



Research article

2022 Shandong Province university medical technical skills competition nursing track: An effective project to improve core competencies of nursing students

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ABSTRACT

Background: The core competencies of nursing students have gradually become the focus of attention of nursing educators. Nursing skills competitions are an important form of educational and teaching activity in universities and the nursing track at the Shandong Provincial University Students' Medical Technical Skills Competition gives nursing students an opportunity to demonstrate their clinical skills and knowledge. This study aims to describe the organisation and procedures of the nursing track, analyse the competition results and explore the impact the competition has on the core competencies of the nursing students. This will provide new ideas for future nursing professional education.

Methods: Statistical analysis of the competition results was performed as a means of understanding the current status of theoretical knowledge and clinical skills of nursing students in Shandong Province. The impact of the competition on the core competencies of participating students was analysed by distributing questionnaires to universities in Shandong Province that participated in the competition.

Results: 14 universities with nursing programmes participated in the competition, including eight public universities and six private universities. 220 questionnaires were distributed to nursing students at the participating universities and 218 were ultimately included, demonstrating an efficiency rate of 99.09%.

Conclusions: The 2022 nursing track included the addition of a comprehensive written examination as a means of judging the competencies of nursing students in Shandong Province from a variety of aspects. Skills competitions are effective for improving the core competencies of nursing students and they will become an important means for nursing educators to reform education and improve the core competencies of nursing students in the future.

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1. Introduction Background

The “Health China 2030” [1] plan outlines the necessity for increasing investment in the practical training of nurses. This will improve their service capacity while also ensuring the provision of quality and efficient medical services. The State Council’s “Opinions on Deepening Medical Education Synergy to Further Promote the Reform and Development of Medical Education” [2] proposed the gradual improvement of the management system of medical education and the incentive mechanism for nursing talent by 2020 and the improvement of the policy environment of medical education in China and the creation of a healthy society with strategic goals by 2030. And these goals can’t be achieved without the development of nursing talents. Nurses’ core competencies are the most important competencies that nursing personnel must possess. Nursing students, as an important part of nursing talent development, have gradually become one of the focuses of nursing educators’ attention in terms of their core competencies.

The core competencies of nursing students are the most basic and major comprehensive competencies they must possess and are an organic combination of the relevant knowledge, skills and attitudes of nursing students in clinical nursing practice [3]. As the reserve army of nursing talents, the level of core competencies of nursing students directly affects nursing care quality and nursing talent team stability. Cultivating the core competencies of nursing students involves school education and clinical practice. School education enables nursing students to acquire medical and nursing knowledge. Following the completion of school education, nursing students should have developed certain core competencies [4]. Clinical practice is the key step for helping nursing students successfully become qualified nurses and quickly adapt to the job requirements and the new working environment. It has a profound impact on the professional attitude, nursing knowledge and skills and clinical problem-solving skills of nursing students and also plays a crucial role in nursing student training [5]. In conjunction with relevant departments, the Chinese Ministry of Education has continued with its development of nursing skills competitions on a countrywide basis as they are an important form and effective extension of educational and teaching activities in universities and an important way to improve the quality of nursing training and the core competencies of nursing students.

The Nursing Skills Competition is aimed to facilitate the promotion of the construction and teaching reform of the nursing profession and improve the quality of education and teaching. It is a skills event that dovetails with the needs of industry while also reflecting the teaching level of national vocational education. The competition helps universities introduce advanced teaching concepts, improve teaching resources, update curriculum models, reform teaching methods, strengthen faculty development, promote the standardisation of practice teaching and improve the level of practice teaching, which serves to improve the skills and practical abilities of students while also developing their skills in the areas of critical thinking, humanistic care and communication [6]. The core competencies of nursing students are ultimately affected through changes in their knowledge, skills and attitudes.

The nursing track at the Shandong Province University Medical Technology Skills Competition had already followed the competition for three years and the 2022 competition was the fourth. The nursing track was established as a means of providing nursing students with the opportunity to demonstrate their clinical skills and knowledge and it is one of the largest competitions that is held in Shandong Province. The aim of this study is to introduce the organisation and procedures of the nursing track, analyse the competition results, explore the impact the competition has on the core competencies of the nursing students and provide suggestions regarding future nursing talent education.

2. Methods

2.1. Organization

The Shandong Provincial Government hosted the 2022 Shandong Province University Student Medical Technology Skills Competition and it was co-hosted by two universities in Shandong. The competition adopted a two-tier system of school-level preliminary rounds and professional rounds. The content and rules of the competition were provided by the organisers in advance through their website, emails and WeChat.

2.2. Participants

The participants were fourth-year undergraduate nursing students in clinical practice and all universities in Shandong Province with undergraduate nursing programmes were eligible to participate. Nursing students for the written examination were chosen at random by the Department of Education to participate in 10% of the nursing enrolment of the school. Teams of students participating in the practical skills practice were divided into two groups: Group A and B. Group A consisted of four students who were chosen by each school through a school-level preliminary round, while Group B consisted of four members who were chosen at random by the organising committee a month before the competition from the top 50% of students based on the comprehensive assessment scores of each participating university.

2.3. Competition procedures

In order to further promote the reform of nursing practice teaching, strengthen the theoretical knowledge and clinical skills of nursing students, enhance their critical thinking and clinical thinking abilities, humanistic care spirit and teamwork awareness and comprehensively improve the overall quality and talent training quality, internal selection was initially conducted at the respective schools to determine who would enter the professional competition. The professional competition was divided into two parts by the

organisers: a comprehensive written examination and a practical competition, with two parallel tracks, A and B. The scope of the written test was in accordance with the examination stipulations of the National Licensing Examination for Nurses, mainly covering Basic Nursing, Internal Nursing, Surgical Nursing, Obstetrics and Gynaecology Nursing, Paediatric Nursing and Acute and Critical Care Nursing. 100 questions were asked, which included 70 single-choice questions and 30 multiple-choice questions, each of which was worth one mark (Table 1). The organisers organised experts to form a specialist group of questions with a high degree of confidentiality. The test questions favoured clinical application and were based on case studies, which served to mainly test the abilities of students to analyse and solve problems. In addition, a small part of the questions were designed to test their memory of pure knowledge. The scope of the practical practice competition was based on the assessment scope of the 10th China University Students' Medical Technical Skills Competition (for the nursing course) that was announced by the Steering Committee of the Nursing Professional Category of the Ministry of Education. It was stated that there would be five stations of practical practice, each of which having one case and involving three practices, for a total of 15 practices. Nursing supplies for the competition were placed according to type, such as sterile items, drugs, instruments and nursing paperwork. The disposal of items after use and medical waste were placed in separate areas. Competition nursing items were separated by type and items were separated for post-use disposal and medical waste. As a means of ensuring the competition ran smoothly, there were two group leaders for each of Group A and Group B. One or two volunteers at each station had responsibility for ensuring order was maintained on the course and all consumables were replenished. There were two or three volunteers outside the course who could deal with emergency matters, such as testing or replacing instruments, replenishing supplies, dealing with any injuries that occurred to students and collecting and summarising score sheets for all students. Throughout the entire practical practice process, each group had four group members, three of whom participated in the competition and one of whom was a backup. At the end, judges and volunteers performed the tallying and calculations before awarding the various prizes (Fig. 1).

2.4. Competition referees

The organisers invited senior clinical nurses and experts who had relevant professional experience from hospitals and non-participating universities to serve as referees. Each practice was scored by a minimum of two referees, the average of which was taken and there was double-blind between the referees and the competitors. Prior to the competition, all referees received full training regarding the rules and procedures of the competition, the use of scoring sheets, scoring criteria and strategies for dealing with emergencies. One day before the competition, the referees entered the venue to familiarise themselves with the competition equipment with the aid of volunteers so they would be able to deal with various situations during the competition.

2.5. Analysis of the effectiveness

The competition results were analysed based on data relating to the written examination results and nursing skills performance of Group A and Group B from participating universities. Questionnaires were distributed to all undergraduate nursing students from the participating universities via www.wjx.cn to collect and analyse the impact the competition had on their core competencies. This study has received approval from the Ethics Committee of Shandong First Medical University and written informed consent was obtained from every participant. The questionnaire obtained general information about the respondents and the Chinese version of the Competency Inventory for Nursing Students (CINS) [7]. The scale was developed by Hsu et al. [8]. and the Chinese version was created by Liao Ruixue et al. [7], with 38 items in six factors, including clinical biomedical science (five items), general clinical skills (six items), critical thinking and reasoning (three items), caring (five items), ethics and accountability (14 items) and lifelong learning (five items). Cronbach's α coefficient of the scale was 0.966 and Cronbach's α coefficient of each dimension was 0.827-0.951; split-half reliability was 0.828 and the split-half reliability of each dimension was 0.724-0.942; the retest correlation coefficient of the scale was 0.737 and reliability and validity were both good. The scale was rated on a 7-point Likert scale that ranged from "not competent at all" to "entirely competent", with scores ranging from 1 to 7 and total scores ranging from 38 to 266. Higher scores indicated higher core competencies of the nursing students.

2.6. Ethical considerations

A simulation scenario consisting of standardised patients (SPs) and advanced multifunctional simulators were used in the competition. The organisers recruited SPs prior to the competition starting and briefed them on the content and purpose of the

Table 1
Distribution of questions in the Written Examination.

The Courses/Type of question	Single-choice questions	Multiple-choice questions	Total
Basic Nursing	15	8	23
Surgical Nursing	17	7	24
Internal Nursing	18	8	26
Obstetrics and Gynaecology Nursing	6	3	9
Paediatric Nursing	7	2	9
Acute and Critical Care Nursing	7	2	9
Points	70	30	100

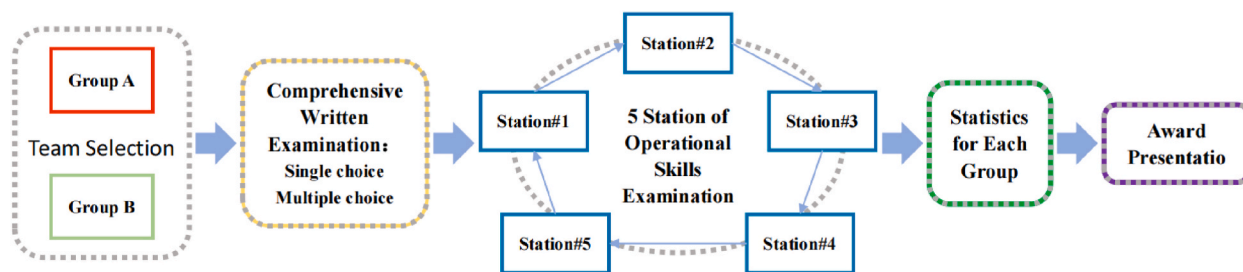


Fig. 1. Flow chart of the 2022 Shandong University Student Medical Technical Skills Competition-Nursing Category.

competition, explaining their rights and obligations, including working hours and compensation. The SPs were given the right to accept or refuse the competition programme and the right to withdraw from the competition at any time. It was also ensured that the legitimate interests of the SPs were not infringed upon and that all principles of respect, protection of privacy and ethical supervision were adhered to as strictly as possible [9]. The results were only used for award judgement and research and the personal information of the nursing students was not disclosed. The awarded judgement only announced the rankings and not the specific scores. In cases where there was a question about the competition results, the results were verified by specialised personnel. For questionnaire collection, the researcher introduced the content and purpose of the study to respondents before they started the survey and assured them that their personal information would never be disclosed and the data would only be used for the study and the publication of the article. They were also informed that they could withdraw from the study at any time entirely free from consequences.

2.7. Statistical analysis

The software IBM SPSS Statistics 24 was used for statistical analysis. Exploratory analysis of the competition results and questionnaire results was carried out to test whether the data obeyed a normal distribution. Measures were expressed as Mean±SD or Median (IQR) and t-tests were used for comparisons between groups conforming to a normal distribution; Kruskal-Wallis H tests were used for comparisons between multiple groups with a non-normal distribution and Mann-Whitney U tests were used for comparisons between two groups. Spearman’s correlation was used to analyse the correlation between core competencies of nursing students and whether they were in public school, different attitudes towards employment, and different attitudes towards the clinical teaching they were currently receiving. $p < 0.05$ was considered a statistically significant difference.

3. Results

3.1. Participation in the competition

14 universities in Shandong Province with nursing programmes participated in the 2022 Shandong Province University Medical Technical Skills Competition - Nursing Track, including eight public universities and six private universities. Each university chose four students to represent them competitively through school-level competition, which meant that the number of students who participated in the school-level selection was more than 1000. The total number of students who registered for the written examination was 456, with 435 taking the test, demonstrating a participation rate of 95.39%. There were 42 participants in Group A in the practical competition, including eight groups from public universities and six groups from private universities, and there were 39 participants in Group B, including seven groups from public universities and six groups from private universities. Approximately 100 teachers and experts from major universities in Shandong Province were involved in the design and adjudication of the written and practical examinations and approximately 100 volunteers participated in the service of the competition.

3.2. Competition results analysis

3.2.1. Analysis of written examination results

The Mann-Whitney U test was used to compare the total scores, single-choice and multiple-choice scores of public and private

Table 2
Comparative performance of the Written Examination in nursing tracks in Public and Private Universities (M (IQR), Point).

Projects		No. of people	Points	M(IQR)	Z	P
Total points	Public Universities	276	100	60.00 (12.50)	-7.618	< 0.001
	Private Universities	159		50.50 (17.00)		
Single-choice questions	Public Universities	276	70	46.00 (9.00)	-7.342	< 0.001
	Private Universities	159		40.00 (14.00)		
Multiple-choice questions	Public Universities	276	30	13.50 (5.00)	-6.642	< 0.001
	Private Universities	159		11.00 (5.00)		

universities, and the differences were statistically significant ($p < 0.05$), as shown in Table 2. The Mann-Whitney U test was used to compare the total scores and single-choice scores of public universities Group A and Group B, and the difference between the two teams was not statistically significant ($p > 0.05$); the multiple-choice scores were tested using the independent samples t -test, and the difference between the two teams was not statistically significant ($p > 0.05$). Independent samples t -test was used for the total score, single-choice and multiple-choice question scores of Group A and Group B in private universities, and the difference between the two teams was not statistically significant ($p > 0.05$), as shown in Table 3. The Mann-Whitney U test was used for the scores of the written examination of the nursing students in the public and private universities in each of the courses, and the difference was statistically significant ($p < 0.05$), as shown in Table 4.

3.2.2. Analysis of nursing skills practice results

The skills practice scores of nursing students in Group A and Group B of all participating universities were tested by t -test, and the difference between the two teams of private universities was statistically significant ($P < 0.05$), as shown in Table 5. The skills practice scores of each item of nursing skills practice practice are detailed in Table 6.

3.3. Results of the questionnaire

Questionnaires were distributed to nursing students at 14 participating universities. 220 questionnaires were returned and 218 were ultimately included in the study, demonstrating an effective rate of 99.09%. 180 respondents out of the 218 questionnaires participated in the competition and 38 did not participate. The Mann-Whitney U test and Kruskal-Wallis H test were used for analysing the general information of the questionnaires and statistically significant differences ($p < 0.05$) were observed between the groups of whether they were public universities, whether they participated in the skills competition, different groups of attitudes towards employment prospects and different attitudes towards the clinical teaching they were currently receiving, which can be seen in Table 7. The highest-scoring core competency factor was the ethics and accountability factor, while the lowest-scoring was the critical thinking and reasoning factor, as is presented in Table 8. All 180 respondents who participated in the competition were analysed using the Mann-Whitney U test and the Kruskal-Wallis H test for the different dimensions of core competencies based on whether they were in the public universities group, the group with different attitudes towards employment prospects or the group with different attitudes towards the clinical teaching they were currently receiving, which can be seen in Table 9. A positive correlation was observed between the total core competency score and scores relating to each factor of the core competency for nursing students ($p < 0.05$) and whether they were at public universities (0 = no, 1 = yes). There was a negative correlation ($p < 0.05$) with different attitudes towards employment (1 = easy, 2 = not easy, 3 = uncertain). The total core competency score and scores on each factor of the core competency for nursing students (with the exception of the ethics and accountability factor) were found to be negatively correlated ($p < 0.05$) with different attitudes towards the clinical teaching they were currently receiving (1 = satisfied, 2 = normal, 3 = dissatisfied), as is shown in Table 10.

4. Discussion

Although it is smaller in scale than the China University Medical Technical Skills Competition [10], this is a test of the nursing technical skills level of university students throughout Shandong Province and is of great significance in the promotion of the reform of nursing practice teaching in Shandong and the cultivation of high-level nursing competencies for serving the new needs of the health of people. The competition is dedicated to encouraging nursing students to learn nursing knowledge and technical applications independently, enhancing their core competencies, promoting a positive learning culture, creating a strong practice atmosphere and providing new ideas for future nursing talent education.

Table 3
Comparison of the Written Examination scores between Group A and Group B in Public and Private Universities (Point).

Projects		No. of people	Mean \pm sd/M (IQR)	t/Z	P	
Public Universities	Total points	Group A	40	64.25 (13.00)	-1.587	0.113
		Group B	236	60.00 (12.50)		
	Single-choice questions	Group A	40	49.00 (10.00)	-1.763	0.078
		Group B	236	46.00 (10.00)		
Private Universities	Multiple-choice questions	Group A	40	13.75 \pm 3.73	0.635	0.526
		Group B	236	13.34 \pm 3.77		
	Total points	Group A	30	52.13 \pm 8.78	1.025	0.307
		Group B	129	49.72 \pm 12.13		
Private Universities	Single-choice questions	Group A	30	40.57 \pm 6.88	0.829	0.408
		Group B	129	39.06 \pm 9.36		
	Multiple-choice questions	Group A	30	11.57 \pm 2.98	1.248	0.214
		Group B	129	10.66 \pm 3.69		

Table 4
Comparative performance of Public and Private Universities in the Written Examination for Courses (M (IQR), Point).

Projects		No. of people	Total points	M(IQR)	Z	P
Basic Nursing	Public Universities	276	23	13.00 (4.50)	-6.335	< 0.001
	Private Universities	159		10.50 (4.50)		
Surgical Nursing	Public Universities	276	24	15.00 (4.00)	-7.285	< 0.001
	Private Universities	159		13.00 (5.00)		
Internal Nursing	Public Universities	276	26	15.00 (3.50)	-4.111	< 0.001
	Private Universities	159		14.00 (4.50)		
Obstetrics and Gynaecology Nursing	Public Universities	276	9	5.50 (2.88)	-4.691	< 0.001
	Private Universities	159		5.00 (2.50)		
Paediatric Nursing	Public Universities	276	9	5.50 (2.00)	-3.483	< 0.001
	Private Universities	159		5.00 (2.00)		
Acute and Critical Care Nursing	Public Universities	276	9	6.00 (2.50)	-6.061	< 0.001
	Private Universities	159		5.00 (2.50)		

Table 5
Comparative performance of Group A and Group B in practical exercises (Mean±SD, Point).

Projects	Group	No. of people	Minimum value	Maximum value	Mean±SD	t	P
All Universities	Group A	42	41.25	91.30	70.48 ± 12.56	1.660	0.100
	Group B	39	27.20	94.95	64.69 ± 17.44		
Public Universities	Group A	24	49.80	91.30	77.24 ± 10.12	0.650	0.520
	Group B	21	43.90	94.95	74.99 ± 13.08		
Private Universities	Group A	18	41.25	74.20	61.46 ± 9.54	2.050	0.048
	Group B	18	27.20	82.25	53.11 ± 14.35		

Table 6
Specific scores for each item of the practical exercises (Mean±SD, Point).

Projects	N	Total points	Minimum value	Maximum value	Mean±SD	Ranking
Pulmonary examination	54	100	19.50	81.00	38.58 ± 15.26	15
Intravenous blood collection	54	100	29.00	93.00	69.37 ± 17.53	8
Transoral and nasal aspiration	54	100	10.00	97.00	60.59 ± 22.19	12
Blue light exposure	54	100	14.00	91.50	60.06 ± 21.27	13
Physical growth measurement	54	100	49.00	97.00	74.53 ± 13.92	4
Infant feeding	54	100	11.00	99.00	69.29 ± 22.86	9
Fetal heart monitoring	54	100	32.00	96.00	73.76 ± 19.03	5
Four-step palpation + Measurement of uterine height and circumference	54	100	46.00	96.00	79.19 ± 11.99	3
Intradermal injection	54	100	10.50	99.50	53.62 ± 23.79	14
CPR	54	100	47.00	96.00	79.47 ± 10.49	2
Intravenous injection	54	100	25.00	97.50	71.28 ± 20.38	6
Cardiac monitoring	54	100	19.50	100.00	70.39 ± 22.12	7
Intramuscular injection	54	100	35.00	97.50	82.66 ± 14.50	1
Gastrointestinal decompression	54	100	19.00	96.00	65.57 ± 17.94	11
Intravenous infusions	54	100	24.00	97.00	66.88 ± 19.76	10

4.1. The competition introduces a written examination for the first time

This competition is a pioneering addition to the comprehensive written examination and it is conducive to examining the comprehensive theoretical level of nursing students. The content of the written examination is in accordance with the scope of the examination that is set out in the National Licensing Examination for Nurses, which evaluates whether applicants for nursing qualifications have the necessary nursing expertise and working ability to practise. It is also an important bridge between nursing education and clinical practice [11]. The questions are designed with clinical practice tasks in mind and to test the ability of nursing students to apply the appropriate knowledge as a means of completing nursing tasks in a clinical context. It plays a guiding and normative role in helping nursing education universities produce nursing professionals who are aware of the actual needs of society [12]. The content of the written examination in the competition aligns with the content of professional nursing examinations in China and some of the questions are composed by experts to suit clinical and practical contexts, which is a quality test and feedback on the professional knowledge and skills possessed by nursing students in Shandong Province. This study has found there to be a statistically significant difference between public and private universities in terms of written examination scores (Table 2) and scores in different subject questions (Table 4). This may be related to the education support policy of the Chinese government, in which public universities are emphasised, which results in private universities with shorter histories, weaker faculties and less distinctive characteristics, ultimately

Table 7
Comparison of core competency scores of nursing students by group (M (IQR), Point).

Projects	No. of people	Core competency score (M (IQR))	Z/ χ^2	P
Whether it is a Public Universities				
Yes	132	213.00 (36.00)	Z = -6.487	< 0.001
No	86	190.00 (12.00)		
Whether to participate in skills competitions				
Yes	180	205.50 (34.00)	Z = -5.986	< 0.001
No	38	186.50 (16.00)		
Attitudes towards employment prospects				
Easy	145	208.00 (37.00)	$\chi^2 = 27.828$	< 0.001
Not easy	40	190.00 (20.00)		
Uncertain	33	191.00 (19.00)		
Attitudes towards the clinical teaching currently received				
Satisfied	160	202.00 (34.00)	$\chi^2 = 16.959$	< 0.001
Normal	56	188.00 (29.00)		
Dissatisfied	2	188.00 (-)		

Table 8
Specific scores on different factors of core competencies for nursing students participating in the competition (Mean \pm SD, Point).

Factors	Total points	Mean \pm SD	No. of items	Ranking
Clinical biomedical science	26.18 \pm 4.84	5.24 \pm 0.97	5	5
General clinical skills	31.83 \pm 4.24	5.30 \pm 0.71	6	4
Critical thinking and reasoning	15.53 \pm 2.42	5.18 \pm 0.81	3	6
Caring	27.04 \pm 3.59	5.41 \pm 0.72	5	3
Ethics and accountability	79.36 \pm 8.78	5.67 \pm 0.63	14	1
Lifelong learning	27.26 \pm 3.66	5.45 \pm 0.73	5	2
Total competence score	207.21 \pm 22.52	5.45 \pm 0.59	38	-

affecting the educational advantages of nursing students [13]. The overall scores of both public and private universities were not high and the difference between the Group A and Group B scores was not found to be statistically significant (Table 3). They were analysed for three reasons. Firstly, the questions were highly comprehensive with more practical clinical applications, and the ability of students to analyse and solve problems through the use of comprehensive knowledge was still lacking. Secondly, the questions tested more details of knowledge points and the memories of students were not accurate and solid, thereby indicating insufficient integration with theoretical knowledge in the internship process. Thirdly, although Group A had been trained for a longer period, the competition introduced written items and students did not have sufficient practical experience. In future competitions, the addition of a comprehensive written examination that requires candidates to have a firm grasp of the basic theoretical knowledge of the profession and a certain degree of clinical nursing ability and experience should be considered. This would complement the nursing skills assessment in the competition and serve as an objective indicator of the quality of nursing student teaching.

4.2. Average scores in skills practice and poor humanistic care

Nursing skills embody nursing assessment, decision-making, planning and clinical thinking in the workplace. They can be expressed in a variety of ways and means for solving the health problems of patients and satisfying their health needs in clinical work in order to achieve nursing goals [14]. The items of nursing skills practice are mostly common clinical practices. The items students mastered best were intramuscular injection, cardiopulmonary resuscitation (CPR) and four-step palpation + measurement of uterine height and circumference, whereas the items they mastered less were pulmonary examination and intradermal injection (Table 6). This demonstrates that the teaching of health examination and the handling of the details of each practice should be strengthened in actual teaching. No statistical difference was observed between the results of Group A and Group B at public universities, which indicates that although the nursing students in Group A at public universities had received training that lasted for a longer period of time and their performance had improved slightly, without any essential change, which indirectly indicated that nursing students at public universities still require more solid and effective training. A statistical difference was found between the results of Group A and Group B at private universities, which suggests that the skills practice training of students was generally insufficient (Table 6). Public universities can strengthen the skills training of nursing students in the following ways as a means of promoting their solid mastery of nursing skills: ① Optimise the experimental teaching methods, create and open simulation laboratories and make full use of the clinical simulation teaching platform. This can be done both online and offline to improve the various practical skills of students and enhance their learning experience and effectiveness. ② Form a high-quality teaching case library. Clinical cases can be introduced in nursing practice teaching and nursing skills can be set as practical training tasks based on changes in clinical situations, which will improve both teaching quality and the practical abilities of students. ③ Establish a comprehensive clinical skills integration course and form a specialised clinical skills teacher team for the course. The team should cover management and disciplines, including diagnostics, internal medicine, surgery, obstetrics and gynaecology, paediatrics, emergency medicine, nursing and other disciplines, as a means of

Table 9
Comparison of different groups on different factors of core competencies for nursing students participating in the competition (M (IQR), Point).

Factors/Projects	Whether it is a Public Universities		Attitudes towards employment prospects			Attitudes towards the clinical teaching currently received		
	Yes	No	Easy	Not easy	Uncertain	Satisfied	Normal	
No. of people		95	85	116	35	29	132	47
Clinical biomedical science	M (IQR)	5.60 (0.80)	4.80 (0.60)	5.30 (1.20)	4.80 (1.00)	5.00 (0.70)	5.20 (1.20)	5.00 (0.80)
	Z/ χ^2	Z = -7.521		$\chi^2 = 22.471$			$\chi^2 = 13.124$	
	P	< 0.001		< 0.001			0.001	
General clinical skills	M (IQR)	6.00 (0.83)	5.00 (0.33)	5.67 (1.00)	5.00 (0.67)	5.00 (0.75)	5.33 (1.00)	5.00 (1.17)
	Z/ χ^2	Z = -7.81		$\chi^2 = 33.14$			$\chi^2 = 11.40$	
	P	< 0.001		< 0.001			0.003	
Critical thinking and reasoning	M (IQR)	6.00 (1.00)	5.00 (0.33)	5.33 (1.25)	5.00 (1.00)	5.00 (0.50)	5.00 (1.25)	4.67 (1.33)
	Z/ χ^2	Z = -6.91		$\chi^2 = 26.27$			$\chi^2 = 14.14$	
	P	< 0.001		< 0.001			0.001	
Caring	M (IQR)	6.00 (0.40)	5.00 (0.30)	5.60 (1.00)	5.00 (1.20)	5.00 (1.00)	5.60 (1.00)	5.00 (1.20)
	Z/ χ^2	Z = -7.39		$\chi^2 = 15.36$			$\chi^2 = 17.14$	
	P	< 0.001		< 0.001			< 0.001	
Ethics and accountability	M (IQR)	6.00 (0.57)	5.00 (0.50)	6.00 (0.89)	5.00 (0.79)	5.29 (0.86)	5.86 (0.86)	5.36 (1.00)
	Z/ χ^2	Z = -9.76		$\chi^2 = 31.82$			$\chi^2 = 4.16$	
	P	< 0.001		< 0.001			0.125	
Total competence score	M (IQR)	6.00 (0.40)	5.00 (0.30)	5.80 (1.00)	5.00 (1.00)	5.00 (0.70)	5.60 (1.00)	5.00 (1.40)
	Z/ χ^2	Z = -6.84		$\chi^2 = 20.46$			$\chi^2 = 6.45$	
	P	< 0.001		< 0.001			0.040	
Total competence score	M (IQR)	223.00 (20.00)	190.00 (12.00)	216.50 (33.00)	190.00 (18.00)	192.00 (20.00)	209.00 (35.00)	191.00 (32.00)
	Z/ χ^2	Z = -9.45		$\chi^2 = 38.61$			$\chi^2 = 14.14$	
	P	< 0.001		< 0.001			0.001	

Table 10

Correlations between scores on different factors of core competencies of nursing students participating in the competition and different groups.

Factors	Whether it is a Public Universities		Attitudes towards employment prospects		Attitudes towards the clinical teaching currently received	
	r	p	r	p	r	p
Clinical biomedical science	0.391	<0.001	-0.253	0.001	-0.211	0.004
General clinical skills	0.557	<0.001	-0.353	<0.001	-0.217	0.003
Critical thinking and reasoning	0.504	<0.001	-0.321	<0.001	-0.242	0.001
Caring	0.481	<0.001	-0.203	0.006	-0.302	<0.001
Ethics and accountability	0.697	<0.001	-0.366	<0.001	–	–
Lifelong learning	0.493	<0.001	-0.313	<0.001	-0.178	0.017
Total competence score	0.672	<0.001	-0.381	<0.001	-0.230	0.002

improving the practical skills of nursing students through the integrated skills team [15–17]. Private universities can strengthen the skills training of nursing in the following ways: ① Increase the number of practice hours and ensure the labs are open all day. Increase the number of hours in which students practice nursing skills and make students more enthusiastic to take the initiative to practice after class. ② Emphasise clinical short-term apprenticeships and internships so students can experience the complexity and high pressure of a clinical work environment and gain more physical experience of skill practice. ③ Improve the practice assessment mode, establish objective visual and structured grading rules and reduce subjective grading. This will enable students to enhance the practice intensity of their weak skills through every aspect of scoring criteria [15,17].

In addition, the competition was found to be poor in terms of humanistic care, which is a concrete expression of the respect for life nurses have and requires special attention in clinical learning. The humanistic care of some nurses in the competition was only verbal and for example, they did not cover the patient during a gynaecological examination and protect their privacy. Humanistic care is the focus of nursing student training, which suggests that humanistic care for nursing educators should not be limited to memorisation and procedures and focus solely on simple external forms of expression, but should form a professional quality that is “internalised in the heart and externalised in action” [18].

4.3. Competition enhances core competencies of nursing students

The results of this study have found there to be differences between the core competencies of nursing students who participated in the competition and those who did not participate. The overall mean of the core competencies of the nursing students who participated was (5.45 ± 0.59) with scores of more than 5 in all 6 factors, which indicates that the core competencies of nursing students after participation were at a medium to high level. However, there was still room for further improvement. The Shandong Province University Students' Medical Technology Skills Competition uses the latest industry standards and development dynamics and can be used to guide both teachers and students in Shandong Province. Through university training, students repeatedly study and analyse teaching materials, closely integrate with the actual clinical norms of the practice process, restore real clinical scenarios and perform standardised case training and clinical real-life training as a means of cultivating the six dimensions of the core competence of nursing students. This enables them to comprehensively assess, reasonably judge, scientifically decide and accurately operate within the integrated context and efficiently communicate and proactively collaborate as part of a team, ultimately helping them achieve the goal of enhanced core competencies. The top three scores for each factor were for ethics and responsibility, lifelong learning and caring factor. The three lowest scores were for critical thinking and reasoning, clinical biomedical science and general clinical skills (Table 8). Caring, ethics and responsibility awareness are the main manifestations of the humanistic care competencies of students [19]. High scores on caring and ethics and responsibility demonstrate that nursing educators in Shandong province are focused on humanistic care competencies development in nursing students and have managed to achieve good results, which is potentially related to the current clinical practice of the human health-focused care model and patient-focused care philosophy. However, the situation in the skills competition was opposed to that of the questionnaire and written examination where there was a better performance regarding humanistic caring. Future educators should consider the adoption of a better educational approach that can enable the translation of the concept of humanistic caring into action and clinical activities by students. The relatively low critical thinking and reasoning and clinical biomedical science scores may be because nursing students have only experienced competitions and not yet entered clinical positions, so they do not fully understand the hospital situation or fully integrate theoretical knowledge in clinical situations. At the same time, it may be related to the current method of nursing education in China, which is unlike teaching abroad where the population base and the number of educated people are both large, and is still based on indoctrination and the education of the thinking and reasoning skills of nursing students is weak. The core competency scores and individual factor scores of the participating nursing students differed based on whether they attended public universities, their different attitudes to employment and attitudes to current clinical teaching (Table 9) and were correlated (Table 10), which is consistent with the results of previous studies [20,21]. However, no significant difference was found between the ethics and responsibility scores and the different attitudes towards the clinical teaching currently received, which may be due to the fact that humanistic education is practised in all undergraduate nursing education throughout Shandong Province.

Developing the core competencies of nursing students is a long process. Through the theoretical learning they undertake at school, nursing students develop certain core competencies, which are further improved through the in-depth learning of clinical practice and

internship. The nursing skills competition serves as an important bridge between the two and is an important tool for the improvement of nursing training quality and the core competencies of nursing students. This also demonstrates that nursing educators and clinical teachers should emphasise cultivating the core competencies of nursing students in their daily teaching, while also improving their core competencies by altering the teaching mode and innovating teaching methods with the ability to satisfy clinical needs.

5. Limitations

Regarding data collection, all questionnaires were completed on a voluntary basis and no strict control group data was used, resulting in the amount of data received relating to non-participating nursing students being relatively small. In addition, the results of the study were subject to a certain amount of chance, so a more rigorous research design is required for the collection of data in the future.

6. Conclusion

In summary, the 2022 Shandong Province University Medical Technical Skills Competition for students in Shandong Province involved the addition of a comprehensive written examination where participating nursing students had to compete from theoretical knowledge to operational skills. The abilities of nursing students in Shandong Province were judged from every aspect and the competition proved that technical skills competitions can effectively improve the core competencies of nursing students. In the future, competitions such as this will become an important way for nursing educators from every walk of life to reform their education models and this should attract the participation of more universities.

Data availability statement

Data will be made available on request.

Funding

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Availability of data and materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Ethics approval

The Ethics Review Committee (ERC) of Shandong First Medical University & Shandong Academy of Medical Sciences (R202302240030) granted permission to conduct the study. We certify that the study was performed by the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Consent to participate

Each respondent was informed extensively about the study through an information letter. Participation was always voluntary. All participants signed informed consent. The respondent could withdraw from the study at any time without giving a reason.

Consent for publication

Not applicable.

Code availability

Not applicable.

CRedit authorship contribution statement

Yahui Liang: Writing – review & editing, Writing – original draft, Validation, Supervision, Software, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **WeiHua Liu:** Writing – review & editing, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Xiaolei Li:** Writing – original draft, Software, Data curation. **Yan Zhang:** Writing – original draft, Software, Data curation. **Li Yang:** Writing – original draft, Software, Formal analysis, Data curation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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