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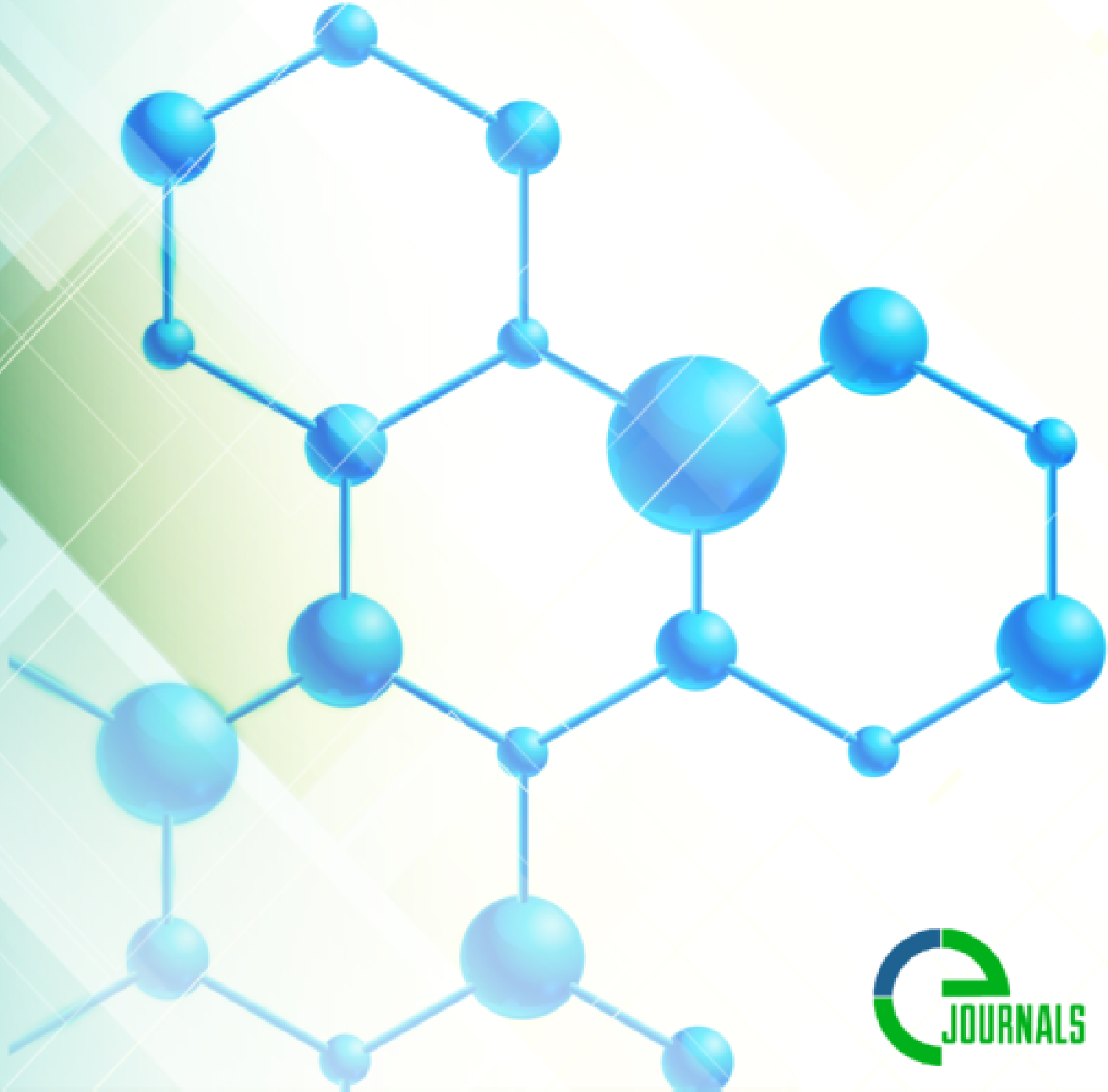

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EFFICIENCY OF USING SCREEN SIMULATION TECHNOLOGIES IN DEVELOPING PRACTICAL SKILLS AMONG STUDENTS OF PEDIATRIC FACULTIES

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Abstract: This article presents the results of a study of the effectiveness of using screen simulation technologies in developing practical skills in students of pediatric faculties. A comparative analysis of the level of development of professional competencies in students who studied using screen simulators and students who received education using traditional methods was conducted. The study showed a statistically significant advantage of simulation training in developing clinical thinking and practical skills of future pediatricians.

Relevance of the topic : Modern medical education faces a number of challenges associated with the need to train highly qualified specialists who possess not only theoretical knowledge, but also developed practical skills. This problem is especially acute in pediatrics, where errors in diagnosis and treatment can have critical consequences for the health of children [1]. The traditional model of clinical training based on work with real patients has a number of limitations: ethical aspects, a limited number of thematic patients, the impossibility of multiple repetitions of manipulations, the lack of standardization in the assessment of skills [2].

Simulation-based learning offers a solution to many of these problems by allowing students to practice skills in a safe environment, repeat manipulations many times, and receive objective feedback on their performance [3]. On-screen simulators, which are computer programs that simulate clinical situations, are becoming an increasingly popular tool in medical education [4]. They allow students to develop clinical reasoning, diagnostic skills, and decision-making in conditions that are as close to real ones as possible.

Despite the growing popularity of simulation technologies, research on their effectiveness in developing practical skills in pediatric students remains limited [5]. There is particularly little data on the impact of screen simulators on the development of professional competencies of future pediatricians in the context of the Uzbek medical education system.

Objectives of the study

1.To evaluate the effectiveness of using screen simulation technologies in developing practical skills among students of pediatric faculties.

2.Compare the level of development of professional competencies among students who studied using screen simulators and students who received education using traditional methods.

3.To determine students' perception of simulation training and their readiness to apply acquired skills in clinical practice.

4.To identify employers' expectations regarding the practical skills of pediatric graduates.

5.Develop recommendations for optimizing the use of screen simulators in the educational process.

Materials and methods of research

The study was conducted at the Department of Simulation Training and Clinical Modeling of the Tashkent Pediatric Medical Institute from September 2024 to May 2025. The study involved 140 4th-5th year students of the faculties "Pediatrics-1" and "Pediatrics-2", who were divided into two groups:

- The main group (n = 90) - students who underwent training using screen simulators;
- Control group (n = 50) - students who studied using traditional methods.

The distribution of students into groups is presented in Table 1.

Table 1. Distribution of students by research groups

Group	Number of students	Faculty of Pediatrics-1	Faculty of Pediatrics-2	4th year	5th year
Main	90	45 (50.0%)	45 (50.0%)	42 (46.7%)	48 (53.3%)
Control	50	25 (50.0%)	25 (50.0%)	23 (46.0%)	27 (54.0%)
Total	140	70 (50.0%)	70 (50.0%)	65 (46.4%)	75 (53.6%)

The groups were comparable in terms of gender, age, academic performance and initial level of practical skills (p >0.05).

Characteristics of the screen simulator

The study used the Filatov on-screen simulator, which included 12 pediatric cases covering the main clinical situations:

1. Acute respiratory infection in young children
2. Bronchial asthma: diagnosis and emergency care
3. Pneumonia in children of different age groups
4. Acute stenosing laryngotracheitis
5. Acute intestinal infection: diagnosis and treatment
6. Meningococcal infection: clinical presentation, diagnostics, emergency care
7. Convulsive syndrome in children
8. Anaphylactic shock: diagnosis and emergency care
9. Acute heart failure in children
10. Diabetic ketoacidosis : diagnosis and treatment
11. Acute renal failure in children
12. First aid for poisoning in children

Each case included the following components:

- History of the disease and life

Physical examination data

- Results of laboratory and instrumental studies
- Interactive elements for making diagnostic and treatment decisions
- Feedback and assessment system for student actions
- Debriefing with analysis of mistakes made

Students in the main group completed all 12 cases during the academic year, with the opportunity to repeat and practice skills multiple times.Each case took2-3 academic hours, including debriefing .

Assessment methods

The following methods were used to evaluate the effectiveness of training:

1. Survey of students. A special questionnaire was developed, including 25 questions aimed at assessing:

-Subjective perception of the effectiveness of training

-Level of confidence in your own skills

-Readiness for independent clinical work

-Attitudes towards simulation training

2. Objective assessment of practical skills. Conducted using:

-Structured Clinical Examination (OSCE)

- Solutions to standardized clinical problems

-Assessment of actions in simulated clinical situations

3. Survey of employers. 35 heads of medical institutions, who are potential employers of graduates, were surveyed. The questionnaire included questions about:

- Expected practical skills of graduates
- The importance of various professional competencies
- Attitude towards graduates who have completed simulation training
- Willingness to hire specialists with experience in simulation training

Statistical data processing was performed using the SPSS 23.0 program. For comparison of quantitative indicators, the Student's t -test was used, for qualitative indicators – the χ^2 criterion . Differences were considered statistically significant at $p < 0.05$.

Research results

Assessment of students' practical skills

The results of the objective assessment of practical skills of students in the main and control groups are presented in Table 2.

Table 2. Results of assessment of students' practical skills (scores, M ± SD)

Skill	Main group (n =90)	Control group (n = 50)	p
Collection of anamnesis	4.6±0.4	3.9±0.6	<0.001
Physical examination	4.5±0.5	3.7±0.7	<0.001
Interpretation of laboratory data	4.3±0.6	3.8±0.5	<0.001
Interpretation of instrumental data	4.2±0.5	3.6±0.6	<0.001
Making a diagnosis	4.4±0.5	3.5±0.7	<0.001
Prescribing treatment	4.3±0.6	3.4±0.8	<0.001
Providing emergency care	4.7±0.4	3.2±0.9	<0.001
Communication skills	4.5±0.5	3.8±0.6	<0.001
Overall score	4.4±0.5	3.6±0.7	<0.001

As can be seen from Table 2, students in the main group demonstrated statistically significantly higher results in all assessed skills. Particularly pronounced differences were observed in the skills of providing emergency care (4.7±0.4 vs. 3.2±0.9, p <0.001) and making a diagnosis (4.4±0.5 vs. 3.5±0.7, p <0.001).

For a more detailed analysis of the effectiveness of training using screen simulators, an assessment of the success of solving clinical problems in various pediatric cases was conducted (Table 3).

Table 3. Success in solving clinical problems in various pediatric cases (%)

Clinical case	Main group (n =90)	Control group (n = 50)	p
Acute respiratory infection	92.2	78.0	<0.01
Bronchial asthma	88.9	70.0	<0.01
Pneumonia	91.1	76.0	<0.01
Acute stenosing laryngotracheitis	87.8	62.0	<0.001
Acute intestinal infection	93.3	80.0	<0.05
Meningococcal infection	85.6	58.0	<0.001
Convulsive syndrome	88.9	64.0	<0.001
Anaphylactic shock	90.0	56.0	<0.001
Acute heart failure	84.4	54.0	<0.001
Diabetic ketoacidosis	86.7	60.0	<0.001
Acute renal failure	83.3	52.0	<0.001
Poisoning in children	94.4	72.0	<0.001
Average rate	88.9	65.2	<0.001

Analysis of the data in Table 3 shows that students in the main group demonstrated higher results in solving clinical problems in all 12 cases. The greatest differences were observed in solving problems related to emergency conditions: anaphylactic shock (90.0% vs. 56.0%, p <0.001), acute heart failure (84.4% vs. 54.0%, p <0.001), and acute renal failure (83.3% vs. 52.0%, p <0.001).

Results of the students' survey

The results of the students' survey regarding their subjective assessment of their skills and attitudes towards simulation training are presented in Table 4.

Table 4. Results of the student survey (%, proportion of positive responses)

Parameter	Main group (n =90)	Control group (n = 50)	p
Confidence in your own skills	87.8	62.0	<0.001
Willingness to work independently	82.2	56.0	<0.001
Satisfaction with the quality of education	91.1	70.0	<0.01
Desire to continue training using simulators	94.4	78.0	<0.01
Assessing the practical significance of training	88.9	64.0	<0.001
Comfort of the educational environment	90.0	72.0	<0.01
Evaluation of the objectivity of knowledge control	86.7	68.0	<0.01

Students in the main group demonstrated a statistically significantly higher level of confidence in their own skills (87.8% vs. 62.0%, p <0.001) and readiness for independent work (82.2% vs. 56.0%, p <0.001). They also expressed higher satisfaction with the quality of training and a desire to continue training using simulators.

Results of the employer survey

Table 5 presents the results of a survey of 35 heads of medical institutions regarding their expectations of graduates of pediatric faculties.

Table 5. Results of the employer survey (%, share of positive responses)

Parameter	Meaning
The Importance of Practical Skills in Graduates	97.1
The Importance of Experience with Simulators	88.6
Willingness to hire graduates with simulation training experience	94.3
Preference given to graduates with simulation training experience	82.9
Willingness to invest in simulation training for employees	77.1
Evaluation of graduates' skills compliance with practice requirements	65.7

Data analysis shows that the majority of employers (97.1%) consider practical skills to be the most important criterion when hiring pediatric graduates. At the same time, 88.6% of respondents noted the importance of experience working with simulators, and 94.3% expressed their willingness to hire graduates who have undergone simulation training.

About discussion of results

The results of the study demonstrate a statistically significant advantage of using screen simulation technologies in developing practical skills in pediatric students compared to traditional teaching methods.

Students in the main group showed higher results in all assessed practical skills, especially in the area of emergency care, diagnosis and treatment prescription. This is consistent with other studies showing the effectiveness of simulation training in developing clinical thinking and practical skills [6, 7].

Of particular importance is the significant superiority of students in the main group in solving clinical problems related to emergency conditions. This can be explained by the possibility of multiple repetitions and practicing algorithms of actions in critical situations, which is difficult to implement in the traditional training model [8].

Subjective assessment of students' skills also showed the advantage of simulation training. Students in the main group demonstrated a higher level of confidence in their own skills and readiness for independent work, which is an important factor in the professional adaptation of young specialists [9].

The results of the employer survey confirm the practical importance of simulation training. Most heads of medical institutions consider experience with simulators an important advantage of graduates and are ready to give them preference when hiring.

The data obtained allow us to formulate a number of recommendations for optimizing the use of screen simulators in the educational process:

1.Integration of simulation training into the core curriculum of pediatric faculties with the allocation of at least 10% of academic time to working with simulators.

2.Development and implementation of additional cases reflecting the specifics of regional pathology.

3.Creation of a system for continuous updating and actualization of simulation scenarios in accordance with changes in clinical recommendations.

4.Organization of regular trainings for teachers on the methodology of conducting

simulation training and debriefing .

5.Implementation of a system for assessing the effectiveness of simulation training using objective criteria.

Conclusions

1.The use of screen simulation technologies in teaching students of pediatric faculties statistically significantly increases the level of development of practical skills compared to traditional teaching methods.

2.The greatest advantage of simulation training is observed in the development of skills in providing emergency care, making a diagnosis and prescribing treatment.

3.Students who have been trained using on-screen simulators demonstrate a higher level of confidence in their own skills and readiness to work independently.

4.Employers consider experience with simulators an important advantage for graduates and are willing to give them preference when hiring.

5.To improve the effectiveness of simulation training, it is necessary to integrate it into the main educational program, regularly update simulation scenarios and train teachers.

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