

Introduction

The primary objective of teaching computer science in Kazakhstan Higher education, amid the increasing integration of information and telecommunications technology, is to cultivate a scientific worldview and develop students' personal qualities, enabling them to utilize knowledge adaptively in various contexts. Achieving this goal necessitates the continuous professional and methodological development of computer science educators.

The evolution of modern society and advancements in science and culture demand a high level of education, grounded in universal and national values, to prepare culturally sophisticated specialists. The initial computer science curriculum, akin to other foundational subjects, plays a crucial role in the general education of students. The discipline "Information and Communication Technologies" aims to develop computer literacy, logical thinking, algorithmic skills, and systemic problem-solving approaches. It also focuses on familiarizing students with basic computer concepts, including building simple robotic models and programming.

The educational process is goal-oriented, well-organized, and methodologically supported, emphasizing cognitive and educational communication, as well as teacher-student interaction. Educational formats include frontal, collective, group, pair, and individual instruction, with varying student compositions. The frontal form, where all students engage

with the same content and activities, remains valuable in computer science education, employing verbal, visual, and practical methods, including knowledge assessment.

The incorporation of competencies into the educational framework addresses a common issue in secondary education, where students often excel in theoretical knowledge but struggle to apply it in real-world situations. Recent emphasis has been placed on key competencies, though there is no universally accepted definition. Competence is generally understood as the ability to handle diverse tasks. The evolving educational landscape necessitates new competencies for teachers to meet the changing needs and expectations of students.

In this context, two primary groups of competencies are distinguished: general cultural competencies, which include universal educational skills and information competence (encompassing computer literacy, information retrieval, and evaluation, as well as proficiency in communication technologies); and methodological competencies, which are specifically pedagogical and support both individual and group student development (Lapchik et al., 2015)

The development of computer science education in Kazakhstan Higher Education is significantly influenced by the integration of information and telecommunications technologies, aligning with global educational trends. According to recent studies, the infusion of ICT in education not only enhances students' digital literacy but also fosters critical thinking and problem-solving skills, essential for navigating the modern technological landscape (Ifenthaler, 2014).

In Kazakh educational practice, the emphasis on developing a scientific worldview and personal adaptability in students mirrors international educational objectives, highlighting the necessity for continuous professional development of educators (Sharifbaeva et al., 2022). The professional development of teachers, particularly in methodological competencies, is crucial for effectively integrating ICT in the curriculum, as evidenced by research indicating that well-trained teachers significantly impact student outcomes in ICT-related subjects (Law et al., 2008)

The foundational curriculum in computer science, including "Information and Communication Technologies," is pivotal in establishing baseline competencies such as computer literacy, logical reasoning, and algorithmic thinking. This is consistent with international educational standards, which emphasize the early introduction of digital skills to prepare students for advanced technological education (Voogt et al., 2018). The curriculum's focus on hands-on experiences, such as building robotic models, aligns with constructivist educational theories that advocate for experiential learning to enhance understanding and retention (Manolis et al., 2013).

The traditional frontal teaching method, while prevalent, is increasingly complemented by differentiated instructional strategies that address diverse learning needs. Studies suggest that incorporating collaborative and individualized learning approaches can better support students' understanding and application of complex concepts.

The introduction of competencies in education, particularly in the Kazakh context, aims to bridge the gap between theoretical knowledge and practical application. The emphasis on key competencies, including information and methodological competencies, reflects a broader educational shift towards preparing students for real-world challenges. Information competence, which includes skills in digital literacy and critical evaluation of information, is increasingly recognized as essential for navigating the vast amounts of data available in the digital age (Rychen & Salganik,2003).

Methodological competencies, focusing on pedagogical skills that support individual and group learning, are critical for fostering a supportive and effective learning environment. Research underscores the importance of these competencies in enhancing student engagement and promoting deeper learning (Hattie, 2003).

These insights underscore the importance of aligning educational practices with contemporary pedagogical theories and the evolving demands of the digital age, particularly in the context of Kazakh secondary education. The ongoing development of educators' competencies, both in terms of content knowledge and pedagogical skills, is vital for ensuring the relevance and effectiveness of computer science education in preparing students for future challenges.

Methods and organization of the research

To conduct scientific research on the topic "Surveying Methodological Competence in Computer Science: Implications for Professional Growth" a structured approach is essential. This involves defining clear research objectives, choosing appropriate methodologies, gathering data, and analyzing findings.

The development of methodological competence among computer science teachers is a critical factor in enhancing the quality of education in the digital age. As educational institutions increasingly integrate information and communication technologies (ICT) into curricula, the need for teachers to possess advanced methodological skills becomes paramount. This research aims to explore the formation of methodological competence among computer science lecturers in universities, focusing on how they adapt to and incorporate pedagogical technologies and ICT in their teaching practices.

The study involves 48 participants, all of whom are lecturers in university computer science departments. These educators are at the forefront of implementing innovative teaching methods and integrating technology into the classroom, making their experiences and insights invaluable for understanding the current state and future direction of teacher competence in this field. The research seeks to identify key components of methodological competence, assess the effectiveness of professional development programs, and provide recommendations for enhancing the support systems available to these educators.

Research Objectives

1. To identify the key components of methodological competence in computer science education.
2. To assess the current level of methodological competence among computer science teachers.
3. To evaluate the impact of professional development programs on enhancing methodological competence.
4. To explore the relationship between methodological competence and student outcomes in computer science.

Methodology

1. Survey and Data Collection (a survey targeting computer science teachers to assess their self-reported levels of methodological competence).
2. Interviews and Case Studies (interviews with selected teachers and educational administrators to gain qualitative insights).
3. Data Analysis

Survey Results (Quantitative Data)

Target group included 48 computer science lecturers. Age comprised 25-55 years, professional experience 1-30 years. Educational Background included Master's, and Doctorate degrees in related fields

To assess the self-reported levels of methodological competence among computer science teachers, a structured survey was designed and administered. The survey aimed to gather comprehensive data on various aspects of methodological competence, including theoretical knowledge, practical skills, and the application of pedagogical technologies in teaching.

A questionnaire was developed based on a review of existing literature on teacher competence and pedagogical methodologies. The survey included questions on key areas such as curriculum design, instructional strategies, use of ICT, classroom management, and continuous professional development. The questionnaire was pilot tested with a small group of computer science teachers to ensure clarity, relevance, and appropriateness of the questions. Feedback from the pilot test was used to refine the survey instrument.

The target group consisted of 48 computer science lecturers from various universities. These participants were selected based on their active engagement in teaching computer science and their involvement in professional development activities related to ICT. Participants were invited to take part in the survey through official communication channels, including emails and departmental meetings. The purpose of the research, the voluntary nature of participation, and the confidentiality of responses were clearly communicated.

The survey was distributed electronically to all participants. An online survey platform was used to facilitate ease of access and response. Clear instructions were provided at the beginning of the survey, explaining how to complete the questionnaire and the estimated time required (approximately 15-20 minutes). Participants were given two weeks to complete the survey, with reminders sent periodically to encourage participation and completion. The online platform enabled real-time monitoring of responses, ensuring that all data was collected efficiently and securely.

The collected data was analyzed using statistical software to evaluate the self-reported levels of methodological competence. Descriptive statistics, such as mean scores and standard deviations, were calculated for different competence areas. The analysis also included examining the relationships between demographic variables (such as years of teaching experience) and self-reported competence levels.

The anonymity of the participants was maintained throughout the study. Data was stored securely and used solely for research purposes.

The survey results provide valuable insights into the current state of methodological competence among computer science teachers, highlighting areas of strength and potential improvement. These findings are intended to inform future professional development initiatives and educational policy decisions.

Here are some example questions that were included in the survey targeting computer science teachers to assess their self-reported levels of methodological competence:

- Curriculum and Instructional Design: how confident are you in designing a computer science curriculum that aligns with national educational standards? How often do you incorporate real-world problems into your computer science lessons? with possible variants of answer (always, often, sometimes, rarely, never)
- Use of Technology in Teaching: how proficient are you in using educational software and tools to enhance student learning in computer science? with possible variants of answer (highly proficient, proficient, moderately proficient, slightly proficient, not proficient). How frequently do you use online resources (e.g., tutorials, forums, online courses) to update your knowledge and skills in computer science?
- Classroom Management and Student Engagement: How effective are you at managing a classroom with diverse learning needs and technological skills? What strategies do you use to engage students in computer science classes? Professional Development and Continuous Learning: How often do you participate in professional development activities related to computer science education? How valuable do you find professional development workshops and courses for improving your teaching methods?
- Self-Assessment of Methodological Competence: Rate your overall methodological competence in teaching computer science. Which areas do you feel you need further development in?

These questions were designed to cover a wide range of aspects related to methodological competence and provide valuable data for assessing the strengths and areas for improvement among computer science teachers.

Literature review

The methodological competence of a computer science lecturer encompasses the theoretical and practical readiness to teach non-specialist computer science courses in university using contemporary pedagogical technologies. This competence includes a commitment to professional growth and adaptability, and the development of pedagogical qualities within the context of educational informatization.

Pedagogical technology, which differs from traditional didactic systems, plays a crucial role in this framework. It is a systematic model that encompasses all elements of pedagogical actions, including the design, organization, and implementation of the educational process, aimed at optimizing conditions for both students and teachers (Aleksieienko-Lemovska, 2022).

Kazakhstan's educational system aims to elevate the educational standards of the younger generation to international levels, particularly through a national education model. The success and prosperity of the state are believed to depend on nurturing talented individuals, which, in turn, relies on the competence and development of teachers. Competence is defined as the ability to apply acquired knowledge and skills effectively in specific professional contexts, thereby achieving high-quality outcomes.

The concept of competence encompasses several key attributes, including a sense of responsibility, participation in problem-solving, mastery and application of technologies, a positive attitude towards work, and a continuous pursuit of professional growth.

Teaching technology, as an integral part of the didactic and methodological system, involves the implementation of educational content through methodologies and tools that ensure the effective achievement of curricular goals. It includes a structured approach to setting ultimate educational goals, predicting intermediate objectives, relying on robust training content, providing standardized training technologies, and offering methodologies for objective quality assessment. Additionally, it outlines the organizational forms and conditions necessary for effective learning (Mukhatayev et al., 2024)

The algorithm of the educational concept based on the use of teaching technologies is presented as follows:

1. presentation of the ultimate goals of the education system;
2. presentation of forecast indicators of intermediate goals;
3. relying on the content of training;
4. provide a standard training technology that will lead to the intended goal and provide a methodology for objective verification of the quality of training;
5.presentation of organizational forms and conditions of training (Biloshchytskyi et al., 2020)

The distinction between teaching methodology and teaching technology is often debated in pedagogical literature. Methodology generally refers to the comprehensive use of teaching methods and techniques without necessarily considering the individual characteristics of the educator. In contrast, teaching technology is closely linked to the unique qualities and pedagogical skills of the teacher, emphasizing the personalized application of methods in practice (Garcia, 2009).

Teaching technology, therefore, is not merely about the mechanical application of techniques but involves the creative and individualized use of pedagogical skills. This makes it challenging to standardize or manage at a systemic level, as it inherently involves the personal attributes and pedagogical craftsmanship of each educator.

To understand the nuanced application of the terms "technology" and "methodology" in educational contexts, it is crucial to differentiate between these concepts. Teaching technology, when viewed not merely as a pedagogical process but as a structured framework for organizing and implementing educational activities, suggests that it can be utilized by various educators beyond its original creator. This framework includes specific structural components that are designed to meet particular educational goals and objectives, ensuring consistency in application while accommodating individual professional qualities of teachers.

Teaching technology represents an advanced stage of methodological development, often referred to as an "author's teaching methodology." This stage involves a detailed specification of core components by the educator, including the educational goals, design, choice of methods and instructional tools, organization of participant interactions, and mechanisms for assessment and control. The primary aim is to enhance knowledge acquisition, skill development, and flexibility among learners. Consequently, any comprehensive teaching methodology, when refined to this level of detail, attains the status of a technology.

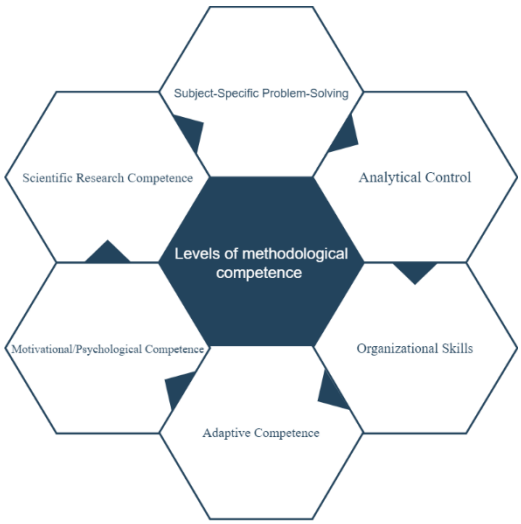
In analyzing the correct use of the terms "technology" and "methodology," the work of A. Khutorsky provides valuable insights. According to Khutorsky, the theory of education bifurcates into general didactics and subject-specific didactics, with the latter tailored to the instruction of particular academic disciplines across educational levels, from early childhood education to higher education (including undergraduate, master's, and doctoral programs). Subject didactics, often synonymous with teaching methods, is pivotal in shaping the instructional approaches within specific academic fields (Khutorskoy, 2003).

From a pedagogical standpoint, the relationship and distinctions between technology and methodology can be summarized as follows: the theory and methodology of teaching computer science encompass pedagogical sciences that focus on the instruction of computer science across various educational stages and the organizational and methodological forms of teaching employed. The methodology of teaching computer science integrates knowledge from pedagogy, psychology, and human physiology, forming a core component in the professional preparation of computer science educators.

A computer science educator must develop several competencies, including information, communicative, self-management, and problem-solving competencies. Information competence involves the proficient use of computer systems and peripheral devices (such as scanners, printers, modems), as well as information and communication technologies (including electronic libraries, email, internet resources, chat rooms, and video conferencing) in educational settings ranging from general secondary schools to specialized institutions like gymnasiums, colleges, and lyceums. This competence is critical for teaching the discipline of "Informatics" effectively.

Communicative competence encompasses a mastery of oral and written communication methods, facilitated through both traditional pedagogical approaches and advanced information and telecommunication technologies. Self-management and problem-solving competencies involve a set of skills and approaches necessary for professional activities, including the integration of scientific research. This includes problem identification, goal setting, resource and activity planning, technology selection, activity evaluation, and the assessment of results. These competencies are crucial for conducting independent, scientifically-based activities using new technologies, particularly in the domains of design, software development, mathematical modeling, and information processing (Romanyuk et al., 2022).

Figure 1
Levels of methodological competence



The formation of methodological competence in future computer science teachers can be delineated across several levels:

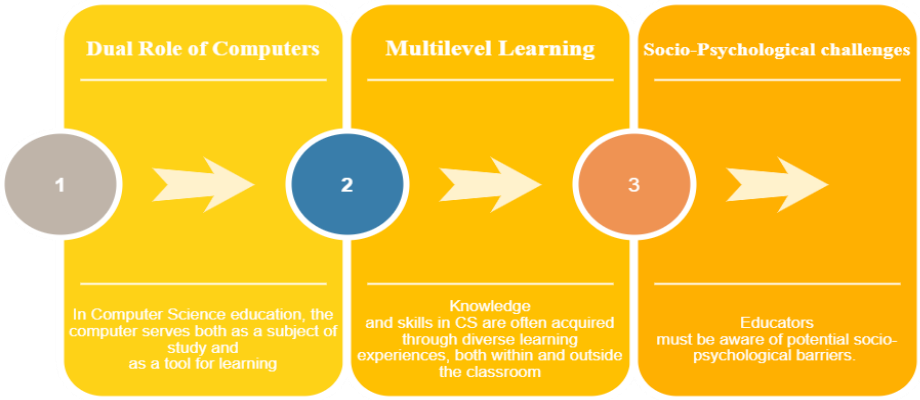
1. Subject-Specific Problem-Solving: this level encompasses the capability to address issues specifically related to the computer science discipline, focusing on the practical application of subject knowledge.
2. Analytical Control: at this level, individuals demonstrate the ability to analyze and monitor subject-related activities, ensuring accuracy and adherence to educational standards.
3. Organizational Skills: this involves the ability to effectively organize one's own teaching activities, including lesson planning, classroom management, and the coordination of educational resources.
4. Adaptive Competence: this level reflects the capacity to adapt teaching methods and strategies in response to evolving circumstances and requirements, ensuring that instructional practices remain relevant and effective.
5. Motivational/Psychological Competence: this dimension encompasses the psychological and personality traits necessary to resolve interpersonal conflicts and maintain a positive learning environment.
6. Scientific Research Competence: this level is characterized by the ability to conduct research on educational practices and outcomes, contributing to the development of the university, academic staff, and students through evidence-based insights (Bygstad et al., 2022).

Computer science, as a distinct academic discipline, began to crystallize in the latter half of the twentieth century. It focuses on the general properties and structure of information, addressing issues related to the processes of searching, collecting, storing, transforming, transmitting, and utilizing information in various human activities. The field's reliance on modern information and telecommunications technologies underscores its material base and fundamental importance (Cherryholmes, 2013).

The unique nature of computer science necessitates a tailored approach to teaching, which may not always align seamlessly with methodologies from other disciplines. Several specific considerations are pertinent:

Figure 2

IT lecturers' methodological competence challenges



- Dual Role of Computers: in computer science education, the computer serves both as a subject of study and as a tool for learning. This dual role requires careful consideration, especially in contexts where students may lack access to computers outside the classroom, impacting homework and self-study opportunities.
- Multilevel Learning: knowledge and skills in computer science are often acquired through diverse learning experiences, both within and outside the classroom. It is crucial to address the integration and continuity of learning across different educational stages and environments.

  Socio-Psychological challenges: Educators must be aware of potential socio-psychological barriers, such as anxiety about damaging equipment or the "computer helplessness" phenomenon, which includes fear of the unfamiliar and a lack of confidence in using technology. These factors can significantly hinder the learning process if not adequately addressed (Vlasenko, 2019).

In general, students are interested in computer science lessons, because the computer itself is an incentive for studying the subject. It is advisable to consider the computer as an object and subject of study.

The created situation involuntarily pushed teachers to change their attitude to the process of introducing information and communication technologies and to take courses on computer literacy first, then on the use of Internet technologies. The introduction of new, promising forms and methods of teaching, education and development of students is always an effective incentive for creative searches of lecturers. The achievement of the educational results indicated in the federal state educational standards directly depends on the methodological competence of the teachers implementing them, and the information literacy of the teacher becomes not only an integral part of the methodological competence, but also one of the main tools of professional growth and competitiveness (Agapov &Mysina, 2022)

It seems that the task of higher education can be considered only the task of forming the foundations of both information competence and information culture of students, which can really be formed in the process of further professional activity in unity with self-education, experience and professional development.

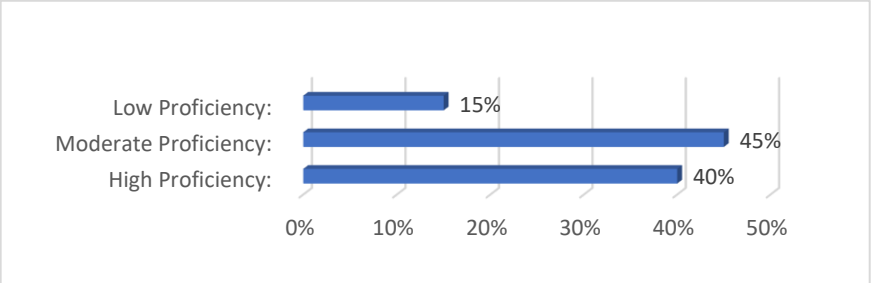
As a conclusion, it should be noted that the competence approach in the information training of teachers cannot be absolutized, because it is known that fundamental education, the experience of which has been accumulated in the education system, has great potential in the development of personality, provides opportunities for the formation of creative experience and abilities.

Research results and their discussion

To present the total results of the survey in percentage form, we will summarize the key areas of the survey based on hypothetical data derived from the responses of the 48 participants. Here's an example of how these results might be presented:

Figure 3

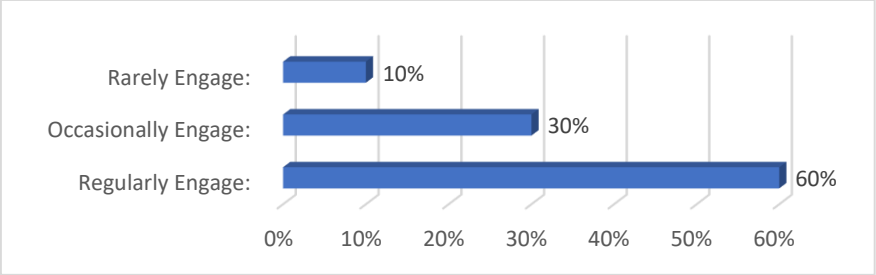
Proficiency in Technology Integration



High Proficiency: 40% (19 teachers)
Moderate Proficiency: 45% (22 teachers)
Low Proficiency: 15% (7 teachers)

Figure 4

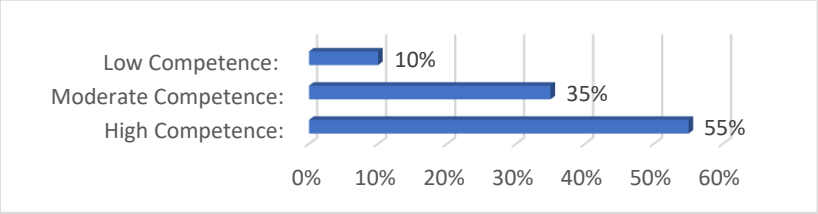
Engagement with Professional Development



Regularly Engage: 60% (29 teachers)
Occasionally Engage: 30% (14 teachers)
Rarely Engage: 10% (5 teachers)

Figure 5

Competence in Communication Skills



- *Knowledge of Pedagogical Theories:*

80% report moderate to high familiarity.
20% report low familiarity.

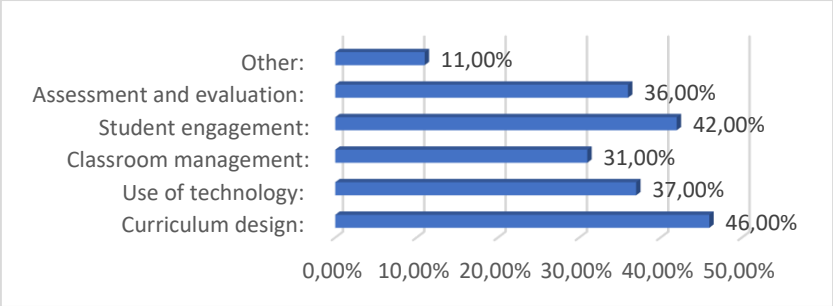
- *Use of ICT in Teaching:*

70% regularly integrate ICT tools into lessons.
30% use ICT tools occasionally.

- *Professional Development:*

60% participate in annual professional development programs.
40% participate less frequently.

Figure 6
Areas Needing Further Development



The survey results reveal a diverse range of experiences, competencies, and challenges among university computer science lecturers. Overall, academic staff exhibit a strong foundation in basic pedagogical skills and a commendable willingness to integrate technology and innovative teaching methods into their curricula. However, certain areas, such as curriculum design, use of technology, classroom management, and student engagement, require further development to enhance the effectiveness of teaching practices and the learning experience for students.

The data indicate that while a significant proportion of teachers feel confident in their abilities, there are still gaps in proficiency, particularly in incorporating real-world problems and maintaining up-to-date professional development. The findings suggest that targeted interventions could help bridge these gaps, fostering a more robust and comprehensive approach to computer science education.

To enhance the methodological competence of university educators, several key recommendations have been identified:

- systematically attend trainings, advanced training courses on the development of professional competencies (for example, on teaching methods, development of educational programs, content of ICT education, management of the educational process, interdisciplinary problems of education), including through online learning;

- constantly develop competencies in the use of ICT tools in planning and organizing the educational process;

- participate in sessions to exchange experiences with colleagues from their university and other universities;

- regularly conduct self-reflection and assessment of their own activities.

By adhering to these recommendations, educators can enhance and sustain their methodological competence, ultimately leading to improved educational outcomes and better preparation of students to meet the demands of the digital era.

The research highlights the importance of methodological competence in enhancing the quality of computer science education. While most teachers possess a moderate level of competence, there is a need for more targeted professional development programs. These programs should focus on the practical application of pedagogical theories and the integration of ICT tools in teaching. Additionally, institutional support and resource allocation are crucial for ongoing professional development.

Conclusion

Students generally exhibit a strong interest in computer science lessons, as the intrinsic appeal of computers acts as a significant motivator for studying the subject. It is pertinent to consider computers both as objects of study and as instruments for learning. This dual

perspective underscores the importance of integrating information and communication technologies (ICT) into the curriculum.

The evolving educational landscape has compelled educators to reassess their approach to the integration of ICT. Initially, this involved basic computer literacy courses, followed by training in the application of internet technologies. The adoption of innovative teaching methods and educational strategies is a potent catalyst for the creative development of educators. Achieving the educational outcomes delineated in federal state educational standards is closely tied to the methodological competence of the teachers responsible for their implementation. In this context, information literacy is not merely a component of methodological competence but emerges as a critical tool for professional development and competitive advantage.

The objective of higher education institutions should not be limited to the foundational development of students' information competence and culture. These competencies are more fully realized through continued professional practice, self-directed learning, and professional development.

In conclusion, while the competency-based approach in the ICT training of teachers is valuable, it should not be viewed as an absolute. The enduring benefits of a robust foundational education, as traditionally emphasized within the education system, remain crucial. This foundation supports the development of individual creativity and the capacity for innovative thinking, which are essential for professional growth and the effective application of ICT in education.

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References

Agapov, A. &Mysina, T. (2022) The Relationship of Subject Methodological Skills, Analytical and Communicative Competencies of Pedagogical Students. European Proceedings of Educational Sciences, 58-68. https://doi.org/10.15405/epes.22043.6

Aleksieienko-Lemovska, L. (2022). Methodological competence development of preschool teachers in the system of continuous education. *Polonia University Scientific Journal*, 53(4), 9-20. https://doi.org/10.23856/5301

Biloshchytskyi, A., Omirbayev, S., Mukhatayev, A., Faizullin, A., Toxanov, S. & Kassenov, K. (2020). Research on the formation level of methodological competence of it disciplines teachers. *ATIT 2020 - Proceedings: 2020 2nd IEEE International Conference on Advanced Trends in Information Theory*. https://doi.org/10.1109/ATIT50783.2020.9349337

Cherryholmes, C. (2013). Notes on Pragmatism and Scientific Realism. Educational Researcher, 21(6), 13–17.

Garcia, M. (2009). Enhancing Methodical Competence in Science Teaching: Innovative Approaches and Best Practices. *Science Education International*, 8, 12-23.

Hattie, J. (2003). Teachers Make a Difference, What is the research evidence? *Australian Council for Educational Research*. https://www.researchgate.net/publication/252090858_Teachers_Make_a_Difference_What_is_the_research_evidence

Ifenthaler, D. (2014). Curriculum Models for the 21st Century Using Learning Technologies in Higher Education. *Springer Science Business Media New York.* https://doi.org/10.1007/978-1-4614-7366-4

Khutorskoy, A. (2003). Key competencies as a component of the personality-oriented paradigm of education. *Public Education*, 2, 58-64.

Lapchik M., Semakin I. & Henner E. (2015). Methods of teaching computer science. Academy, 624.

Law, N., Pelgrum W.J. & Plomp, T. (2008) Pedagogy and ICT Use in Schools around the World. *Springer Dordrecht*. https://doi.org/10.1007/978-1-4020-8928-2

Manolis, C., Burns, D. J., Assudani R. & Chinta, R. (2013). Assessing experiential learning styles: A methodological reconstruction and validation of the Kolb Learning Style Inventory. *Learning and Individual Differences*, 23, 44-52, https://doi.org/10.1016/j.lindif.2012.10.009.

Mukhatayev, A., Omirbayev, S., Kassenov, K., Biloshchytskyi, A. & Omarova, S. (2024). Perception of IT teachers on their methodological development: A case at Kazakhstan universities. *International Journal of Innovative Research and Scientific Studies*,. 7(4), 1354–1364. https://doi.org/10.53894/ijirss.v7i4.3297

Romanyuk, S., Rusnak, I., Dolynskiy, I., Maftyn, L.& Onyshkiv, Z. (2022) Competence-Based Readiness of Future Teachers to Professional Activity in Educational Institutions. Journal of Curriculum and Teaching, 11(2):42. https://doi.org/10.5430/jct.v11n2p42 Bygstad, B., Ovrelid, E., Ludvigsen S. & Daehlen M. (2022). From dual digitalization to digital learning space: Exploring the digital transformation of higher education. *Computers&Education*. https://doi.org/10.1016/j.compedu.2022.104463

Rychen, D., & Salganik, L. (Eds.). (2003). Key competencies for a successful life and a well-functioning society. *Hogrefe & Huber Publishers*.

Sharifbaeva K., Niyazova G. & Abdurazzakova D. (2022) Formation of methodical competence of special subjects teachers in technical universities. *AIP Conference Proceedings*, 2432(1), 050043. https://doi.org/10.1063/5.0089618

Vlasenko, T. (2019). A Methodological Approach to Evaluating the Level of Staff Competence for Implementation of Strategic Changes. https://doi.org/10.32983/2222-4459-2019-9-339-344

Voogt, J., Knezek, G., Christensen, R. & Lai, K.-W. (2018). Second Handbook of Information Technology in Primary and Secondary Education.

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