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PEDAGOGICAL AND PSYCHOLOGICAL FACTORS IN DEVELOPING DIAGNOSTIC COMPETENCE THROUGH CLINICAL CASE-BASED LEARNING IN OPHTHALMOLOGY

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Abstract: This article analyzes the pedagogical and psychological factors contributing to the development of diagnostic competence in students through clinical case-based learning in ophthalmology. The study emphasizes how clinical cases promote analytical thinking, reflective observation, and independent decision-making among medical students.

Keywords: Ophthalmology education, diagnostic competence, clinical case-based learning (CBL), reflective thinking, simulation technologies, pedagogical psychology, critical reasoning, empathy, medical decision-making, interdisciplinary integration.

In modern medical education, the formation of diagnostic competence is recognized as one of the essential outcomes of professional training. In ophthalmology, this competence requires not only theoretical knowledge but also strong analytical and observational skills, as many ocular pathologies demand precise visual assessment and logical reasoning.

Clinical case-based learning (CBL) serves as an effective pedagogical framework that bridges theory and practice. Through real or simulated clinical cases, students are exposed to problem-solving tasks requiring interpretation of symptoms, identification of disease mechanisms, and justification of clinical decisions. This active approach transforms students from passive recipients of information into critical thinkers capable of evidence-based reasoning.

Pedagogically, the use of clinical cases ensures experiential learning through active analysis, reflection, and synthesis of information. Psychologically, it engages students' motivation, emotional involvement, and empathy - factors that enhance the internalization of diagnostic logic and ethical responsibility. The integration of CBL into ophthalmology therefore creates a multi-dimensional environment where cognition, emotion, and professional identity interact dynamically.

In addition, simulation-based learning environments, including digital ophthalmic models, VR-based diagnostic tools, and interactive visual materials, allow students to practice diagnostic algorithms in a risk-free setting. The teacher's role transforms from a knowledge provider to a facilitator guiding reflective discussion, feedback, and analytical reasoning.

Table 1. Pedagogical and psychological factors developing diagnostic competence based on clinical cases in ophthalmology.

No	Educational and pedagogical factors	New content and scientific basis
1	**Neurodidactic factor**	The prefrontal cortex of the brain is actively involved in analyzing clinical cases; this enhances students' diagnostic thinking, visual memory, and decision-making speed. Neurodidactics supports the student's neuropsychological development.
2	**Metacognitive activity**	The student observes, analyzes, and evaluates their own thinking process; they understand the logic behind diagnostic decisions and gain the ability to automate this process in the

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		future.
3	**Emotional-intellectual environment**	In case-based learning, by integrating emotion (empathy for the patient's condition), motivation, and cognition, the student solves clinical problems not only intellectually but also through emotional perception.
4	**Digital immersion**	Understanding the diagnostic situation "through the eyes" using VR/AR technologies, virtual patients, and 3D images; this method significantly enhances classic clinical observation skills.
5	**Collaborative diagnostics**	During group decision-making processes, the student defends their opinion and engages in discussions with others based on medical evidence. This fosters a "culture of collegial clinical thinking."
6	**Reflective resilience**	The student develops positive psychological resilience when analyzing clinical errors, which increases stress tolerance in the diagnostic process.
7	**Cultural-conceptual thinking**	In ophthalmology, diagnostic thinking is formed that takes into account national and cultural disease characteristics (such as climate, genetics, lifestyle).
8	**Cognitive flexibility**	The ability to quickly adapt to various disease scenarios and solve non-standard diagnostic situations through "non-linear reasoning" is developed.
9	**Visual cognition**	By studying the structure and pathologies of the eye, students develop clinical sensitivity, morphological thinking, and visual analytical reflexes.
10	**Visual perception thinking**	Reflection involves not only analyzing one's own activity but also evaluating others' opinions in group discussions and drawing new conclusions from a multidisciplinary perspective.

1. Neurodidactic and metacognitive interrelationship. The neuropsychological basis for the formation of diagnostic competence in students is the processes of thinking, analysis, and decision-making that occur in the prefrontal cortex of the brain. While the neurodidactic approach activates the biological mechanisms of information perception and processing in the educational process, metacognitive activity develops the ability to understand, observe, and manage this process in the student's consciousness. These two factors together transform education into an automated cognitive system, resulting in students acquiring knowledge not through "mechanical memorization," but through "diagnostic processing."

2. The interaction of emotional-intellectual environment and reflective stability. The process of medical education is inextricably linked not only with mental activity but also with emotional experience. Through the emotional-intellectual environment, students develop empathy towards patients, which increases their clinical sensitivity. Reflective stability, on the other hand, maintains this emotional activity in psychological balance: students accept mistakes not with fear, but with an analytical approach. Together, these two factors shape the "empathetic, yet emotionally stable physician personality."

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3. Integration of digital environment and visual cognition. Working with VR/AR technologies, 3D models, and virtual patients develops students' skills in visually perceiving, analyzing, and identifying diagnostic situations. Through visual cognition, students acquire the ability to think based on images, that is, "seeing to think." This is especially important in ophthalmology, as the correct analysis of eye structures and pathologies is the main prerequisite for accurate diagnosis. As a result of digital immersion, students enhance their observation skills, speed of thinking, and ability to identify logical connections.

4. The connection between collective diagnostics and integrative reflection. During the process of collective discussion of clinical cases, students defend their opinions, engage in scientific evidence-based debates with others, and develop a "culture of collegial clinical thinking." In collective diagnostics, students move beyond individual thinking and synthesize knowledge through group analysis. Integrative reflection further deepens this process, teaching students to analyze not only their own opinions but also the perspectives of others. As a result, knowledge exchange occurs in two directions - at both individual and collective levels.

5. The harmony of cultural-conceptual thinking and cognitive flexibility. Considering cultural and contextual factors in clinical analysis enhances the accuracy of diagnostic decisions. Students conduct analyses taking into account the influence of climate, lifestyle, genetic, and cultural characteristics. Cognitive flexibility, in turn, guides them to develop new ideas in non-standard situations and find solutions based on non-linear reasoning. Together, these two factors create a global yet personalized model of medical thinking.

6. Systemic integration and resultant effectiveness. The factors mentioned above - neurodidactic, metacognitive, emotional, digital, reflective, and cultural components - function as a unified pedagogical system. While neurodidactics and digital immersion enhance cognitive activity, reflective and emotional factors strengthen psychological stability, and cultural and adaptive thinking shapes the student's professional consciousness. As a result, the training model based on clinical cases becomes a comprehensive system that not only imparts knowledge but also prepares individuals with mature diagnostic thinking in personal, social, and professional aspects.

Developing diagnostic competence in ophthalmology students through clinical case-based learning requires the interplay of pedagogical and psychological factors. Effective teaching involves the integration of cognitive, affective, and psychomotor domains - supported by simulation technologies, reflective discussion, and problem-based assessment. Psychologically, student motivation, empathy, and cognitive flexibility strengthen the learning process and promote self-directed professional growth.

Hence, clinical case-based education in ophthalmology not only enhances diagnostic accuracy and reasoning but also fosters emotional maturity, ethical awareness, and reflective self-evaluation - key features of a competent medical professional in the 21st century.

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