Methods and Materials for Non-Medical Students to Enhance Medical Literature Reading

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Abstracts: Medical English (ME) is of paramount importance both in theory and practice, and the need for professionals with high proficiency in ME has increased due to the COVID-19 pandemic. The EMP (English for Medical Purposes) teaching methods and materials for medical students have been widely discussed, while the learning process of non-medical students is ignored. Non-medical students have various difficulties in reading medical English literature because of their different proficiency of general English and absence of medical knowledge. Considering ME's utilitarian nature and unique lexicon and syntax, this paper discusses four main approaches to help non-medical students to enhance medical literature reading, including Johns and Davies' TAVI approach, Divasson's reading strategies for different types of medical prose, Pavel's focus on grammar and lexicon, and Hamid Rushwan's aiding tool of machine translation. Non-medical students are recommended to focus more on the practical information involved in literature than the lexical and syntactic analysis, though it is still meaningful to analyze words and sentences to get used to the common usages of lexicon and syntax. Machine translation also aids reading comprehension for non-medical students. Textbooks, journals, and multimedia vehicles are recommended for non-medical students to acquire medical English and improve their reading proficiency.

Keywords: ESP; EMP; Non-Medical Students; Medical Terminology; Medical Literature Reading.

1. INTRODUCTION

English as a language has become indispensable for the academic community. According to statistics, each year nearly three million papers are published in seven different languages in 20,000 journals, among which about 80% are written in English (Salager-Meyer, 1991). Therefore, academic reading proficiency is the minimum requirement for non-native English speakers to gain a foothold in the academic community. Besides, English is also essential at workplaces worldwide. People with higher English proficiency are usually paid more at work. In today's world of medicine, English also plays as a lingua franca of medical communication across the globe, the same as Greek, Latin and German were in the past; consequently, it is a significant prerequisite for anyone who wishes to pursue a medicine-related career.

In the wake of the COVID-19 outbreak, the global cooperation in the fight against the pandemic has triggered higher demand for professionals who have a good command of medical English. The language of medical English has never been more significant in this critical period. Medical English proficiency is essentially needed and highly relevant for both researchers and doctors to carry out their work in labs and operating rooms.

In the era of COVID-19, more non-medical students shift their attention to the learning of medical knowledge and seek job opportunities in the biology and healthcare industries. However, the entry barrier to the medical world is terrifically high for any non-medical student who has little foundation in this highly complex and interdisciplinary medical world. This provides plenty of difficulties for non-medical students to deal with, as they long for the acquisition of medical terminology and knowledge.

The non-medical students in this paper refer to those who lack systematic learning processes for medicine (for example, degree-seeking lectures in colleges and universities), have little understanding of the content and inner logic of the medical knowledge system, and know little about the word-building methods of medical terminology.

Typical non-medical students include 1) non-medical majors in medical universities (including non-medical major undergraduates who are required to learn a certain amount of medical courses and postgraduate students who did not get medical bachelor's degree but shift to learning medicine-related courses in their postgraduate program, for example, MTI (Masters of Translation and Interpreting) students in China and abroad who wish to further advance their translation and interpreting skills in medicine and healthcare), 2) non-medical professionals who desire for medical knowledge to sharpen their competitive edge at work (especially in those industries having dealings with medicine), and 3) ordinary people who gain medical knowledge simply to live healthier and longer.

In terms of learning medicine, listening to lectures and taking notes alone are insufficient, and consequently, it is highly necessary for non-medical students to expand their medical terminology effectively and read extensively and intensively on their own. Due to their weak foundation of medical knowledge, common problems faced by non-medical students in their medical learning process include the difficulties in memorizing and producing medical terminology, in pronouncing different medical terms, in comprehending medical literature,difficulty in memorizing medical knowledge, in understanding the inner logic of the medical system, and in relating medical knowledge to practical application in the real world.

This paper analyzes previous studies on medical English or English for Medical Purposes, a unique part of ESP (English for Specific Purposes), and then it lists common challenges faced by non-medical students in their reading comprehension of medical literature, followed by solutions to these challenges. Methods and materials are discussed in this essay to help non-medical students increase medical terminology and enhance medical literature reading, based on previous studies and the author's personal experience.

2. PREVIOUS STUDIES ON MEDICAL ENGLISH

It was Salager who started a thorough study of the lexis of fundamental medical English in 1980. She managed to determine 1,425 core roots that were homogeneously distributed across the medical spectrum and constitute the main body of the language of medical English through statistical tests. The tests were based on a corpus of 100,000 words from specialized medical articles. According to Salager, the roots of medical English can be classified into three types, i.e. BME, FME, and SME, which are short for Basic Medical English, Fundamental Medical English, and Specialized Medical English respectively. Based on her research results, Salager finds that the roots of verbs, nouns, adjectives, and function words in the medical literature have different usage tendencies, as is shown in Table 1 (Salager, 1983).

Table 1. Salager's finding on lexical strata and their usages in Medical English

Lexical Strata	Usage
Verbal roots	a) general methodology of scientific inquiry (description, analysis, comparison, cause-effect relationships) b) evolution of diseases and/or the patient's clinical state
Noun roots	a) medical procedure b) measurement
Adjectival roots	a) illness or injury b) quality and/or timing of treatment
Function words	causality, opposition, and purpose

According to Bird (1984), a combination of synchronic and diachronic approaches still would considerably reduce the number of roots in the corpus, and the relationships between BME and Germanic, FME and Latin, and SME and Greek had been stronger and clearer. It is, therefore, necessary to bring the learning of the Latin origin of FME roots, the Germanic origin of BME roots, and the Greek origin of SME roots into medical English classrooms. This argument was then reinforced by the statement from Salager that recognizing cognates (words sharing the same origin as another word) may considerably reduce the workload of teaching and learning (Salager, 1983).

In the research of the development of medical English, it is contended that English medical terminology derived from medieval Latin terminology, and the Latin terminology absorbed Greek terms after derivation. Only a small proportion of medical English terms have their origin in the oldest English, i.e. the language of Anglo-Saxon. During

the Middle Ages, the influence of French was obvious that French introduced new medical terms developed from Greek or Latin elements. Nowadays English tends to create new medical terms with its language elements (Dzuganova, 2002).

Apart from the development of medical English, the research of this field is also often connected to EMP, an abbreviation short for English for Medical Purposes. It is defined as the teaching of English for doctors, nurses, and other personnel in the medical professions. EMP is generally designed for a utilitarian purpose; therefore, it has three focuses: a) meeting the specific language needs of medical learners; b) targeting medical-specific themes and topics; and c) paying attention to a specific range of skills that medical learners require (Maher, 1986).

According to Maher (1986), EMP has two broad categories: EOP (English for Occupational Purposes) and EEP (English for Educational Purposes). This classification is based on purposes. If EMP is for occupational purposes, this can be referred to as EM-OP, which is closely associated with consultation skills, conference presentation, and other active professional requirements. Another type of EMP is for educational purposes, then called EM-EP, which entails language training in medical studies. The two branches of EMP serve different training programs correspondingly for two different groups of learners. Group one could be doctors, nurses, paramedical staff, and other qualified medical professionals, while group two could be students in medical and nursing colleges. Despite sharing knowledge repository of content, EM-OP and EM-EP should vary in teaching activities and procedures, the complexity of knowledge imparted, and customized purposes for professionals and students.

However, the previous studies on EMP fail to discuss the medical English teaching and learning of non-medical students. This indicates an academic vacancy in terms of how to help non-medical students learn medical English and read medical literatures written in English more efficiently and effectively. As an increasing number of people are paying attention to their health conditions and healthcare industries are booming today, it is imperative and utilitarian for ESP/EMP practitioners to ponder over the teaching and learning process of medical English for non-medical students.

3. MATERIALS AND METHODS TO ENHANCE MEDICAL LITERATURE READING

3.1. Problems

In Pavel's 28-week course of English for Medical Purposes, most of the students were able to recognize the meaning of words but have difficulty in producing them. They were not proficient in speaking medical English and pronouncing different medical terms. Due to students' varying proficiency levels of General English, students performed differently in their learning of Medical English. Those who still struggled to learn General English well were almost overwhelmed by a large number of basic concepts of Medical English. (Pavel, 2014) In summary, non-medical students learning to increase their medical terminology have problems in producing and pronouncing medical terms due to their different stages of general English proficiency.

In terms of teaching materials, the ESP textbooks available on the market are not universally adaptable for every ESP teacher and learner, let alone EMP. No EMP textbook perfectly matches the needs of a specific group of learners (i.e. non-medical students discussed in this paper). Therefore, one suggestion to fix this limitation is to gather up EMP resources in various forms (textbooks, academic articles, multimedia vehicles such as short videos, the trendiest information vehicle in the era of the internet) to provide a completely tailored EMP course/textbook to a certain group of non-medical students.

The problems that non-medical students have to deal with when reading and understanding medical texts can be attributed to their inadequate command of medical terminology and inability to figure out syntactic structures in medical texts. According to Elliman's theory, if the proportion of unknown words exceeds 10%, reading comprehension is compromised to frustration level (Elliman, 1980).

3.2. Methods

Due to medical English's unique practical nature and complexity of its disciplinary systems, it is of paramount importance to figure out methods for non-medical students to reading medical English literature effectively and efficiently. Previous studies have discussed four main approaches to reading medical English, including 1) Johns and Davies' TAVI approach, 2) Divasson's reading strategies for different types of medical prose, 3) Pavel's focus on grammar and lexicon, and 4) Hamid Rushwan's aiding tool of machine translation.

3.2.1. Johns and Davies' TAVI Approach

Tim Johns and Florence Davies from the Universities of Birmingham and Sheffield emphasized that the function of texts is a vehicle for information (TAVI) instead of a linguistic object (TALO). The potential value of texts should be the primary criterion for selection. By implementing the TAVI approach, classroom interaction can be different from that of the TALO approach. In class, students can work in groups to identify the meaning of texts with a sequence of assignments, such as preparatory work, work on text, and follow-up work (Johns & Davies, 1983).

TAVI-style assignments include predicting the content of the text before reading, marking words in the text that the reader already knew or did not know before, answering questions related to the text after reading, summarizing or retelling the main idea, and rearranging statements in order. Outside the classroom, students can also imitate the procedures carried out in class to try self-reading with various text-related tasks, a self-teaching practice inspired by the TAVI approach.

In the scene of medical English reading where utilitarian purposes are emphasized, the TAVI approach helps students retrieve the most practical and useful information from medical texts and prevent them from struggling to analyze syntactic structures of the whole text. Emphasis on the practical needs of medical and non-medical learners is of paramount importance. For example, medical students learn medical English to write patients' case histories, communicate in wards and operating rooms, and discussing cases during consultations. For non-medical students who learn medical English, they aim at acquiring knowledge to help themselves have healthier lives and obtaining better job opportunities by being "compound talents" who can juggle tasks associated with both their respective majors and medicine.

Even though the TALO approach is widely encouraged by ESP practitioners and coursebooks, it is still recommended to adopt the TAVI approach in terms of reading medical English materials because it is more worthy to retrieve medical information and develop medical technology for the sake of longer life expectancy than to analyze syntactic and semantic structures.

Indeed, the TALO approach is meaningful in terms of the accumulation of medical terminology, expressions, and sentence patterns commonly seen as "jargon" in medical literature.

3.2.2. Divasson's Reading Strategies for Different Types of Medical Prose

Textbooks, Journals, and Occupational Publications are the most common types of professional medical literature. Divasson proposes different reading strategies tailored to each type of medical prose based on based her recognition of basic intellectual structure, as illustrated in Table 2 (Divasson, 1995).

Table 2. Divasson's reading strategies for three types of medical prose.

Type of Medical Prose		Reading Strategy
Textbooks		Emphasizing rhetorical organization (definition; the organs comprised; shape, size, location and function; physiology; common related ailments)
Journals	Research Papers	a) Paying attention to the IMRAD pattern of the scientific article adopted in 1960 (Introduction, Method, Results, and Discussion) b) (optional) Focusing on Statement of the Problem and Recommendations
	Reviews	Reading the results of bibliographical work (Data Identification, Study Selection, Data Extraction and Synthesis)
	Case Reports	Retrieving information of Case Presentations, Findings and Comments
Occupational Publications		Stressing main structure (personal details; clinical history; present complaint; physical examination; analysis; diagnosis; treatment; follow-up)

With Divasson's suggestions on reading focuses of Textbooks, Journals (Research Papers, Reviews, and Case Reports), and Occupational Publications, non-medical students have fewer learning burdens and more confidence and priorities in reading different types of medical literature. This type of reading aids may welcome efficient and effective reading outcomes.

3.2.3. Pavel's Focus on Grammar and Lexicon

The TALO approach has its value in terms of help non-medical students get used to a medical-specific grammar and lexicon style because articles written in medical English must never be inaccurate and ambiguous. Based on her experience in teaching English for Medical Purposes, Pavel summarized the characteristics of grammar and lexicon of medical English as Table 3 (Pavel, 2014).

Table 3. Pavel's summary on grammatical and lexical characteristics of ME

Category	Type	Characteristics
TENSE	Present Simple Tense	a) to describe processes, functions, mechanisms and diseases; b) to ask questions about present illnesses, habits, etc.
	Past Tense	a) to take a medical history; b) to refer to childhood/adult diseases, previous hospitalization, or the onset of a symptom, etc.
	Present Perfect Tense	a) to ask about or describe the onset of an illness b) to refer to recent discoveries, research, or medical procedures, etc.
VOICE	Passive Voice	to show an impersonal and objective attitude
LEXICON	Modal Verbs	used for hedging, expressing judiciousness and possibility, and formulating statements with appropriate accuracy and caution.
	Abbreviations	a same abbreviation standing for different terms
	Plural Forms	nouns with irregular plural forms derived from Latin and Greek and abiding by Latin and Greek declensions
	Adjectives	a) adjective or their combining forms derived from Greek and Latin; b) adjectives appearing mostly in compounds and joined to nouns or verbs; c) adjectives added with suffixes to become nouns.
	Verbs	a) verbs derived from Greek and Latin; b) verbs added with root words to form words; c) verbs added with prefixes and suffixes to form words.
	Prefixes and Suffixes	a) consisting of no less on syllables. b) showing relationships between word elements. c) modifying meaning when added to verbs, adjectives, or nouns.

Pavel's summary on grammatical and lexical characteristics of ME provides non-medical students with a clear

map of regularities and rules in learning medical English, in particular in their reading and comprehension process. Familiarizing lexical characteristics of medical English also helps non-medical students to understand word formation and then produce medical terminology on their own.

3.2.4. Hamid Rushwan's Aiding Tool of Machine Translation

It is acknowledged that in ESP research, the use of L1 in teaching English is a hot topic that always causes great sensations. Because medical terminology is enormous in its quantity and complicated in its quality and medical articles are often written with complex medical terminology and compound sentences, many EMP learners are particularly anxious and puzzled when reading medical literature. Thanks to the advent of machine translation, some research shows that translation is important as a pedagogical tool for medical English learners to comprehend terminologies and texts. According to the research conducted by Hamid Rushwan (2017), the findings are:

1) Using translation as a pedagogical tool is beneficial and highly significant to develop the comprehension skills of EMP learners because most EMP learners are not equipped with adequate levels of English skills.

2) But the target texts produced by machine translation are less qualified than the ones translated by human researchers in cohesion and semantic organization.

Therefore, it is feasible for non-medical EMP learners to use machine translation tools to aid their reading process, but it is also necessary to remind them of the possible inaccuracies of machine translation. When using machine translation, it is also recommended to improve their ability to identify inaccuracies and correct the mistakes, then the medical expressions will be reinforced in learners' minds, thus gaining better improvements in reading medical English literature. A special reminder for non-medical students who are learning medical English would be wisely using authentic resources from the internet (e.g. professional online forums, or scientific documentaries) and local libraries to figure out puzzles from reading.

3.3. Materials

Recommended materials for non-medical students to learn medical English are classified into textbooks, journals, and multimedia vehicles (such as YouTube videos, University Open Courses, and MOOC resources). Medical Terminology-titled textbooks are highly recommended because they explain the combination of medical terms (with combining forms, suffixes, and prefixes), accompanied by English-to-English of medical terminology, display of authentic case reports, and follow-up exercises. Using medical terminology textbooks improves both accumulations of medical terminology and proficiency of reading comprehension. Recommendations of Journals are based on a quantitative analysis for the most influential medical journals (Jemielniak et al., 2019). Based on relevant research and good comments online, Table 4 is displayed to summarize recommended reading materials for medical English learners.

Table 4. Recommended materials for non-medical students to learn medical English

Category	Recommended Materials
Textbooks	Medical Terminology: -Chabner, Davi-Ellen. (2007). The language of medicine. St. Louis, Mo.:Saunders/Elsevier, -Chabner, D. E. (2015). Medical Terminology: A Short Course/by Davi-Ellen Chabner. -Gylys, B. A., & Wedding, M. E. (2017). Medical terminology systems: a body systems approach. FA Davis.
Journals	- Cochrane Database of Systematic Reviews - The New England Journal of Medicine (NEJM) - PLOS One - The Lancet - The BMJ

	- JAMA: The Journal of the American Medical Association - Nature - Science - Annals of Internal Medicine - Proceedings of the National Academy of Sciences of the United States of America
Multimedia	YouTube Channels: - Armando Hasudungan's Medical Channel - One Minute Medical School - Interactive Biology - MedCram Videos - CrashCourse University Open Courses - Havard Medical School MOOC resources: - Edx – Medicine Courses - Coursera

Based on the author's experience in using these resources, the textbooks listed above are now widely used in colleges and universities, hospitals, and other medical settings worldwide, famous for their clarity, simplicity, and practicality. The authors of these textbooks excel at making complicated medical subject matters understandable with explanations of terms written in simple English. The textbooks are also easy to use with its repetitive memory mechanism with recap exercises throughout the book. They are also formatted with introduction to body systems, which help non-medical students to grasp the whole picture of the medical world. By reading articles of Journals, non-medical students can not only accumulate medical common expressions but also gain cutting-edge, practical information to rich their knowledge, thus reinforce their reading ability through repetitive practice. With the aid of multimedia, non-medical students can learn with fun and informative videos, making their learning process more vivid. Besides, multisensory learning approaches are better for solid memory.

DISCUSSION AND CONCLUSION

English for Medical Purposes is of high theoretical and practical significance. The teaching methods and materials for medical students have been widely discussed, while the learning process of non-medical students has not obtained enough attention in the academic circle. Non-medical students have difficulty in learning medical English due to their disparity of general English proficiency and lack of medical knowledge. On account of the practical nature and unique terminology and expressions of medical English, non-medical students should pay more attention to the information conveyed by passages than words and sentences to be analyzed. However, it is still meaningful to analyze words and sentences to get used to the common usages of lexicon and syntax. Machine translation can also aid reading comprehension. Textbooks, journals and multimedia vehicles are highly recommended for non-medical students to acquire medical English.

This paper only displays four possible guiding approaches for non-medical students to improve their reading proficiency. Future research can be conducted on country studies with quantitative analysis; for example, which is the approach that helps Chinese/Koreans/Russians/Arabs non-medical English learners improve reading proficiency to the max? Besides, finding potential approaches is also suggested in this field. For instance, is there other single or hybrid approaches also help non-medical English learners read more efficiently and effectively?

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