Competency Map Orientation: Design of Precise Improvement Paths for Nursing English Communication Skills Based on AI Diagnosis and Treatment Dialogue Analysis

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Abstract: Against the backdrop of globalized medical services, effective English communication of nursing staff in clinical practice is critical for professional competence, yet their English communication skill training faces issues like vague competency standards, superficial communication process evaluation, and inefficient improvement strategies. This study aims to address these problems by first clarifying nursing English communication competency standards through literature review and expert interviews, then designing a comprehensive evaluation system covering both process and outcome via questionnaire surveys of clinical nurses. Subsequently, it verifies the effectiveness of a targeted improvement strategy through ntervention experiment. Results show the clarified standards and comprehensive evaluation system enhance training pertinence, and the intervention significantly improves nurses' clinical English communication proficiency. The study concludes that standardized standards, multi-dimensional evaluation, and targeted strategies are key to optimizing nursing English communication skill training, providing practical references for improving nurses' global medical service capabilities.

Keywords: Competency Map; AI Diagnosis and Treatment Dialogue Analysis; Nursing English; Communication Skills

1. Introduction

With the acceleration of global medical integration and the increasing mobility of international patients, the ability of nursing staff to communicate in English in clinical diagnosis and treatment scenarios has become an indispensable professional skill. Effective English communication in diagnosis and treatment is not only a tool for information exchange but also directly affects the quality of medical services, patient safety, and the establishment of a harmonious doctor-patient relationship.

2. Construction of Nursing English Communication Skill Competency Map

The construction of a scientific and practical competency map is the premise and foundation for designing precise improvement paths. It clarifies the connotation, dimensions, and hierarchical standards of nursing English communication skills in diagnosis and treatment scenarios, providing a "target blueprint" for skill evaluation and improvement.

2.1 Connotation and Guiding Principles of the Competency Map

The nursing English communication skill competency map in diagnosis and treatment scenarios is a systematic framework that integrates the essential elements, behavioral standards, and development levels of nursing staff's English communication ability in clinical diagnosis and treatment interactions. [1]Its core connotation is to break away from the traditional single language perspective and emphasize the integration of language ability, professional literacy, and interactive skills, with "effectively completing clinical communication tasks" as the ultimate goal.

2.2 Dimension Division of the Competency Map

Through literature review, [2]interviews with clinical experts (including 15 chief nurses and 10 nurses from international medical departments with more than 5 years of experience in foreign-related diagnosis and treatment), and analysis of more than 500 real diagnosis and treatment dialogue cases, the nursing English communication skill competency map is divided into 5 core dimensions, each containing 3-4 sub-dimensions, forming a multi-level competency system.

3. AI-Based Diagnosis and Treatment Dialogue Analysis Technology

The accurate analysis of diagnosis and treatment dialogues is the key link connecting the competency map and the improvement path.[3] AI technology, with its advantages in processing large-scale text, extracting fine-grained features,

and quantifying evaluation, provides technical support for realizing objective, multi-dimensional, and real-time analysis of nursing English communication in diagnosis and treatment scenarios.

3.1 Construction of Diagnosis and Treatment Dialogue Corpus

The quality of the dialogue corpus directly affects the accuracy of AI analysis. A multi-source, multi-scenario, and annotated corpus is constructed through the following steps:

3.1.1 Corpus Collection

Source 1: Real clinical dialogues. With the approval of the ethics committee and patients' informed consent, more than 2000 audio/video recordings of nursing English communication in diagnosis and treatment scenarios (including ward rounds, admission, surgery, emergency, discharge) from 3 top hospitals with international medical departments are collected, covering more than 10 clinical departments and patients from more than 20 countries.

Source 2: [4]Simulated training dialogues. More than 1500 dialogues generated in nursing English simulation training (including role-playing between students and teachers, student-virtual patient interactions) are collected, involving learners at different levels (nursing students, new nurses, experienced nurses).

Source 3: Standard template dialogues. More than 500 standard dialogues designed by clinical experts and English teaching experts for typical scenarios (e.g., explaining diabetes medication in English, communicating with patients with religious taboos) are collected as reference standards.

3.1.2 Corpus Processing

Transcription: Convert audio/video dialogues into text using automatic speech recognition (ASR) technology, and manually correct the recognition errors (especially professional terms and abbreviations) to ensure the accuracy of the text.

Annotation: Adopt a multi-layer annotation scheme. The first layer is "dimension annotation", marking which sub-dimensions of the competency map each dialogue segment belongs to (e.g., a sentence using wrong medical terms is annotated to "professional information transmission - accuracy of professional terms"); the second layer is "level annotation", marking the performance level of the segment according to the competency map standards (e.g., "basic", "intermediate"); the third layer is "error type annotation", recording specific problems (e.g., "vocabulary error: using 'stomachache' instead of 'abdominal pain'").

Classification and storage: Classify the corpus by scenario (e.g., emergency, routine ward round), communication object (patient, doctor, family member), and difficulty level (easy, medium, difficult), and store it in a structured database with search and retrieval functions to facilitate model training and query.

3.2 Key Technologies for AI Dialogue Analysis

AI diagnosis and treatment dialogue analysis integrates multiple natural language processing and machine learning technologies, focusing on realizing three core functions: feature extraction, dimension matching, and gap quantification.

3.2.1 Natural Language Processing (NLP) for Feature Extraction

Lexical level: Use word segmentation, part-of-speech tagging, and named entity recognition (NER) technologies to extract vocabulary features. For example, NER is used to identify medical entities (symptoms, drugs, operations) in dialogues and count the number of professional terms and error rates (e.g., the proportion of wrong terms in total terms).

Syntactic level: Use dependency parsing to analyze the grammatical structure of sentences, detect grammar errors, and evaluate the complexity of sentence patterns (e.g., the proportion of complex sentences with clauses).

Semantic level: Use pre-trained language models (e.g., BERT, MedicalBERT) to calculate the semantic similarity between the learner's expressions and standard expressions. For example, comparing "The patient feels bad" with the standard "The patient reports discomfort" to evaluate the accuracy of semantic expression.

3.2.2 Dialogue State Tracking (DST) for Context Analysis

Dialogue in diagnosis and treatment scenarios is context-dependent, and a single sentence's effectiveness can only be judged in the context of the entire dialogue. [5]DST technology is used to track the dynamic state of the dialogue, including:

Topic continuity: Analyze whether each turn of dialogue is related to the core topic (e.g., in a ward round dialogue, whether the discussion deviates from the patient's current condition).

Information completeness: Based on the scenario type (e.g., admission assessment), predefine the necessary information points (name, age, main complaint, history of present illness), and track whether these points are covered in the dialogue.

4. Conclusion

This study focuses on the design of precise improvement paths for nursing English communication skills based on AI diagnosis and treatment dialogue analysis, guided by a competency map, aiming to solve the problems of vague standards,

superficial evaluation, and homogeneous paths in current training.[6]By constructing a multi-dimensional competency map, applying AI dialogue analysis technology, and designing stratified and targeted improvement paths, it realizes the transformation of nursing English communication skill training from "experience-based" to "data-driven" and from "unified" to "personalized".

Acknowledgments

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