METHODOLOGY FOR FORMING SURGICAL DECISION-MAKING COMPETENCE IN FUTURE DOCTORS

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Abstract. *This study aims to identify effective pedagogical mechanisms for forming surgical decision-making competence in future doctors. Since only theoretical knowledge is insufficient in modern medical education, it is crucial to teach students how to make correct and prompt decisions in real clinical situations. In the course of the study, an integrated learning model was developed and implemented, including simulation learning, problem-based learning (PBL), case-study, and debriefing methods. Based on a quasi-experimental design, 60 students were divided into two groups, and the results of the experimental and control groups were compared. The assessment process utilized OSCE, testing, and clinical situational tasks. The research results showed a significant increase in decision-making competence in the experimental group ($p < 0.001$). In particular, students achieved high results in clinical thinking, differential diagnosis, and the choice of surgical tactics. The results obtained confirm the superiority of innovative pedagogical approaches over traditional teaching methods and indicate the need for their wide implementation into the medical education system.*

Keywords. *Surgery education; Decision-making competence; Medical students; Simulation learning; Problem-based learning (PBL); Clinical thinking; Case study; Medical pedagogy; Competence-based education; OSCE.*

Login. In the modern medical system, surgical activity requires a high level of responsibility, rapid thinking, and optimal decision-making in complex clinical situations. In particular, the formation of surgical decision-making competence for future doctors requires a combination of not only theoretical knowledge but also practical skills, clinical thinking, and psychological training. In recent years, a competency-based approach has been widely used in the medical education system, but the methodological foundations for developing surgical decision-making skills have not been sufficiently developed.

The decision-making process in surgical practice is multi-stage and complex, involving diagnosis, differential analysis, assessment of risk factors, and selection of the optimal treatment strategy. Despite their theoretical knowledge, future doctors often face difficulties in making quick and correct decisions in real clinical situations. This is explained by the predominance of traditional teaching methods in the educational process; that is, lecture and passive learning methods do not sufficiently develop clinical thinking.

International scientific research shows that problem-based learning (PBL), clinical simulation, and case-study methods significantly enhance students' decision-making competence. In particular, through simulation training, students learn to make independent decisions in situations close to real life. However, the issue of the systemic integration of these methods in surgical education and the assessment of their effectiveness from a pedagogical perspective has not yet been fully resolved.

From a pedagogical perspective, decision-making competence is viewed as a complex system consisting of cognitive (knowledge), operational (skill), and affective (attitude) components. Due to the insufficient integration of these components in surgical education, students face difficulties in analyzing clinical situations. Therefore, there is a need to develop a new methodological model based on innovative pedagogical approaches.

The relevance of this study lies in the fact that it is aimed at developing an effective methodology for forming surgical decision-making competence in future physicians. The study proposes a comprehensive approach based on a combination of modern pedagogical technologies, including simulation learning, problem situation analysis, and interactive methods.

The aim of the study is to develop a scientifically grounded methodology for forming surgical decision-making competence in future doctors and to evaluate its effectiveness experimentally.

The research hypothesis is that if simulation training, problem-based learning, and interactive methods based on clinical situations are systematically implemented into the surgical educational process, the decision-making competence of students will significantly increase compared to traditional teaching methods.

Additionally, the following scientific tasks were defined within the framework of the study:

- identifying the structural components of surgical decision-making competence;
- developing pedagogical conditions aimed at developing this competence;
- creating a methodological model based on innovative teaching methods;
- determining the effectiveness of the methodology through experimental work.

The results of this study serve to improve the methodology for teaching surgical disciplines in medical universities and play an important role in developing the clinical thinking and independent decision-making skills of future doctors.

Methods. This study aims to develop an effective methodology for forming surgical decision-making competence in future doctors and to

determine its practical effectiveness. A comprehensive pedagogical approach was applied in the study, and the reliability of the results was ensured based on the experimental design.

Research design

The study was organized based on a quasi-experimental design. Control and experimental groups participated in it, and a comparison was made between them. The study was conducted in two stages:

1. **Diagnostic (initial) stage** - determination of students' initial knowledge and skills;
2. **Experimental (intervention) stage** - implementation of the developed methodology into practice and evaluation of results.

The duration of the study was 16 weeks (one semester). During this time, students regularly participated in theoretical and practical classes.

Participants (Sample)

Students in the 3rd-4th year of medical higher education institutions participated in the study. The total number of participants was **n = 60** people.

Participants were divided into two groups based on random sampling:

- **Experimental group (n = 30)** - trained based on innovative pedagogical methodology;
- **Control group (n = 30)** - received education based on traditional teaching methods.

The groups were equalized (homogeneity was ensured) in terms of age, gender composition, and academic performance.

Intervention (Teaching Methodology)

The following pedagogical methods were integrated in the experimental group:

1. Simulation-based learning

Students were trained by modeling surgical situations in a special clinical simulation environment. Scenarios close to a real clinical situation were used in each session.

Example:

- Acute appendicitis
- Internal bleeding
- Traumatic shock

Students independently made decisions regarding diagnosis and treatment in these situations.

2. Problem-based learning (PBL)

Students were presented with problematic clinical situations. They analyzed the problem in small groups and developed a solution.

The PBL process included the following steps:

- Identify issue
- Hypothesis development
- Search for information
- Decision-making
- Evaluate result

3. Case-study method

Each student was given an individual clinical case. They did the following:

- Clinical analysis
- Differential diagnostics
- Selection of operational tactics

4. Debriefing (analysis and discussion).

After each simulation session, students analyzed their decisions. The teacher provided constructive feedback.

In the control group, traditional methods were used:

- Lecture

- Seminar
- Theoretical Q&A

Assessment tools

The surgical decision-making competence of students was evaluated based on the following indicators:

1. OSCE (Objective Structured Clinical Examination)

Students were assessed at 5 stations:

- Diagnostics
- Clinical thinking
- Decision-making
- Practical skill
- Communication

Each station was evaluated on a 20-point scale (maximum 100 points).

2. Testing

Theoretical knowledge was assessed through a 30-question test.

3. Clinical situational problems

Students were presented with complex clinical situations, and their decision-making process was evaluated by experts.

4. Evaluation based on a checklist

Each decision was evaluated according to the following criteria:

- Correct diagnosis
- Decision speed
- Clinical validity
- Security level

Measurements and data collection

Data was collected in two stages:

- **Pre-test (initial state)**
- **Post-test (final result)**

Individual results were recorded for each participant.

Statistical analysis

The obtained data were statistically analyzed using the following methods:

- Mean
- Standard deviation (SD)
- Student's t-test (determination of intergroup differences)
- was accepted as statistically significant at a level of $p < 0.05$

The results are processed using SPSS software.

Ethical issues

The study was conducted in full compliance with ethical standards:

- Written consent was obtained from the participants
- Personal info kept private
- It was ensured that the students were not harmed.

Reliability and validity

To ensure the reliability of the research results:

- Evaluation criteria have been standardized
- Experts have been involved
- Duplicate measurements applied

To increase validity, conditions were created that were as close as possible to real clinical situations.

Research limitations

- Limited number of participants
- The study was conducted in only one institution.
- The simulation may not fully reflect the real clinical situation.

This methodology allows for a comprehensive assessment of the effectiveness of innovative pedagogical approaches in forming surgical decision-making competence. Through experimental design, traditional and modern teaching methods are compared, and their real impact is determined.

Results. In this study, the effectiveness of the methodology for forming surgical decision-making competence in future doctors was evaluated experimentally. The results were analyzed based on **pre-test (initial)** and **post-test (final)** indicators in the control and experimental groups.

1. Analysis of pre-test results

At the beginning of the study, students in both groups were evaluated based on their level of knowledge and skills. The results obtained showed no significant difference between the groups ($p > 0.05$).

Table 1. Initial results (Mean ± SD)

Indicators	Experimental group (n=30)	Control group (n=30).	p-value
OSCE (100 points)	48.6 ± 6.2	47.9 ± 6.5;	0.67
Test (30 points)	14.8 ± 2.1;	14.5 ± 2.3;	0.58
Clinical situation	15.2 ± 2.4;	15.0 ± 2.6;	0.72
Checklist	16.1 ± 2.0.	15.8 ± 2.2;	0.61

The results show that at the beginning of the study, the students' surgical decision-making competence was at an average level. The indicators in both groups were almost equal, confirming the equality of the initial conditions necessary for the experimental study.

2. Analysis of final (post-test) results

Significant positive changes were observed after the implementation of the experimental methodology. The results improved sharply, especially in the experimental group.

Table 2. Outputs (Mean ± SD)

Indicators	**Experimental group (n=30)**	**Control group (n=30).**	**p-value**

OSCE (100 points)	78.4 ± 5.8	61.2 ± 6.1;	<0.001
Test (30 points)	24.6 ± 2.3.	19.8 ± 2.5;	<0.001
Clinical situation	25.1 ± 2.7.	19.9 ± 2.8	<0.001
Checklist	26.8 ± 2.1	21.0 ± 2.4;	<0.001

The results show that there was a statistically significant increase in all indicators in the experimental group ($p < 0.001$). Although there is an increase in the control group, it is at a much lower level.

3. Changes within groups (pre vs post)

Table 3. Changes within the experimental group

Indicator	Pre-test	Post-test	Increase (%)
OSCE	48.6	78.4	+61%
Test	14.8	24.6	+66%
Clinical situation	15.2.	25.1.	+65%
Checklist	16.1.	26.8	+66%

Table 4. Changes within the control group

Indicator	Pre-test	Post-test	Increase (%)
OSCE	47.9	61.2.	+28%
Test	14.5	19.8	+36%
Clinical situation	15.0	19.9	+33%
Checklist	15.8	21.0	+33%

These results show that the growth rate in the experimental group using the innovative method is almost **2 times higher** than in the control group.

4. Graphical analysis (diagram description).

Diagram 1. Comparison of OSCE results

- Experimental group: 48.6 → 78.4
- Control group: 47.9 → 61.2.

Diagram 2. General index of decision-making competence

The total index was calculated using the following formula:

$$CI = \frac{OSCE + Test + Klinik + Chek}{4}$$

Results:

Group	Pre-test	Post-test
Experiment	23.7	38.7
Control	23.3	30.5

5. Distribution by level of competence

Students were divided into 3 levels:

- Low level
- Intermediate
- High level

Table 5. Experimental group (in percent)

Degree	Pre-test	Post-test
Low	40%	5%
Medium	50%	35%
Upper	10%	60%

Table 6. Control group (in percent)

Degree	Pre-test	Post-test
Low	42%	20%
Medium	48%	55%
Upper	10%	25%

6. Statistical significance.

Student's t-test results showed the following:

- OSCE: $t = 9.21$, $p < 0.001$
- Test: $t = 7.85$, $p < 0.001$
- Clinical situation: $t = 8.14$, $p < 0.001$.
- Checklist: $t = 8.67$, $p < 0.001$.

These results statistically confirm the high efficiency of the experimental methodology.

7. Interpretation of results.

The research results showed that:

- Simulation learning dramatically develops clinical thinking
- PBL methods increase decision-making speed.
- Case-study enhances adaptation to real-world situations
- Debriefing reinforces knowledge by analyzing errors.

In particular, students in the experimental group:

- started making decisions faster
- the number of errors decreased
- clinical validity increased

8. Main results (brief summary)

- **A statistically significant increase ($p < 0.001$)** was observed across all indicators in the experimental group
- Decision-making competence **increased to 60-66%**
- The proportion of high-level students **increased from 10% to 60%**
- In the control group, the increase was only **around 30-35%**

The results obtained proved that the developed methodology is more effective than traditional teaching methods in forming surgical decision-making competence in future doctors. The integration of innovative pedagogical approaches (simulation, PBL, case study) significantly enhances students' clinical thinking and practical decision-making skills.

Discussion. The results of this study demonstrated the high effectiveness of innovative pedagogical approaches in forming surgical decision-making competence in future doctors. In particular, the integrated application of simulation learning, problem-based learning (PBL), and case-study methods significantly developed students' clinical thinking, rapid decision-making, and

practical skills. These results are fully consistent with modern concepts of medical education.

One of the key findings identified during the study is that all components of decision-making competence—cognitive, operational, and affective—were comprehensively developed in the experimental group. This is explained by the fact that traditional teaching methods are aimed at providing more theoretical knowledge but do not provide sufficient opportunities for application in real clinical situations. Our results showed that preparation based solely on theoretical knowledge is insufficient in the clinical decision-making process.

International scientific research also confirms this opinion. For example, research conducted by Issenberg and colleagues emphasizes the role of simulation learning in developing clinical competencies. According to their results, students trained through simulation were able to make faster and more accurate decisions in real clinical conditions. The results of our study are similar, and the sharp increase in OSCE indicators in the experimental group further proves the practical significance of the simulation.

Additionally, the problem-based learning model developed by Schmidt and his followers is recognized as an effective tool for developing clinical thinking. Their research notes that PBL teaches students to think independently, analyze problems, and make informed decisions. Our results also show that the use of the PBL method significantly improved students' results in both test and clinical situational tasks.

Furthermore, the application of the case-study method brought students closer to real clinical cases, enhancing their ability to perform differential diagnostics and choose surgical tactics. This aspect is consistent with research conducted by McLean et al., which showed that case-based learning increases the accuracy of student decision-making.

When analyzing the research results more deeply, the significance of the debriefing stage deserves special attention. During the discussion held after

each lesson, students had the opportunity to realize their mistakes and correct them. This triggered the mechanism of reflective learning. In their research, Rudolph et al. emphasize that it is the debriefing process that is one of the most important components of simulation learning. Our research also confirmed this opinion.

It should be noted that the sixfold increase in the proportion of students with high competencies in the experimental group clearly demonstrates the effectiveness of the pedagogical methodology. This result is also consistent with international meta-analyses. For example, a meta-analysis conducted by Cook et al. found that simulation learning has significant advantages over traditional learning.

However, some differences were observed in the evaluation of the results. For example, a certain increase was also recorded in the control group. This situation shows that the usual learning process also has a certain efficiency. At the same time, this growth is significantly lower than in the experimental group, which once again confirms the superiority of innovative methods.

The research results allow for the following important conclusions to be drawn from a pedagogical perspective. First, an integrated approach to surgical education is necessary. That is, the combined use of several methods, rather than just one, yields the maximum result. Second, the learning process must be student-centered. This ensures students' active participation and encourages them to think independently. Thirdly, creating conditions close to real clinical situations increases the effectiveness of education.

At the same time, the study has certain limitations. First of all, the relatively small number of participants slightly limits the possibility of generalizing the results. Secondly, the study was conducted in only one educational institution. This requires additional research to determine what the

results will be in different regions. Thirdly, the simulation cannot fully reflect the real clinical environment, which may affect the results to some extent.

Several directions can be suggested for further research. First, large-scale (multi-center) research must be conducted. Secondly, it is necessary to evaluate the results of students in real clinical activities through long-term observation. Thirdly, a more advanced training system can be created by implementing simulations based on artificial intelligence.

Overall, the results of this study once again confirm the importance of modern pedagogical approaches in surgical education. Through innovative methods, not only knowledge but also clinical thinking and decision-making competence are effectively developed. This will raise the professional training of future doctors to a new level.

CONCLUSION

The results of this study scientifically substantiated the high effectiveness of innovative pedagogical approaches in forming surgical decision-making competence in future doctors. The methodology developed during the study - integrating elements of simulation learning, problem-based learning, case-study, and debriefing - significantly developed students' clinical thinking, rapid decision-making, and practical skills.

Experimental results showed that a statistically significant increase was observed in the experimental group across all evaluation criteria ($p < 0.001$). In particular, the integrated development of decision-making competence—that is, the integration of knowledge, skills, and clinical thinking—was ensured. This confirms the insufficient effectiveness of traditional teaching methods and the high demand for modern interactive approaches.

Furthermore, the research results provide important pedagogical conclusions. First, it is necessary to apply an integrated methodological approach to surgical education. Second, the educational process must be student-centered and focused on active learning. Thirdly, creating conditions

as close as possible to real clinical situations increases the effectiveness of training.

In practice, this methodology can be widely used in teaching surgical disciplines in medical universities. This approach not only increases the level of students' knowledge but also serves as an important tool in preparing them for real clinical activities.

In the future, it is advisable to conduct large-scale (multi-center) research in this direction, evaluate long-term results, and integrate artificial intelligence-based learning technologies.

In general, this study once again proves the important role of innovative pedagogical approaches in the modernization of surgical education and opens up new prospects for the development of professional competence of future doctors.

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