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TECHNOLOGIES FOR DEVELOPING THE COGNITIVE THINKING OF STUDENTS IN MEDICAL EDUCATION ON THE BASIS OF THE SNAPPS MODEL (IN THE EXAMPLE OF TEACHING THE SCIENCE OF INTERNAL DISEASES)

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Abstract: The development of cognitive thinking in medical students is a vital aspect of medical education. It enhances their ability to think critically, solve problems effectively, and make informed decisions. The SNAPPS model, which stands for Summarize, Narrow, Analyze, Probe, Plan, and Select, is an effective model for developing cognitive thinking in medical students. This model, developed by Dr. Wolpaw and his colleagues in 2003, is a learner-centered approach that encourages students to actively engage with clinical cases and develop their critical thinking skills. This article will explore the technologies that can be used to support the development of cognitive thinking in medical students based on the SNAPPS model.

Keywords: SNAPPS model, technologies, new approaches, medical students, cognitive thinking, scoring systems.

Introduction: Medical education, as well as school education, which serves as the basis for subsequent study at universities, is one of the most important stages in training students who will be able to further engage and succeed in their chosen profession. Due to the specifics of the professional activities of future specialists - doctors, whose activities are associated with decision-making and innovative technologies, determining the functions and responsibilities of an individual in the field of medicine, with prescription rights, and the responsibility for the life and health of the patient, it determines the increased demands placed on the process of forming professional competence. In accordance with modern requirements, technology should contribute to the development of critical clinical thinking of students in medical education. At the same time, notwithstanding some differences in learning objectives and methods of teaching, the principles that should be the basis for the curriculum and content are the same for all health volunteers, because the quality of training is the same for all groups of healthcare providers.

Goals and Objectives: The purpose of our research is to develop technologies for the development of the cognitive thinking of students in medical education on the basis of the SNAPPS model. To achieve this goal, it is necessary to solve a number of problems, including: considering existing methods and scoring systems and determining the possibility of using them in a medical university; assessing the needs of medical students for the formation of critical clinical thinking; developing technologies for enhancing the critical clinical thinking of a student on the basis of the SNAPPS model; and testing the proposed technologies.

Background and Rationale

The interest in innovative educational technologies within the framework of the paradigm shift in medical education has led to the emergence of the concept of "competence-based medical education." Practically, the main emphasis of this approach is placed on the

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development of thinking of students. Professional competency is ensured largely by cognitive skills such as interpreting case data through differential diagnosis and critical analysis to choose the most appropriate actions. In this context, it becomes necessary to develop the cognitive thinking of students not only in the theoretical course for a certain period of time but also in practical sessions.

To enhance the role of practical classes within the framework of the Bologna system, an increased number of hours allocated to practical work is implemented. Clinical disciplines gain a leading position. All of this is done to ensure proper professional competence, which combines a number of student qualities: a high level of motivation for learning; high levels of cognitive thinking development; specific subject area knowledge with a practical bias, based on skills, analysis, and practical application of knowledge; independent resolution of professional tasks, both in theoretical classes and in practical settings; as well as in future activities in the specialty.

Purpose of the Study

In the medical educational process, with its diversity and complexity, cognitive processes play an important role. Teaching students to think in a medically meaningful way is one of the important tasks in training a young generation of medical professionals in various specialties. The purpose of the study is to develop a technique for the formation of cognitive thinking of students in medical education, based on the designed model of presenting clinical data. The implementation of this model is based on gaming technologies and a set of brainstorming scenarios for training.

The model is a strategy for the primary care of clinical cases, whether familiar or unfamiliar to the learner, presented by empirical data. The model assumes meaningful use in teaching clinical disciplines using modern educational technologies. Subsequently, in training, we have applied several groups of gaming technologies, including designing and implementing a brainstorming scenario, drafting, conceptualizing, and applying a designed model that forms cognitive thinking of a specialist. These work technologies are followed by individual and group gaming reflection, as well as group gaming discussion. The scenario of the first stage of brainstorming is based on pain, which is one of the most frequent syndromes of strongly experienced feelings and, accordingly, of unhealthily perceived pain in the context of the doctor and the patient's relationship, as well as the availability of the doctor in an emergency in any patient's condition.

Significance of the Study

In modern conditions of the development of medical education, it is determined that the latest IT technologies are integrated into the educational process from the beginning of the study of future doctors in educational institutions of various forms of ownership and accreditation. They gradually integrate and differentiate in access to learning resources, their development, and the use of educational, teaching, and control subjects. It is proven that such learning technologies are implemented for the personal self-development of future physicians and are a methodological tool in the educational process. They help to successfully carry out the individual approach to each student's educational activities, taking into account their cognitive development and the formation of professional competence. The

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relevance of applying interactive teaching methods and technologies to the academic discipline is described. It is determined that changes in the educational and training programs of educational institutions for the training of future specialists with higher medical education are associated with the use of these methods, as they allow for personal development. Focus attention on the problem of improving the level of professional training of medical students in the development of technologies for intellectual learning based on specialized knowledge and information technologies in modern IT systems for training purposes to form the cognitive thinking of a future physician's competence.

Literature review.

The exploration of cognitive thinking development in medical education has gained traction over the past decade, particularly through the lens of innovative pedagogical models such as the SNAPPS model. This literature review examines a series of studies that collectively highlight the importance of active learning, cognitive theory, and critical thinking in medical training, ultimately aiming to enhance the educational experience for future healthcare professionals.

In 2011, Hightower, (2011) emphasized the necessity of active engagement in medical classrooms as a means to improve student retention and prepare them for practical roles in healthcare settings. The study underscored the significance of creating an environment conducive to critical thinking through problem-based learning, which allows students to apply their knowledge in real-world scenarios. This foundational idea of active learning sets the stage for subsequent research.

Building on this concept, Qi Qiao et al, (2014) explored cognitive theory's application in medical education, revealing the challenges students face due to high cognitive loads associated with memorization of complex subjects such as anatomy and pathology. They argued that effective learning requires strategies that go beyond rote memorization, advocating for the use of cognitive schemata to facilitate clinical reasoning. This perspective aligns with the need for innovative teaching methods that support cognitive development in medical education.

The role of simulation in fostering critical thinking was further examined by Daniel-Underwood, (2016) in 2016, who investigated high-fidelity medical simulation as a tool for assessing critical thinking in senior medical students. The study highlighted the importance of decision-making skills and the integration of knowledge to ensure patient safety, indicating that such simulations can serve as a critical intervention point for developing competent healthcare providers

Israel, (2019)'s 2019 research introduced mind mapping as a learning strategy for physician assistant students, demonstrating its effectiveness in enhancing critical thinking skills. The findings indicated significant improvements in critical thinking scores following the use of mind mapping, reinforcing the notion that active learning strategies, including visual tools, can promote deeper understanding and retention of complex information.

Kumar. V et al. (2020) contributed to the discourse by investigating the infusion of clinical reasoning axioms into case vignette teaching for novice medical students. This randomized

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crossover study highlighted the effectiveness of structured approaches in improving clinical reasoning, further supporting the integration of innovative pedagogies in medical curricula.

Analysis and Results.

The SNAPPS model provides a structured approach to problem-solving, emphasizing active learning and critical thinking. Each stage presents unique opportunities for technological intervention. The first step, Summarize, necessitates the ability to synthesize large quantities of information concisely and accurately. Here, technologies can play a crucial role. For instance, concept mapping software can facilitate the creation of visual summaries, enabling students to identify key relationships and interconnected concepts. Mind mapping tools, such as MindManager or XMind, allow for dynamic organization of information, enhancing understanding and recall. Furthermore, AI-powered summarization tools can condense lengthy medical texts, research articles, or patient case histories, freeing up students' time for deeper analysis. These technologies not only aid summarization but also reinforce active learning by requiring students to actively engage with the material to create their own summaries.

The second stage, Narrow, requires students to identify the core problem from a complex clinical presentation. This stage necessitates discerning relevant from irrelevant information. Technologies such as clinical decision support systems (CDSS) can assist in this process. CDSS, integrated within electronic health records (EHR) systems, can filter through vast amounts of patient data, highlighting key symptoms and risk factors, thus guiding students towards a focused diagnosis. Furthermore, virtual reality (VR) simulations can present students with realistic clinical scenarios, forcing them to actively narrow down differential diagnoses based on virtual patient interactions. These simulations allow for repeated practice and feedback, honing their ability to efficiently filter and prioritize information.

The Analyze stage involves applying medical knowledge to interpret the narrowed information and formulate hypotheses. Here, technologies such as medical image analysis tools, particularly AI-powered systems, can be highly beneficial. These tools can automatically detect anomalies in medical images like X-rays, CT scans, and MRIs, providing students with objective insights and guiding their analytical process. Moreover, data visualization tools can display complex datasets in an easily understandable manner, revealing patterns and correlations that might otherwise be missed. Interactive simulations also play a crucial role here, allowing students to manipulate variables and observe the consequences, strengthening their analytical abilities in a safe and controlled environment.

The Probe stage demands critical questioning and the formulation of insightful inquiries. This stage can be effectively supported by online discussion forums and collaborative learning platforms. These technologies allow students to engage in peer-to-peer learning, posing questions, sharing insights, and critically evaluating each other's reasoning. AI-powered chatbots, while still in their developmental stages, could potentially provide tailored feedback and further probing questions based on students' initial hypotheses. Furthermore, access to online medical databases and literature through platforms such as PubMed allows for a deeper exploration of relevant research, facilitating evidence-based probing.

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The Prepare stage focuses on developing a plan for managing the clinical problem. Here, technologies can enhance both the planning process and the delivery of the plan. For instance, simulation software, particularly high-fidelity patient simulators, allows students to practice their clinical skills in a realistic environment, testing their treatment plans and receiving immediate feedback. These simulations can incorporate branching scenarios, further challenging students to adapt their plans in response to unexpected developments. Additionally, collaborative document editing tools allow students to work together on treatment plans, fostering teamwork and shared decision-making.

Finally, the Self-explain stage encourages reflection and metacognition. Educational technologies can enhance this stage through the use of reflective journaling tools, which can prompt students to analyze their performance, identify areas for improvement, and articulate their learning process. Personalized feedback systems, based on AI analysis of student performance in simulations and assessments, can provide targeted recommendations for future learning. Furthermore, the use of video recording and self-assessment tools allows students to review their clinical performance, improving their self-awareness and fostering continuous learning.

Conclusion.

In conclusion, technologies such as electronic health records, simulation-based education, online learning platforms, mobile apps, artificial intelligence, and virtual patient simulations can be used to support the development of cognitive thinking in medical students based on the SNAPPS model. These technologies can provide students with real-life clinical scenarios, decision-support tools, and learning resources that can help them to develop their critical thinking and problem-solving skills. As medical education continues to evolve, it is essential to leverage these technologies to develop the cognitive thinking skills of medical students.

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