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# Teaching Medical Terminology to Speakers of English as a Foreign Language

**Abstract:** Medical terminology is one of the challenging aspects of English for Medical Purposes (EMP) instruction. These terms are primarily derived from Latin and Greek origins and based on suffixes and prefixes. Medical students often find learning medical terminology difficult and tedious; therefore, it is important to find techniques to motivate them. Research on medical words has largely focused on linguistic aspects, and there is a dearth of studies on teaching techniques addressing medical terminology. The present study discusses the effects of various authentic techniques for teaching medical terminology. The study was conducted with 30 L1 Turkish speakers of English as a foreign language. It employed a qualitative-based methodology comprising the researcher's observations and students' reflections. The students' reflections suggested that the techniques scaffolded their learning process. They were motivated by authentic exercises. Additionally, pre- and post-test results showed that the students' medical vocabulary knowledge improved after the techniques. The study further explains that the medical terminology course can be introduced at the preparatory levels before students enroll in mainstream faculty courses.

**Keywords:** medical terminology, English for medical purposes, scaffolded teaching activities

## 1 Introduction

The role of English as a lingua franca is eminent not only in global communication but also in education, academic fields and print publications. Similarly, this role in the medical discipline is increasing, as most of the publications, medical textbooks, journals and conferences are growing firmly in English (Chia et al., 1999; Hwang & Lin, 2010). Concomitantly, this has led to the rise of the field of English for Medical Purposes (EMP). EMP is gaining the attention of tertiary education also in Turkey for several reasons. In Turkey, the number of international students at medical faculties is rising. Likewise, the number of Turkish students enrolled at faculties of English medium of instruction is increasing as well. Another need is to prepare future health professionals for better workplace communications, as Turkey has become a favorite destination for international health-tourists. Consequently, this has posed requirements on the parts of both trainers (e.g., universities, teachers) and trainees (e.g., medical

students, nurses, pharmacists) to meet these needs. Considering that ESP is a learner-centered approach (Hutchinson & Waters, 1987), Turkish researchers have conducted needs analyses to explore the learners' needs in order to furnish them with suitable techniques. The focus of needs analysis was to learn what kind of skills are important for medical students in terms of reading, writing, listening, and speaking.

Another angle of research on EMP in the international context has focused on different aspects, including a perception of everyday language and medical terminology among international medical graduates in Australia (Dahm, 2011), discourse analysis in health-care settings, doctor-patient and doctor-doctor communications and other features (for further discussion, see Ferguson, 2012). Nevertheless, there is a dearth of research on the effects of EMP instruction, particularly medical terminology. Medical terminology continues to be one of the challenging aspects in EMP because it contains words with Latin and Greek origins. Moreover, it heavily relies on affixation rules. Hence, knowing the suffixes and prefixes facilitates the learning process of medical words. However, students may find learning medical words challenging and boring. The present study addresses this issue from a learner-centered approach and discusses the effects of various techniques from qualitative perspectives in a classroom context.

## 2 Background

ESP can be defined as “an approach to language teaching in which all decisions as to contents methods are based on the learners' reason for learning” (Hutchinson & Waters, 1987, p. 19). To meet the learners' needs, researchers have conducted a needs analysis and prepared syllabus and teaching materials addressing those needs (Antic 2009; Karimkhanlouei, 2012; Popa, 2013; Faraj, 2015; Kayaoglu & Akbas, 2016; Celik, 2017; Celik & Topkaya, 2018, and others). In the EFL (English as a Foreign Language) context in Turkey, Celik (2017) conducted a questionnaire study with 88 second and third grade medical students at a public university to learn their perceptions about language needs. The top reported skills were reading medical textbooks, carrying out general conversations, interacting with personnel, talking to foreign colleagues and patients, participating in discussions at seminars and conferences, writing research papers and case histories, and listening to medical conversations. Another questionnaire study was conducted by Kayaogly and Akbas (2016) with 169 medical faculty students at a public university in Turkey. Needs analysis study revealed that the students reported these skills to be important for their studies: reading

medical books, technical reports and manuals, writing articles, projects, and prescriptions, listening to medical conversations, and discussing medical issues in conferences.

Another line of study has paid more attention to the EMP-related specific grammar points including present simple, past simple and present perfect tenses, passive voice and modal verbs because they have been frequently used in EMP textbooks and instruction materials (Pavel, 2014; Faraj, 2015). Other studies focused on activities attending to linguistic issues or skills such as grammar and lexicon for EMP (Antic, 2010; Pavel, 2014); moves in medical research papers (Antic, 2007), reading EMP related texts (Alagozlu, 1994; Tasci, 2007; Yeniceri, 2008); medical discourse analysis (Hoekje, 2007), pronunciation of medical words (Labov & Hanau, 2005), and medical terminology.

## 2.1 Medical Terminology

Vocabulary knowledge plays an important role in EMP because it is based on specific terminology. According to Kondratyev (2018), there are approximately 60.000 medical words. It is required for a doctor to know medical terms of which 70 % are derived from Greek and Latin origin. Hence, it is not surprising that medical terminology is taught at several medical universities as a credit-bearing course. This course can come under different names, such as “Medical terminology”, “Latin and foundations of medical terminology”, “Greek-Latin medical terminology”, “Foundations of medical terminology” in medical universities in the European Union countries (Kondratyev, 2018).

Medical terminology mainly consists of prefixes, which can denote the number, measurement, location and others, suffixes, and word roots. As these words are built on affixation rules, it is of significance to know not only the word roots but also the affixes (prefixes and suffixes). In this regard, studies have considered word formation rules and suggested training learners in specific medical terminology (Antic, 2009; Pavel, 2014; Piroozan, Boushehri, Fazeli, 2016). For example, Pastae (2017) suggested mind-mapping games for teaching prefixes. McGuire (2009) categorized terminology learning under three categories: repeatedly encountering the words, making inferences through prefixes, suffixes and roots, and memorization through medical terms. In his teaching experience with Japanese medical students, McGuire (2009) proposed exercises where the words are decoded, and terms are encoded through those inferences. Yang (2005) found that 89 Taiwanese college nursing major students reported using the top three strategies of reading vocabulary section of coursebooks,

taking notes, and using a bilingual dictionary. Low-level learners, on the other hand, used rote memorization and repetition.

Taie (2015) specifically focused on medical terminology in her study with medical faculty students in Iran. She applied a word-part analysis strategy (WPAS) technique in her class. This technique features teaching the word roots and related affixation rules. Multiple-choice (MC) post-test results showed that the students' vocabulary knowledge improved. Taie (2015) further checked the correlation between the students' knowledge of unfamiliar medical words, measured by MC tests, and critical thinking, measured by the California Critical Thinking Skills Test (CCTST) and found a positive correlation between the two skills. Taie (2015) implied that students' critical thinking skills and building terminology knowledge are correlated. However, although it showed satisfactory results, the methodology was limited to the WPAS technique.

Wette and Hawken (2016) collected data from 10 voluntary students taking an EMP course in New Zealand. The program included teaching medical words and the use of those words in health-care-related communication settings in written and spoken forms. Post-test results showed that the students' knowledge of medical vocabulary improved, though the same could not be claimed about more sophisticated aspects of interviewing skills in spoken forms.

In conclusion, few studies have investigated the effectiveness of EMP instruction (Ferguson, 2012). The studies lack in directly offering a student-centered approach. Although teachers and researchers have suggested different techniques of teaching medical terms, they have not reported direct implications of these activities in classrooms. This gap is also valid in Turkey, where researchers have mostly focused on conducting needs analyses in the EMP context for curriculum design purposes (Alagozlu, 1994; Celik, 2017; Celik & Topkaya, 2018; Kayaoglu & Akbas, 2016; Tasci, 2007; Yeniceri, 2008). Hence, motivated both by the literature and needs of the medical faculty and students at a private university in Turkey, the purpose of this study is to address the needs of Turkish speakers of English and train them in learning medical terminology. The study is guided by a research question that specifically addresses the issue:

How can the EMP course facilitate learning medical terminology in pre-medical classes?

### **3 Methodology**

#### **3.1 Participants**

The participants of this study were 30 students studying at an English language preparatory course in a private university in Turkey. In Turkey, after a year of

a pre-sessional program, successful students pursue their studies in faculties. The language proficiency level of the participants was B1+ and B2 classified by the CEFR (Common European Framework) scale according to the proficiency test administered by the university. As part of the national curriculum, all the students had taken a Biology and Human Anatomy course in high school.

In the first semester, the students took courses in grammar, reading and writing, listening and speaking, and content-based medical English. In the content-based medical English course, the students practiced authentic activities, some of which were reading short texts related to specific illnesses and doctor's prescription letters, listening to doctor-patient dialogues, and role-playing as doctors, nurses, or patients. In the second semester, the same courses were followed, but the content-based English course was replaced by the Medical Terminology course. The objective of the Medical Terminology course was to familiarize the students with the formation of terminology and facilitate their learning process before enrolling in faculty courses. Inclusion of this course in the syllabus was required by the medical faculty teachers in that learning medical terminology is challenging for first-year students and, therefore, they should have some initial preparation. The course period lasted from January till June and was offered in 6 sessions a week. Before conducting this study, consent was obtained from the school and students.

### 3.2 Design and Procedure

In the first academic week, students were introduced to a general view of medical terminology in five sessions to have a general idea about word formation principles in medical terminology. After the introduction sessions, the scaffolding techniques and tasks were implemented during the course. For this study, a pre-test was used to check the learners' prior knowledge of medical terms. The terms were the most frequent ones that the students were expected to encounter in their medical textbooks. After implementing the activities and tasks with all chapters, a post-test on pre-tested vocabulary knowledge was used at the end of the semester to check the effect of the implementation. The test consisted of 90 multiple-choice (MC) questions with four options (answer choices) taken from Fremgen and Frucht (2016).

Example pre- and post-test questions:

A medical term that means *polydipsia* is called \_\_\_\_\_

- A) many thirst
- B) many bacteria
- C) many hair growth

D) many infected cells

Answer: *many (excessive) thirst*

Which term means *surgical repair of a nerve*?

A) neuroplasty

B) neuropexy

C) neurorrhaphy

D) neuropathy

Answer: *neuroplasty*

The scaffolded activities were the WPAS technique, exercises in the Terminology lab, a Kahoot project, assigning the students to prepare their projects for terminology on a specific body system, and reading research articles. WPAS technique and Terminology lab exercises were exercised throughout the entire course period. Project-oriented assignments (a Kahoot project, research projects on the terminology, and reading research articles) were implemented for revision purposes after completion of each chapter. It should be noted that the study is not experimental and does not make comparisons among different techniques. It rather aims to report the effects of certain activities on students' motivation in a classroom context. In addition to the students' pre- and post-test results, their reflection notes were collected as well. After each session, the students were asked to write their ideas about the techniques and give feedback on how these techniques helped them. As the researcher for my class, I also took my observation notes. The following techniques were implemented during the course.

### 3.2.1 Word-Part Analysis Strategy Technique

The WPAS (word-part analysis strategy) technique (Nation, 2001) deals with teaching vocabulary. Research has demonstrated that it has a successful effect on learning medical terminology as well (Taie, 2015). In the WPAS, words were broken down into roots and prefixes/suffixes. For example, *brady* means slow, and when this word is used in combination with different word roots, learners are expected to critically transfer this knowledge across and build the meaning. In other words, for instance, the word *bradycardia* (*brady-* slow; *cardia-heart*) means slow heartbeat, and by already knowing the root and prefix, learners are expected to be able to build the meaning of *bradypnea* (slow respiration rate). This technique is also one of the most common methods offered in medical course-books (Cohen, 2008; Fremgen & Frucht, 2016, and others).

### 3.2.2. Terminology Lab

The course was conducted through interactive tasks, videos and other visuals. In the interactive tasks, the students combined a correct prefix/suffix with given random word roots projected on the board. In order to understand better and strengthen the vocabulary knowledge, supplementary videos and photos of medical words (photos of illness or disease) were also projected. The educational videos were complimentary to textbook materials. The purpose was to familiarize the students with the usage of terms in authentic contexts with examples. For example, the condition of “leukemia” was explained with the word-part analysis and a brief video was displayed to explain it. It should be noted that the videos covered the terminology which the students would be expected to encounter most frequently in their textbooks. An example from a root and affix exercise in the language lab is demonstrated below. The exact screenshot of the program was not included here. A similar example can be used by other teachers without an access to this program.

A sample exercise for root and affix

Select the container that is a match for the text on the pill:

|                      |                |
|----------------------|----------------|
|                      | gonad/o        |
|                      | cortic/o       |
| <u>Outer portion</u> | mast/o         |
|                      | <u>-megaly</u> |

The next sample illustrates a sample terminology exercise in the language lab. In the lab, students usually matched the medical word with its definition under a time control. Nevertheless, teachers without access to the lab can prepare flashcards, or ask students to prepare such cards. The cards can be shuffled and practiced in the class.

A sample medical terminology exercise

Match the given meaning with the terminology:

Excessive thirst

|                      |                     |                 |                   |
|----------------------|---------------------|-----------------|-------------------|
| <u>Hyperglycemia</u> | <u>Hyperkalemia</u> | <u>Polyuria</u> | <u>Polydipsia</u> |
|----------------------|---------------------|-----------------|-------------------|

### 3.2.3 Kahoot Project

One of the interactive activities implemented in the class was through the online tool, called Kahoot ([www.kahoot.com](http://www.kahoot.com)). This is a game-based learning platform

and has been successfully implemented in schools and educational institutions. The students already had some prior experience in using the Kahoot platform in their other lessons. Usually, teachers prepared quizzes, and students answered test questions using the Kahoot platform. However, in this study, the students prepared their quizzes. The purpose was to engage the students in producing test questions and actively exploring the chapters/words rather than being passive receivers. For this project, students were assigned reading chapters on a specific body system and preparing online quiz tests with 30 questions. After I checked their assignments, the quiz tests were used for revision purposes in the class. Hence, the test questions were projected on the whiteboard, and the students used their mobile phones to answer the questions. For this, students installed the Kahoot app on their mobile phones and gained access to quiz tests with the code that I provided. At the end of the activity, Kahoot automatically provided the scores. After each project, students discussed the questions and shared their reflections on these projects.

### 3.2.4 “Research” Project

As part of the project, the students were also assigned chapters on body systems and asked to list the affixes, roots and definitions of terms (e.g., certain pathology or condition) supplemented with pictures. Hence, the students were asked to search for pictures and extra information about a given disease or condition. This was assumed to build a mental and visual representation of the words and avoid rote memorization. After I checked the assignments, these projects were also shared in the class for learning and revision purposes. The following table (Tab. 1) is an example from a student’s project.

**Tab. 1:** An example from a student’s “research” project

| Term         | WPAS                                   | Definition  |                 |
|--------------|--|---|-----------------|
| Nephromegaly | nephro: kidney<br>-megaly: enlargement | -enlargement of kidney.   | <i>Picture*</i> |
| Gingivitis   | Gingiv/o: gums<br>-itis: inflammation  | -a gum disease that causes irritation, redness and swelling of gingiva. | <i>Picture*</i> |

*\*In the actual projects, the students provided pictures from different websites. Due to copyright issues related to those pictures, they have been deleted here.*



### 3.2.5 *Reading Research Articles*

Research papers published in English by medical doctors were chosen for this activity. It must be noted that the articles with moderate language difficulty were chosen, as students at this level found it hard to read the articles with difficult language features. The students read the introduction and summary parts of the articles, found medical terminology and checked the meanings. They were allowed to use their notes. The purpose of this activity was to motivate the students and introduce them to authentic materials where they could notice the learned words/terms. After this activity, the students and I discussed the words and their usage in the context. The students checked their knowledge of already learned words for revision and self-assessment purposes. This technique was implemented towards the end of the course after the students further built on knowledge of medical terminology.

## 4 Results

This section reports the quantitative and qualitative data analyses. Quantitative results come from the pre- and post-tests, while qualitative outcomes report the students' reflections on the implemented techniques.

### 4.1 Results of Quantitative Data

The students' results on pre- and post-tests were entered in the SPSS (Statistical Package for Social Sciences) program. The results featured how many test questions they answered correctly out of 90 questions. As can be seen in Tab. 2, the data are approximately normally distributed (Shapiro-Wilk  $p = 0.267$ ). After checking the data, paired-sample t-test was conducted to compare the difference between pre- and post-tests results (Tab. 3). A paired-samples t-test determined that there was a significant difference between the pre- and post-test scores,  $t(29) = 14.32$ ,  $p < 0.001$ . On average, the scores increased by 44.63 points/scores ( $M = 44.63$ ) in the post-test compared to the pre-test with a 95 % confidence interval.

**Tab. 2:** Tests of normality

|      | Kolmogorov-Smirnov |    |                   | Shapiro-Wilk |    |              |
|------|--------------------|----|-------------------|--------------|----|--------------|
|      | Statistic          | df | Significance      | Statistic    | df | Significance |
| diff | .108               | 30 | .200 <sup>*</sup> | .957         | 30 | .267         |

\*. This is a lower bound of the true significance.

**Tab. 3:** A paired samples t-test for pre- and post-tests

| Paired Differences     |       |                |                 |  |                |       |                    |
|------------------------|-------|----------------|-----------------|--|----------------|-------|--------------------|
| Pair 1                 | Mean  | Std. Deviation | Std. Error Mean | 95 % Confidence Interval of the Difference |                | t     | df Sig. (2-tailed) |
| Post test-<br>Pre test | 44.63 | 17.06          | 3.11            | Lower<br>38.26                             | Upper<br>51.00 | 14.32 | 29 .000            |

## 4.2 Results of Qualitative Data

This part reports on the findings from the students' reflections on each activity. I took notes during the implementation and checked further with the students. The reflections are reported for each technique. For the space economy, not all the reflections collected from the students can be reported here. Pseudonyms are used to replace the students' names.

### 4.2.1 Word-Part Analysis Strategy Technique

The students claimed that the WPAS technique helped them think critically and transfer the already learned prefix/suffix rules to another term with the same prefix/suffix. It also facilitated the recalling process, as there were many terms to learn. Student reflections on the WPAS include:

S.B.: *We should pay attention more to word root, prefix and suffix because they help me learn the terms.*

A.B.: *'Prefix and suffix exercises were helpful because we can see the same parts in different chapters and in different words.*

As I observed, the students articulated how they applied this technique when they tried to understand the definition of the words. They solved exercises like mathematical problems. Once the students knew the affixes, they were able to critically transfer this knowledge to other words and find the meaning. It appeared that this technique facilitated memorizing the affixes as well.

### 4.2.2 Terminology Lab

The students found the online activities in the medical terminology lab very useful and claimed that the lab helped them better learn the terms and recall them later. On the other hand, they claimed that the traditional way of learning (e.g., practicing only by using a book) was tedious. The students reported that visual aids helped them understand the illnesses, conditions, and other medical terminology words and recall those words later.

*S.S.: I found it helpful to check my notes in the book against the projected materials. Using a book only would be boring; therefore, supplementing it with an overhead projector, videos and other visual aids make the lesson enjoyable.*

*D.S.: 'More visuals and repetition through pictures helped me learn and recall the terms and illnesses, rather than focusing only on memorization.*

Though many students found technology-aided materials helpful for learning medical terminology, only two students stated that there is no difference for them. Nevertheless, these students also stressed the essence of visual aids.

*S.Y.: I do not have anything to do with a traditional way of teaching, but it won't be useful in terms of learning medical terminology.*

*E.E.: Traditional way is OK for me, but more pictures help me understand the definitions better.*

*S.S.: Though pictures are helpful for visual learners, these activities and tasks were helpful for revision and made clear of what we knew or did not know.*

The observation notes show that the students appreciated the visual aids and videos. They related the definitions or illnesses to the pictures. They looked for other pictures by using their mobile phones and shared in the class.

### 4.2.3 Kahoot Project

The students claimed that they were motivated by participating in Kahoot quiz-games. Also, preparing their quizzes and testing each other created a discussion environment. Such interaction and preparation activities helped them for revising the medical words.

*M.D.: These games helped better concentrate on and recall the definitions.*

*M.B.: These quizzes do not just make us only memorize but understand and internalize the words.*

A.T.: *There are so many terms, but these projects facilitated learning them, and the test became manageable.*

D.Z.: *I learnt a lot while preparing my own quiz and answering my friends' questions too which helped me be successful in the test.*

My observation diary also showed that the students were competing while answering the questions. Moreover, after the Kahoot quizzes, the students had discussions and debates and reflected on what they learned, remembered, and what actions needed to be taken further.

#### 4.2.4 Research Project and Research Articles

Regarding the research-project and research article techniques, the students claimed that these activities created an authentic learning process. Rather than only memorizing the words, finding them in the authentic materials helped them recall the definitions and relate them to the materials outside the classroom. In other words, while the previous techniques were useful for learning, these two techniques were useful in applying their knowledge of medical words to real-world tasks which were not like 'robotic' ways of learning, as claimed by one of the students:

E.S.: *This project was helpful because I did not learn the words like a robot.*

SS.B.: *When preparing and finding so many interesting facts made me better memorize the terms. It was interesting to find different diseases related to my chapter.*

S.O.: *I was so excited to see our medical terms in other sources. I was happy that I recognized these words in tests.*

Y.Y.: *It saves time to learn new information from our friends' projects.*

N.C.: *It is important to check terms in papers because it is real. It is not just a list of words to memorize'.*

E.B.: *'It prepares us to faculty classes from another perspective too. Because we will see such papers at faculty lessons.*

E.S.: *'When I read these articles I better understand and try not to forget the words.*

## 5 Discussion

The study implemented various techniques to teach medical terminology. The techniques were the word-part analysis strategy (WPAS), terminology lab, Kahoot quiz-games for revision, terminology projects, and revision and

self-assessment of learned terminology through research articles. In the WPAS technique, the words were broken into roots and affixes. In the terminology lab, the students answered the questions related to medical definitions. The students prepared Kahoot quiz projects and competed in class with further discussions. They also completed projects about medical definitions of illnesses with pictures. Finally, when reading research articles, the students were required to find the medical terms and check if they could recall the meaning of those words.

It can be concluded that the test results and qualitative data gathered during this study showed that the implemented methodology was successful and the students' vocabulary knowledge developed. Also, according to the students' claims and my observation, the activities did not focus on rote memorization but rather strengthened the learning process of terms by transferring their knowledge to real life-like tasks. Moreover, the methodology did not feature a '*robotic-way of learning*', as stated by one of the students. It focused on trying to find a solution on how to enable the students to internalize the learned words. It should also be noted that the students' prior knowledge of Biology was of great importance to remember some subjects and terms. This appeared to facilitate the process of associating new knowledge with prior knowledge which requires critical skills on students' parts.

The results also showed that the students appeared to be equipped with skills which can also be useful at the faculty. By preparing their projects and applying the learned knowledge into practice, they were trained independently which can be called autonomous learning. Also, it helped them think critically and transfer this knowledge into practice which is essential for ESP courses as well (Bahous, 2001). In addition, this study's methodological approach with different activities can also be applied in medical terminology where the WPAS technique is impossible to apply for such terms, e.g., *duodenum*, as it was found by Taie (2015). Additionally, gamification-based practices like Kahoot or other projects appeared to enhance the learners' attitudes and motivation towards the lessons. Both the students' reflections and my observation can support it, which are in line with other studies (Yildirim, 2017).

The study showed that a similar methodology can be implemented with English as a Foreign Language (EFL) learners before enrolling at mainstream courses. In this context, this class was instructed to meet the requirements of the faculty in order to familiarize the students with medical terminology before the mainstream faculty courses. Similar programs can also be implemented in different EFL contexts to prepare the learners with self-confidence and prior knowledge of medical terminology before enrolling at the faculties.

Given that the methodology implemented for this research focused on enabling the students to internalize the learning process of medical terms, it would be ideal to check to what extent the students can recall the learned medical words after some time, i.e., at the faculty. Further follow-up analysis can be carried out with a content teacher as part of the adjunct teaching. Moreover, the students can be investigated to what extent they apply or produce the learned terminology in communication skills in a medical context, as this scope bears one of the essential issues for EMP (Wette & Hawken, 2016; Dahm, 2011).

Finally, another important point in the EMP context is teaching the learners with varying levels of language proficiency which can make the situation difficult (Eggly, Musial & Smulowitz, 1999; Rivera-Goba & Campinha-Bacote, 2008). Foreseeing this problem, this course was offered in the second semester when the learners' language proficiency level improved up to an upper-intermediate level. Moreover, the ongoing academic and general English courses and pre-content-based English course were facilitating factors in this respect. Therefore, teachers planning to design such lessons are advised to consider learners' language proficiency levels.

## 5.1 Limitations

The study cannot be claimed without its limitations. The techniques designed for the purpose of this study were implemented during the entire period of the course; however, the students' vocabulary knowledge was pre- and post-tested on three body systems (Endocrine System, Nervous System, and the Eye and Ear) for practicality purposes. Investigating the students' progress or differences in their progress across different chapters (body systems) would be an interesting aspect to explore further. Additionally, it would be interesting to investigate the effect of the teaching techniques on students' learning progress through experimental design projects. Another limitation is that there was only one student (outlier) whose scores did not improve significantly. The reason is that this student took the test voluntarily. However, he was not going to attend the faculty course probably due to changes in his plans to pursue his further education in dentistry instead of medicine. This student's results were included in data analysis because he was active in class activities and was willing to participate. Finally, the implications of this study may not be generalizable due to a limited number of students. Nevertheless, the qualitative results suggest that the scaffolding techniques can be tailored to suit similar teaching contexts.

## 6 Conclusion

The great majority of studies on EMP studies have addressed the linguistics aspects of medical English. However, there is a dearth of research on offering a pedagogical approach to EMP (Ferguson, 2012; Wette & Hawken, 2016). This situation is also valid for the EMP courses of instruction in Turkey. Several needs analysis studies were conducted in Turkey to address this issue. They mainly focused on macro-skills (reading, writing, listening, and speaking) and ignored the role of teaching medical vocabulary. In fact, the skills perceived to be important by medical faculty students in those studies (e.g., Celik, 2017; Kayaoglu & Akbas, 2016) were building medical vocabulary for successfully reading medical textbooks, technical reports and manuals, participating in discussions at medical seminars, talking to foreign colleagues, writing case histories, research articles and prescriptions, and listening to medical conversations.

This learner-centered approach to teaching medical terminology echoes suggestions by Boztas (1987) in that a learner-centered approach should be conducted in teaching medical English to Turkish EFL learners. This research offers pedagogical implementation with various authentic techniques in teaching medical terminology. The quantitative data suggested that the students' test scores increased after the techniques. According to the students' reflections and teacher observation, the activities scaffolded the learning process. The students were motivated because the techniques were various and authentic, supplemented with visual and video aids. They did not memorize the words but internalized the construction principles of medical definitions.

Furthermore, the students prepared projects which enabled them to be autonomous learners. By looking for the instructed words in medical research articles, they were more motivated and eager to learn because this was what they would face in the faculty courses, as claimed by the students. In conclusion, it can be suggested that similar techniques can be implemented in similar contexts to facilitate the learning process of medical terminology, motivate the students and prepare them before enrolling in mainstream faculty courses.

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