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Constructivism-Based Medical English Teaching: A Case Study of the Course "Emerging Pathogenic Fungal Infections"

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Abstract: The advancement of medical science has elevated medical English to a critical role in facilitating international medical exchange and scientific collaboration. However, traditional medical English pedagogy often suffers from an overemphasis on linguistic knowledge at the expense of practical application and a teacher-centered approach that neglects knowledge construction. These limitations hinder the cultivation of interdisciplinary talents required for clinical practice and scientific research. Guided by constructivist learning theory and utilizing the teaching case of the course "Emerging Pathogenic Fungal Infections," this study explores reform pathways through reconstructing teaching objectives, redesigning instructional processes, and optimizing assessment systems. Specifically, targeted curriculum enhancements were implemented to strengthen students' international literature reading proficiency. The reform aims to holistically improve students' ability to utilize medical English for solving practical problems, offering valuable insights for medical English education.

Keywords: Constructivism; Medical English; Teaching reform; Fungal infections; Literature reading ability

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1. Introduction

Against the backdrop of accelerating medical globalization, transnational clinical collaboration, multinational research initiatives, and the dissemination of cutting-edge knowledge have emerged as core drivers of medical advancement. As the foundational conduit for these activities, the efficacy of medical English instruction critically determines whether medical students can effectively integrate into the global healthcare ecosystem [1].

"Emerging Pathogenic Fungal Infections" represent a growing global public health challenge characterized by intrinsic complexity and dynamic evolution. *Candida auris*, for instance, first identified in 2009, has triggered nosocomial outbreaks across more than 40 countries [2]. Critical research on its multidrug-resistant

mechanisms and cross-species transmission dynamics is predominantly disseminated through English-language journals such as "Nature Microbiology" and "Clinical Infectious Diseases" [3,4]. Similarly, real-time surveillance data on the global spread of drug-resistant *Aspergillus fumigatus* strains relies heavily on English clinical alerts. The acquisition and interpretation of such rapidly evolving evidence directly influence the timeliness and accuracy of clinical decision-making [5].

Nevertheless, prevailing medical English pedagogy remains entrenched in traditional "vocabulary-grammar-translation" paradigms. Instructors frequently prioritize isolated terminology drills (e.g., Pathogenicity or Antifungal Susceptibility), yet students consistently encounter difficulties when processing authentic English literature containing experimental datasets or statistical models—a phenomenon epitomized by the "word-comprehension versus conceptual incoherence" dilemma. This pedagogical disconnect stems fundamentally from the neglect of knowledge's actively constructed nature, which artificially segregates linguistic tools from clinical reasoning into discrete cognitive systems.

Constructivist learning theory offers a robust framework for addressing this pedagogical disjunction [6]. Grounded in Piaget's cognitive development theory, constructivism posits that knowledge acquisition is an active process wherein "learners construct meaning through contextualized social interaction with scaffolded support". This theoretical foundation aligns intrinsically with the operational demands of medical English: the evolving knowledge system of "Emerging Pathogenic Fungal Infections" necessitates contextualized inquiry for internalization, while English literature functions as a dynamic knowledge carrier requiring interpretive processes that inherently integrate domain-specific cognitive schemata and disciplinary language proficiency [7].

Anchored in this paradigm, the present study employs the "Emerging Pathogenic Fungal Infections" medical English course as an implementation platform. We investigate how strategically designed contextual immersion, collaborative problem-solving, and cognitive scaffolding can simultaneously advance students' professional English literacy and scientific interpretation skills during authentic inquiry tasks, including tracing antimicrobial resistance gene origins in *Candida auris* and evaluating clinical controversies surrounding novel antifungal agents. This approach aims to establish an actionable pedagogical framework for transforming medical English instruction.

2. Theoretical foundations: Constructivism-guided medical English pedagogy

Constructivist learning theory provides profound theoretical alignment with medical English instruction, with its three epistemological tenets offering explicit pedagogical guidance.

2.1. Active knowledge construction

This elucidates fundamental mechanisms of knowledge acquisition. Medical knowledge systems exhibit inherent structural complexity, exemplified by interdependent relationships among taxonomic criteria, pathogenic mechanisms, and antimicrobial resistance pathways in emerging fungal pathogens. Such characteristics necessitate active development of personalized cognitive schemata through autonomous analysis, inductive reasoning, and conceptual integration, precluding passive knowledge reception.

Within literature comprehension, this process manifests as students deconstructing scientific narratives by:

(1) Identifying research questions through critical analysis of Introduction contexts;

(2) Evaluating evidentiary validity via methodological scrutiny in Methods sections;

(3) Synthesizing original interpretations from discursive reasoning in Discussions;

(4) Transcending superficial terminology memorization to engage in authentic scientific discourse.

2.2. Socially mediated learning

This provides the theoretical basis for collaborative pedagogy. International medical knowledge production and clinical practice rely fundamentally on collective intelligence, evidenced by diagnostic consensus-building in transnational case conferences and data harmonization in multicenter trials, all requiring linguistic mediation for scholarly exchange.

In pedagogical contexts, collaborative interpretation tasks operationalize this principle. When analyzing drug-resistant gene mechanisms in *Aspergillus fumigatus* literature, students may assume specialized roles (e.g., validating gene sequencing methodologies, correlating phenotypic resistance patterns, or assessing clinical implications), followed by cross-verification through structured English discourse. This approach not only mitigates individual knowledge gaps but also refines logical comprehension through perspectival triangulation, effectively simulating authentic academic collaboration.

2.3. Situated cognition

This underscores context-dependent knowledge application. Medical English proficiency culminates in real-world competencies: delivering conference presentations, conducting transnational case consultations, and authoring peer-reviewed manuscripts, all demanding integration of linguistic resources with domain-specific contexts. Instructional simulations (e.g., evidence-based guideline interpretation workshops) therefore create practice-oriented environments where students discover, through problem-solving, why clinical research Results must report 95% confidence intervals, and why Discussions must delineate empirical findings from clinical inferences. Such contextualization transforms literature analysis from abstract procedural skills into actionable clinical problem-solving tools, significantly enhancing knowledge transfer efficacy.

3. Teaching reform practice in “Emerging Pathogenic Fungal Infections”

“Emerging Pathogenic Fungal Infections” is an interdisciplinary course integrating medical microbiology and infectious diseases. It addresses core topics including the classification, epidemiological characteristics, diagnostic techniques, and therapeutic strategies for emerging fungi (e.g., *Candida auris*, azole-resistant *Aspergillus fumigatus* strains). Given that cutting-edge research in this field is predominantly published in authoritative English-language journals such as The *Lancet* and The *New England Journal of Medicine*, the course inherently integrates “specialized knowledge” with an “English-language medium” [8]. This integration establishes it as an ideal platform for implementing professional medical English teaching reform.

3.1. Restructured learning objectives

The reform begins by reconstructing the learning objective framework. Building upon the original three-dimensional objectives (knowledge, skills, and literacy), it emphasizes the tiered development of literature reading proficiency:

(1) Basic Level: Focuses on core information identification, enabling students to rapidly locate key terminology (e.g., biofilm formation, azole resistance) and research elements within English literature.

(2) Intermediate Level: Enhances logical analysis skills, guiding students to deconstruct the argumentative framework of literature, e.g., evaluating the correlation between experimental design and conclusions.

(3) Advanced Level: Cultivates critical thinking, training students to compare divergent perspectives across

literature and formulate independent insights.

This scaffolded approach aligns with the progressive nature of skill acquisition and accommodates students' diverse proficiency levels.

3.2. Iterative teaching process design

The instructional process employs a closed-loop model: Contextual Priming → Strategy Scaffolding → Collaborative Deepening → Applied Transfer, integrating literature reading development at each stage.

(1) Contextual Priming: Instructors present a hospital-based *Candida auris* outbreak case report (in English) as an anchor, posing problem-based inquiry sequences: "How is the novel fungal pathogen identified?" "What are key transmission risk factors?" "How are antifungal agents selected?" This demonstrates that resolving such clinical problems necessitates engagement with English materials (e.g., CDC guidelines, contemporary research), thereby transforming abstract reading goals into concrete tasks.

(2) Strategy Scaffolding: Students predict thematic content using titles, abstracts, and keywords (e.g., inferring "azole-resistant *Aspergillus fumigatus* in China" as the core focus of a study). Collaborative glossary construction using specialized dictionaries addresses terminology gaps.

(3) Structural Analysis: Using NEJM articles as exemplars, instructors analyze the IMRaD (Introduction, Methods, Results, and Discussion) framework. Tasks like paragraph-function matching (e.g., assigning "Patients were enrolled from 12 hospitals between 2020–2023" to Methods) reinforce comprehension of academic structure.

(4) Critical Interpretation: Exercises target graphical data in Results sections, requiring data description translation + conclusion synthesis (e.g., "Figure 1 indicates voriconazole resistance rose from 12% to 34% over three years, suggesting..."). This bridges linguistic decoding and conceptual understanding.

Collaborative inquiry sessions enhance the application of reading through task-driven methodologies. During the data collection phase, students are divided into four groups, each tasked with exploring sub-themes including "pathogen classification and identification," "epidemiological data," "diagnostic methods," and "treatment strategies." They are equipped with search protocols for English-language databases such as PubMed and ScienceDirect, with each group required to screen 2–3 core literatures, extract critical information, and develop English-language PPT presentations. Teachers specifically emphasize, "Focus on how authors substantiate their conclusions with data, this is pivotal to comprehending academic papers."

In the interactive discussion phase, following each group's presentation, teachers facilitate cross-group questioning and encourage English-language debates. For contentious issues, such as the resistance mechanisms of novel azole drugs, teachers introduce authoritative English-language reviews to assist students in rectifying cognitive biases, deepening their grasp of the literature through intellectual discourse.

The meaning-construction phase facilitates knowledge transfer via simulation of real-world scenarios, incorporating a task entitled "Literature-Supported Clinical Decision-Making". A complex English-language case involving a diabetic patient with *Aspergillus fumigatus* infection is provided, requiring students to retrieve 3 relevant English-language literature and compile English-language "literature evidence summaries." They must clarify the rationale for selecting treatment regimens and cite experimental data or clinical conclusions from the literature. This enables students to tangibly recognize the practical value of medical English literature in addressing clinical challenges.

4. Effectiveness and reflection on teaching reform

In the teaching practice involving 40 postgraduates at West China School of Medicine, the constructivism-oriented teaching reform has demonstrated remarkable effectiveness. Students' ability to read medical English literature has been significantly enhanced, with a substantial improvement in reading efficiency. They have transitioned from word-for-word decoding to quickly grasping core information, and the accuracy in extracting key arguments and supporting data from the literature has been notably elevated. Most students can now independently sort out the logical context of literature with the IMRaD (Introduction, Methods, Results, and Discussion) structure, breaking free from the constraint of fragmented term memory.

In terms of learning initiative, students' awareness of independently searching for English literatures and extracting core viewpoints has been strengthened. The frequency of in-class interactions, such as actively raising questions and conducting discussions around the literature content, has significantly increased. The progress in professional medical English application ability is also prominent. The overall quality of the final English case reports is markedly higher than that under the traditional teaching mode, and students have a stronger awareness of actively citing literature data to support diagnosis and treatment plans in their reports. It is worth noting that some students, based on the literature materials studied in class, can independently put forward research ideas related to fungal drug resistance, demonstrating a breakthrough in the ability to transfer knowledge acquired from literature reading.

The reform process has also encountered some practical challenges. There exist individual differences in students' English proficiency. Some students face difficulties in in-depth reading due to insufficient vocabulary reserves. In response, the teaching team has designed "hierarchical task cards": providing literature excerpts with annotated core terms for students with weaker foundations, and equipping students with stronger foundations with literature logical analysis templates. Through differentiated support, the learning threshold has been lowered.

In terms of teachers' capabilities, there is a shortage of interdisciplinary teachers who possess both profound medical professional backgrounds and proficient medical English application skills. The solution is to form a "bilingual teaching team," where medical professional teachers are responsible for controlling the depth of content, and medical English teachers focus on guiding literature reading strategies. Advantage complementation is achieved through pre-class collaborative lesson preparation.

The timeliness of teaching resources also has limitations, as the acquisition of English clinical cases and the latest guidelines lags. Currently, a "medical English teaching resource database" has been established in collaboration with the Department of Infectious Diseases of the affiliated hospital. Clinicians upload materials such as English cases and international conference materials in real time to ensure that the teaching content is updated synchronously with clinical practice.

5. Conclusion

Constructivism offers a novel theoretical framework for reforming medical English teaching. Specifically, through progressive training in reading strategies and task-driven collaborative inquiry, it can effectively enhance students' competence in interpreting medical English literature [7,9]. The practice embodied in the course "Emerging Pathogenic Fungal Infections" demonstrates that reconstructing teaching objectives, creating contextualized learning environments, strengthening collaborative interactions, and optimizing assessment mechanisms can comprehensively boost students' active learning capabilities and professional medical English application proficiency.

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