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Article

A Study on the Current Status and Influencing Factors of Clinical Communication Skills Among Higher Vocational Nursing Students in the Context of Smart Healthcare

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Abstract: Objective: To investigate the current status of clinical communication skills among nursing students in vocational colleges within the context of smart healthcare, analyze the influencing factors, and provide empirical evidence for the reform of nursing communication teaching in vocational colleges. Methods: Using the convenience sampling method, 246 nursing students in vocational training from multiple tertiary Grade A hospitals in Tianjin were selected as the study subjects. A questionnaire survey was conducted using a general demographic questionnaire and the Nursing Students' Clinical Communication Skills Assessment Scale. SPSS 26.0 software was employed for descriptive statistics, univariate analysis, and multiple linear regression analysis. Results: The total score of clinical communication skills among the nursing students was (80.15 ± 14.72) points, indicating a moderate level; the lowest scores were observed in the dimensions of "joint participation" and "effective information transmission." Multiple linear regression analysis revealed that whether the students had access to smart wards or mobile nursing systems, and whether they had participated in practical training for communication skills, were independent positive influencing factors on their clinical communication skills ($P < 0.05$). Conclusion: In the smart healthcare environment, there remains room for improvement in the clinical communication skills of nursing students in vocational colleges, with joint participation and effective information transmission being the primary areas of weakness. Educational institutions should align their training programs with the demands of smart nursing roles, enrich digital communication scenario-based practical training, expand the coverage of communication practice training, and implement the integration of job requirements, curriculum, competitions, and certification systems, thereby cultivating nursing professionals who possess both digital literacy and clinical communication capabilities.

Keywords: smart healthcare; vocational colleges; nursing interns; communication skills

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1. Introduction

The "Healthy China 2030" Planning Outline proposes to vigorously develop smart healthcare, promoting the implementation of "Internet + Healthcare," smart wards, mobile nursing, online follow-ups, and intelligent health education platforms in medical institutions [1]. Smart healthcare is not merely a digital upgrade of nursing tools; it also redefines the communication scenarios between nurses and patients [2]. While using mobile devices to collect data, nurses must simultaneously manage multi-channel communication-both online and offline-with patients and their families. Faced with the vast amounts of health information generated by smart devices, nurses need to filter this information, provide accessible interpretations, and guide patients in engaging in self-health management. This transformation has significantly altered the content, format, and complexity of clinical communication [3].

Smart healthcare has expanded nurse-patient communication from traditional bedside face-to-face interactions to diverse scenarios-including online consultations, remote health education, and device-assisted communication-thereby placing greater demands on nursing students' information processing skills, empathetic communication abilities, and multi-channel communication competencies [4]. Clinical communication constitutes a core competency for nursing professionals; it directly impacts the quality of care, patient safety, and patient experience, serving as a critical capability for vocational nursing students to achieve successful career transition. Existing research indicates that the overall communication skills of nursing students still require improvement, yet the need for communication strategies tailored to the new scenarios of smart healthcare has not yet received sufficient attention.

Existing research has predominantly focused on traditional clinical settings, with limited exploration of how the smart healthcare environment influences the communication skills of nursing students [5]. Smart healthcare has reshaped the communication information ecosystem, requiring nursing students to possess both conventional communication skills and digital communication literacy, thereby presenting new challenges to vocational nursing education [6]. Currently, there is a scarcity of empirical studies investigating the clinical communication abilities of vocational nursing students in the context of smart healthcare, and the analysis of influencing factors remains insufficiently in-depth. To address this gap, this study examines the current status of clinical communication skills among vocational nursing students and analyzes the factors influencing these skills, aiming to provide empirical evidence for nursing education reform and the cultivation of nursing students' communication competencies, thereby contributing to the development of high-quality nursing professionals suited to the demands of the smart healthcare era.

2. Subjects and Methods

2.1. Study Subjects

This study employed convenience sampling to recruit nursing students from vocational colleges who were undergoing internships in multiple Grade III Level A hospitals in Tianjin for a questionnaire survey. Inclusion criteria: (1) Full-time nursing students in vocational colleges; (2) Completion of foundational nursing courses and courses related to interpersonal communication; (3) Provision of informed consent and voluntary participation in this study. Exclusion criteria: (1) History of mental disorders or cognitive dysfunction; (2) Inability to participate due to leave of absence, academic suspension, or similar reasons; (3) Insufficient time to complete the questionnaire or a demonstrable pattern of repetitive responses. The primary statistical analysis employed in this study was multiple linear regression analysis; according to statistical requirements, the sample size should be 10–20 times the number of independent variables. Given that approximately 14 independent variables were included in this analysis, the required sample size was at least 140 participants. Ultimately, 257 questionnaires were collected; after excluding invalid and duplicate responses, 246 valid questionnaires were retained, yielding an effective response rate of 95.7%.

2.2. Research Tools

This study employed a questionnaire survey to collect data, and the research instrument consisted of two components:

2.2.1. General Data Survey Form

This form was independently designed by the researcher. The variables encompass demographic and sociodemographic characteristics, exposure to and learning experiences in smart healthcare, practical learning experiences, and subjective attitudes. The variables include: gender; personality type; place of origin; whether the participant is an only child; whether the participant holds a student leadership position; proficiency level in using smart nursing devices; nursing students 'attitudes toward clinical communication skills;

prior exposure to smart wards / mobile nursing systems; completion of courses related to smart healthcare; participation in practical training for communication skills; participation in skill competitions and awards won; and passing the National Computer Rank Examination (Level 1). Binary variables were coded as 0 or 1; personality type and nursing students' attitudes toward clinical communication skills were treated as ordinal categorical variables, for which dummy variables were constructed for regression analysis; proficiency level in using smart nursing devices was treated as an ordered categorical variable, assigned ordinal values; the coding scheme for all independent variables is detailed in Table 1.

Table 1. Independent Variable Values

variable classes	Variable Name	Assignment Notes
Demographic sociological variables	sex	Male = 1; Female = 0
	Place of origin (rural / urban)	Rural = 1; Urban = 0
	Are you an only child?	Yes = 1; No = 0
	Are you a student leader?	Yes = 1; No = 0
	character type	Original grouping: Extraverted = 1, Neutral = 0, Introverted = 2; In the regression model, dummy variables were included, with the neutral personality type serving as the reference group.
Smart healthcare-related variables	Proficiency in using smart nursing devices	Unskilled = 0; Average = 1; Skilled = 2
	Have you had access to a smart ward / mobile nursing system?	Yes = 1; No = 0
	Whether to take courses related to smart healthcare	Yes = 1; No = 0
Attitude and Practical Variables	Health students' attitudes toward clinical communication skills	Original grouping: Like = 1, Neutral = 0, Dislike = 2; In the regression model, dummy variables were included, using the "Neutral" attitude as the reference category.
	Whether to participate in practical training on communication skills	Yes = 1; No = 0
	Whether you participated in a skills competition and won any awards	Yes = 1; No = 0
	Did you pass the National Computer Rank Examination (Level 1)?	Yes = 1; No = 0

2.2.2. Nursing Student Clinical Communication Ability Assessment Scale

The Nursing Student Clinical Communication Ability Assessment Scale [7], developed by Yang Fangyu et al., was employed. This scale comprises six dimensions: establishing a harmonious relationship, attentive listening, identifying patient concerns, collaborative participation, conveying effective information, and validating feelings, with a total of 28 items. A four-point Likert scale was used, where 1 indicates "never" and 4 indicates "always"; the total score ranges from 28 to 112, with higher scores indicating

stronger clinical communication abilities. The scale demonstrated a structural validity coefficient of 0.841 and a Cronbach's α coefficient of 0.820, indicating good reliability and validity.

2.3. Data Collection Methods

In this study, electronic questionnaires were distributed via the Wenjuanxing platform. Prior to the survey, the researchers explained the study objectives and completion requirements to the clinical instructors in each department; these instructors then assisted in forwarding the questionnaire link to the nursing students in clinical training. The first page of the questionnaire contained an informed consent statement, after which the nursing students voluntarily decided whether to participate in the survey. The questionnaires were completed anonymously, and all items were mandatory to prevent omissions. The completion time per questionnaire was approximately 10–15 minutes. Data collection was conducted from October 2025 to December 2025.

2.4. Quality Control

To ensure data quality, this study implemented the following quality control measures: (1) During the questionnaire design phase, nursing education experts were invited to conduct content validity assessments on the general information questionnaire to ensure that the questionnaire content was comprehensive and accurate; (2) In the pre-survey phase, 30 nursing students were selected to participate in a pre-survey to evaluate the questionnaire's readability and completion time; the questionnaire was then revised and refined based on the feedback received; (3) In the formal survey phase, reverse-scored items and attention-check items were incorporated into the questionnaire to identify invalid questionnaires; (4) During the data processing phase, two researchers independently performed data cleaning, excluding questionnaires with completion times shorter than 3 minutes, those exhibiting obvious response patterns (e.g., all respondents selecting the same option), and duplicate submissions; (5) In the statistical analysis phase, the data underwent double data entry and logical verification to ensure data accuracy.

2.5. Statistical Methods

In this study, SPSS 26.0 was used for statistical analysis. Descriptive statistical analyses were conducted on the baseline characteristics of nursing students and their clinical communication competency scores. Measurement data conforming to a normal distribution are expressed as mean ± standard deviation; data not conforming to a normal distribution are expressed as median (interquartile range); enumeration data are expressed as frequency and percentage (%). Univariate analyses employed the independent samples t-test, analysis of variance (ANOVA), and the χ^2 test; multivariate analyses employed multiple linear regression analysis. A P-value <0.05 was considered statistically significant (As shown in Table 2, 3, 4).

Table 2. Clinical Communication Ability Scores of Nursing Students $(\bar{x} \pm s)$

project	dimension	Number of entries	total points	Average score per entry
Clinical communication skills of nursing students	total points	28	80.15±14.72	2.86±0.53
	Establish harmonious relationships	6	16.74±3.34	2.73±0.56
	Attentive listening	5	16.09±3.34	3.22±0.67
	Confirm the patient's concerns	5	15.61±3.47	3.12±0.69
	fellowship	4	9.58±2.98	2.40±0.75
	Convey effective confidence	3	7.45±1.88	2.48±0.63
	Verification feedback	5	15.05±3.40	3.01±0.68

Table 3. Univariate Analysis of Clinical Communication Skills among Nursing Students Based on Different Characteristics $(\bar{x} \pm s)$

project		n	Total Communication Skills Score	t/F/Z	P
sex	man	39	82±17.55	-0.853a	0.394
	woman	207	79.81±14.14		
character type	extravert type	54	87.30±14.77	9.397b	0.000
	neutral	134	78.94±12.91		
	introvert type	58	76.31±16.50		
From urban or rural areas	city	68	82.96±15.15	-1.855a	0.065
	rural area	178	79.08±14.45		
Are you an only child?	the only child	52	81.58±15.08	0.784a	0.434
	non-only child	194	79.77±14.63		
Are you a student leader?	Student representative	72	83.07±15.93	-2.011a	0.045
	Not a student representative	174	78.95±14.06		
Proficiency in using smart nursing devices	Unskilled = 0	211	79.67±14.76	1.338b	0.264
	General = 1	13	79.77±13.65		
	Proficiency = 2	22	85.05±14.60		
Health students' attitudes toward clinical communication skills	attach importance to	119	86.00(76.00~95.00)	32.486c	0.000
	same as	117	76.00(66.00~84.00)		
	indifference	10	71.00(58.00~79.00)		
Have you had access to a smart ward / mobile nursing system?	yes	186	83.24±13.91	-6.237a	0.000
	deny	60	70.57±12.99		
Whether to take courses related to smart healthcare	yes	195	81.00(74.00~93.00)	-5.081c	0.000
	deny	51	73.00(60.00~80.00)		
Whether to participate in practical training on communication skills	yes	198	82.84±13.66	-6.258c	0.000
	deny	48	69.06±13.81		
Whether you participated in a skills competition and won any awards	yes	15	74.4±20.93	1.568c	0.118
	deny	231	80.53±14.2		

Did you pass the National Computer Rank Examination (Level 1)?	yes	159	79.00(72.00~93.00)	-0.939c	0.348
	deny	87	79.00(71.00~90.00)		

a: t-test; b: F-test; c: H-test

Table 4. Multivariate Analysis of Clinical Communication Skills among Vocational Nursing Students

argument	regression coefficient	standard error	standardized regression coefficient	t	P
constant	68.666	2.251		29.615	0.000
character type	-0.451	1.058	-0.025	-0.426	0.671
Are you a student leader?	2.605	1.919	0.081	1.357	0.176
Nursing students' attitudes toward clinical communication	1.877	1.611	0.073	1.165	0.245
Have you had access to a smart ward / mobile nursing system?	6.718	3.046	0.196	2.205	0.028
Whether you have systematically studied courses related to smart healthcare	1.078	3.295	0.030	0.327	0.744
Whether to participate in practical training on communication skills	7.508	3.038	0.203	2.471	0.014

3. Results

3.1. General Demographic Characteristics of Nursing Students in Higher Vocational Education Institutions

A total of 246 valid participants were ultimately included in this study. Regarding gender distribution, there were 207 female participants (84.0%) and 39 male participants (16.0%), with the proportion of females being significantly higher than that of males-a finding consistent with the overall gender composition of nursing students. In terms of personality type, the largest group consisted of individuals with a neutral personality (134 participants, 54.5%), followed by introverted and extroverted types in descending order. Concerning place of origin, 178 nursing students (71.8%) came from rural areas, while 68 (28.2%) came from urban areas, indicating a relatively high proportion of rural participants. Regarding whether they were only children, 194 participants (78.2%) were non-only children, and 52 participants (21.8%) were only children. As for whether they held student leadership positions, 174 participants (70.2%) did not hold such positions, whereas 72 participants (29.8%) did hold such positions. Regarding professional attitudes, 119 nursing students (48.4%) placed particular emphasis on clinical communication. Regarding training experiences, 186 nursing students (76.0%) had exposure to smart wards or mobile nursing systems; 195 nursing students (79.0%) had systematically studied courses related to smart healthcare; 198 nursing students (81.0%) had participated in practical training for communication skills; 159 nursing students (65.0%) had passed the National Computer Rank Examination (Level 1); and 231 nursing students (94.0%) had not won any awards in professional skills competitions.

3.2. Current Status of Clinical Communication Skills among Nursing Students in Higher Vocational Education Institutions

The total score for clinical communication skills among 246 nursing students in vocational colleges was (80.15 ± 14.72) points, while the mean score per item was (2.86 ± 0.53) points. Based on the total score range of the scale (28–112 points), the theoretical

median score was 70 points. Although the mean total score of this cohort of nursing students exceeded the theoretical median, the mean item score of 2.86 (out of 4 points) indicates that their clinical communication skills are at a moderate level, suggesting considerable room for improvement.

The scores across the six dimensions are as follows: the "Establishing harmonious relationships" dimension scored (16.74 ± 3.34) points, the highest among the six dimensions; the "Attentive listening" dimension scored (16.09 ± 3.34) points; the "Confirming patient concerns" dimension scored (15.61 ± 3.47) points; the "Validating feelings" dimension scored (15.05 ± 3.40) points; the "Joint participation" dimension scored (9.58 ± 2.98) points; and the "Conveying effective information" dimension scored (7.45 ± 1.88) points, the lowest among the six dimensions. See Table 2.

Analysis based on the mean scores of the items revealed the following results: the mean score for the "Establishing a harmonious relationship" dimension was 2.79; for the "Attentive listening" dimension, it was 2.68; for the "Confirming patient concerns" dimension, it was 2.60; for the "Validating patient feelings" dimension, it was 2.51; for the "Joint participation" dimension, it was 2.40; and for the "Effective information delivery" dimension, it was 2.48. These findings indicate that nursing students performed relatively well in establishing harmonious relationships and demonstrating attentive listening, whereas their performance was weaker in terms of joint participation in patient care decision-making and effective information delivery. This outcome suggests that nursing students in vocational colleges are particularly adept at building rapport and listening to patients in clinical settings, yet they exhibit notable deficiencies in actively engaging in patient care decision-making and effectively conveying information.

3.3. Univariate Analysis of Clinical Communication Skills among Nursing Students Based on Different Characteristics

Using the total score of clinical communication ability as the dependent variable and general demographic characteristics along with training-related variables as grouping variables, a one-way ANOVA was conducted. The results indicated that differences in clinical communication ability among nursing students were statistically significant ($P<0.05$) across six dimensions: personality type, whether they held student leadership positions, their attitude toward clinical communication, prior exposure to smart wards/mobile nursing systems, completion of systematic courses related to smart healthcare, and participation in practical training for communication skills. See Table 3.

3.4. Multivariate Analysis of Clinical Communication Skills among Nursing Students in Higher Vocational Education

Using the total score of clinical communication ability as the dependent variable, six variables that showed statistically significant differences in the univariate analysis (personality type, whether the student held a student leadership position, attitude toward clinical communication, prior exposure to smart wards/mobile nursing systems, completion of systematic courses related to smart healthcare, and participation in practical training for communication skills) were included as independent variables in a multiple linear regression model. The results of the multiple linear regression analysis indicated that only two variables ultimately entered the regression model: prior exposure to smart wards/mobile nursing systems and participation in practical training for communication skills. This demonstrates that, after controlling for other variables, prior exposure to smart wards/mobile nursing systems and participation in practical training for communication skills are independent influencing factors for the clinical communication ability of vocational nursing students.

4. Discussion

4.1. Current Status of Clinical Communication Skills among Higher Vocational Nursing Students in the Context of Smart Healthcare

The results of this study indicate that the total score of clinical communication skills among 246 nursing students in vocational colleges was (80.15 ± 14.72) points, with a mean score per item of (2.86 ± 0.53) points, placing their performance at a moderate level. These findings are largely consistent with reports from domestic studies, suggesting that the overall clinical communication competence of vocational nursing students is acceptable, yet there remains considerable room for improvement [8-9]. Specifically, students scored relatively high in the dimensions of "attentive listening" and "confirming patient concerns," whereas they scored the lowest in "joint participation" and "delivering effective information." In the context of smart healthcare, nurses are not only required to collect and interpret vast amounts of monitoring data generated by intelligent devices but also to provide health education to patients in plain language, guiding patients to participate in self-health management. Joint participation and effective information delivery are precisely the competencies frequently demanded in smart nursing roles; however, nursing students in this study demonstrated significant deficiencies in these two dimensions. This highlights that traditional nursing communication training has predominantly focused on listening and empathy exercises, while lacking practical training scenarios involving information dissemination and patient engagement within digital environments-a gap that creates a disconnect between current teaching practices and the demands of smart nursing positions. The expansion of smart healthcare has broadened the scope of nurse-patient communication: online consultations and remote follow-ups have increased, non-verbal communication cues have diminished, and human-machine co-working scenarios have proliferated. Consequently, there is a tendency to "prioritize equipment operation over humanistic communication." Nursing students in academic settings have not yet fully adapted to the communication patterns of smart healthcare; therefore, it is essential to incorporate appropriate practical training components into their educational curricula [10-11].

4.2. Analysis of Factors Influencing Clinical Communication Skills of Nursing Students

Results from multiple linear regression analysis indicate that exposure to smart wards/mobile nursing systems and participation in practical training for communication skills are independent positive determinants of clinical communication competence among nursing students. Students who have used smart wards or mobile nursing systems demonstrate superior communication skills. Through such exposure, nursing students gain insight into authentic clinical work scenarios, develop an understanding of nurse-patient communication tasks in digital environments, and acquire concrete knowledge of communication requirements in their professional roles-thereby indirectly enhancing their communication capabilities. Notably, merely completing theoretical courses on smart healthcare does not independently improve communication skills; this finding underscores that classroom-based theoretical learning alone is insufficient to translate knowledge into practical competence, and that real-world exposure and hands-on experience are essential.

Participation in practical communication skills training constitutes another independent positive influencing factor. Nursing students who have undergone such practical training demonstrate significantly higher clinical communication skills compared to those who have not. These findings underscore the pivotal role of practical training in fostering communication skills [12].

Communication competence is fundamentally a type of procedural knowledge and skill; purely theoretical instruction alone is insufficient to translate this competence into practical ability. Practical training methods-such as scenario simulations, standardized patients, and role-playing-can effectively cultivate nursing students' abilities in communication and expression, empathy, and information transmission. These findings are consistent with domestic research in nursing education [13-14]. In this study, 81.0% of nursing students participated in practical training for communication competence, indicating that the majority of higher vocational nursing institutions have recognized the importance of such training. However, 19.0% of nursing students did not participate,

possibly due to limited training slots, scheduling conflicts, or insufficient personal emphasis on the training. It is therefore recommended that higher vocational nursing institutions further expand the coverage of practical training by incorporating communication competence development into mandatory practical training components, thereby ensuring that every nursing student has ample opportunities to engage in practical communication exercises.

Univariate analysis revealed statistically significant differences in personality type, student leadership roles, and nursing students' subjective attitudes; however, after adjusting for confounding variables using dummy variables, these factors no longer exhibited independent effects. This suggests that personality and subjective attitudes may exert some influence on communication scores; nevertheless, communication competence is modifiable-exposure to relevant scenarios and practical training can mitigate the disparities attributable to innate personality traits. Nursing education should therefore avoid simplistically attributing communication competence to individual personality characteristics.

This study found no significant impact of winning nursing skill competitions on communication skills, suggesting that existing nursing skill competitions place greater emphasis on operational techniques while assigning insufficient weight to the communication dimension, and have thus failed to adequately address the changes in communication patterns driven by the advent of smart healthcare.

4.3. Implications for Nursing Education in Higher Vocational Colleges in the Context of Smart Healthcare

First, align the communication and practical training content with the demands of intelligent nursing roles. To address common shortcomings in collaborative participation and effective information exchange, additional simulated scenarios-such as operating smart wards, using mobile nursing terminals, conducting online health education, and interpreting intelligent monitoring data-have been introduced. These scenarios train nursing students to operate intelligent devices while maintaining humanistic communication skills, thereby preventing an overemphasis on technical proficiency at the expense of interpersonal communication.

Second, strengthen practical training and optimize assessment and evaluation mechanisms. Rather than relying solely on theoretical classroom instruction, we should incorporate standardized patients and scenario-based simulation training; furthermore, we should integrate intelligent nursing scenario communication into practical training assessments, shifting away from an evaluation model dominated by written examinations, thereby leveraging the guiding role of assessment.

Third, synergize the alignment of job requirements, curriculum design, skill competitions, and certification programs to optimize the talent development pipeline. On the job-side, establish standards for intelligent nursing communication skills; on the curriculum-side, implement digitalized communication scenario-based practical training; in skill competitions, incorporate evaluation criteria specific to intelligent nursing communication; and in certification training, enhance practical communication drills-thereby achieving synergistic empowerment across job requirements, curriculum design, skill competitions, and certification programs.

4.4. Limitations of the Study

This study employed convenience sampling, selecting only vocational nursing students currently interning in tertiary Grade A hospitals in Tianjin, which limits the representativeness of the sample; it was a cross-sectional study, which only reflects the correlations among variables and cannot establish causal relationships; the measurement instrument used was the conventional nursing student communication scale, without the addition of specific items addressing smart nursing communication. Future research could involve multi-center sampling to develop communication assessment tools tailored to smart nursing practice, as well as conduct teaching intervention studies to further validate the effectiveness of these reforms.

5. Conclusion

In the context of smart healthcare, the clinical communication skills of nursing students in vocational colleges currently remain at a moderate level, with particular shortcomings in the dimensions of collaborative participation and effective information transmission. Exposure to smart wards or mobile nursing systems, coupled with practical training in communication skills, serves as independent positive factors influencing nursing students 'clinical communication competence. Nursing education programs in vocational colleges should align with the demands of smart healthcare roles by incorporating practical teaching scenarios involving digital communication, intensifying hands-on communication training, addressing weaknesses in students' communication skills, and thereby cultivating nursing professionals who possess both digital competencies and humanistic communication literacy for clinical practice.

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