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MODERN PEDAGOGICAL APPROACH TO DEVELOPING CLINICAL THINKING IN STUDENTS IN TEACHING SURGICAL SCIENCE

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ANNOTATION: This article provides an analytical review, based on scientific sources, of modern pedagogical technologies that serve to form the clinical thinking of medical school students in the process of teaching surgery.
The article reviews the theoretical essence of educational technologies used in surgical science. The impact of approaches on clinical thinking is analyzed in terms of hypothesis generation, symptom grouping, differential analysis, decision-making development, and the formation of a logical diagnostic chain in the student.

Based on international medical education practice and theoretical research, the high intellectual load of surgical science is assessed as a key factor in the formation of clinical thinking. The article shows that modern pedagogical approaches to teaching surgery create an important theoretical basis and didactic opportunity for the development of clinical thinking qualities of students in medical colleges.

Keywords: surgical education, clinical thinking, hypothesis generation, symptom grouping, differential diagnosis, diagnostic chain, clinical decision making, modern pedagogical technologies, Case-Based Learning (CBL), Problem-Based Learning (PBL), simulation training, medical school students.

Surgery is one of the most complex, highly responsible and fast-paced branches of medicine. Therefore, teaching surgery is not a process of conveying simple theoretical knowledge, but a complex pedagogical system aimed at forming analytical, logical, algorithmic and clinical thinking in the student. The psychological and pedagogical features of surgery are manifested in several important factors.

Quick thinking - in surgery, clinical situations are often acute, time-limited, and decision-making cannot be delayed. Student:

- quickly analyze symptoms,
- identify the priority problem,
- assess potential risks,
- make the right decision in a short time

It is necessary to acquire skills such as.

Quick thinking is a fundamental requirement for surgical thinking, and this skill is developed through simplified cases, clinical situational problems, algorithmic exercises, and simulation elements.

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The variability of the situation - in surgery, the clinical situation can change dramatically within a few minutes, new symptoms may appear, or the patient's condition may deteriorate sharply. Therefore, in surgical science:

- flexibility of clinical thinking,
- be able to quickly update hypotheses,
- the dynamics of thinking,
- noticing small changes in condition

required.

From a pedagogical point of view, the use of methods that model the variability of the situation in surgical teaching - mini-PBL, step-by-step cases, "dynamic case" formats - is very effective.

The presence of a logical chain in decision-making

"Symptom → Differential → Tests → Decision" - medical diagnosis is always based on a clear logical chain. This process goes like this:

1. **Symptom** — the student must correctly interpret the symptom
2. **Differential** — several possible diagnoses are formulated
3. **Tests** — the necessary laboratory and instrumental examinations are selected
4. **Decision** — the final decision is made (diagnosis and tactics)

This logical chain is the central structure of clinical thinking, and teaching this sequence is one of the main didactic tasks in surgical education. When a student learns to make decisions based on this algorithm, diagnostic errors are reduced and thinking becomes scientifically sound.

Surgery is a science that is learned through practical exercises - in surgery, knowledge is formed not in theoretical form, but in practical activities. Therefore, in the educational process:

- analysis of clinical cases,
- application of surgical algorithms,
- mini-simulation,
- OSCE elements,
- practical training sessions

is applied.

The student deepens clinical thinking by visualizing, modeling, and practicing surgical situations. “Seeing,” “feeling,” and “making decisions” are interrelated psychomotor and cognitive activities in surgical pedagogy.

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The above characteristics indicate that surgery, unlike other clinical sciences, is a field that requires a high level of dynamic, analytical, and logical thinking. To develop clinical thinking in surgical education, a student must:

- rapid diagnostics,
- logical analysis,
- algorithmic thinking,
- practical decision-making

must acquire skills.

Therefore, pedagogical technologies used in surgical education should activate the student's thinking process, model the situation, explain dynamic processes, and be formative based on practical training.

Modern methods and their analytical interpretation

Surgical education is not limited to traditional lectures or demonstrations in the formation of clinical thinking; it requires methods that are practical, interactive, and activate cognitive processes. Modern medical pedagogy notes the high effectiveness of methods such as mini-PBL, SCT, simulation, think-aloud in surgical science. Below is a scientific and analytical assessment of these methods.

Mini-PBL (mini–Problem-Based Learning) is a simplified, short, and focused version of classic PBL. In surgery, this method is used to break complex clinical cases into small blocks and activate the student's basic clinical thinking processes.

Advantages of Mini-PBL in surgical education:

- It presents a complex situation in a simplified form , which reduces the cognitive load on the student and focuses attention on the important symptoms.
- Develops the skill of hypothesis generation , as each mini-case requires rapid probabilistic analysis in the student's mind.
- Effective in teaching surgical algorithms , especially
in cases such as appendicitis, intestinal obstruction, trauma, and internal bleeding.
- The student builds a logical chain : symptom → syndrome → diagnosis → examination → decision.

Scientific studies have shown that mini-PBL can help develop clinical reasoning in high-risk disciplines such as surgery.

SCT (Script Concordance Test) — is a test that measures the student's ability to logically reason in the clinical thinking process , assess probabilities, and compare a script with a real situation .

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The importance of SCT in surgical education:

- the student's illness scripts are .
- It examines Bayesian thinking through questions such as “How does the probability of diagnosis change if ...?”
- BMC Medical Education, AMEE, and other sources have recognized the SCT as a particularly useful test in surgery because surgical situations require multivariate, probabilistic analysis.
- The SCT diagnoses the accuracy of a student's clinical-analytical thinking .

Therefore, SCT is one of the most modern tools for assessing clinical thinking in surgical education.

Simulation is one of the most powerful tools in surgical training, simultaneously developing a student's clinical thinking, decision-making, coordination, and psychological stability skills.

How does simulation impact clinical thinking?

— Creates a safe environment

The student experiences a complex situation without the risk of harming a real patient.

— Allows for error detection and analysis

Errors made in simulation are pedagogically valuable, and analyzing them strengthens the student's clinical thinking.

— Practices decision-making

The simulation student:

- rapid assessment of the situation,
- setting priorities,
- Strengthens skills in applying surgical algorithms.

According to AMEE recommendations, simulation is the most convenient method as an "introductory practice" in surgical science.

— Develops thinking under stress

During simulation, the student is exposed to clinical stress, which enhances the adaptability of surgical thinking to real-world conditions.

Think-aloud is a method that helps to identify the clinical reasoning process of a student by having them explain their thought process out loud.

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Advantages of this method:

- Clearly identifies deficiencies and gaps in the student's diagnostic thinking **.**
- The teacher asks the student:

– method of generating a hypothesis,
– interpreting symptoms,
– comparing alternatives,
– monitors decision-making strategy in real time .

- metacognitive activity by explaining his/her thinking .
- Think-aloud is recognized in scientific sources as the most powerful cognitive tool for teaching and analyzing clinical reasoning.

This method ensures "transparency of thought" in surgical education.

Conditions that develop analytical thinking in surgical education

Clinical thinking in surgery is formed through the following intellectual processes:

— Breaking down a complex situation into parts

The student learns to break down a clinical situation into its individual components and identify the relationship between symptoms, syndromes, and causes.

— Create a hypothesis

The key feature of surgical thinking is the ability to immediately formulate several possible diagnoses based on the situation.

— Compare alternatives

The student compares possible diagnoses with the evidence and selects the most plausible option. This is the critical analysis stage.

— Analysis based on algorithms

Surgical decisions are based on an algorithmic sequence:

"Symptom → Differential → Tests → Decision" .

This chain forms the logical basis of surgical thinking.

The above analysis shows that the most effective way to develop clinical thinking in surgical education is the integrated use of mini-PBL, SCT, simulation, think-aloud , and analytical methods. These approaches allow the student to:

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- clinical reasoning,
- analytical thinking,
- make logical decisions,
- enrich clinical scripts

actively develops. Modern pedagogical technologies create a solid theoretical and didactic basis for the formation of a student's clinical thinking in surgical science.

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