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Application-Based Learning Approach in Medical English Education: Common Causes of Poor Communication and a Proposed Solution

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Abstract

As the medical field becomes increasingly globalized, many medical departments and universities have sought better approaches to English for Medical Purposes (EMP) (Lodhi et al. 2018, Kayaoglu & Akabas 2016). In many medical contexts, word-for-word translations from Japanese to English simply do not work. In these cases especially, translation theory offers effective skills for transferring from one language to another for both translation and interpretation. (Baker 2009, 2011, Picken 1989). This study investigates the hypothesis that the fundamental difficulties in EMP are the same as those faced by professional translators and interpreters, and that the application of translation theory could effectively contribute to better medical explanations from Japanese doctors or medical students. To test this hypothesis, we applied Baker's (2009, 2011) translation theory and compared the effectiveness of application-based learning (ABL) instruction and conventional memory-based learning (MBL) instruction under experimental conditions. ABL instruction was significantly more effective under the conditions of the experiment. Analysis of the subjects' translations suggested three main reasons for poor translations: inappropriate word-for-word translation, unfamiliarity with common fixed medical expressions, and different thought processes applied to medical discussions in the two languages. These results suggest that the proposed ABL approach could be used in teaching to help overcome these problems.

1. Introduction

Due to the advances of globalization in the medical field, as seen in the response to COVID-19, international collaborative research and development have never been seen as more important than they are today. According to our own survey of syllabi of departments of medicine at 51 Japanese universities in 2018, as many as 70 percent of national universities had incorporated medical English classes in their medical schools, attesting to a perceived increase in the importance of EMP. However, an effective EMP teaching approach has yet to be established, a situation visible in the lack of effective textbooks of medical English. For example, most medical English textbooks for

Japanese medical students deal not with clinical medicine essential for doctors but with basic health issues that most medical students are already familiar with (e.g. Kobayashi 2007, Kondo et al. 2015, Masago et al. 2020). This paper proposes an approach for the improvement of the EMP of medical students and doctors. To assess the effectiveness of the proposed approach, the authors conducted an experiment in which two MBL and ABL approaches were compared. The objectives of this study are, first, to uncover common causes of poor translation and failed communication among Japanese medical professionals, and second, to determine through experimental tests the effectiveness of ABL instruction in medical English communicative acquisition so as to address this problem.

2. Proposed application-based learning (ABL)

This section explains the Medical English teaching approach that the authors devised as a solution to the above-mentioned problems in current English education for medical students. Since the proposed approach is based on Baker's translation theory, it is instructive to explain what that is and how it works. The proposed instruction focuses upon ABL, which consists of five steps, Steps (A) to (E) (see Figure 1).

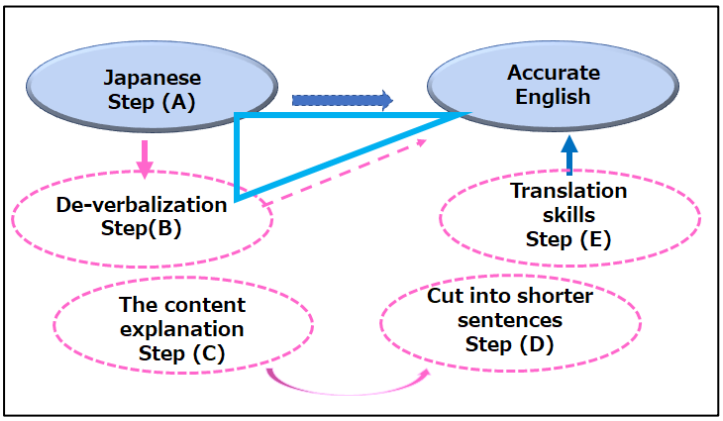

Figure 1. Application-Based Learning

- Step (A): Confirm the medical content.

This means grasping Japanese medical content before translating into English to decide whether or not the direct translation is applicable. If not, one can move on to Step B. In either case, it is necessary to use the specific words, phrases, or sentence patterns commonly used in medicine.

- Step (B): 'Deverbalize' the Japanese words.

This means moving away from the original, a step known as de-verbalization in translation theory. Put simply, the speaker should stop explaining merely by switching from the source language to the target language. To take a simple example, the word-for-word translation of "shita no ketsuatsu wa shinzo ga ookiku naru toki no mono desu. (下の血圧は、心臓が大きくなる時のものです)" is "the lower blood pressure is the thing when the heart becomes big," which does not make too much sense. It would be more appropriate to say "The bottom number is the blood pressure when your heart relaxes."

- Step (C): Express the content. (The content explanation)

This step involves paraphrasing the content, repacking complex medical content into simple explanations so that a patient can easily understand. This three-sided model, shown above in the blue triangle (Seleskovitch 1968), has already been demonstrated in semantic theory and translation theory. The most important thing in clinical explanations is to accurately convey the medical content. Therefore, it is easy to recognize the match between a theoretical "medical content explanation" and the "content explanation" as shown in Figure 1.

- Step (D): Break the information into short sentences (Hasegawa, 2012).

This step involves cutting long sentences into shorter sentences. Examples of the exercises used for this step are given later in Example 2 in 3.4.

- Step (E): Apply Baker's translation skills to interpret the information into English.

Based on Baker's translation skills (2009, 2011) and Hasegawa's applied version of translation skills between Japanese and English (2012), the authors devised an original list of medical English translation skills. The following shows two examples of the translation skills.

1. Structural Change
   1.1 Voice change: passive voice ⇔ active voice
   1.2 Subject change
   1.3 Use of inverse expressions
   1.4 Addition of a subject or an object as necessary
2. Omission
   This means omitting redundancy or medical terms as necessary while retaining the same connotations.

3. Experimental method

To assess the effectiveness of our proposed approach, two educational approaches were compared. One was a conventional memory-based learning (MBL) approach, using a medical textbook on the market. The other was an ABL approach based on Baker's (2009, 2011) translation theory. This section describes the details of the experiment.

3.1 Subjects

The subjects in the present study were medical and medical-related students in a Japanese national university. They were divided into two groups. The first group A consisted of 22 subjects whose English proficiency level was intermediate (average TOEIC level: 639). They were involved in a two-hour face-to-face MBL approach on November 15th, 2019. The second group B consisted of 13 subjects whose English proficiency level was also intermediate (average TOEIC level: 722). They were involved in a two-hour online ABL approach on July 14th, 2020. The online session was

an interactive session, conducted using Zoom, to be as close to the face-to-face session as possible. Written informed consent was obtained from all subjects in both groups.

The two groups A and B were matched as closely as possible. All subjects were second year students in the medical, pharmaceutical, and dental departments. The range of TOEIC score of above 600 indicates a sufficient grasp of English grammar. Further, the background of the subjects suggested that they would not be familiar with medical English, and the results of the experiment bear this out, with the exception of one subject in group B. The two groups do have different average TOEIC scores, but the results on the pre-test indicate that they were sufficiently closely matched for this experiment. (see 4.5).

3.2 Instruction structure

The experiments consist of two kinds of instruction: (A) MBL instruction and (B) ABL instruction. Each experiment comprised five steps. Both groups received instruction with the same structure, with only the instructional content of Step 3 differing between them. They were also given the same homework assignments before the instruction, as shown below:

Topic: Angina and acute myocardial infarction (AMI)
Homework assignments: Memorizing medical terminology related to AMI and reading short articles about AMI from handouts based on an existing medical textbook. (The Japan Society for Medical English Education, 2017).

The steps from 1 to 5 are as follows:

- Step 1: Test before lectures: Translate explanations of two kinds of circulatory diseases from Japanese into English (angina and myocardial infarction, and ventricular septal perforations.)
- Step 2: Study AMI by watching a video of US medical lectures on AMI with English muted and a Japanese explanation of the content provided. This is to exclude effects from the presence or absence of auditory learning (Silve de Souzal 2013).
- Step 3: Instructional content: (A) MBL instruction or (B) ABL instruction.
- Step 4: The same test performed after the lecture.
- Step 5: Performance assessed after the completion of both experiments by a US medical graduate student with the help of one of the authors. This assessment was more focused on whether or not a medically trained native speaker can understand the medical content rather than on English language ability. Test papers were blinded so that neither assessor knew which section of the experiment they were from, or whether they were pre-tests or post-tests.

For both groups, it took two hours to do the steps from 2 to 4. In terms of content, while Steps 1, 2, and 4 were the same in both groups, Step 3 was different. The next sections provide the relevant details.

3.3 MBL instruction

The following offers the details of Step 3 for the MBL instruction given to Group A. As teaching material, the authors used handouts based on an English medical textbook, *English for Medical Purposes, Step 2* (2017), including basic medicine. In Step 3, the subjects read short articles on AMI, including pathology, etiology, causes, and treatments. Then they completed several exercises based on the English version of the Japanese national doctor's qualification tests.

3.4 ABL instruction

This section offers the details of Step 3 for the ABL instruction given to Group B. The authors used custom materials that were prepared for use in the experiment with reference to several textbooks (Husain 2011, Nishimura 2012, Le & Bhushan 2018, Medic Media 2018). In Step 3 the subjects received application-based instruction. First, they were shown many cases of invalid sentences produced by word-for-word translation from Japanese to English and were given the major reasons for the differences between Japanese and English. This process corresponds to Step (A) in Figure 1. Subjects were then shown how to apply translation theory and skills to medical English with the aid of exercises. This process corresponds to Steps (B) through (D) in Figure 1. Logical reasoning is crucial in the medical field, as it can yield logical thinking (X ⇒ Y⇒ Z) that can help explain medical phenomena **(**Maki 1999). It can be safely said that the logical thinking process (X ⇒ Y⇒ Z) is linear and it is possible to break it down to its components (X, Y, and Z), which is one of the translation skills (Hasegawa 2012).

The following examples show two types of translations of the Japanese sentence; a word-for-word translation (Example1), and a translation based on ABL (Example 2).

Japanese explanation of "ischemic heart disease":

虚血性心疾患: ①心臓の筋肉（心筋）が動くために必要な酸素を送る冠動脈に、動脈硬化が進んだ結果、②血液の流れが悪くなり、③心臓がポンプ機能を担うために必要とする酸素の需要・供給バランスが崩れ、④心筋の一部が酸素不足（虚血）になる病気を言う。
(虚血性心疾患(狭心症・心筋梗塞)｜KOMPAS (keio.ac.jp)

Example 1) A word-for -word translation:

Ischemic heart disease is a condition in which ①arteriosclerosis *goes forward* (P) in the coronary arteries *that send oxygen necessary for the movement of heart muscle* **(O)** ②and then, blood flow gets worse, ③and the *demand and supply of oxygen necessary for its pumping function* **(O')** *becomes unbalanced* (P), ④and part of the heart muscle becomes short of oxygen.

The reason why a direct translation, as seen above, leads to a poor translation is the presence of unnecessary repetition (O) and (O'), which imply the same content, as well as inappropriate English expressions (P). Additionally, the conjunctions in the above sentence do not clarify the "cause and effect" relationship between the two sentences. Therefore, it can be thought that all these factors contribute to the poor translation.

Example 2) Translation based on ABL:

Ischemic heart disease is a condition in which ① as atherosclerosis **worsens,** ② the blood flow **is reduced**. ③ **This causes** an imbalance between demand and supply of oxygen necessary for its pumping function. ④ T**his leads to** ischemia in part of the heart muscle.

Appropriate word choice is important (Step (A) in ABL), such as "worsens" in ① and "is reduced" in ②. As seen at ③ and ④, Step (D) encourages cutting the Japanese sentences into shorter sentences and clarifying the connections of "cause and effect" between the sentences using words such as "cause", "lead to", or "result in". The translator should omit the underlined portion (O) in Example 1, which has the same content as (O').

3.5 Tests and assessment method

The following offers details on the pre- and post-instruction tests given to both groups. In the test the subjects were asked to explain the content of the following Japanese passages in English.

1. ①狭心症も心筋梗塞も冠動脈の血液の流れが悪くなり、②詰まった冠状動脈から血液を受ける心筋の一部に酸素不足が生じる結果、③胸に痛みや圧迫感を感じます。(Keio University Hospital)

Answer:

① In both angina and myocardial infarction, less blood flows to the heart muscle. ② This causes lack of oxygen in the heart muscle that receives blood from the occluded artery. ③ As a result, patients often feel chest pain or a sense of pressure.

2. ④⑤欠損孔が大きい場合は、左心室が右心室より圧力が高いため、左心室の血液が右心室に容易に通過する。⑥ 初期の段階では無症状であるが、長期的には、左心室から右心室への血流の流れる量が増加することで、右心負荷がおこり、⑦ 肺動脈高血圧および右室肥大等が生じる。⑧ 左室と右室の圧力勾配が逆になり、⑨ 酸素の少ない血流が左心室を通って全身に流れて, ⑩ チアノーゼを引き起こす。(Created by author)

Answer:

④ When the septal perforation is large, the blood in the left ventricle goes into the right ventricle, ⑤ because the blood pressure in the left ventricle is higher than in the right ventricle. ⑥ In the early stages, patients with VSD are asymptomatic. Over time, this leads to an increase in the amount of blood and (places) the burden on the right ventricle. ⑦ This causes pulmonary artery hypertension, and right ventricular hypertrophy ⑧ where the pressure gradient between the two ventricles reversed. ⑨ As a result, oxygen-poor blood flows into the left ventricle and then to the whole body. ⑩ This results in cyanosis.

Annotations were given for medical terminology, such as 'angina', 'myocardial infarction', and 'the heart muscle'. Dividing the above two Japanese sentences into ten parts, as shown above in the English sentences, each part was assessed according to the following three standards.

Score 10: Perfect or almost perfect with minor mistakes such as misspelling or articles. The medical content of the sentence can be understood without any problems.
Score 5: Half of the sentence can be correctly understood.
Score 0: Grammatical mistakes, awkward expressions, or inappropriate word choices which make it hard for the reader to understand.

The highest possible score was 100 points.

4. Data analysis and results

4.1 Analytical procedure

The subjects in both groups were asked to complete a translation test (see 3.5) before and after a two-hour lecture. All of these tests were assessed by an American medical student and one of the authors. The marking was blinded so that they were unaware of which tests fell into each category. After the marking was completed, the authors analyzed the causes of the invalid translations and created a diagram of the mechanism of the mistakes.

4.2 How students make mistakes

Figure 2 illustrates the mechanism of the subjects' common mistakes and how typical invalid translations were made. A lack of understanding of medical content and a lack of knowledge of fixed medical English expressions were the primary causes of mistakes (①). This led to a direct translation (②), resulting in confused sentence structures (③) and inappropriate phrases or words (④).

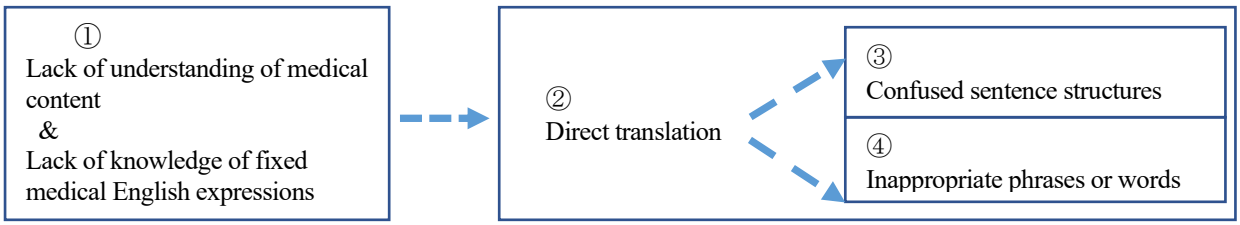

Figure 2. The Mechanism of Common Mistakes

Although direct translation is possible in some cases, it is unsuitable in medical contexts in many cases. Direct translation of Japanese sentences results in confused sentence structures (③), which likely arises from differences in the structure of the two languages. For example, Japanese sentences sometimes omit subjects or objects. They may also include information regarding different time frames or overload information into long sentences. By contrast, English sentences

tend present information in a logical manner or via a cause-and-effect sequence. Because of these differences, a direct translation from Japanese to English may yield a confused and invalid sentence structure.

Even in properly structured sentences, the meaning will not be understood if inappropriate words or phrases are chosen (④). Mistakes at the vocabulary level are mainly related to inappropriate word choices, such as the selection of a common verb instead of medical terminology. For example, "sashitsu ni fuka ga okoru (左室に負荷が起こる)" was translated as "**Burden occurs** in the left ventricle," but it should have been translated as "This **increases the burden** on the left ventricle." Although direct translation is possible in some cases, it is particularly unsuitable for medical contexts, partly because there are fixed expressions in both languages. These types of mistakes are common, especially in complex medical explanations.

4.3 Results and analysis of MBL instruction

This section compares the results of the two groups A and B. Figure 3 shows the scores on the pre- and post-tests and their differences in Group A, along with analytical comments and example error sentences.

No	Pre	Post	D	Analytical comments & Example error sentences
1	20	35	15	Scores improved since one correct sentence was added in the post-test. Basic grammatical mistakes: main verbs were omitted in two sentences. Inappropriate word choice: e.g.) You have asymptomatic
2	15	40	25	Scores improved since two correct sentences were added Basic grammatical mistakes Main verb and conjunction were omitted.
3	20	20	0	A key verb was omitted. Basic grammatical mistakes
4	45	40	-5	Scores reduced since one incorrect phrase was added. e.g.) become a shortage of oxygen.
5	63	63	0	Cause and effect are inverted. Commonly used words such as asymptomatic and occur were used. Logical thinking was seen.
6	0	0	0	Three wrong sentences were written. No correct sentences
7	10	10	0	One direct translation was correct.
8	45	45	0	Grammar was good.
9	18	18	0	One direct translation was nearly correct.
10	35	35	0	Inappropriate word choice
11	35	40	5	Inappropriate word choice The sentence structures commonly used in medicine were good.
12	25	25	0	One correct sentence was added in the post-test. e.g.) And cyanosis develops.
13	30	25	-5	Inappropriate word choice e.g.) You make cyanosis. e.g.) Cyanosis exists in the body Scores reduced since inappropriate expressions were added.
14	20	25	0	Three sentences were incomplete in both tests. One correct phrase was added in the post-test. Inappropriate word choice: e.g.) You feel asymptomatic. e.g.) Burden of it occurs.
15	25	25	0	No change
16	25	25	0	No change

17	25	40	15	One correct sentence was added in the post-test.
18	45	45	0	No change
19	25	25	0	No change
20	45	35	−10	Inappropriate word choice e.g.) burden occurs Scores reduced since inappropriate expressions were added.
21	20	20	0	No change
22	20	20	0	No change

Figure 3. The Results of the Tests in Group A (MBL)
No: The individual subject number.
Pre: Score on the pre-test
Post: Score on the post-test
D: Difference between the pre-test and the post-test (Post-test score minus pre-test score)

Overall, most subjects showed no or minimal improvement after the lecture. Only three improved by more than 10 points and three even received a lower score.

The general range of test results was from 20 to 40, with a few outliers at both ends. Two out of 10 sentences in the test were easy to translate into English by a direct translation; 19 out of 22 subjects (those except Nos 2, 6 and 7 in Figure 3), earned 20 points or more by translating these two sentences correctly on the pre-tests. The three subjects (Nos 2, 6 and 7) scoring below 20 made basic grammatical mistakes, suggesting a weakness in their foundational understanding of English. In eight out of the 10 sentences on the test, a direct translation does not work, but the subjects showed little improvement in their translation after the instruction. Thus, we cannot say that the memory-based teaching improved their ability to create a good translation.

Four subjects (Nos 4, 5, 8 and 18 in the table) used appropriate words or phrases such as “occur” or “develop” correctly, and earned scores a bit higher than 20 points. This suggests the possibility that they had a slight familiarity with medical English from experience of reading medical articles. Knowing some vocabulary commonly used in medicine is a real advantage.

In five subjects (Nos. 4, 7, 12, 14 and 17), the improvements seem to have been due to familiarity with the test, as the same questions were set before and after the lecture. For example, the words “bld” or “blad” were written correctly on the second attempt (No. 4). A verb was changed from “have” to “get,” which is a more appropriate word in the test (No. 7). In several cases, one or two correct sentences were added (Nos. 12 ,14 and 17). These changes do not suggest that the teaching had a strong impact. In general, the subjects in the MBL group did not show positive improvement after the lecture.

4.4 Results and analysis of ABL instruction

Figure 4 shows the scores on the pre- and post-tests and their differences for Group B, along with analytical comments and example error sentences. An analysis of the mechanisms of mistakes given in Figure 2 is shown in the middle columns in order to clarify how each subject improved in the post-test, after the lecture.

No	Pre	Post	D	①	②	③	④	Analytical comments & Example error sentences
1	45	80	35	○	NP	NP	NP	Difference between the two tests seems to be due to speeded up writing on the second test, as sentence flow was good in both tests.
2	81	96	15	NP	NP	NP	NP	Cause and effect become clearer. Medical expressions improved.
3	0	65	65	○	NP	×	×	Cause and effect were wrongly inverted. Fixed medical expressions expanded.
4	0	50	50	◎	◎	◎	×	Three wrong sentences were improved. Key verbs used in medicine such as 'increase' or 'reduce' were still omitted in the post-test.
5	25	50	25	◎	◎	NP	×	Though direct translations improved, word choices were still inappropriate.
6	30	45	15	○	NP	NP	×	Fixed expressions or key words increased. e.g.) cause, occur
7	50	50	0	×	×	×	×	No change
8	25	50	25	◎	◎	◎	○	Correct sentences increased Key verbs used in medicine were not written. Basic grammatical mistakes: Article and verb changes were incorrect.
9	55	65	10	○	◎	NP	×	Though direct translations improved, word choices were still inappropriate. e.g.) at first → in the first stage Basic grammatical mistakes: Omitted key verbs There was no improvement in mistaken inversion of cause and effect. Some expressions improved.
10	35	70	35	◎	◎	◎	◎	Word choices improved. e.g.) make → cause e.g.) bad circulation → less blood flows
11	65	80	15	◎	◎	◎	×	Cause and effect became correctly ordered. Some word choices were still inappropriate.
12	60	60	0	×	×	×	×	No change
13	60	80	20	◎	◎	◎	◎	Cause and effect become clearer. More correct sentences are added in the post-test. e.g.) Blood (glow into → blood flows to)

Figure 4. The Results of the Test in Group B (ABL)

No: The individual subject number.
Pre: Score on the pre-test
Post: Score on the post-test
D: Difference between the pre-test and the post-test (Post-test score minus pre-test score)
①－④: the type of mistakes as shown in Figure 2.
◎: significant improvement between the two tests.
○: moderate improvement between the two tests.
×: no change. Nothing was improved.
NP: no problem. No mistakes were found in the post-test.

As Figure 4 shows, there was a wide range of improvement in the subjects after ABL instruction. Five subjects (Nos. 1, 2, 10, 11 and 13) out of the 13 scored over 70 in the post-test after the lecture. They came to be careful about the cause and effects of the disease through understanding the content provided, and translated the sentences logically, cutting long sentences into shorter sentences. In most of them, word choices were appropriate. Only one subject (No. 2) might have been able to do this before the lecture. Six subjects (Nos. 3, 4, 5, 6, 8 and 9) scored less than 65. Their logical translation improved, but word choices were still not appropriate. In two subjects (Nos. 7 and 12), there was no improvement between the tests. In all of the subjects except for those two, the direct translation (② in Figure 2) was avoided and the sentences were translated logically. In most of the

subjects, confused sentence structures (③) were not found, which means that this type of improvement can be achieved through a two-hour lesson. On the other hand, there are many subjects who still have problems with appropriate word choices (④). Accumulation of medical expressions will be needed to overcome this issue.

The analytical comments in Figures 3 and 4 do not comprehensively cover the changes or improvements in each subject, but rather focus on prominent features in the subject's performance. These comments may be useful when giving advice to individual students. After this experiment, the learners assigned to Group A were given an appropriate follow-up lesson to prevent any educational disadvantages.

4.5 Statistical comparison of the two groups

The table 1 below provides the descriptive statistics for the results. Groups B's mean improvement of 23.1 with ABL instruction is much higher than Group A's mean improvement of 1.59 with MBL instruction. These numbers indicate a much greater and positive change in results with ABL instruction than MBL instruction, suggesting that the ABL approach is more effective.

Table 1. *Comparison of Group A and Group B's Results*

	Group A Mean (Median) Minimum-Maximum	**Group B** Mean (Median) Minimum-Maximum
Pre-test	27.8 (25) 0－63	40.8 (45) 0－81
Post-test	29.8 (25) 0－63	64.7 (65) 45－96
Difference	**1.59 (0)** -10－25	**23.1 (20)** 0－65

This finding was also supported by statistical analysis. To carry out multiple comparisons between Group A and Group B, we first performed two-way ANOVA analysis, followed by the Holm-Sidak post hoc testing. ANOVA allowed us to confirm whether there were any significant differences in the data set as a whole, and the Holm-Sidak test allowed us to determine which differences were statistically significant between and within the two groups. The test data shown in Figures 3 and 4 were analyzed by two-way ANOVA, with a significance level of 0.05, to test for significant differences between the results from Group B (ABL) and Group A (MBL). The data were tested for normality and homogeneity of variance, and both were acceptable; thus, ANOVA was used for the analysis as planned. There were significant main effects for the method of teaching ($F=33.8$, d.f.=1, $p<0.001$) and test scores before and after teaching ($F=9.9$, d.f.=1, $p<0.003$), with a significant

interaction between teaching method and scores (F=7.0, d.f.=1, p=0.01). Holm-Sidak post hoc testing, with a significance level of 0.05, was used to test for significant differences between the groups. Overall, Group B had significantly higher scores than Group A (t=5.8, p<0.001), and post-test scores were significantly greater than pre-test scores (t=3.1, p=0.003). Within Group A, there was no significant difference between pre- and post-test scores (t=0.41, p=0.69). However, within Group B, post-test scores were significantly greater than pre-test scores (t=3.6, p<0.001). Additionally, there was no significant difference in pre-test scores between the two groups (t=2.2, p=0.28), but there was a significant difference in post-test scores (t=6.0, p<0.001).

Collectively, these results suggest that the ABL approach was superior to the MBL approach, given that only the ABL approach led to a statistically significant improvement in scores. Although there was a slight difference in initial ability between the groups, as indicated by the difference in TOEIC scores, this was overwhelmed by the difference in effectiveness of the teaching methods. The next section demonstrates how the MBL approach can be used to overcome common mistakes through practical coursework.

5. Coursework Design: proposed ABL approaches to overcome common mistakes

Based upon the analysis of the experiments, coursework is proposed, including several key factors designed to promote quick progress in learning to express medical information in English. Figure 5 shows five processes from (A) to (E), and their connections in coursework design.

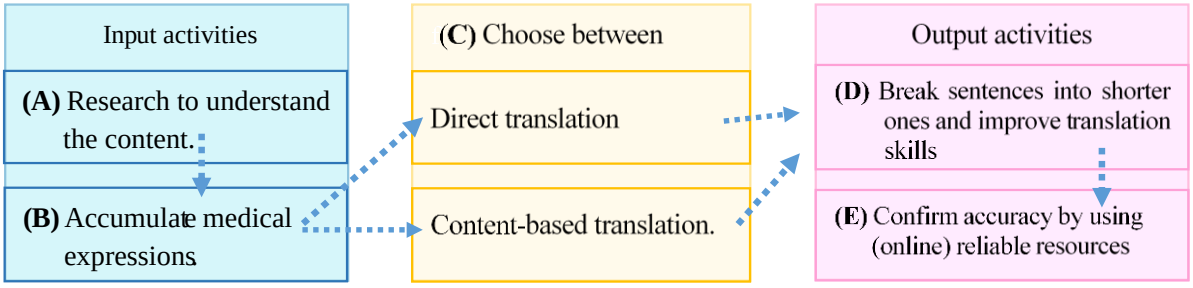

Figure 5. Coursework Design from (A) to (E)

- Process (A)—research to understand the content—is important in input activities because a thorough understanding of the content is the first step in conveying accurate medical information. Thus, this should be given priority. It is recommended that students consume authentic and reliable medical articles (for reading) or authentic and reliable medical lectures (for listening) to support this.
- In Process (B)—the accumulation of medical expressions—students must be taught terminology and commonly used expressions or sentence patterns in medicine. For example, English sentence patterns to describe diseases include the following: "(disease name) is a

condition in which ～," or "(disease name) is a condition characterized by ～." During this input process, it is vital to develop students' familiarity with medical English.

- Process (C) is concerned with choosing suitable translation skills. Familiarity with medical expressions also makes it easier to choose whether a direct translation or content-based explanation should be applied in a particular context.
- Process (D) in output activities is concerned with altering sentence structures. The technique of breaking up longer sentences into shorter ones, as well as other translation skills, can be helpful, especially when encountering difficulties in translation or when a direct translation does not yield a comprehensible sentence.
- Process (E) in output activities involves confirming the appropriateness of a translation by checking it against reliable online sources (Kayaoglu & Dag Akabas 2016) or medical books. This can be an effective way to find appropriate medical expressions.

At the input stage of the ABL approach, background knowledge of medical content is as important as in other approaches. Additionally, medical students will learn English medical terminology in regular Japanese classes. However, the acquisition of terminology alone, which tends to be generally recognized as important, will not significantly help doctors learn medical English in a way that allows them to properly communicate. Professionals in English education should support students not only in the acquisition of medical terminology, but also in expanding their stock of fixed medical expressions using basic words and phrases. Additionally, it is important to make students aware that medical expressions often cannot be translated directly. Recognizing that a direct and literal translation is not possible in many cases, students will work to make the right choices when translating.

Further, in the output stages of ABL, it is important to continue active exercises such as role playing and presentations, as students can cultivate their ability to practically apply the techniques to other medical contexts through such exercises. Thus, the practice of key processes in ABL coursework—accumulating fixed expressions, avoiding a direct translation when necessary, and applying translation skills to convey accurate medical information—can offer rapid improvement in medical English.

6. Conclusion

In this study, two different approaches were compared for teaching medical English. The proposed ABL approach, which explicitly uses translation theory, was compared to a conventional MBL approach. Both approaches were used in two-hour classes with similar groups of subjects, and their ability to translate medical Japanese into English was assessed before and after the instruction. The ABL approach appears to more significantly improve the ability of subjects to express medical ideas in English than the MBL approach. Given that most medical explanations are structured in a

logical manner, ABL is broadly applicable to other medical English explanations, including etiology, pathology, treatment, and diagnosis. Therefore, in the field of EMP, further detailed research should be conducted, and appropriate teaching materials incorporating the ABL approach should be created. Finally, the ABL approach should be widely introduced in medical universities and schools.

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